JMJ COLLEGE FOR WOMEN (A), TENALI

PAPER PUBLICATIONS 2017-18

NO.OF PUBLICATIONS 2017-18 - 43

DEPARTMENT OF ENGLISH

1 Published a paper on "Role of Myth in R.K.Narayan's The Man Eater of Malgudi"in the book titled *Plurality and Difference- Emerging Trends in Indian Writing in English*, Edited by Prayer Elmo Raj & Ch. Radhika, ISBN No.978-93-5207-552-2 published by AUTHORS PRESS, Publishers of Creative and Scholarly Books, New Delhi, July 2017, Pp.225-233.

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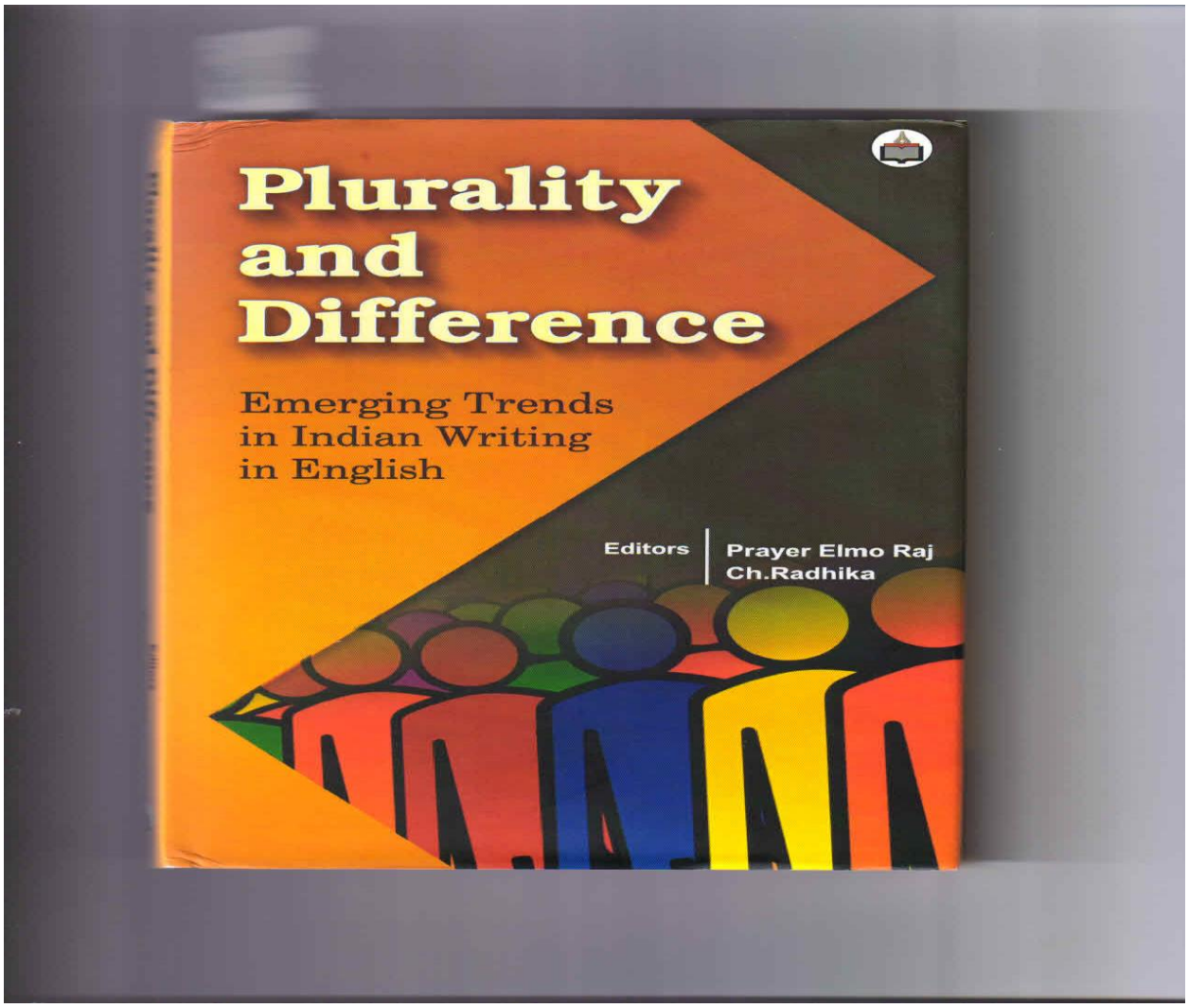

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Role of Myth in R.K. Narayan's *The Man Eater of Malgudi*

Shiny K.P.

The Man Eater of Malgudi tells the tale, through the first-person voice, of a printer named Nataraj who lives in the fictional South Indian town of Malgudi. Rasipuram Krishna Swami Narayan is a versatile writer and one of the greatest novelists of Indian Writing in English. The setting of the novel is portrayed realistically by mentioning places like Kabir Street, New Extension and so on which leads the reader to picture the setting with meticulousness and empowers the place with a sense of geographic legality. His novels throw light upon the characters and personalities of middle class family. He uses very simple language which is readable and enjoyable. The story discovers multiple relationships, themes, and symbolic elements that collide in conflict over the power of an individual to change the action of someone more powerful than he is. Although Narayan writes with a light tone and comedic prose, Man-Eater questions the role of the colonised in accepting the entrance of the colonising forces. The ineffectiveness of Nataraj's attempts to confront Vasu, his lifestyle, and his line of work offer a microcosm of the larger issues of colonialism. Malgudi is the symbol of mythic space which actively participates and

determines the action of the novel. It has psychological and physical dimensions and brings a ritualistic element into the novel. Narayan has a very distinctive style which has been considered as objective, plain and professional.

Myth is an expression of the sacred in words; it presents the realities and events from the origin of the world that remains significant. It reflects the literary and traditional aspects of the life of the people. It is mainly used to support an argument and explains a contemporary situation because myth exists as something real. Narayan uses ancient myths, legends; folklore consciously as a technique of narration. He is well versed in the Hindu epics like Ramayana and Mahabharata and other Hindu scriptures as also in the myths and legends which form a part of the Indian folklore. In the novel, he used myth as a technique in the manner of such modern English writers like T.S. Eliot, W.B. Yeats, Eugene O' Neill, James Joyce and many others. The novel is based on the mythical structure, war between God and Asura i.e. demon and the defeat of Asura's by God.

In the novel *The Man Eater of Malgudi*, Narayan uses myth to present the facts of modern life in order to bring out the similarity and contrasts between the past and the present. For instance in the novel, Sastri is the character who links myth and reality. His name Sastri which means man of scriptures indicates a mythical link. He possesses ancient wisdom which seems to frame everything in a perfect manner. He is the one who compares Vasu as Rakshasa, a demon who is an embodying force of destruction. He is the one who is an in-charge of Nataraj's inner sanctum at the press. Being a Brahmin, he performs Satyanarayana Puja on full moon days as homage to Lord Vishnu and he also makes pilgrimages to holy sites.

Nataraj, the main character of the novel is living in Kabir Street and lives a quiet and content life until he meets the rough Vasu, an aspiring taxidermist who interrupts Nataraj's daily printing business, forcibly moves in above the shop, and wreaks havoc around town as he seizes animals through unorthodox measures to populate his demand for exotic stuffed pieces to be shipped to buyers around the world. As Vasu aggressively seeks out exotic animals for his business, he comes across a sacred temple elephant that he is determined to have as a prize for his collection.

Nataraj must figure out how to deter Vasu from his mission to shoot the elephant at a sacred festival in town. He said, "Vasu, I have come to you as a friend. I thought it would be fun to have you around. We could see things together and laugh at things together. Perhaps you are worried we might ask about those collections...' (172). "Vasu, I have come to appeal to you not to harm our elephant tonight" (173). However, the pitiless taxidermist threatens to kill the temple elephant who is to be taken in a festival procession organised to celebrate the poet's completion of his religious epic on God Krishna. Nataraj is very fond of the elephant, Kumar. He becomes naturally upset the moment he learns from Range the notorious dancing woman brought by Vasu that he intends shooting it on the night of the proposed procession. Nataraj immediately posts the wicked intentions of Vasu to his friend, the poet, the lawyer, and other important people of the town. The matter is reported to the police authorities but they express their inability to take any action against him until the crime has been actually committed.

The very thought of the temple-elephant, Kumar's murder, drives Nataraj crazy. Even while compelled to stay in his house owing to the agitated condition of his mind, he constantly thinks of the danger awaiting Kumar. As the procession passes

in front of the printing press, his heart begins to beat pit a pat with fear. He is afraid of hearing the fateful gun shots and cries of panic-stricken people. He is surprised when the procession passes away without any untoward incident. Freed from a nagging worry, Nataraj goes to his office in the morning. To his utter shock and dismay, he learns that Vasu, the taxidermist is dead. The police authorities of the town soon start investigations. Murder is suspected; Nataraj, his friends, and Rangi, the temple dancer, are interrogated by the police. From the medical report it is gathered that Vasu had died of a concussion received on his right forehead from a blunt instrument. When the police fail to find any clue of the culprit, the matter is dropped. Rangi later tells them that while striking a mosquito that settled on his forehead, Vasu slapped his temple and died instantaneously. He thus died of his own hammer-fist.

In the novel, Vasu was introduced as an evil incarnate. He is six feet tall with large powerful eyes, bull neck, large forehead and hammer-fist. He is very confident, hard-hearted and does not have perception of morality. He boasts of being the rival to Nature whose values of life are based on material sources and destructive reasons. He abhors marriage system and comments that only fool crave to get married. Like how a demon Kumbakarna in the Ramayana shows his gluttony diet, Vasu also possess the diet which involves almonds with milk, six eggs with honey every morning, rice and chicken at lunch and profusion of vegetables and fruits at night. His physical edifice, appearance and destructive thoughts reflect an ogre. He petrifies children, slays animals, repels neighbourhood people with the stench of his workshop and defies social conventions by bringing in prostitutes. All these negative acts set him apart from common human beings. His bull-neck and hammer-fist, personalities make him appear more like a fiend than a man. His

hair is described as a 'black halo'. In common case, 'halo' should be bright, radiance, aura and considered as a mark of exceptionality or divinity but here it is contemplated as an evil man which refereed to his negative role in the novel. The narrator shows all the definitions of *Rakshasa* by the persevere natter of Sastri and went on to define Vasu as Rakshasa and says, "Every *Rakshasa* gets swollen with his ego. He thinks he is invincible, beyond every law. But sooner or later something or other will destroy him. He stood expatiating on the lives of various demons in Puranas to prove his point" (84).

The novel is read as a modern restructuring of the stories of the Puranas where a demon works hard usually by prayer and penance propitiates a deity of his choice, acquires a boon and then uses this for negative and destructive purposes. Finally, the deity is so tortured that he takes divine help to destroy the demon. He thinks he is invincible, beyond every law, but finally he oversteps his limitations and is destroyed. Nataraj is comparable to the deity who grants the demon Vasu, a place and adequate encouragement to carry out his murderous profession and finally it is Nataraj who is most troubled by the demoniac Vasu and the strength with which he perpetrates endless violence and destruction is finally the cause of his own death. In very little time, Vasu has shown derision for almost everything that Nataraj holds i.e., the caste system, the path of peacefulness, admiration for elders, the inviolability of the family and of chastity and the sanctity of life itself. When he kills Nataraj's cat it shows that he is not above killing something that is part of Nataraj's family. The only thing left for him is to insult Nataraj's devotion to the gods. Vasu kills a tiger, a symbol of Shiva, and also sees him stuffing golden eagle Nataraj says to

But Vasu makes a joke of it and retorts stridently, "I want to try and make Vishnu use his feet on now and then" (58). This is an offensive thing to Nataraj who have deep faith in God but Vasu who is an atheist cannot sympathise with his viewpoint. Eventually, Vasu sketches to slay the temple elephant; it amounts to a direct attempt on the life of a god. Kumar is a sacred elephant being associated with the temple, and represents the Lord Ganesha. His killing of the sacred animals shows his disrespect for the gods which is a feature of demons. Like how the demons threatens Indra, God of heaven Vasu also threatens Nataraj and kills animals which causes his own ultimate destruction and order is restored again in the world.

Vasu is not only just a killer of animals but also disturbs the existence of Nataraj. He acts like a true Rakshasa, a demon who threatens to destroy Nataraj's way of life. He kidnaps Nataraj and leaves him stranded far from home to pass through inevitable suffering which shows Vasu's devilish spirit. We can see a parallel between that event and the kidnapping of Sita by Ravana in the Ramayana. He is also reckons to have poisoned Kumar, causing his illness and also shooting Kumar for financial benefit which is attributed to demons in mythology. He will not give importance to the cultural heritage and does not care for people's spiritual and poignant emotions. He imparts Nataraj: "I can make ten thousand out of the parts of this elephant". This causes much mental agitation and spiritual anguish to Nataraj and he grows delirious and loudly cries out 'Vishnu', which makes the agitated people rush to him to see what has gone wrong. "Oh, Vishnu! I howled. 'Save our elephant, and save our innocent men and women who are going to pull the chariot" (155).

In the novel, Narayan uses the Bhasmasura myth as a conscious technique, the mythical technique and the purpose

being to stress the self-distributive nature of Vasu so as to enrich the texture of the novel and to link it up with the Indian classical tradition. When Sastri, the helper says to Nataraj, "to deal with a Rakshasa one must possess the marksmanship of a hunter, the width of a pundit, and the guile of a harlot" (84). He further said,

> There was Ravana, the demon of Ramayana, who had ten heads and twenty arms and enormous yogic and physical powers, and a boon from the gods that he could never be vanquished. The earth shook under his tyranny. Still he came to a sad end. The other demon Mahishasura who meditated and acquired a boon of immortality and who had secured an especial favour that every drop of blood shed from his body should give rise to another demon in his own image and strength, and who nevertheless was destroyed. The Goddess with six arms, each bearing a different weapon, come riding for the fight on a lion which sucked every drop of blood drawn from the demon" (84).

> "Then there was a Bhasmasura, who acquired a special boon that everything he touched should be scorched, while nothing could every destroy him. With this special boon he made humanity suffer. Later God Vishnu was incarnated as Mohini, a beautiful dancer with whom the asura turn out to be obsessed. She assured to acquiesce to him merely if he imitated all the gestures and movements of her own dancing. At the end of the dance, Mohini put her palms on her cranium, and the fiend pursued the same gesticulation in absolute forgetfulness and was reduced to ashes that very moment, the blighting touch flattering active on his own cranium. Every man can assume that he is great and will be eternal, but none can speculate from which part his destiny will approach" (84-85).

In the novel, Sastri stresses the parallel between Vasu and Bhasmasura and hints at the manner of Vasu's sudden and unexpected death. At the end Vasu dies like Bhasmasura with a blow of his first on his own head and the novel concludes with the words of Sastri as,

> Every demon appears in the world with a special boon of indestructibility. Yet the universe has survived all the *Rakshasa* that were ever born. Every demon carries within him, unknown to himself, a tiny seed of self-destruction and goes up in thin air at the most unexpected moment. Otherwise what is to happen to humanity? He narrated again for Nataraj's benefit the story of Bhasmasura the unconquerable who scorched everything he touched, and finally reduced himself to ashes by placing the tips of his fingers on his own head. (203)

Finally, Nataraj realises the story of Gajendra-Moksha in Vishnu Purana, where Lord Krishna who is the incarnation of Lord Vishnu who saved the life Gajendra, Kumar. This teaches the moral lesson of how to pull down the killer and save the innocent: "God Krishna was really an incarnation of Vishnu, who had saved Gajendra; he would again come to the rescue of the same animal" (154). The novel has a well-knit plot and a fine gallery of vivid, life-like characters. The character of Vasu, the central figure is a masterpiece. The narration is enlivened by Narayan's comic vision which often mingles with pathos. In short, Vasu's death suggests mythical parallel. The novelist wants to show that no one can escape from Karma. He also shows the relation of birth and death to Karma. Even the character of Nataraj exemplifies the kind of people who the novelist would like to inhabit in his Malgudi. However, the novel also clearly shows that Vasu is open- hearted, vivacious and sometimes appears kind hearted too. If he takes Natraj to the Mempi village it is not for any harm but out of his high spirits and playfulness. At the same time, Vasu is a gigantic ex-circus "trong-man", is farther attributed as wild animal hunter and a taxidermist. Thus the main characters are in constant conflict with one another and illustrate the differences between two cultures.

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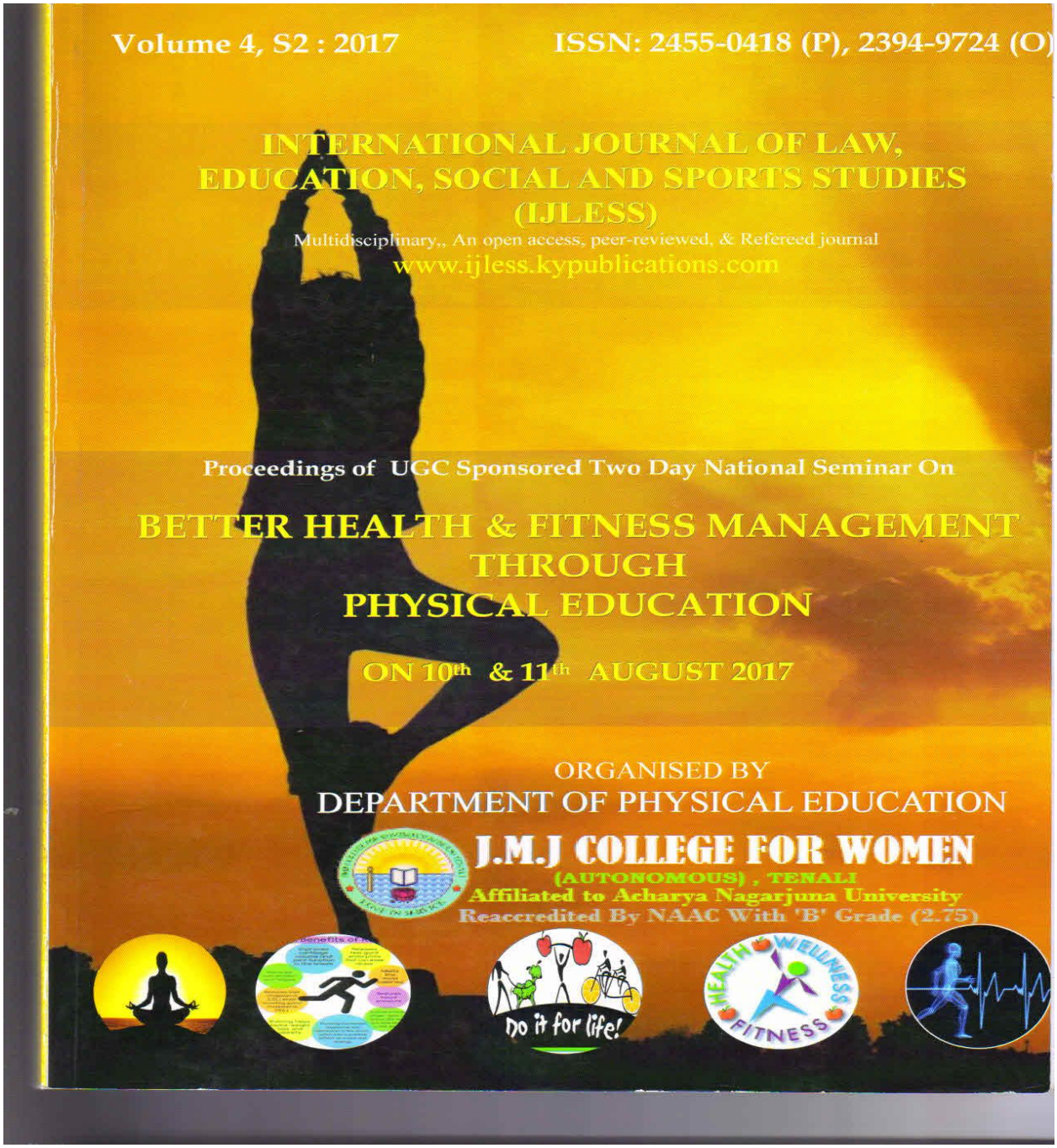

IJLESS
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INTERNATIONAL JOURNAL OF LAW, EDUCATION, SOCIAL AND SPORTS STUDIES (IJLESS)
Multidisciplinary, Peer-Reviewed and Refereed Journal
http://www.ijless.kypublications.com
editorijless@gmail.com
ISSN:2455-0418(P), 2394-9724(E); Vol.4.S2.2017

HEALTH AND FITNESS - BENEFITS OF SPORTS

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ABSTRACT

Sports and other physical activities have innumerable physical health benefits such as improving cardio respiratory and muscular fitness, bone health, increasing life expectancy, and coronary health. Sports can also help prevent various types of cancer and weight gain and have positive effects on mental health by reducing gloominess and improving cognitive function. There is an overwhelming amount of scientific evidence on the positive effects of sports and physical activity as part of a healthy lifestyle. The positive, direct effects of engaging in regular physical activity are particularly apparent in the prevention of several chronic diseases, including: cardiovascular disease, diabetes, cancer, hypertension, obesity, despair and osteoporosis. The WHO has estimated that one in four patients visiting a health service has at least one mental, neurological or behavioural disorder, but most of these disorders are neither diagnosed nor treated. A number of studies have shown that **exercise may play a therapeutic role in addressing a number of psychological disorders**. Studies also show that exercise has a positive influence on depression. Thus this article discusses the health benefits of sports and physical activity in individuals and communities as it enable the persons to maintain fitness to lead a happy life.

Keywords: Health, Fitness, Benefits, Sports and Physical Activity, Healthy Lifestyle

INTRODUCTION

Games and sports keep one physically and mentally fit. They keep one away from diseases relating to heart, obesity, mental stress and sleeplessness. They instil in the player a spirit of self-confidence, self-reliance, discipline, justice, fair play and patriotism. In recent decades, there has been a progressive decline in the level of physical activity in people's daily lives in developed countries. Later, people realized that physical inactivity is a major risk factor for most common non-communicable diseases. Presently sports and physical activity is used by young and old as a tool to improve mental, physical and social well-being. Moderate exercise and good sleep both enhance immune function. There is an overwhelming amount of scientific evidence on the positive effects of sports and physical activity as part of a healthy lifestyle. The positive, direct effects of engaging in regular physical activity are particularly apparent in the prevention of several chronic diseases, including: cardiovascular disease, diabetes, cancer, hypertension, obesity, depression and osteoporosis. Physical activity can help to prevent hip fractures among women and reduce the effects of osteoporosis. Remaining physically active can enhance functional capacity among older people, and can help to maintain fitness, quality of life and independence.

Games are very essential for students but they are neglected in schools and colleges. Even parents do not have high opinion about games and they want their children to devote more time to studies. India lacks funds, and proper training facilities are not provided to the players. Sports bring rich dividends to sportsmen. The government has formulated a New National Sports Policy. Effective measures should be taken to popularize, and encourage participation in games and sports. According to the World Health Organization, 'Health is a state of complete physical, the absence of disease.' Academics serve the purpose of nourishing the mind. But a healthy mind resides in a healthy body. One can develop and maintain a healthy body by actively participating in games and sports. Games keep the body alert, active, youthful and energetic. They instil in us a

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editorijless@gmail.com
ISSN:2455-0418(P), 2394-9724(E); Vol.4.S2.2017

spirit of adventure. Games increase the circulation of blood, boost metabolism, burn calories and improve the respiration and digestive system. A healthy person can work hard cheerfully for a long period of time, and can face dangers boldly. Games also instil in the players the spirit of self-reliance, self-confidence, justice, and fair play. They enable him to follow other virtues like discipline, honesty, integrity, loyalty and patriotism.

While playing games various exercises are performed automatically and one need not join a gymnasium to exercise. Brisk walking, running, cycling, skipping, swimming and yoga are common activities to keep fit. They also tone up the body of both the young and the old. Mild exercises are beneficial for patients recovering from heart attacks and those who suffer from obesity, diabetes, blood pressure etc. Exercise invigorates the mind and the body and helps to keep fit. A player develops team spirit; he learns to adjust with other person's shortcomings. A player respects and follows the rules of the game he plays. He, thus, becomes a man of principles. Sportspersons display punctuality, diplomacy and self-discipline. Sports help us to face the challenges in life bravely.

Many individuals may not take time to do exercise at home like pounding away on a treadmill or working up a sweat in the gym, but once the people start enjoying it, they will gain a number of benefits such as improving general health and well being. There are plenty of reasons why one should involve in sports as it reduce the body fat, bone strengthening, improve stamina and flexibility and so on. The following are some of the many health and fitness benefits of participating in sports and doing regular exercise:

- Playing sports helps reduce body fat or controls body weight.
- Sports enhance fitness and skills.
- Sports help to fight depression and anxiety.
- Sports enable to face challenges and set goals.
- Playing sports helps strengthen bones.
- Sports help aid coordination, balance and flexibility.
- Sports improve stamina and concentration.
- Sports allow one to experience the highs and lows of both winning and losing
- Sports enable the person to meet with a similar interest people and to gain many new friends.
- Sports improve healthy lifestyle.

Besides the above mentioned benefits, sports mainly emphasize on health as discussed below;

Physical activity and psychosocial health

The WHO has estimated that "one in four patients visiting a health service has at least one mental, neurological or behavioural disorder, but most of these disorders are neither diagnosed nor treated". A number of studies have shown that **exercise may play a therapeutic role in addressing a number of psychological disorders**. Studies also show that exercise has a positive influence on depression. Physical self-worth and physical self-perception, including body image, has been linked to improved self-esteem. The evidence relating to health benefits of physical activity predominantly focuses on intra-personal factors such as physiological, cognitive and affective benefits, however, that does not exclude the social and inter-personal benefits of sports and physical activity which can also produce positive health effects in individuals and communities.

Cardio respiratory Health

Sports can help people of all ages maintain and improve the health of their heart, lungs and blood vessels. Physical activity can significantly reduce the risk of coronary disease and stroke. According to the British Parliamentary Office of Science and Technology, approximately 40 percent of deaths related to

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ISSN:2455-0418(P), 2394-9724(E); Vol.4.S2.2017

coronary heart disease are related to inadequate physical activity, obesity, stress and raised blood pressure. Sports can help with all of these physical issues, decreasing the risk of **coronary disease by about 50 percent.**

Cancer

Sports can decrease the risk of colon cancer by as much as 300 percent, according to the British Parliamentary Office of Science and Technology. It can also significantly decrease the risk of breast cancer, and might decrease the risk of endometrial and lung cancer.

Psychological Health

Sports can be a form of mental therapy for people with psychological disorders and depression. Sports may promote self-esteem in the form of positive perception of body image and self-worth. By participating in sports with others, people can also enter in positive social environments to promote psychological health. Physical activity can also decrease the risk of cognitive decline that comes with aging and can reduce anxiety in adolescents.

Weight Maintenance

Sports can help promote long-term weight loss and help avoid weight gain. Sports increase metabolic rates and can help increase lean body mass while burning calories and getting rid of excess fat. Although the amount of physical activity needed varies by body type and caloric intake, sports can help a person maintain a healthy weight. According to the U.S. Department of Health and Human Services, between two and half to five hours of moderately-intensive physical activity can help achieve weight stability.

Bone Stimulation

Research has shown that even modest levels of physical exercise during growing years have a measurable, positive impact on bone strength. One study in particular determined that active children accumulated as much as 10 percent to 40 percent more bone mass in certain areas than non-active peers. However, the intensive and weight-conscious sports such as gymnastics and wrestling might lead to slower bone growth. Both female gymnasts and male wrestlers have later onsets of puberty and are shorter than children of the same age. Scientists suspect that a combination of high-intensity workouts and a restricted diet might work to slow overall development and bone growth. Light resistance training performed under appropriate supervision both improves performance in young athletes and protects against injury. The important point is that youth training should focus on technique rather than building muscle.

Barriers to participation in sports and physical activity

- Barriers to participation in physical activity include high costs, poor access to facilities and unsafe environments.
- A major socio-cultural and economic barrier is the manifest idea that sports is masculine and elitist. It is a widely shared perception transmitted by men and women through traditions, beliefs and social practices. This entails that women are not meant to be competitive and their body should not be muscular.
- Practical barriers include poverty and scarcity of economic means. For women this means a lack of time, a lack of appropriate, safe and accessible infrastructure, and no adequate clothing.
- Knowledge barriers include the lack of awareness of the benefits of physical activity. They however also deal with the myths such as the still prominent and thoroughly false perception that sports is a potential impairment to female fertility.

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ISSN:2455-0418(P), 2394-9724(E); Vol.4.S2.2017

CONCLUSION

Sports and other physical activities have innumerable physical health benefits, including improved cardio respiratory and muscular fitness, bone health, increased life expectancy, and coronary health. Sports can also help prevent various types of cancer and weight gain and have positive effects on mental health by reducing depression and improving cognitive function. On the whole, playing sports or engaging in extracurricular activities play an important part in one's character and personality development. One develops management skills, negotiation skills, communication skills, convincing skills, conflict management and confidence. However, effective measures should be taken to ensure people's active participation in games. The government should evolve a long-term national sports policy. Selection of players for national and international games should be fair. And also the government should find out the solutions for the barriers to participate in sports and physical activity by the people and promote the participation of skilled young people in sports and games as participation in sports and games could improve the overall health of the nation and its citizens.

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INTERNATIONAL JOURNAL OF MULTIDISCIPLINARY ADVANCED RESEARCH TRENDS
ISSN : 2349-7408
VOLUME IV ISSUE 2(2), SEPTEMBER, 2017

ROLE OF HIGHER EDUCATIONAL INSTITUTIONS IN NURTURING SOCIAL RESPONSIBILITY

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ABSTRACT

Higher educational institutions play a crucial role in creating knowledge society and it is the most important instrument for social, economic and political transformation of any society. Universities and colleges are essentially expected to inculcate values in students. Students being part of the society should know their responsibility in which they live and earn their livelihood. The recent economic crisis has highlighted societal commitment to education, underscored by the decision of some of the leading economic powers to spend massively on education as a sound investment for economic recovery and growth. Educational universities and colleges presently look to education not just to educate students and youth, but to bring out some social change and set a path to peace and sustainable development. Educational outreach efforts have the potential to make a real and lasting difference in the society and it is the most important sector to discharge its social responsibility. This paper discusses the need for the higher educational institutions to initiate and nurture social responsibility to impact social and economic development of the society.

Introduction

The economic, political and social changes that took place over the past decades have had an impact on the higher educational institutions, which have undergone an ample reform process meant to meet the new challenges. The changing environment in which universities and colleges function and the challenges that higher education has been facing were identified as: mass expansion of higher education; decrease of state expenditure and support for colleges & universities; diversification of financial resources; internationalization; commercialization; changes brought by Information and Communications Technology development, the adaptation of curricula to accommodate and capitalize on labour market requirements. These changes and challenges will have their impact on the quality of education, university and college autonomy, academic freedom, its changing focus and responsibilities towards society. This highlight that higher educational institutions are moving toward corporatization which calls for them to be a good corporate citizen and the best approach for the institutions to achieve that is by adapting the concept of Social Responsibility. Therefore, University & College students are taking up activities that make a difference to the marginalized sections of the society while at the same time enriching their learning experience. College going youth of today are a different bunch of thinkers. They are not just rooted to their passion to climb the academic ladder, but are equally concerned about bringing changes for the lesser privileged. They are utilizing their passion by encouraging them to give their time and energy for the social causes. The youths, now not only love to work for a cause while they study but continue to do the same even after getting jobs. It's a win-win situation

for the students who learn important life lessons by extending their service to the less privileged.

NURTURING SOCIAL ACTIVITIES ON CAMPUS

Students also work for the skill development initiatives for the under privileged as a part of social responsibility. These activities are contributing towards making the youth more responsible towards the nation.

According to Kantanen (2004, p.2), the role of education is crucial in social development and economic growth and recently cultural shifts are forcing teachers, scientist and policy makers to reflect on their purpose and function in the society. Hence, universities and colleges do not just educate students and youth, but to bring out some social change and set a path to peace and sustainable development. Producing the leaders of tomorrow and instilling in them the values and knowledge, it is necessary to build a more sustainable future, that it is also the social responsibility of institutions of higher education to take on an anticipatory role – to foresee and alert society to emerging trends and, ideally, to help prevent major crises. In Sweden, the service element, interaction with the society, was written in the Universities Act in 1998 (Virtanen, 2002). In Finland, the Universities Act has been amended and one of the changes is to strengthen universities' social role where universities are expected to engage and interact with the rest of society and to promote the social impact of their research findings (Kantanen, 2004).2 In the United States, a coalition of universities known as Campus Compact committed to helping students develop valuable skills through participation in public and community service .3

Education has a strategic importance in the current era; meanwhile it can be viewed as a systematic strategy which is used to create desired changes in individual behavior in society. Education produces basic properties and services for meeting the vital needs of a nation like health, security, education, defense, communication and cultural development. Through comprehensive efforts and targeted action plans, communities can improve educational outcomes, employment, and health and well-being of community residents. In order to promote social responsibility, firstly, the higher educational institutions should support a true culture of responsible activities throughout their institutions. Secondly, universities and colleges should extend community service focusing on one area and then developing other places by identifying their needs.

Social responsibility can be put into practice when university and college leaders emphasize responsibility to the public, ethical behavior, and the need to practice good citizenship. The leaders should be role models on ethics and the protection of community health, safety, and the environment. Practicing social responsibility refers to support of issues that are important to the public but that are within the limits and resources of the institution.

For example:

1. Improving education in the community, 2 pursuing environmental excellence, 3 practicing resource conservation, 4. promoting and improving the health of the community, 5. performing community service, 6. conducting research to generate socio-economic development and 7. providing guidelines for the development and sustainability of society.

Higher educational institutions can also influence other organizations and institutes, whether private or public, to promote research culture in order to develop the society. Universities should play the leading role in promoting research because taking research as one of the important social responsibilities can contribute to the development and sustainability of science, technology, and research. Universities can tailor their research missions to produce research that benefits the public, the local economy, and society (TurkBicakci & Brint, 2005). This can be accomplished through the joint efforts of governments and universities and colleges. Governmental efforts can facilitate a university's efforts to achieve this goal. For example, governments should develop, enforce, and pass laws and policies that help universities establish action plans for training students in technology, the sciences, agriculture, and the mechanical arts to meet the needs of the marketplace, industry, and agricultural technology.4

COMMUNITY EGAGEMENT

Most of the innovative examples of community engagement by institutions of higher education tend to focus on helping the community through the students. Students volunteer to support local schools, clinics, etc.; they help in tree plantation, or garbage collection. In many such examples, the purpose of engagement is based on the assumption that community needs knowledge and expertise that students bring. The second general purpose in these engagements is learning of students about the local realities through volunteering of their time and efforts. It is important, therefore, to more clearly and forcefully mandate that the core purposes of such community engagement by institutions of higher education is to serve mutually agreed interests of both communities and institutions. This implies that the partnership is mutually beneficial, and based on give and take by both sets of parties. Its translation in practice would entail recognition of authentic and actionable knowledge that communities have, which institutions can learn from; and empirical and theoretical knowledge of a macro nature that institutions have from which communities can benefit. It also implies that the thrust of this engagement is mutual empowerment, in the quest of supporting more democratic citizenship in the communities, amongst the students, and academics alike.

The second UNESCO conference on higher education held in Paris in July 2009 recognized the significance of social responsibility and community engagement for institutions of higher education; its declaration stated explicitly that "Higher education is a public good and the responsibility of all stakeholders". "Higher education has the social responsibility to advance our understanding of multifaceted

issues...and our ability to respond to them... It should lead society in generating [illegible] knowledge to address global challenges, inter alia, food security, climate [illegible] water management, intercultural dialogue, renewable energy and public health."

While progress in science and technology has brought considerable [illegible] for many, the associated rapid growth, increasing technology and consumerism [illegible] left a legacy of poverty, social exclusion, inequality and injustice, cultural [illegible] illiteracy and environmental deterioration.-Higher Education Institutions (HEIs) [illegible] no longer continue to stand aloof and disconnected but, rather, must [illegible] opportunities and become spaces of encounter where students and communities of [illegible] 21st century can learn together to become more active, engaged citizens in [illegible] creation of knowledge for a more just and sustainable world.

Conclusion

Education is a man making process and in this process the students should become part of making a better society to live in. Thus, nurturing social responsibility in higher educational institutions needs to be placed as an important pillar of [illegible] future directions. By improving engagements with the community, institutions of higher education can reinforce the values of social responsibility amongst the youth. Institutions of higher education are expected to serve three missions such as teaching, research and service. An emphasis on community engagement is an opportunity to inspire the systematic development of resource materials on the rural sector to build the knowledge and capacity needed to empower disadvantaged rural citizens.

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National Seminar on
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ISBN : 978-93-85101-95-3

THE CONSONANCE OF MATHEMATICS AND ENGLISH

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"Logic will get you from A to B and imagination will get you every where" –Einstein.

As a matter of fact, mathematics is very accurate and seeks clarity, while literature almost and seeks to complicate truths in interests of the aesthetic. There is no shortage of artistic people who claim to be terrified of mathematics and vice versa. But there are important points of connection: both are philosophical and both are creative. It is observed that the best mathematician is also an artist, capable of thinking out of the box and seeing things surprisingly different and better ways. This is how the best theorems have been discovered. While writing academic and creative pieces, one has to make sure that all the little bits fit properly, a harmony of parts to achieve a whole.

Mathematics can create beauty, geometry, harmony, structure, repetition and these things are used in arts for aesthetic purposes. Narration sometimes finds tricks in number 3. Many fairy tales and legends have characters to perform a certain action exactly in 3 ties. Most people have been introduced to the idea that the music has a positive impact on field of education especially mathematics. Logical thinking and music are based on math with patterns and ratios. One, two, buckle the shoe, three, four, knock the door.....our first, toddling relationship to poetry goes with our first fascination with numbers. In learning to rhyme, we begin to make sense of the world through patterns, making numbers run in sequence, connecting words with each other in all sorts of ways. A fundamental goal of the mathematics curriculum is to educate students to be active, thinking citizens, interpreting the world mathematically and using mathematics to make predictions and decisions and about personal and financial priorities and the study of Englishhelps us to create confident communications, imaginative thinkers and informed citizens. It is through the study of English that individuals learn to analyse, understand, communicate with and build relationships with others around them. It helps them to become ethical, thoughtful, informed and active members of society.

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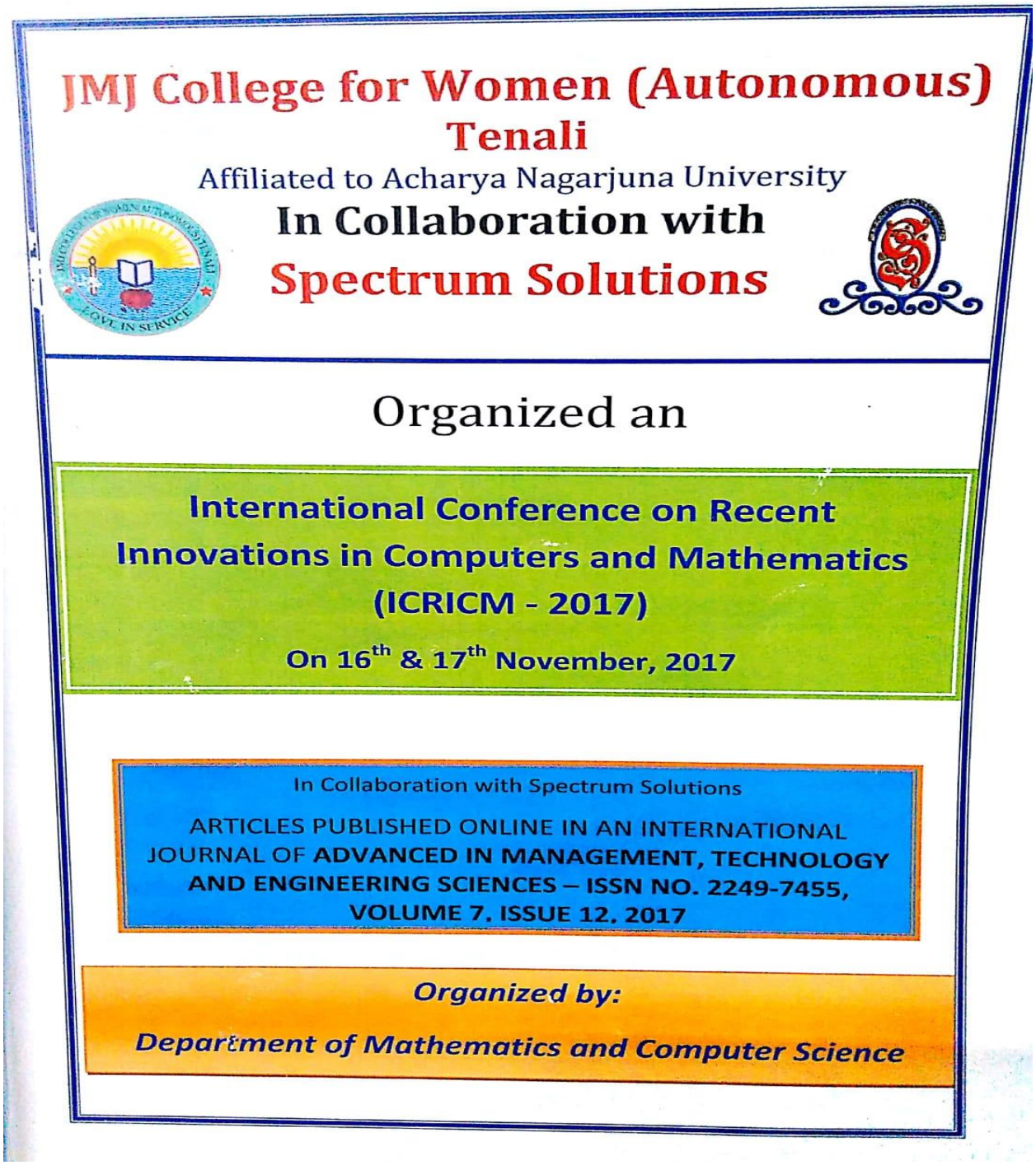

Various Types of Number System form Primitive and Hindu Number System and its Popularity

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Abstract: This paper is intended to present the different types of number systems across the world and their developments along with their notation system. The paper presents the relationship between the number system used in speech and in writing and their usage in the articulation and calculations. Different types of numbering systems are explained from primitive and prehistoric systems to the Hindu number system introduced by Aryabhatta.

Keywords: **Primitive and prehistoric number system, the Hindu number system.**

I-INTRODUCTION

In a simple manner, number system is a type of technique that we use to express numbers. Though each number is unique in its identity, the value of each number is different. It can be observed that different cultures and civilizations across the world have their own style of symbols to represent these numbers. This numbering system has been in usage for ages and still new style of symbols are coming to represent numbers from different countries. This representation is known as notation. When reasoning about numbers, we need some sort of number base, which is the fundamental number in which all other numbers stand in relation to. In recent times—we're talking perhaps a couple of centuries back in time—we also reason a lot about different sets of numbers that we have been able to create; therefore, the term number system has also been made to mean one of these sets. This paper presents the basic structure of various types of number systems across the world and the importance the Hindu number system and it significance.

A. The Relation of Numbers Used in Speech and in Writing

As we use numbers in writing, we use number words to represent the numbers in speech. Usually all the languages have number of words for a finite set of numbers. But most often due to lack of use in practice, many of the large numbers are dead. This paper will present the different types of number systems only if they are of some larger importance or of curious interest but also to speak about their abstract manner in a linguistic survey. Number notation is a type of techniques that is used to form numbers in text. This notation is often tightly linked with the language being used in particular area as there is often a connection between the way words are formed in speech and in the way they are formed in writing. This is, however, not always the case. The notation system is constantly changing over time as the scope of the number system and its usage is expanding. It has been observed that many of the researchers speak about various types of notation systems used by different societies through history. The reasons for much attention in this area are first it is our curiosity to understand the number systems of past times as there is no availability of record of the system used. Second, this continuous thirst for learning helps to understand the mathematical advancement of the civilization. Third, notation is such an inspirational thing and many readers want the written word but not the content. Therefore the study on the number system is increasing day by day.

Generally, a number base is a number in which other numbers stand in relation to. Numbers are expressed in a certain number base and calculations are performed using the values of a number given its base. Throughout the ages there have been an exceedingly large number of radices—a somewhat more scientific term with the same meaning as number base—by which mathematicians have performed their calculations. Perhaps surprisingly, and we are jumping the conclusions somewhat, our decimal—base 10 —number base, where all numbers are expressed as multiples of ten, is not the oldest, nor the one most often used. The number base is of

grave importance to the possibility of further advancement of a number system and the mathematics utilizing it. As we will see, a number base can stagnate a whole civilizations mathematical progression, and we will therefore give it an important role in our discussion.

II-TYPES OF NUMBER SYSTEMS AND THEIR DEVELOPMENTS

A. *Primitive and Prehistoric Number Systems*

Primitive and Prehistoric number systems are number systems that have been developed when there has been some need to express magnitudes. Examples of these are what is known as body count, the "bundle-of-sticks" method, tally sticks, 2-count, and neo-2-count. Although exceedingly primitive and limited in applicability, these systems have been the beginning of counting in almost every civilization, and many are still used by many of the primitive—in the sense of development, not ability to reason— cultures on Earth today. We will make a quick survey of these number systems and discuss their uses and their limitations.

B. *The "bundle-of-sticks" Method*

This method—for it is hardly a number system in its own right—is a way to represent magnitudes. It works by mapping a set of unmanageable items, say coconuts, unto something more manageable, say sticks. So, for each coconut we select a stick. When we have gone through all our coconuts, we will have the total number of coconuts represented by a bundle of sticks. This may not be counting in any real sense of the word, but at least we have arrived at a magnitude that is easier to deal with. The "bundle-of-sticks" method cannot be used to express anything but quantities, and can perhaps not even be considered a way to count. Nevertheless, it has been a method often employed for applications like the one described in the previous paragraph.

C. *2-Count*

2-count is what could perhaps be called a counting system, as it provides a way to count, yet provides no means to perform computations. It works as follows: There are number words for numbers 1 and 2, and sometimes an additional for expressing "many", i.e., an uncountable magnitude. These are then combined to express larger quantaties. This is, however, limited to small multiples of 2, as beyond a certain limit, counting the number of times that the word for 2 has been repeated would require a more advanced system in itself! This method of counting is seen across the globe even today, among primitive cultures, and many conjecture that it is so old that it has been with us since the first human civilizations began arising before people spread out on Mother Earth. This type of system is wide popular among the Bushmen in South Africa. As already stated, two-count is rather limited in applicability. Beyond a certain limit, it cannot be used anymore, as the number of repetitions become too large to keep track of. They have, however, played an important role in developing more usable systems and is the ancestor of the neo-2-count system discussed in the next section.

D. *Neo-2-Count*

Neo-2-count is an extension to 2-count, where words for 3 and 4 have been added, and larger multiples of 2 are expressed as multiplications of 2 with 3 or 4. The Toba in Paraguay use the system outlined in There are several variations to this scheme, but all amount to a simplification of expressing larger numbers. Of most interest, perhaps, is a system where groups of 4 is used, instead of 2. Still, these systems all share the same limitations as basic 2-count, in that they have an inherit limit in expressiveness.

E. *Body Counting*

Body Counting is another method for describing magnitudes. Body parts are associated with a given quantity and by touching them, the given quantity is inferred. It can be as limited to the ten fingers or as advanced as upwards of forty different parts of the body. Again, this system is constrained to a fixed limit, yet is an advancement over both types of 2- count. Body counting only occurs in areas prone to 2-count.

F. Tally Tricks

Not only limited to notches on sticks, tallies are most likely the oldest means of recording quantaties in human history. It is also the one that has stuck with us the longest, even being used for accounting well into the 1800th century. A tally stick is simply a piece of wood in which notches have been made, representing some quantity. More advanced forms have different notches, e.g., deeper grooves or crossed notches, to represent larger quantities. For recording some transfer of goods, talies where sometimes made and split in two along the tally so that later the transfer could be validated by both parties. When used for recording debts, tally sticks where often made shorter as parts of the debt were payed, removing notches corresponding to the returned amount. Not much more than a way to record transactions and quantities, tally sticks nonetheless have played an important role in many civilizations, as the need for such records have become apparent. Many are truly a beautiful piece of history, as their importance often warranted great care in their creation.

G. The Hindu Number System

The Hindu number system as we know it today—for it is more or less the one we (as in us Westerners) use today as well—can be attributed to two men: the great hindu astronomer Âryabhaṭa and his pupil Bhâskara I, during the period 499-522 B.C.E. Âryabhaṭa invented a system that was based on using syllables and combining them to form greater numbers. Bhâskara I simplified the system somewhat and made it decimal place-value system. The Hindus had used a decimal system for a long time and even had the zero before this time, but it was not until these two astronomers came up with their system for forming numbers that the system was more or less complete. As all Hindu literature was written on verse form, they also had to come up with a system to form numbers that fit well in verse. Thus, they substituted different words for numbers. Examples are "moon" for one, as there is only one moon, "eyes" for two, as we have two arms, and so on. 201 would then be paksa-kha-eka, or eyes-hole-one. The zero was very important in the development of the Hindu number system, as it allowed for the introduction of a place-value decimal system using only nine other symbols. This made calculations much simpler than any previous system could have provided. The zero later reached the Arabs, who were not very fond of it. Even the great al-Khowârîzmî-who has given name to the word "algorithm"—considered there to be only nine numerals, even though he made use of the zero. Even though, that Devanagari is only one of a multitude of different scripts in the Hindu region and is merely an example of Hindu numerals.

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IF : 4.547 | IC Value 80.26

Volume-6, Issue-9, Special Issue September-2017 • ISSN No 2277 - 8160

Original Research Paper

English

GENDER EQUALITY AND WOMEN EMPOWERMENT

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ABSTRACT The article discusses gender equality, legal and constitutional safeguards against gender inequality, women in Indian cinema and literature, empowerment of women, and strategies for women empowerment. Gender equality is defined as discrimination against women based on their sex. Women are traditionally considered by the society as weaker sex. She has been accorded a subordinate position to men. She is exploited, degraded, violated and discriminated both in homes and in outside world. Women are insinuated in films as bearing the burden of sexual objectification that male roles cannot. Most Indian women live a silent life with enormous amount of sacrifices and retain their frustration within themselves for the sake of societal pressure. The constitution promises formal equality to man and woman but the structure and functions of the society through its institutions norms values etc., and is in a peculiar way that man is getting the privileges and advantages and woman is underprivileged and disadvantaged. Hence, empowering the women in this 21st century is very essential as it gives them the capability of challenging and changing their subordinate position in the society. It not only empowers their position but enable them to live productive lives whereby improves the lives of their children, families and the nation.

KEYWORDS : Gender Equality, Women and Cinema, Women Empowerment, Strategies

INTRODUCTION

Gender equality has been universally accepted as a serious shift towards sustainable human development. In India, although some progress in women's development has been made, yet women continue to lag behind which is an outcome of a web of complex forces. The adverse sex ratio, poor educational and nutritional status, inequality in wages and violence against women are prevalent in the Indian society, like many other patriarchal societies of the world, even today, and the gender discrimination certainly continues to be an enormous problem within the Indian society. To fight for the equal rights for women, there have been feminist movements around the globe. It had started in France and UK, and gradually spread across the entire world. Modern Western Feminist history is split into three periods or waves. The first-wave feminism of the nineteenth and early twentieth century focuses on overturning legal inequalities. The second wave feminism includes cultural inequalities, gender norms and the role of women in society. The third wave feminism refers to both continuations of the second wave and a response to the perceived failures and it also refers to post-colonialism. While women in the western countries had to fight for the voting rights, women in India had been granted the voting rights by the Constitution of India. Indian feminists had to fight against culture-specific issues within India's patriarchal society. The patriarchal attributes include dowry, giving importance to sons etc. Also there are issues like female infanticide and female foeticide that exist in the Indian society. Saroj Nalini Dutt, Sarala Devi Chaudhury, Prem Chowdury are some of the well-known Indian feminists who have fought for the women's rights. But, despite the progress made by the Indian feminist movements, women living in the modern India still face various issues of discrimination. However, today, women in India are struggling to be at par with men. The social reformers like Raja Ram Mohan Roy, Pandit Ishwar Chandra Vidyasagar and others brought a revolution in the Indian society by abolishing sati and encouraging widow remarriage. They also played a great role in introducing western education and in encouraging women to become educated by setting up schools and colleges especially for women. Even the political revolutionists like Mahatma Gandhi and Pandit Jawaharlal Nehru gave women a new dimension. There have been women like Sarojini Naidu, Indira Gandhi, Kiran Bedi, Kalpana Chawla and many others who have been successful in proving the fact that they are no less than men. There are also women who have played a heroic part in the Indian freedom struggle. Therefore, women must be allowed to participate at all levels of society.

LEGAL AND CONSTITUTIONAL SAFEGUARDS AGAINST GENDER INEQUALITY

Indian Constitution provides for positive efforts to eliminate gender inequality; the Preamble to the Constitution talks about goals of achieving social, economic and political justice to everyone and to provide equality of status and of opportunity to all its citizens. Further, women have equal right to vote in our political system. Article 15 of the Constitution provides for prohibition of discrimination on grounds of *sex* also apart from other grounds such as religion, race, caste or place of birth. Article 15(3) authorizes the Sate to make any special provision for women and children. Moreover, the Directive Principles of State Policy also provides various provisions which are for the benefit of women and provides safeguards against discrimination.

Other than these Constitutional safeguards, various protective Legislations also have been passed by the Parliament to eliminate exploitation of women and to give them equal status in society. For instance, the Sati (Prevention) Act, 1987 was enacted to abolish and make punishable the inhuman custom of Sati; the Dowry Prohibition Act, 1961 to eliminate the practice of dowry; the Special Marriage Act, 1954 to give rightful status to married couples who marry inter-caste or inter-religion; Pre-Natal Diagnostic Techniques (Regulation and Prevention of Misuse) Bill (introduced in Parliament in 1991, passed in 1994 to stop female infanticide and many more such Acts. Furthermore, the Parliament time to time brings out amendments to existing laws in order to give protection to women according to the changing needs of the society, for instance, Section 304-B was added to the Indian Penal Code, 1860 to make dowry-death or bride-burning a specific offence punishable with maximum punishment of life imprisonment. So there are varied legislative safeguards and protection mechanisms for women but the ground reality is very different. Despite all these provisions women are still being treated as second rate citizens in our country; men are treating them as an object to fulfil their carnal desires; crimes against women are at alarming stage; the practice of dowry is still widely prevalent; female infanticide is a norm in our homes.

WOMEN IN INDIAN CINEMA AND LITERATURE

The medium of cinema representing social and historical practice regarding gender approach is a crucial phenomenon in sociological studies. It can be said that media are crucial in the construction of gender ideologies and gender socialization. Products of media culture provide materials out of which we get our identities, our sense of selfhood, our construction of ethnicity, race and nationality, of sexuality and of 'us' and 'them' (Dines and Humez, 2003).Film and cinema are the most commonly used mass media to communicate with the public. The fact that cinema is a mediator of social realities and personal dreams, collective concerns and individual aspirations

make it assume a seminal dimension as a humanistic discourse which has the potential to redirect the cultural and material fabric of our everyday lives (Jain and Rai, 2002). Women's position within media power structures and media representation of women are persistent concerns in every society, because negative stereotyping and lack of female input both reflect and reinforce wider gender inequalities. Films, indeed in the most effective manner maintain the diffusion of traditional female gender roles, which women are depicted in culture and society. Research on gender and cinema has emphasized the question about women's identity. In fact, the study of the images of women in cinema were a central concern of the 'second wave' feminism of the 1960s and 1970s, criticizing women's image in film and women's roles in the film industry (Jackson and Jacjie, 1998).

Women are insinuated in films as bearing the burden of sexual objectification that male roles cannot. Hence, they become the bearer, and not the maker of meaning says Laura Mulvey (Mulvey 834). Most Indian women live a silent life with enormous amount of sacrifices and retain their frustration within themselves for the sake of societal pressure. They are portrayed either as damsels in distress or demented feminists or simple belly-shaking glam dolls whose sole ambition is to attract the attention of the male gender. Occasionally, do we see a female being the protagonist of a film than merely being objects of sexual desire. In some cases there appears to be a clash between 'modern feminism' and 'traditional values'. Indian cinema often acts like an emotional register and is very resourceful while reading the characterization of women. The men in Indian cinema either projected as 'romantic heroes' or the 'bad guy' are indubitably majestic on screen space unlike our female characters that always tend to lead a surrendered life even on the screen. *As Vrinda Mathur (2009: 66) says,* ***'The male characters of Indian cinema, i.e. the heroes(those knights in shining armour) and the villains (those over-energetic sharks) move around the space of the movie like players in a deadly choreographed game of chess - with the women characters as sacrificial pawns.'*** The films that focus on women protagonists showcase their search for self through their bodies. This is quite outstanding in the film *Chandni bar*. taMumz character played by Tabu the protagonist is forcefully sent by her maternal uncle to be a show girl in a dance bar. Her major source of income was from performing the dance in the bar. She would maximum need to groove her body to the music and there would be scores of men willing to shed their money on her for the very own reason - voyeuristic desires. This woman's body is given the penultimate magnitude in many of the films. And in these films the act tends to start with a rebellious nature and the instrument being their body. *As Jasbir Jain (2009: 121) has observed, "Rebel women are portrayed with ridicule and comedy. Rebelliousness need not always be conclusive or even approved within the narrative structure. At times it may be part of the discourse on modernity and perceived as a potential threat to patriarchy through the values of education/westernization/independence".*

The condition of women has also been reflected in literature. While Jane Austen's works addressed women's restricted lives in England in the early part of the nineteenth century, Charlotte Bronte, Anne Bronte and George Eliot depicted women's misery in their works. Likewise, even Indian literature has projected the terrible condition of women in the Indian society. In *Roots and Shadows*, Shashi Deshpande studies the issues and problems of the contemporary middle class women. Again, Rabindranath Tagore reveals the dark side of the Indian society in his famous short story, *Dena Paona*. Nirupama, the sensitive girl in *Dena Paona*, was humiliated to death as her father did not pay the dowry in full. Mahesh Dattani also projects in his post-modern drama, *Bravely Fought the Queen*, how every woman is crumbled by patriarchy in the Indian society.

HOW WE CAN ELIMINATE GENDER INEQUALITY

The list of legislations as well as types of discriminations or inequalities may go on but the real change will only come when the mentality of men will change; when the male species of human beings would start treating women as equal and not subordinate or weaker to them. In fact not only men but women also need to change their mindset as through cultural conditioning they have also become part of the same exploitative system of patriarchy and are playing a supportive role in furthering men's agenda of dominating women.

Therefore, what is needed is the movement for Women's empowerment where women can become economically independent and self-reliant; where they can fight their own fears and go out in the world fearless; where they can snatch their rights from the clutches of men and they don't have to ask for them; where women have good education, good career, ownership of property and above all where they have freedom of choice and also the freedom to make their own decisions without the bondages of age old saying of **Manu**.

Let's hope and wish that our participative democracy, in times to come, and with the efforts of both women and men, would be able to found solutions to the problem of gender inequality and would take us all towards our cherished dream of a truly modern society in both thought and action.

Empowerment of Women

Empowerment of women means rearranging gender relations within the family and in the society. It also means giving societal recognition to gender equality and considering the contributions of each gender as independent persons. Empowerment of women gives them the capability of challenging and changing their subordinate position in society. Women are able to put forward their viewpoint by way of their participation from the beginning of planning process or a project. It also helps women to develop the ability for effective bargaining. Empowerment of women means creating a fearless society for the women to live in free from all violence and atrocities.

Strategies for Women Empowerment

- **Education:** Education is an undeniable fundamental human right; for it improves self esteem and forms the basis for active participation. Professional counselling and career which stimulate women's creativity need to be promoted, so as to develop self-confidence and self reliance leading to an independent status.
- **Technology**: In terms of knowledge and skills, technology has to become accessible to women. The society should give the freedom to women to improve and upgrade their skills to use latest inventions and innovations to top their creativity.
- **Training in various skills:** Trainings provide the women with an opportunity to grow as an individual with an independent and equal status to that of a man. If the Government provide them training and opportunities, that promote specific skills, women are able to further not only their own growth and development but also that of their families.
- **Access to Credit:** It is essential for a woman to be able to lead an independent existence and emerge from the secondary status. Poverty has driven countless women to low status; low paying occupations in the unorganized sector with hardly any social, emotional, physical. Women's economic contribution to development in terms of her household chores and domestic responsibilities has to be accorded due recognition.
- **Space to Grow:** One must encourage women to enter non-traditional schools of learning and occupations, their creativity and talent and skills be given opportunities to flourish. Only this can ensure the emergence of the woman as human being with an individual personality.

CONCLUSION

Gender equality can come only when there is a transformation of the patriarchal structures and systems that lie at the root of women's subordination and gender inequality. The prosperity of India depends completely on the condition of women. Providing women

and girls with equal access to education, health care, decent work, and representation in political and economic decision-making processes will fuel sustainable economies and benefit societies and humanity at large. If there is gender equality, only then can India advance towards progress and prosperity. Empowering women to participate completely in economic life across all sectors is essential to build stronger economies, achieve internationally agreed goals for development and sustainability, and improve the quality of life for women, men, families and communities. Gender equality in films is very essential to enhance women's exposure, power and payment. The proposed **Sustainable Development Goal 5** addresses this and reads "Achieve gender equality and empower all women and girls". The vital role of women and the need for their full and equal participation and leadership in all areas of sustainable development was reaffirmed in the future.

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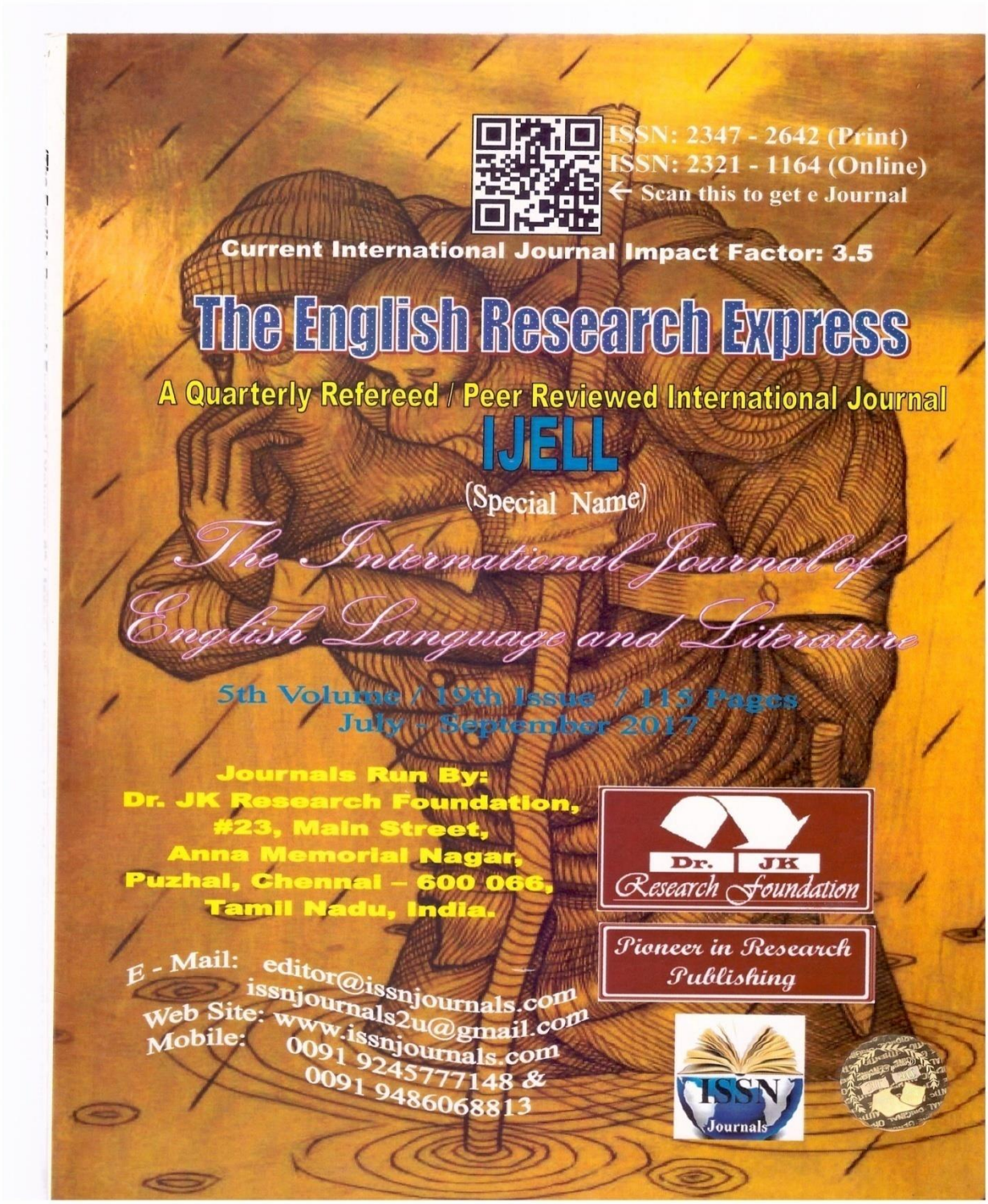
ISSN: 2347 - 2642 (Print)
ISSN: 2321 - 1164 (Online)
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Current International Journal Impact Factor: 3.5
The English Research Express
A Quarterly Refereed / Peer Reviewed International Journal
IJELL
(Special Name)
The International Journal of English Language and Literature
5th Volume / 19th Issue / 113 Pages
July - September 2017
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Volume: 5 / Issue: 19 / Pages: 115
July - September 2017 (First Edition)

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The English Research Express ISSN: 2321-1164 (Online); 2347-2642 (Print)
IJELL- International Journal of English Language and Literature
Peer Reviewed (Refereed) International Journal run by Dr. JK Research Foundation, Chennai, India
2016-17 Journal Impact Factor: 3.5

Dr. JK Research Foundation

Pioneer in Research Publishing

Volume: 5th & Issue: 19th (July – September 2017) PP: 76-82 Date: 25-09-2017

HOME AND ABROAD: THE EMOTIONAL SAGAS OF JHUMPA LAHIRI'S *INTERPRETER OF MALADIES*

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Abstract:

In her first collection of short stories, Interpreter of Maladies, which won her the Pulitzer prize for fiction 2000, Jhumpa Lahiri has portrayed the various experiences of the diasporas in Boston and Calcutta. In seven out of the nine stories in this collection, Lahiri presents the three generations of mainly Indian Bengali Expatriates to America, who came to America to escape political or economic difficulties of their native land, or to study or as professionals "as part of the brain drain", Indian born Americans and their children. It reveals the conflict between distinct cultural and regular encounters between different worldviews shape the emotional life of the diaspora even in multi-ethnic, multicultural societies like India and the USA. It is a complex portrayal of family life of Indian immigrants trying to saddle two cultures – their Indian heritage and the American dream. Interpreter of Maladies, despite the clear insignia of Indianness is universally relevant. With a remarkable insight, she gets deep into the psychological depths of her characters and reveals their inner world by a fascinating yet deceptively simple style. We come across more reality than fancy in her fiction.

Keywords: *Interpreter, Indian Bengali Expatriates, economic difficulties, Cultural, multi-ethnic, multicultural, psychological depths.*

The English Research Express ISSN: 2321-1164 (Online); 2347-2642 (Print)
IJELL- International Journal of English Language and Literature
Peer Reviewed (Refereed) International Journal run by Dr. JK Research Foundation, Chennai, India
2016-17 Journal Impact Factor: 3.5

clutching at a world that was never fully ours with encouragement."

This dilemma, this sense of emotional exile and the excruciating pain it entails is at the core of the stories in Interpreter of Maladies which has not only gleaned rare reviews from countless critics but has also been sold in Germany, the U.K. and in several other countries. Six of the nine stories in the collection have their settings in America and deal with the lives of Indian immigrants who hope to find a better life. But what they discover is often vastly different from what they imagined. The rest three are set in India and deal with the type of subaltern personalities and the conflicting encounters among them in a style that is highly accessible, absorbing and moving.

The opening story *A Temporary Matter* finely portrays the conjugal crisis of a young couple – Shoba and Shukumar- who don't know how to cope with the grief bequeathed by their stillborn child, and the gradual erosion of their intimate togetherness in Boston. The announcement of hour-long power cuts in the evening – though a temporary matter- comes to their rescue. They begin to sit together again and communicate with each other during the black-outs, share some moments of intimacy, exchange confessions and appear to have moved closer to some understanding. Memories of India do play a vital role in their interludes of intimacy.

> ***"I remember during power failures at my grandmother's house, we all had to say something,"***

Shoba continued

> ***"…….. Shukumar hadn't spent as much time in India as Shoba had…….He wished now that his own childhood story of India."***

"It was only then …… that I knew what it meant to miss someone who was so many miles and hours away" sets the tone of When Mr. Pirzada Came to Dine, the second story in the collection. Set again in Boston, the story has Indo- Pak war of 1971 and the birth of Bangladesh as the backdrop. In the story Lahiri attempts a 'forge her own amalgamated domain' rather than respond to her parents cultural nostalgia. In her own words,

> ***"My focus in this story wasn't the unilateral translation of a place or language. Instead it was a simultaneous translation in both directions of characters who literary dwell into two different worlds."***

The title story *Interpreter of Maladies*, the third and longest story in the collection, is set in Puri, India. The phrase

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'Interpreter of Maladies' flashed across Lahiri's mind following an encounter with an acquaintance in Boston way back in 1991. It is a complex story about an Indian-American couple-Mr. Das, his wife Mina and their three children – Tina, Ronny and Bobby.

The two other stories with their setting in india are *A Real Durwan* and *The Treatment of Bibi Haldar*. In these two stories lahiri portrays the lives of servants and marginal figures. They are unlike their economically sound counterparts in other stories. Questioned as to why she made this choice, Lahiri answers:

> ***Both of these characters came out of observations of people when I was there (Calcutta). What drew me to writing about them was partly a projection of my feelings of being marginal when there, of not being of the culture, of feeling foreign even when this was a place my parents call home and refer to in their minds as home, even though they've been away for 30 years.***

A Real Durwan was written, recalls Lahiri, "soon after return in g from a visit to India in 1992, in my bedroom in parents' house in Rhode Island." It is a pathetic but powerful pen-picture of an old lady, Boori Ma, a self-employed sweeper of the stairwell of a multi-storeyed building. Her services 'came to resemble those of a real durwan' because in exchange for her lodging below the letterboxes, she kept the 'crooked stairwell 'spotlessly clean. Apart from this, 'the residence liked that Boori Ma, who slept each night behind the collapsible gate, stood guard between them and the outside world'. But the same residents, accusing her of the theft of the basin, throw her out one day because they need a real durwan as 'Boori Ma has endangered the security of the building'. The vagaries of material possession plaguing human relationship from the matrix of this story.

The treatment of Bibi Haldar is yet another moving tale of a 29 year orphan, unmarried girl who suffers from a mysterious disease. Staying in a married cousin's house ,she has to sleep, initially, on a camp cot downstairs but is, subsequently, forced to stay in the storeroom forever as her presence, the Haldar couple to get her married, as the doctor in charge of Bibi's case, after performing a series of blood tests 'concluded that a marriage would cure her'. The story ends on a positive note: "for years afterwards, we wondered who in our town had disgraced her…… But there was no point in carrying out an

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investigation. She was, to the best of our knowledge, cured".

A brief but deeply intimate adulterous relationship constitutes the core of *Sexy*, the fifth story in this collection. Miranda, a young American, falls in the love with Dev, a married Bengali investment banker, whose wife has left for India for a few weeks. The story ends with Miranda's deciding to end the relationship and returning to places where Dev had kissed her.

The poignant realization of the loss of the familiar is well treated in the next story *Mrs. Sen*. The story presents the difficulties faced by Indian wives in an alien culture, without friends or family, struggling to cope with the new surroundings they can't call their home. It skillfully probes the mixed feelings of an American child fear, astonishment, fascination and awe-toward an Indian abroad.

> ***"In this beautifully observed story East meets West in the shared experience of loneliness and the poignancy of Mrs. Sen's situation in handled with utmost delicacy and control unsullied by any hint of mawkishness."***

The story is partly autobiographical. Lahiri herself admits, *Mrs. Sen* is based on my mother who baby sat in our home. I saw her one way but imagined that an American child may see her differently reacting with curiosity, fascination or fear to things I took for granted.

In *This Blessed House* a more cosmopolitan community is the background for a power struggle to a fairly newly married Indian couple who try to adjust to life in postmodern America. Both husband and wife are ethnic Indians, united through an arranged marriage that took place in India. Sanjeev is soon frustrated as he felt that

> ***"he was getting nowhere with her, with this woman whom he had known for only four months. This woman with whom he now shared his life".***

The reasons behind the emotional and spiritual distance between spouses trying to adopt the culture of their new home are excellently explored in this story. Lahiri empowers her female protagonist at the expense of her male one, and the means by which she does so has something to do with Twinkle's ability to transform her mindset so that it might align itself effortlessly to a different, 'western' culture.

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The English Research Express ISSN: 2321-1164 (Online); 2347-2642 (Print)
IJELL- International Journal of English Language and Literature
Peer Reviewed (Refereed) International Journal run by Dr. JK Research Foundation, Chennai, India
2016-17 Journal Impact Factor: 3.5

The stories reflect a wider time span, stretching from the time of post-partition to a cross-cultural, globalised present that lies "beyond". Juxtaposing them gives us an idea not only of how cultural traditions in the past shaped and affected the characters understanding of their subjectivities, but also of how the continuous process of change has influenced individuals more or less radically in different parts of the world. The characters search for their origin, finding a place or a nation that may be called one's own and belonging to either the Indian subcontinent or the USA, or in other words, making a choice between the concepts of cultural identity and multiculturalism seem to remain juxtaposed always. It is at a transitional point between the third world and the first the world of Jhumpa Lahiri's fiction can be located. India with her concept of 'unity in diversity' and the USA as the melting pot of cultures and races, co-exist in her fiction.

Roots, origin, family bonds induce expatriate, immigrant non-resident Indians to return again to the point from where they move away. This emotional and spiritual bond gives form to Jhumpa Lahiri's stories and about such a state of expatriate existence, the following words of Aamer Hussin seem to be the most appropriate:

> ***"it implies neither a forced eviction from one's motherland, nor a deliberate rejection; there are no connotations of permanent or obligatory leave taking. There is, instead, a tremendous inherent privilege in the term, a mobility of mind if not always of matter, to which we as writers should lay claim: a doubling instead of a split."***

Jhumpa Lahiri as a fictional creator, occupies this privileged space in between two countries, two continents, two cultures, and this multiplicity of perspectives, a truly multi-national existence and a multi-cultural experience makes her one of the foremost spokespersons of the multitude of minute yet consequential incidents that constitute contemporary life.

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Title of the Paper: **HOME AND ABROAD: THE EMOTIONAL SAGAS OF JHUMPA LAHIRI'S *INTERPRETER OF MALADIES*** / Author: **Ms. N. Vimala Devi** / Pages: **76-82** / Date of Publication: **25/09/2017**

3. **Naresh Fernandes**, *"An interview with Jhumpa Lahiri,"* Literature 13 June, 1999, 18.

4. **Vibhuti Patel**, *"Maladies of Belonging: An Interview with Jhumpa Lahiri,"* Newsweek International, 20-9-1999

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8.

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The Namesake (2003) is Jhumpa Lahiri's second work in which she deals again with the theme of isolation and the problem of assimilation and adaptation in another country. The novel is an autobiographical in portraying repercussions of what the children of immigrants have to experience when they are destined to born in a country which does not belong to their parents. Jhumpa lahiri who herself is a child of an immigrant couple had admitted it in an interview. The novel opens in a nostalgic mood. A cross-cultural multigenerational saga of a Hindu Bengali family's journey to self acceptance in Boston. *'The Namesake* ' is a novel that offers a "Chekhovian exploration of father and sons, parents and children, as it is resonant in its exploration of what is acquired and lost by immigrants and their children in pursuit of American Dream." The New York Times, aptly describes it as a "debut novel that is as assured and eloquent as the work of a long-time master of the craft."

The spirit of exile and alienation enables the diasporic writers to seek refuge in their writings and establish a permanent place in the minds of their readers. Lahiri does exactly the same. Her handling of the complexities of immigrant experience shows her simple yet a very mature approach, expected of such a fiction writer.

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Jhumpa Lahiri was born in London, in July1967, and brought up in South Kingstown, Rhode Island. Although she was brought up in America, she became very close to her Bengali heritage from an early age. Lahiri has traveled extensively in India, and has experienced the effects of colonialism there in addition to the issues of the Diaspora as they exist. She feels strong ties to her parents' homeland as well as the United States and England. "Though endowed with a distinct universal speech, her stories do bring out fairly successfully the predicament of the Indians who trapeze between and across two traditions,one inherited and left behind, and the other, encountered but not necessarily assimilated " remarks Aruti Nayar. We visited the place often but we didn't have a home. We were clutching at a world that was never fully with us Lahiri described this absence of belonging, "No country is my motherland. I always find myself in exile in whichever country I travel to, that's why I was tempted to write something about those living their lives in exile." This idea of exile runs consistently throughout Lahiri's Pulitzer prize winning book Interpreter of Maladies (1999). It is a complex portrayal of family life of Indian immigrants trying to saddle two cultures – their Indian heritage and American dream. It won critical acclaim for its grace, acuity, and compassion in detailing lives, transported from India to America." Interpreter of Maladies, despite the clear insignia of Indian-ness is universally relevant. With a remarkable insight, she gets deep into the psychological depths of her characters and reveal their inner world by a fascinating yet deceptively simple style. We come across more reality than in her fiction.

Isolation and alienation are common themes portrayed extensively throughout all of Lahiri's short stories. Through tales such as 'A Real Durwan' and 'The Treatment of Bibi Haldar', Lahiri exposes the extreme isolation and alienation experienced by the main characters, presenting them as outsiders who are perceived by others as being , diseased. The characters encounter severe alienation due to a lack of personal possession, value and success. The bare and blatant truth of the Indian caste system as well as the power of materialism is strongly shown in these two stories as a main motive of loneliness. The theme of displacement significantly portrays Lahiri's prose toward interpreting Indian – American customs and traditions, such as food, clothing, language and history.

In a recent interview to Newsweek, Lahiri pointed out that the older she gets, the more aware she is, that she has "inherited a sense of exile" which strongly pervades her major writings. Lahiri's major concern is the "question of identity which is always a difficult one, but more so for those who are culturally displaced, like the immigrants are, or those who grow up simultaneously." When asked how she felt growing up as the child of immigrants, Lahiri explained, "It was always a question of allegiance, of choice. I wanted to please my parents……I also wanted to meet the expectations of my American peers… it was a classic case of divided entity." Thus we can see that it is the complications of being a hyphenated American that informs her work completely. Lahiri's true genius resides in capturing the

ordinary moments in the life of her characters and transforming them into works of art. She combined her authentic familiarity with the lives of the Indian diaspora and her gift for inhabiting the space of he characters while describing the most mundane experiences, thus making the readers identify with the characters.

Unlike the landscape artist with an imposing canvas and sweeping bold strokes, a short story writer is a miniaturist. With deft and precise strokes lahiri too, like a true miniaturist, straddles between two worlds of Boston and Bengal with great ease. Her collection of short stories The Interpreter of Maladies negotiates dilemmas of the cultural spaces, with a master's touch. Lahiri's success is in the fact that she has emerged as an interpreter of exile in its various nuances and manifestation. The Interpreter of maladies is a collection of nine stories, depicting the trauma and angst of the first generation and second generation Indian migrants to the United States. The themes range from emotional struggle of love to immigrants battling new worlds. Her stories are marked by a sense of alienation, longing, loss and hope which so often mark the immigrant experience, and which form a part of what she, her parents and friends too experienced as fellow immigrants. As she says in an interview, "I always say that I feel that I have inherited a sense of that loss from my parents because it was palpable all the time I was growing up, the sense of what my parents had sacrificed in moving to the US and in so many ways."

Though most of the stories in this collection have an American setting, India especially Calcutta keeps rearing its head in the memory of its characters. Her earlier stories – Areal Durvan, The Treatment of Bibi Haldar and The Interoreter of Maladies, are set in India. The first two stories centre around women living on the fringes of the society, and are exploited by their own people. India continues to form a part of the fictional landscape, as Lahiri draws heavily on the memories of her parents to depict an India, she did not know. Her stories though set in America , are full of details of traditional Indian name, food cooking and wardrobe giving character and an Indian flavor to her stories.

Lahiri stories reflected the minutest details of displacement, as she had experienced it firs hand. Probing into the psyche of culturally displaced individuals she says, "I think that for immigrants, the challenges of exile, the loneliness, the constant sense of alienation, the knowledge of and longing for a lost world is more explicit and distressing than for their children. *When Mr. Pirzada Came to Dine, Mrs. Sen and The Third and the Final Continent* present the Immigrant's struggle to survive in this world where they try to fight their homesickness, and also convey the nostalgia for their own country which they have left behind. These stories provocatively present Lahiri's concern for the fading of origins.

A Temporary Matter, Sexy and This Blessed House bears a great closeness to Lahiri's own personal experiences. A Temporary Matter is a story of young couple, Shukumar and Shobha, who have drifted apart after losing their child in a miscarriage. Neither of them have the

capacity to provide emotional anchorage to the other. Both deliberately avoid each other. One day they find a small note in their mail box, indicating that the electricity would remain disconnected for a few hours, everyday for a week. In the enforced darkness the couple finds a pretext for discovering their latent, subconscious fears and dark secrets., and also about their 'little betrayals'. By the time the week is over, the couple reaches a point of no return and Shobha, the bread winner walks out on Shukumar who at thirty-five hasn't progressed beyond being a student. There is a reversal of gender roles here with Shukumar doing all the cooking and cleaning, and being blamed for the miscarriage, whereas in India the mother would bear all the responsibility.

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DEPARTMENT OF MATHEMATICS

9. Published a paper titled "pseudo Symmetric Ideals in Semigroups" in the international journal of Advanced Research Trends in Engineering and technology August 2017 with ISSN:2394-3777, ISSN 2394-3785

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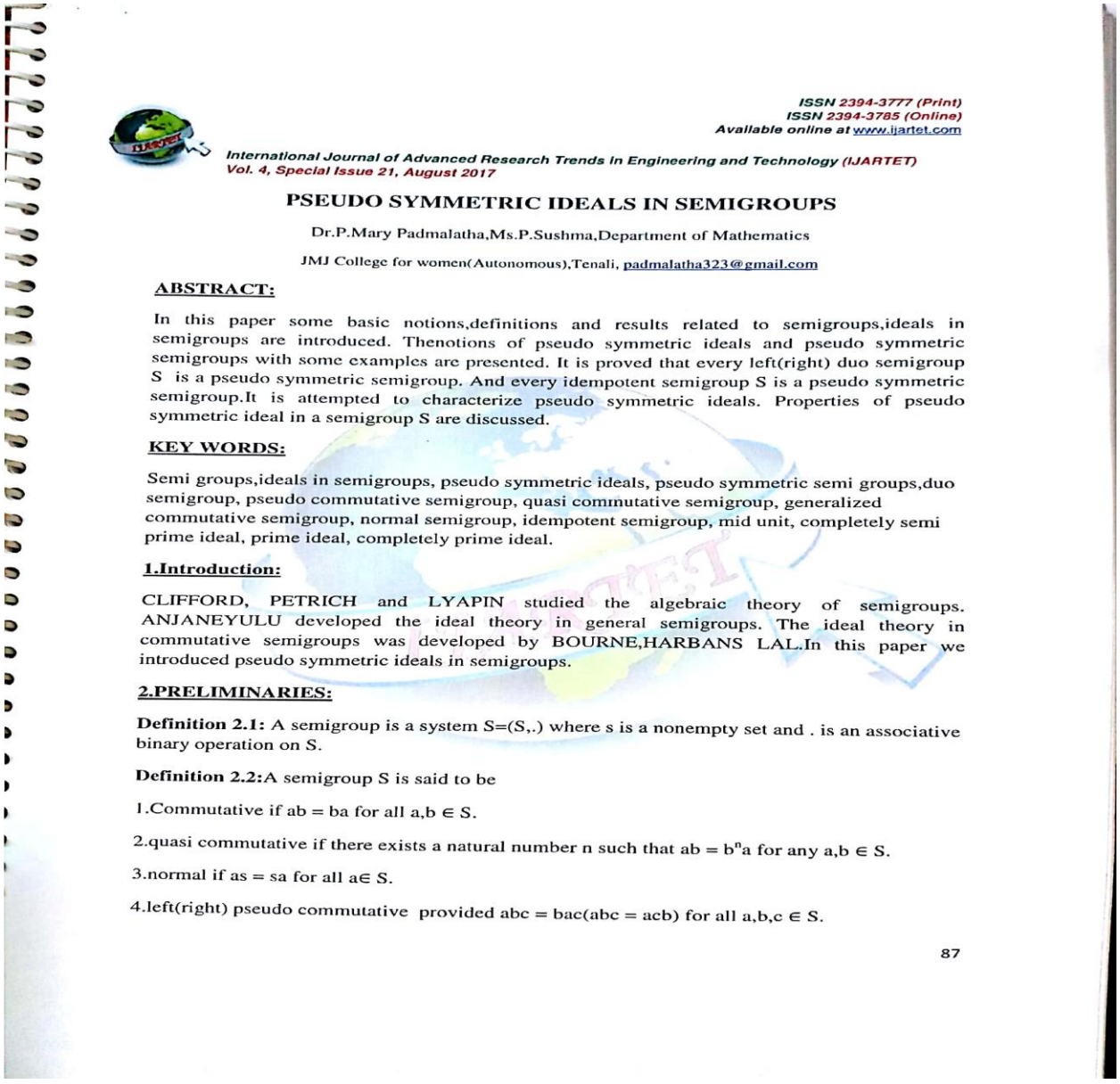

ISSN 2394-3777 (Print)
ISSN 2394-3785 (Online)
Available online at www.ijartet.com

International Journal of Advanced Research Trends in Engineering and Technology (IJARTET)
Vol. 4, Special Issue 21, August 2017

PSEUDO SYMMETRIC IDEALS IN SEMIGROUPS

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ABSTRACT:

In this paper some basic notions,definitions and results related to semigroups,ideals in semigroups are introduced. Thenotions of pseudo symmetric ideals and pseudo symmetric semigroups with some examples are presented. It is proved that every left(right) duo semigroup S is a pseudo symmetric semigroup. And every idempotent semigroup S is a pseudo symmetric semigroup.It is attempted to characterize pseudo symmetric ideals. Properties of pseudo symmetric ideal in a semigroup S are discussed.

KEY WORDS:

Semi groups,ideals in semigroups, pseudo symmetric ideals, pseudo symmetric semi groups,duo semigroup, pseudo commutative semigroup, quasi commutative semigroup, generalized commutative semigroup, normal semigroup, idempotent semigroup, mid unit, completely semi prime ideal, prime ideal, completely prime ideal.

1.Introduction:

CLIFFORD, PETRICH and LYAPIN studied the algebraic theory of semigroups. ANJANEYULU developed the ideal theory in general semigroups. The ideal theory in commutative semigroups was developed by BOURNE,HARBANS LAL.In this paper we introduced pseudo symmetric ideals in semigroups.

2.PRELIMINARIES:

Definition 2.1: A semigroup is a system S=(S,.) where s is a nonempty set and . is an associative binary operation on S.

Definition 2.2:A semigroup S is said to be

1.Commutative if ab = ba for all a,b ∈ S.

2.quasi commutative if there exists a natural number n such that ab = b^na for any a,b ∈ S.

3.normal if as = sa for all a∈ S.

4.left(right) pseudo commutative provided abc = bac(abc = acb) for all a,b,c ∈ S.

ISSN 2394-3777 (Print)
ISSN 2394-3785 (Online)
Available online at www.ijartet.com

International Journal of Advanced Research Trends in Engineering and Technology (IJARTET)
Vol. 4, Special Issue 21, August 2017

Definition 2.3:A nonempty subset A of a semigroup S is said to be

1.a subsemigroup of S if a,b$\in$ A implies ab$\in$ A.

2. a left(right) ideal provided SA$\subseteq$A(AS$\subseteq$A)

3.a two sided ideal or simply an ideal provided it is both a left and a right ideal of S.

Definition 2.4: Let S be any semigroup.Then

1.a nonempty set A is said to generate S if every element of S is a finite product of elements of A.

2.The intersection of all (left,right) ideals of S containing a nonempty set A is called the (left,right) ideal generated by A.

3.The intersection of all ideals in S,if nonempty,is said to be the kernel of S and is denoted by K.

Definition 2.5: An ideal A of a semigroup S is called a

1. principal ideal if A is an ideal generated by single element set.
2. finitely generated ideal if it is a union of finite number of principal ideals.
3. proper ideal if A $\neq$S.
4. trivial ideal if S\A is singleton.
5. maximal idealifA is a proper ideal of S and is not properly contained in any proper ideal of S.
6. minimal ideal ifd it does not contain any ideal of S properly.
7. prime ideal if XY$\subseteq$ A; X,Y are ideals of S,then either X $\subseteq$A or Y $\subseteq$ A.
8. completely prime ideal provided xy$\in$ A; x,y$\in$ S implies either x$\in$A or y$\in$A
9. semiprime ideal if xsx $\subseteq$ A; x$\in$ S implies x $\in$ A
10. completely semiprime ideal if $x^n \in A$; x$\in$ S for some natural number n implies x$\in$ A.
11. globally idempotent ideal if $A^2 = A$.

ISSN 2394-3777 (Print)
ISSN 2394-3785 (Online)
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International Journal of Advanced Research Trends in Engineering and Technology (IJARTET)
Vol. 4, Special Issue 21, August 2017

Definition 2.6: An element 'a' of a semigroup S is said to be

1.an idempotent if $a^2 = a$.

2. a mid unit provided $xay = xy$ for any x,y ∈ S.

3.an r-element provided as = sa for all s ∈ S and if x,y ∈ S,we have $axy = byx$ for some b∈ S.

Definition 2.7:A semigroup S is said to be

1. a group provided S has no left and right ideals.
2. a simple semigroup provided S has no proper ideals.
3. a left(right) duo semigroup provided every left(right) ideals of S is two sided ideal of S.
4. a duo semigroup provided it is both a left and a right duo semigroup.

We introduce the notion of pseudo symmetric ideals and pseudo symmetric semigroups. We characterize pseudo symmetric ideals in a semigroup and give some examples and some classes of pseudo symmetric semigroups.

Definition 2.8: An ideal A in a semigroup S is said to be pseudo symmetric provided

xy ∈ A;x,y ∈ S implies xsy ∈ A for all s∈ S.

Definition 2.9: A semigroup is said to be pseudo symmetric provided every ideal is pseudo symmetric ideal.

Every commutative semigroup is a pseudo symmetricsemigroup and the converse need not true.

Example 2.10: Let S = {a,b,c} and '.' And ' *' be two binary operations in S defined as

*	a	b	c
a	a	b	a

ISSN 2394-3777 (Print)
ISSN 2394-3785 (Online)
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International Journal of Advanced Research Trends in Engineering and Technology (IJARTET)
Vol. 4, Special Issue 21, August 2017

b	a	b	a
c	a	b	c

.	a	b	c
a	a	a	a
b	a	a	a
c	a	b	c

Here(S,.) and (S,*) are not commutative semigroups but pseudo symmetric semigroups.

Theorem 2.11: The following statements are equivalent for an ideal A in a semigroup S.

1.A is a pseudo symmetric ideal.

2.$A_r(a) = \{x \in S: ax \in A\}$ is an ideal of s for all $a \in S$.

3.$A_l(a) = \{x \in S: xa \in A\}$ is an ideal of s for all $a \in S$.

Corollary 2.12: Every left(right) duo semigroup S is a pseudo symmetric semigroup.

Proof: Let A be any ideal in S.Since for all $a \in S$,$A_l(a)$ is a left ideal and hence by the above theorem, A is a pseudo symmetric ideal. Therefore S is a pseudo symmetric semigroup. Similarly every right duo semigroup is a pseudo symmetric semigroup.

Here are the examples of pseudo symmetric semigroups.

1.Every left(right) pseudo commutative semigroup is a pseudo symmetric semigroup.

2.Every quasicommutative semigroup is a pseudo symmetric semigroup.

3.Every generalized commutative semigroup is a pseudo symmetric semigroup.

4.Every normal semigroup is a pseudo symmetric semigroup.

Theorem 2.13: Every idempotent semigroup S is apseudo symmetric semigroup.

Proof: Let A be any ideal in S and let $ab \in A$.Then $ba = baba \in A$ and hence

$asb = asbasb \in A$.Therefore A is a pseudo symmetric ideal.

Theorem 2.14: If S is a semigroup in which every element is a mid unit then S is a pseudo symmetric semigroup.

Proof: Let A be any ideal in S and let $ab \in A$.Now for any $s \in S$,$asb = ab \in A$.

ISSN 2394-3777 (Print)
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International Journal of Advanced Research Trends in Engineering and Technology (IJARTET)
Vol. 4, Special Issue 21, August 2017

So A is a pseudo symmetric ideal.

Theorem 2.15: Every completely semiprime ideal A in a semigroup S is a pseudo symmetric ideal and the converse is not true.

Proof: Let $xy \in A$. Then $(yx)^2 = yxyx \in A$. Since A is a completely semiprime ideal, $yx \in A$.

Now $(xsy)^2 = xsyxsy \in A$ for all $s \in S$ and hence $xsy \in A$.Therefore Ais a pseudo symmetric ideal.

Theorem 2.16: Let A be any pseudo symmetric ideal in a semigroup S. Then $a_1, a_2, \ldots \ldots a_n \in A$ if and only if $< a_1 >< a_2 > \cdots \ldots \ldots \ldots < a_n > \subseteq A$.

Proof : Clearly if $< a_1 >< a_2 > \cdots \ldots \ldots \ldots < a_n > \subseteq A$,then $a_1, a_2, \ldots \ldots a_n \in A$

Conversely if $a_1, a_2, \ldots \ldots a_n \in A$,then for any $t \in < a_1 >< a_2 > \cdots \ldots \ldots \ldots < a_n >$, we have $s_1 a_1 s_2 a_2 \ldots \ldots \ldots \ldots a_n s_{n+1}$, where $s_i \in s^1$. Since A is a pseudo symmetric ideal,we have $t \in A$.

Therefore ,$< a_1 >< a_2 > \cdots \ldots \ldots \ldots < a_n > \subseteq A$.

Theorem 2.17: If A is a pseudo symmetric ideal in a semigroup S,then for any natural number n, $a^n \in A$ implies $< a >^n \subseteq A$.

It can be proved by taking $a_1 = a_2 = \cdots \ldots a_n = a$ in the above theorem.

Theorem 2.18: Every prime ideal P minimal relative to containing a pseudo symmetric ideal A in a semigroup S is completely prime.

Proof : Let T be the subsemigroup generated by s\ p.

First we show that $A \cap T = \emptyset$.If $A \cap T \neq \emptyset$,then there exists $x_1, x_2, \ldots \ldots x_n \in$ s \ p such that $x_1, x_2, \ldots \ldots x_n \in A$.We have $< x_1 >< x_2 > \cdots \ldots < x_n > \subseteq A \subseteq P$.

Since p is a prime ideal,we have $< x_1 > \subseteq P$ for some I, a contradiction. Thus $A \cap T = \varphi$.

Consider the set $\Sigma = \{B : B$ is an ideal s containing A such that $B \cap T = \emptyset\}$.

Since A$\in \Sigma$, Σ is not empty. Now Σ is a poset under set inclusion and satisfies the hypothesis of Zorn's lemma.Thus by Zorn's lemma Σ contains a maximal element,say M.

ISSN 2394-3777 (Print)
ISSN 2394-3785 (Online)
Available online at www.ijartet.com

International Journal of Advanced Research Trends in Engineering and Technology (IJARTET)
Vol. 4, Special Issue 21, August 2017

Let X and Y be two ideals in S such that $XY \subseteq M$ .If $X \nsubseteq M$ and $Y \nsubseteq M$,then MUX and MUY are ideals in S containing M properly and hence by the maximality of M,we have

$(MUX) \cap T \neq \emptyset$ and $(MUY) \cap T \neq \emptyset$

Since $M \cap T = \emptyset$, we have $X \cap T \neq \emptyset$ and $Y \cap T \neq \emptyset$.

so there exists$x \in X \cap T$ and $y \in Y \cap T$.

Now $xy \in XY \cap T \subseteq M \cap T = \emptyset$, a contradiction.

Therefore M is a prime ideal containing A.

Now A$\subseteq M \subseteq S \setminus T \subseteq P$.

Since P is minimal prime ideal relative to containing A, we have M= $S \setminus T = P$

Therefore P is a completely prime ideal .

Hence we deduce that every prime ideal P minimal relative to containing a completely semiprime ideal A in a semigroup S is completely prime.

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http:// iaetsdjaras.org\

IAETSD JOURNAL FOR ADVANCED RESEARCH IN APPLIED SCIENCES ISSN NO: 2394-8442

Properties of Some Types of Ordered Semigroups in terms of Fuzzy Sets

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Abstract: To study the structure and the decomposition of ordered semigroups, the right (left) regular, regular and intra regular ordered semigroups play a vital role .Here we study general classes containing the right regular, left regular, regular and intra-regular ordered semigroups. Characterizations of these in terms of fuzzy sets are discussed. An ordered semigroup S is right (left) regular if and only if for each fuzzy subset f of S we have $f \subseteq f^2 \circ 1$ $(f \subseteq 1 \circ f^2)$.Comparing the theory of ordered semigroup with the theory of fuzzy ordered semigroup.

Keywords: Fuzzy right (left) ideal, fuzzy ordered semi group, fuzzy quasi-ideal, fuzzy bi-ideal in an ordered semi group.

Introduction: CLIFFORD, PETRICH, G.B.PRESTON and LYAPIN widely studied the algebraic theory of semi groups. SANTIAGO developed and studied regular and completely regular semigroups. N.KEHAYOPULU and M.TSINGLIS studied regular ordered semigroups in terms of fuzzy subsets and generalized ideal elements in PO-semi groups .In this paper we introduce fuzzy right ideal, fuzzy left ideal, fuzzy quasi-ideal, fuzzy bi-ideal in an ordered semigroup.

PRELIMINARIES:

DEFINITION 2.1: A System S=(s,.),where S is a non empty set and . is an Associative binary operation on S, is called a semigroup.

DEFINITION 2.2: A semigroup S is said to be a partially ordered semigroup if S is a partially ordered set such that $a \leq b \Rightarrow ax \leq bx, xa \leq xb$ *for all* $a, b, x \in S$.

NOTE 2.3: A partially ordered semigroup is also called as ordered semi group.

DEFINITION 2.4: Let X= {a,b,c} and S=$\{\emptyset, \{a\}, \{b\}, \{c\}, \{a,b\}\{b,c\}\{a,c\}\{a,b,c\}\}$.If for all A,B$\in S$,AB=$A \cap B$ *and* $A \leq B \Leftrightarrow A \subseteq B$, *then* $P(X)$ *is partially ordered semigroup.*

DEFINITION 2.5: A semigroup S is said to be

1. finite provided the cardinality of S is finite.
2. Commutative provided ab = ba for all a,b ∈ S.
3. quasi commutative provided for any a,b ∈ S, there exists a natural number n such that

   $ab = b^n a$.

4. normal provided as = sa for all a ∈ S.
5. left(right) pseudo commutative provided abc = bac (abc = acb) for all a,b,c ∈ S.

DEFINITION 2.6: An element 'a ' of a semigroup S is called a two sided identity or an identity provided it is both a left and a right identity of S.

i.e as = sa = s for all s ∈ S.

DEFINITION 2.7: an element 'a' of a semigroup s is called a two sided zero or zero of s provided it is both a left and a right zero of s.

i.e as = sa = s for all $s \in S$.

DEFINITION 2.8: A nonempty subset A of a semigroup S is said to be

1. a subsemigroup of S provided, a,b ∈ Aimplies ab ∈ A.
2. an m-system provided for any a,b ∈ A,there exists an x ∈ S such that axb ∈ A.
3. a left(right) ideal provided SA⊆A (AS⊆A)
4. a two sided ideal or simply an ideal provided it is both a left and a right ideal of S.

DEFINITION 2.9: A partially ordered semigroup S is a commutative partially ordered semigroup provided S is a commutative semigroup i.e $ab = ba \; for \; all \; a, b \in S$.

DEFINITION 2.10: A partially ordered semigroup S is a said to be quasi commutative partially ordered semigroup provided S is a quasi commutative semigroup.

DEFINITION 2.11: Right regular ordered semigroup An ordered semigroup S is called right regular if for each $a \in S \; there \; exists \; x \in S \; such \; that \; a \leq a^2x$.

DEFINITION 2.12: Left regular ordered semigroup An ordered semigroup S is called left regular if for each $a \in S \; there \; exists \; x \in S \; such \; that \; a \leq xa^2$.

DEFINITION 2.13: Regular ordered semigroup An ordered semigroup is called regular if for each $a \in S \; there \; exists \; x \in S \; such \; that \; a \leq axa$.

DEFINITION 2.14: Intra regular ordered semigroup .An ordered semigroup is called intra-regular if for each $a \in S \; there \; exists \; x, y \in S \; such \; that \; a \leq xa^2y$.

The right regular, left regular and the intra- regular ordered semigroups play an essential role in studying the structure, the decomposition of ordered semigroups. Here we prove that an ordered semigroup S is right (left) regular if and only if for each fuzzy subset f of S we have $f \subseteq f^2 \circ 1 \;\; (f \subseteq 1 \circ f^2)$ and regular if and only if for each fuzzy subset f of S we have $f \subseteq f \circ 1 \circ f$ and intra –regular if and only if have $f \subseteq 1 \circ f^2 \circ$ 1 for each fuzzy subset f of S where 1 is the greatest element of the ordered set of fuzzy susets of S. In this paper we see the similarities between the theory of ordered semigroups and the theory of fuzzy ordered semigroups.

According to L.A .Zadeh, if (S,·, ≤) is an ordered groupoid, then f is a fuzzy subset of S if S is a mapping of S into the real closed interval [0,1].

If A is a subset of S, the fuzzy subset f_A is the characteristic function defined by $f_A{:}S \to [0,1]/x \to f_A(x) := \{1 \; if \; x \in A$

$0 \; if \;\; x \notin A$

For an element a of S, we clearly have $f_a{:}S \to [0,1]/x \to f_a(x) := \{1 \; if \; x = a$

$0 \; if \;\; x \neq a$

For the element a (of S), we define $A_a := \{(y,z) \in S \times S / a \leq yz\}$.

For two fuzzy subsets of f and g of S , we define the multiplication of f and g as the fuzzy subset $f \circ g$ of S defined by

$$f \circ g : S \to [0,1] | a \to \{\sup\{minf(y), g(z)\} \; if \; A_a \neq \emptyset, (y,z) \in A_a$$

0 if $A_a = \emptyset$

And in the set of all fuzzy subsets of S we define the order relation as follows:

$f \subseteq g \; if \; and \; only \; if \; f(x) \leq g(x) forall \; x \in S$

For an ordered groupoid S, the fuzzy subset 1 of S is defined as follows: $1 : S \to [0,1] / x \to 1(x) := 1$

If F(S) is the set of fuzzy subsets of S, it is clear that the fuzzy subset 1 of S is the greatest element of the ordered set $(F(s), \subseteq)$. If S is an ordered groupoid (ordered semigroup) then the set F(S) with the multiplication '0' and the order $\subseteq$ is an ordered groupoid (ordered semigroup) .

NOTE 2.15: Let $(S, \cdot, \leq)$ be an ordered groupoid and f a fuzzy subset of S. We define $f^2 = f$. In particular, if S is an ordered semigroup and N the set of natural numbers $\ni \; k \geq 2$ we define $f^k = f \circ f \circ f \circ \ldots . \circ f$

RIGHT (LEFT) REGULAR ORDERED SEMIGROUPS IN TERMS OF FUZZY SETS.

NOTE2.16: Let $(S, \cdot, \leq)$ be an ordered semigroup,f a fuzzy subset of S and $a \in S$ then we have $f(a) \leq f^k(a^k)$ for each $k \in N$.

NOTE 2.17: Let $(S, \cdot, \leq)$ be an ordered semigroup, $a \in S \; and \; k \in N$ then $f_a^k(a^k) = 1$.

NOTE 2.18: Let $(S, \cdot, \leq)$ be an ordered semigroup, f is a fuzzy subset of S , $k \in N$ and $a, x \in S \; such that \; a \leq a^k x$. then we have $f(a) \leq (f^k \circ 1)(a)$.

NOTE 2.19: Let $(S, \cdot, \leq)$ be an ordered groupoid, f,g fuzzy subsets of S and $a \in S$,

The following are equivalent

1. $(f \circ g)(a) \neq 0$.
2. There exists $(x, y) \in A_a$ such that $f(x) \neq 0$ and $g(y) \neq 0$.

NOTE 2.20: Let $(S, \cdot, \leq)$ be an ordered groupoid and $a, b \in S$. Then we have $b \leq a^2 \Leftrightarrow f_a^2(b) \neq 0$.

NOTE 2.21: Let $(S, \cdot, \leq)$ be an ordered semi group and $a \in S$. Then, for each $b \in S$ and each

$N \ni k \geq 2$ we have $b \leq a^k \Leftrightarrow f_a^k(b) \neq 0$.

Theorem 2.22: Let $(S, \cdot, \leq)$ be an ordered semigroup and $k \in N$ then the following are equivalent:

1. For each $a \in S$ there exists $x \in S$ such that $a \leq a^k x$.
2. $f \subseteq f^k \circ 1$ for each fuzzy subset f of S.
3. $f_a \subseteq f_a^k \circ 1$ for each $a \in S$.
4. $f_a^k \circ 1(a) = 1$ for each $a \in S$.
5. $f_a^k \circ 1(a) \neq 0$ for each $a \in S$.

INTRA-REGULAR ORDERED SEMIGROUPS IN TERMS OF FUZZY SETS.

NOTE 2.23: Let $(S, \cdot, \leq)$ be an ordered semigroup, f a fuzzy subset of S, $k \in N$ and $a, x, y \in S$

Then $a \leq xa^k y \Rightarrow f(a) \leq (1 \circ f^k \circ 1)(a)$.

NOTE 2.24: Let $(S, \cdot, \leq)$ be an ordered semi group, f a fuzzy subset of S, $k \in N$ and $x, a \in S$ then we have

1. $f(a) \leq (f^k \circ 1)(a^k x)$.

2. $f(a) \leq (1 \circ f^k)(x a^k)$.

3. $(f_a^k \circ 1)(a^k x) = 1$.

4. $1 \circ f_a^k(a)\ (x a^k) = 1$.

5. $a \leq a^k x a^n \Rightarrow f(a) \leq (f^k \circ 1 \circ f^n)(a)$.

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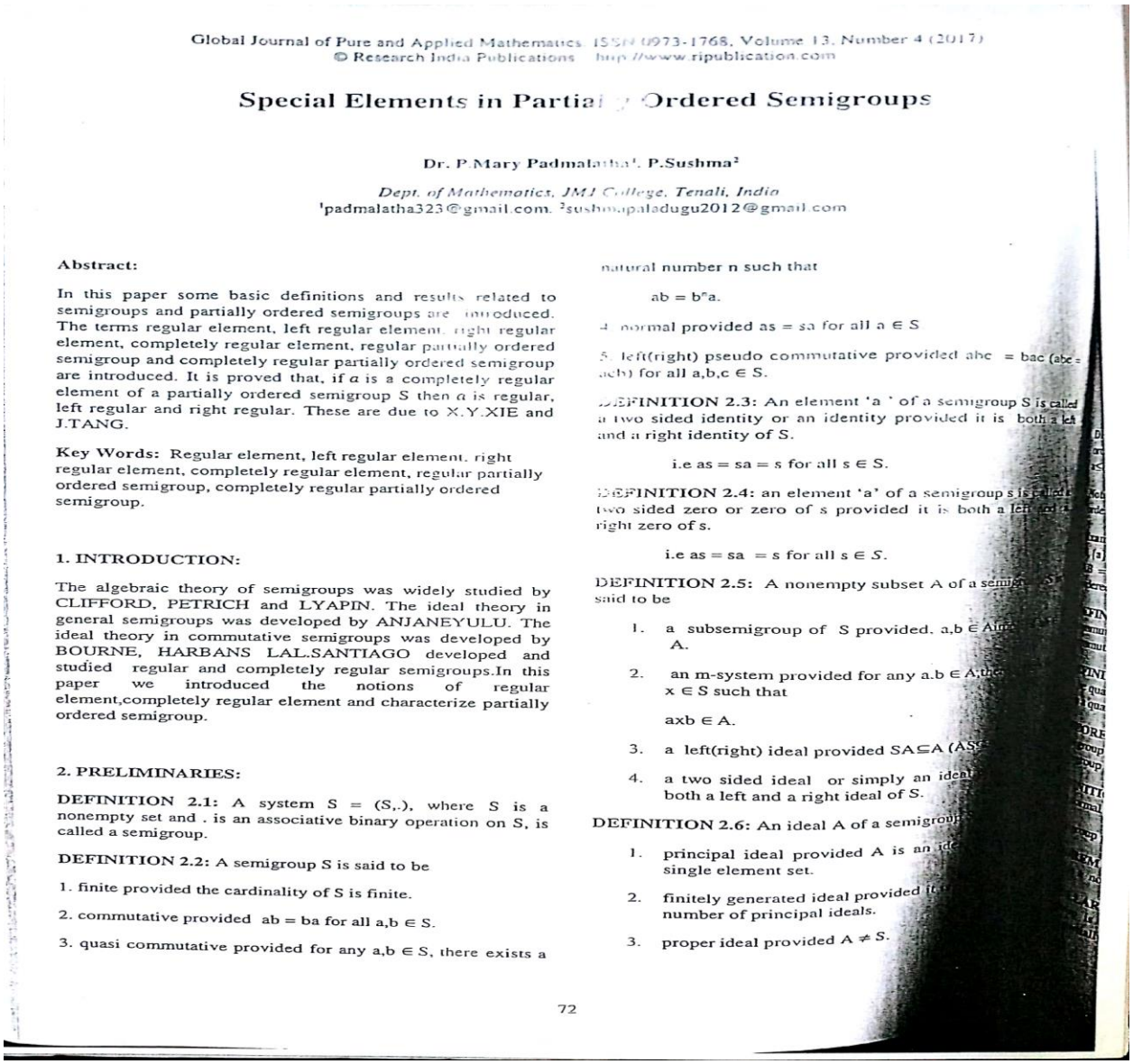
11. Published a paper titled “Special elements in partially ordered semigroups” in the Global Journal of Pure and Applied Mathematics” with ISSN : 0973-1768

http:// www.ripublication.com



Global Journal of Pure and Applied Mathematics. ISSN 0973-1768, Volume 13, Number 4 (2017)
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Special Elements in Partially Ordered Semigroups

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Abstract:

In this paper some basic definitions and results related to semigroups and partially ordered semigroups are introduced. The terms regular element, left regular element, right regular element, completely regular element, regular partially ordered semigroup and completely regular partially ordered semigroup are introduced. It is proved that, if a is a completely regular element of a partially ordered semigroup S then a is regular, left regular and right regular. These are due to X.Y.XIE and J.TANG.

Key Words: Regular element, left regular element, right regular element, completely regular element, regular partially ordered semigroup, completely regular partially ordered semigroup.

1. INTRODUCTION:

The algebraic theory of semigroups was widely studied by CLIFFORD, PETRICH and LYAPIN. The ideal theory in general semigroups was developed by ANJANEYULU. The ideal theory in commutative semigroups was developed by BOURNE, HARBANS LAL.SANTIAGO developed and studied regular and completely regular semigroups.In this paper we introduced the notions of regular element,completely regular element and characterize partially ordered semigroup.

2. PRELIMINARIES:

DEFINITION 2.1: A system S = (S,.), where S is a nonempty set and . is an associative binary operation on S, is called a semigroup.

DEFINITION 2.2: A semigroup S is said to be

1. finite provided the cardinality of S is finite.
2. commutative provided ab = ba for all a,b ∈ S.
3. quasi commutative provided for any a,b ∈ S, there exists a natural number n such that

   $ab = b^n a$.

4. normal provided as = sa for all a ∈ S
5. left(right) pseudo commutative provided abc = bac (abc = acb) for all a,b,c ∈ S.

DEFINITION 2.3: An element 'a ' of a semigroup S is called a two sided identity or an identity provided it is both a left and a right identity of S.

i.e as = sa = s for all s ∈ S.

DEFINITION 2.4: an element 'a' of a semigroup s is called a two sided zero or zero of s provided it is both a left zero and a right zero of s.

i.e as = sa = s for all s ∈ S.

DEFINITION 2.5: A nonempty subset A of a semigroup S is said to be

1. a subsemigroup of S provided. a,b ∈ A⇒ ab ∈ A.
2. an m-system provided for any a,b ∈ A there exists x ∈ S such that

   axb ∈ A.

3. a left(right) ideal provided SA⊆A (AS⊆A)
4. a two sided ideal or simply an ideal provided it is both a left and a right ideal of S.

DEFINITION 2.6: An ideal A of a semigroup S is

1. principal ideal provided A is an ideal generated by a single element set.
2. finitely generated ideal provided it is generated by a finite number of principal ideals.
3. proper ideal provided A ≠ S.

4. trivial ideal provided S\A is singleton

5. maximal ideal provided A is a proper ideal of S and is not properly contained in any proper ideal of S

6. minimal ideal provided it does not contain any ideal of S properly.

7. prime ideal provided $XY \subseteq A$; X,Y are ideals of S,then either $X \subseteq A, Y \subseteq A$.

8. completely prime ideal provided $xy \in A$; $x,y \in S$ implies either $x \in A$ or

   $y \in A$

9. semiprime ideal provided $xsx \subseteq A$; $x \in S$ implies $x \in A$

10. completely semiprime ideal provided $x^n \in A$; $x \in S$ for some natural number n implies $x \in A$.

11. globally idempotent ideal provided $A^2 = A$.

DEFINITION 2.7: A semigroup S is said to be a partially ordered semigroup if S is a partially ordered set such that $a \leq b \Rightarrow ax \leq bx$, $xa \leq xb$ for all $a,b,x \in S$.

Note 2.8: A partially ordered semigroup S is also called as ordered semigroup.

Example 2.9: Let S = { $\emptyset$,{a},{b},{c},{a,b}{b,c},{a,c},{a,b,c}}.If for all A,B $\in$ S, AB = A∩B and A≤B iff A⊆B, then P(X) is a partially ordered semigroup.

DEFINITION 2.10: A partially ordered semigroup S is a commutative partially ordered semigroup provided S is a commutative semi group. i.e ab = ba for all a,b ∈ S.

DEFINITION 2.11: A partially ordered semigroup S is said to be quasi commutative partially orderd semigroup provided it is a quasi commutative semigroup.

THEOREM 2.12: If S is a commutative partially ordered semigroup then S is a quasi commutative partially ordered semigroup

DEFINITION 2.13: A partially ordered semigroup is said to be normal partially ordered

semigroup provided S is a normal semigroup.

THEOREM 2.14: If S is a quasi commutative semigroup then a normal partially ordered semigroup.

COROLLARY 2.15: Every commutative partially ordered semigroup is a normal partially ordered semi group is a partially ordered semigroup.

DEFINITION 2.16: An element a of a partially ordered semigroup S is said to be **regular** if there exist $x \in S$ such that $a \leq axa$.

NOTE 2.17: An element a of a partially ordered semigroup S is regular iff $a \in (axa]$.

DEFINITION 2.18: A partially ordered semigroup S is said to be **a regular partially ordered semigroup** provided every element is regular.

THEOREM 2.19: Every idempotent element in a partially ordered semi group is a regular.

Proof: Let a be an idempotent element in a partially ordered semi group S.

then $a \leq a^2 \leq a.a \leq a^2.a^2 \leq a.a.a.a$

therefore a is regular element.

DEFINITION 2.20: An element a of a partially ordered semigroup S is said to be **left regular** if there exist $x \in S$ such that $a \leq a^2x$

DEFINITION 2.21: An element a of a partially ordered semigroup S is said to be **right regular** if there exist $x \in S$ such that $a \leq xa^2$

DEFINITION 2.22: An element a of a partially ordered semigroup S is said to be **intra regular** if there exist $x, y \in S$ such that $a \leq xa^2y$

DEFINITION 2.23: An element a of a partially ordered semigroup S is said to be **completely regular** if there exist $x \in S$ such that $a \leq axa$ *and* $ax = xa$.

Note 2.24: An element a of a partially ordered semigroup S is said to be **completely regular** if and only if there exist $x \in S$ such that $a \in (axa]$ *and* $ax = xa$.

DEFINITION 2.25: A partially ordered semigroup S is said to be **completely regular partially ordered semigroup** provided every element in S is completely regular.

THEOREM 2.26: Let S be a partially ordered semigroup and $a \in S$.If a is a completely regular element, then a is regular, left regular and right regular.

Proof: Suppose that a is completely regular.

Then there exist $x \in S$ such that that $a \leq axa$ *and* $ax = xa$. Clearly a is regular.

Now $a \leq axa \leq aax \leq a^2x$. Therefore a is left regular.

And $a \leq axa \leq xaa \leq xa^2$. Therefore a is right regular.

THEOREM 2.27: Let S be a partially ordered semigroup and $a \in S$. If a is a regular element,then a is semisimple.

Proof: Suppose that a is regular.

Then $a \leq axa$ for some $x \in S \Rightarrow a \in (< a >^2]$

Therefore a is semisimple.

THEOREM 2.28: Let a be an element of a partially ordered semigroup S.If a is left regular or right regular,then a is semisimple.

Proof: Suppose that a is left regular.

Then $a \leq a^2x$ for some $x \in S \Rightarrow a \in (< a >^2]$

Therefore a is semisimple.

If a is right regular,Then $a \leq xa^2$ for some $x \in S \Rightarrow a \in (< a >^2]$.

Therefore a is semisimple.

THEOREM 2.29: Let a be an element of a partially ordered semigroup S.If a is intra regular then a is semisimple.

Proof: Suppose that a is intra regular.

Then $a \leq xa^2y \leq xaay$ for some $x, y \in S \Rightarrow a \in (< a >^2]$.

Therefore a is semisimple.

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12. Published a paper entitled **"Independent Dominations in Direct Product Graphs arising from Euler Totient Cayley Graphs and Arithmetic Graphs'** in ***International Journal of Advanced Research in Computer Science (IJARCS) -ISSN:*** **0976-5697, Volume – 8, Number -6,** PP 195-199, **July 2017**

ISSN No. 0976-5697

Volume 8, No. 6, July 2017 (Special Issue III)

International Journal of Advanced Research in Computer Science

RESEARCH PAPER

Available Online at www.ijarcs.info

INDEPENDENT DOMINATIONS IN DIRECT PRODUCT GRAPHS ARISING FROM EULER TOTIENT CAYLEY GRAPHS AND ARITHMETIC GRAPHS

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ABSTRACTGraph Theory is one of the most flourishing branches of modern Mathematics finding widest applications in all most all branches of Science & Technology. It is applied in diverse areas such as social sciences, linguistics, physical sciences, communication engineering etc Number Theory is one of the oldest branches of Mathematics, which inherited rich contributions from almost all greatest mathematicians, ancient and modern. Every branch of Mathematics employs some notion of a product that enables the combination or decomposition of its elemental structures. Product of graphs are introduced in graph theory very recently and developing rapidly. In this paper, we consider direct product graphs of Cayley graphs with Arithmetic graphs and present independent dominating set of these graphs.

Keywords: Euler totient Cayley graph, Arithmetic graph, direct product graph, dominating set and independent dominating set.
AMS (MOS) Subject Classification: 6905c

1. INTRODUCTION

'Domination in graphs' is the fast growing area in Graph Theory that has emerged rapidly in the last four decades. Domination in graphs has applications to several fields such as facility location problems, School Bus Routing, Computer Communication Networks, Radio Stations, Locating Radar Stations Problem etc., Number Theory is one of the oldest branches of mathematics, which inherited rich contributions from almost all great mathematicians, ancient and modern. Nathanson [1] was the pioneer in introducing the concepts of Number Theory, particularly, the „Theory of Congruences" in Graph Theory, and paved the way for the emergence of a new class of graphs, namely "Arithmetic Graphs". Cayley Graphs are another class of graphs associated with elements of a group. If this group is associated with some Arithmetic function then the Cayley graph becomes an Arithmetic graph. The Cayley graph associated with Euler totient function is called an Euler totient Cayley graph. Products are often viewed as a convenient language with which one can describe structures, but they are increasingly being applied in more substantial ways. Computer Science is one of the many fields in which graph products are becoming common place.

Now we present necessary definitions, observations and some useful results that we need for next sections.

Dominating set

A subset D of $V(G)$ is said to be a dominating set of G if every vertex in $V - D$ is adjacent to a vertex in D.

The minimum cardinality of a dominating set is called the domination number of G and is denoted by $\gamma(G)$.

Independent dominating set

A dominating set D in which no two vertices are adjacent is called an independent dominating set of G.

The induced subgraph $\langle D \rangle$ is a null graph if D is an independent dominating set.

The minimum cardinality of an independent dominating set of G is called the independent domination number of G and is denoted by $\gamma_i(G)$.

Euler Totient Cayley Graph $G(Z_n, \varphi)$ and its Properties

Madhavi [2] introduced the concept of Euler totient Cayley graphs and studied some of its properties. She gave methods of enumeration of disjoint Hamilton cycles and triangles in these graphs.

For any positive integer n, let $Z_n = \{0,1,2, \ldots . n-1\}$. Then $(Z_n, \oplus)$, where, $\oplus$ is addition modulo n, is an abelian group of order n. The number of positive integers less than n and relatively prime to n is denoted by $\varphi(n)$ and is called Euler totient function.

Let S denote the set of all positive integers less than n and relatively prime to n .That is $S = \{r / 1 \leq r < n$ and GCD $r, n = 1$. Then $S=\varphi n$.

Now we define Euler totient Cayley graph as follows.

For each positive integer n , let Z_n be the additive group of integers modulo n and let S be the set of all integers less than n and relatively prime to n. The Euler totient Cayley graph $G(Z_n, \varphi)$ is defined as the graph whose vertex set V is given by $Z_n = \{0,1,2, \ldots . n-1\}$ and the edge set is $E = \{(x, y) / x - y \in S$ or $y - x \in S\}$.

Clearly as proved in [2], the Euler totient Cayley graph $G(Z_n, \varphi)$ is

1. a connected, simple and undirected graph,

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2. $\varphi(n)$ - regular and has $\frac{n.\varphi(n)}{2}$ edges,
3. Hamiltonian,
4. Eulerian for $n \geq 3$,
5. bipartite if n is even and
6. complete graph if n is a prime.

The independent domination number of these graphs are studied by the authors [3] and the following results are required and they are presented without proofs.

u, v are adjacent in V_n graph if and only if GCD $(u, v) = p_i$, for some prime divisor p_i of n.

In this graph vertex 1 becomes an isolated vertex. Hence we consider Arithmetic graph V_n without vertex 1 as the contribution of this isolated vertex is nothing when the properties of these graphs and enumeration of some domination parameters are studied.

Clearly, V_n graph is a connected graph. Because when n is a prime, V_n graph consists of a single vertex. Hence it is a connected graph. In other cases, by the definition of adjacency in V_n, there exist edges between prime number vertices and their prime power vertices and also to their prime product vertices. Therefore each vertex of V_n is connected to some vertex in V_n.

The independent domination number of these graphs are obtained by the authors and the proof of the following theorem can be found in [3].

Theorem 1.1: If n is a prime, then the independent domination number of $G(Z_n, \varphi)$ is 1.

Theorem 1.2: The independent domination number of $G(Z_n, \varphi)$ is 2, if $n = 2p$ where p is an odd prime.

Theorem 1.3: Suppose n is neither a prime nor $2p$. Let $n = p_1^{\alpha_1} p_2^{\alpha_2} \ldots\ldots p_k^{\alpha_k}$, where $p_1, p_2, \ldots p_k$ are primes and $\alpha_1, \alpha_2, \ldots. \alpha_k$ are integers ≥ 1, then the independent domination number of $G(Z_n, \varphi)$ is $\frac{n}{p_k}$.

Arithmetic V_n graph

Vasumathi and Vangipuram [4] introduced the concept of Arithmetic V_n graphs and studied some of its properties.

Let n be a positive integer such that $n = p_1^{\alpha_1} p_2^{\alpha_2} \ldots\ldots p_k^{\alpha_k}$. Then the Arithmetic V_n graph is defined as the graph whose vertex set consists of the divisors of n and two vertices

Theorem 1.4: If $n = p_1^{\alpha_1} p_2^{\alpha_2} \ldots\ldots p_k^{\alpha_k}$, where $p_1, p_2, \ldots p_k$ are primes and $\alpha_1, \alpha_2, \ldots. \alpha_k$ are integers ≥ 1, then the domination number of $G(V_n)$ is given by

$$\gamma_i(G(V_n)) = \begin{cases} k-1 & \text{if } \alpha_i = 1 \text{ for more than one i} \\ k & \text{Otherwise.} \end{cases}$$

where k is the core of n.

Direct Product Graph $G_1 \times G_2$

In the literature, the direct product is also called as the tensor product, categorical product, cardinal product, relational product, Kronecker product, weak direct product, or conjunction. As an operation on binary relations, the tensor product was introduced by Alfred North Whitehead and Bertrand Russell in their Principia Mathematica[5]. It is also equivalent to the Kronecker product of the adjacency matrices of the graphs given by Weichsel [6].

If a graph can be represented as a direct product, then there may be multiple different representations (direct products do not satisfy unique factorization) but each representation has the same number of irreducible factors. Wilfried Imrich [7] gives a polynomial time algorithm for recognizing tensor product graphs and finding a factorization of any such graph.

Let G_1 and G_2 be two simple graphs with their vertex sets as $V_1 = \{u_1, u_2, \ldots, u_l\}$ and $V_2 = \{v_1, v_2, \ldots, v_m\}$ respectively. Then the direct product of these two graphs denoted by $G_1 \times G_2$ is defined to be a graph with vertex set $V_1 \times V_2$, where $V_1 \times V_2$ is the Cartesian product of the sets V_1 and V_2 such that any two distinct vertices (u_1, v_1) and (u_2, v_2) of $G_1 \times G_2$ are adjacent if u_1u_2 is an edge of G_1 and v_1v_2 is an edge of G_2.

The cross symbol $\times$, shows visually the two edges resulting from the direct product of two edges.

2. RESULTS

Let G_1 be an Euler Totient Cayley graph and G_2 be an Arithmetic V_n graph. Then G_1 and G_2 are simple graphs as they have no loops and multiple edges. Hence by the definition of adjacency in direct product, $G_1 \times G_2$ is also a simple graph.

Now we investigate results related to independent domination number of Direct product graphs of Euler totient Cayley graphs and Arithmetic V_n graphs.

Theorem 2.1: If n is a prime, then the independent domination number of $G_1 \times G_2$ is n.

Proof: Let n be a prime. Then $G_1 \times G_2$ is a completely disconnected graph. So there are no edges between these n vertices and its dominating set consists of n isolated vertices and these n isolated vertices form a minimum independent dominating set. Hence independent domination number of $G_1 \times G_2$ is n. ■

Theorem 2.2: If $n = p_1^{\alpha_1} p_2^{\alpha_2} \ldots\ldots p_k^{\alpha_k}$, where $\alpha_i \geq 1$, then the independent domination number of $G_1 \times G_2$ is $\gamma_i(G_1 \times G_2) = \frac{n}{p_k} \cdot |V_2|$.

Proof: Let V_1, V_2 and V denote the vertex sets of the graphs G_1, G_2 and $G_1 \times G_2$ respectively.

By Theorem 1.3 in [3], it is clear that the elements of the set V_1 can be divided into disjoint sets $D_i = \{r.p_k + i \;/\; r = 0, 1, 2, \ldots\ldots, npk-1$ for $1 \leq i \leq pk$, such that each Di is an independent dominating set of G_1 with minimum cardinality $\frac{n}{p_k}$.

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In particular, let $D_1 = \{0, p_k, 2p_k, \ldots\ldots, npk-1\ pk$ be an independent dominating set of $G1$ with minimum cardinality $\frac{n}{p_k}$.

Let $V_2 = \{v_1, v_2, \ldots\ldots, v_q\}$ be the vertex set of G_2 and consider $D_1 \times V_2$ in $G_1 \times G_2$ as

$$D_i' = D_1 \times V_2 = \left\{0, p_k, 2p_k, \ldots\ldots, \left(\frac{n}{p_k} - 1\right) p_k\right\} \times \{v_1, v_2, \ldots\ldots, v_q\}$$

$$= \{(0, v_1), \quad (0, v_2), \quad \ldots\ldots\ldots\ldots \quad (0, v_q),$$
$$(p_k, v_1), \quad (p_k, v_2), \quad \ldots\ldots\ldots\ldots \quad (p_k, v_q),$$
$$\vdots \qquad \vdots$$
$$\ldots\ldots\ldots \qquad \vdots$$
$$\left(\left(\frac{n}{p_k} - 1\right)p_k, v_1\right), \left(\left(\frac{n}{p_k} - 1\right)p_k, v_2\right), \ldots\ldots\ldots, \left(\left(\frac{n}{p_k} - 1pk, vq\right)\right\}$$

Let $x, y \in D_i'$. Then $x = (mp_k, v_i)$ and $y = (lp_k, v_j)$ for $m \neq l$, $i \neq j$. Now x is not adjacent to y because vertex mp_k is not adjacent to vertex np_k as GCD$(mp_k - lp_k, n) = ((m-l)p_k, n) \neq 1$. This shows that no two vertices in D_i' are adjacent. So, D_i' becomes an independent set of $G_1 \times G_2$.

Next we prove that D_i' is a dominating set.

Let (u, v) be any vertex of $V - D_i'$ in $G_1 \times G_2$. Then u is adjacent to at least one sp_k, $0 \leq s \leq \frac{n}{p_k} - 1$, in D_1, as D_1 is a dominating set of G_1. Now suppose v is adjacent to some vertex v_l in V_2. (Certainly there exists such a vertex in V_2 as V_2 has no isolated vertices). Then vertex (u, v) is adjacent to vertex (sp_k, v_l). Hence every vertex (u, v) of $V - D_i'$ in $G_1 \times G_2$ is adjacent to at least one vertex in D_i'. Thus D_i' becomes a dominating set of $G_1 \times G_2$.

We now prove that D_i' is minimum.

Suppose we remove a vertex say (rp_k, v_i) from D_i'. Then the deleted vertex (rp_k, v_i) is not dominated by any other vertex (sp_k, v_j) of D_i', because for $0 \leq s \leq \frac{n}{p_k} - 1$, GCD $(rp_k - sp_k, n) \neq 1$. This contradicts that D_i' is a dominating set of $G_1 \times G_2$. Hence D_i' becomes an independent dominating set with minimum cardinality. We cannot get any other independent dominating set with less number of vertices than this, because of the properties of prime numbers.

Hence $\gamma_i(G_1 \times G_2) = |D_i'| = \frac{n}{p_k} \cdot |V_2|$. ■

3. ILLUSTRATIONS

For $n = 6$

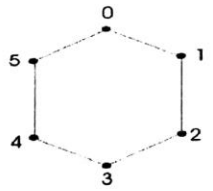

Figure 1
$G_1 = G(Z_6, \varphi)$

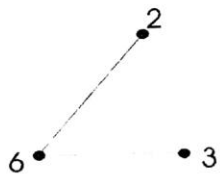

Figure 2
$G_2 = G(V_6)$

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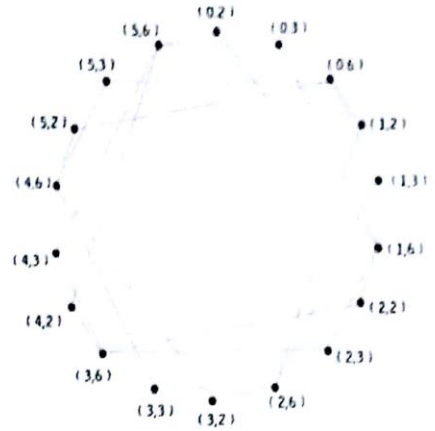

Figure 3

$G_1 \times G_2$

Minimum Independent Dominating set: {(0,2), (0,3), (0,6), (3,2), (3,3), (3,6)}

For $n = 8$

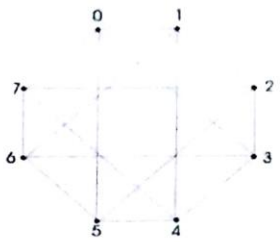

Figure 4

$G_1 = G(Z_8, \varphi)$

Figure 5

$G_2 = G(V_8)$

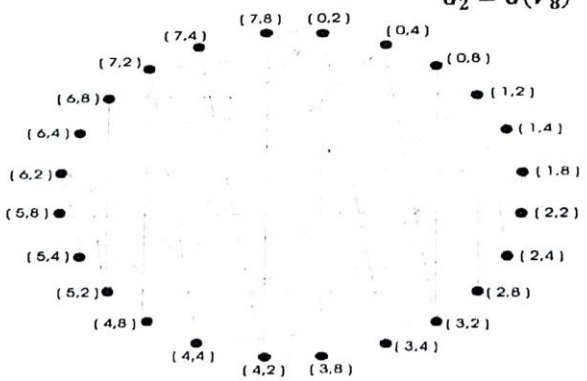

Figure 6

$G_1 \times G_2$

Minimum Independent Dominating set: {(0,2), (0,4), (0,8), (2,2), (2,4), (2,8), (4,2), (4,4), (4,8), (6,2), (6,4), (6,8)}

For $n = 11$

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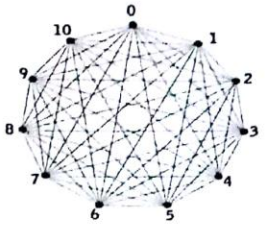

Figure 7
$G_1 = G(Z_{11}, \varphi)$

Figure 8
$G_2 = G(V_{11})$

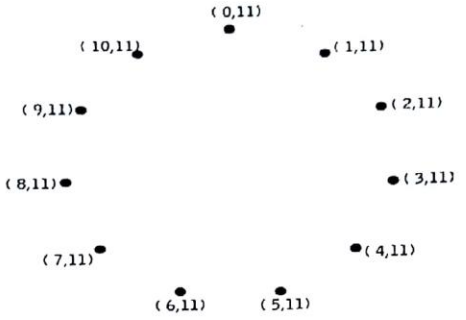

Figure 9
$G_1 \times G_2$
Minimum Independent Dominating set: Vertex set of $G_1 \times G_2$

CONCLUSION

Graph Theory is young but rapidly maturing subject. Its basic concepts are simple and can be used to express problems from many different subjects. The purpose of this work is to familiarize the reader with the direct product graph of Euler Totient Cayley graph with Arithmetic Vn graph. It is useful other Researchers for further studies of other properties of these product graphs and their relevance in both combinatorial problems and classical algebraic problems.

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13. Published a paper entitled **"Total Dominating Sets of Cartesian Product Graphs of Cayley Graphs with Arithmetic Graphs'** in ***Global Journal of Pure and Applied Mathematics -ISSN:*0973-1768, Volume –13, Number 4,** Pp 105-109, **July 2017**

Global Journal of Pure and Applied Mathematics. ISSN 0973-1768, Volume 13, Number 4 (2017)
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Total Dominating Sets of Cartesian Product Graphs of Cayley Graphs with Arithmetic Graphs

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ABSTRACT

Today, graph theory is one of the most flourishing branches of modern mathematics with wide applications to combinatorial problems and to classical algebraic problems. Graph theory has applications in diverse areas such as linguistics, communication engineering, social sciences and physical sciences etc. Because of this diversity in applications it is useful to develop and study this subject in abstract terms of the objects of any particular system in which one may be interested.

Product of graphs are introduced in Graph Theory very recently and developing rapidly.

In this paper, we consider Cartesian product graphs of Cayley graphs with Arithmetic graphs and discuss total domination number of these graphs.

Key words: Euler totient Cayley graph, Arithmetic V_n graph, Cartesian product graph, dominating set, total dominating set and total domination number.

Subject Classification : 6905 c

1.INTRODUCTION

'Domination in graphs' is the fast growing area in Graph Theory that has emerged rapidly in the last four decades. Domination in graphs has applications to several fields such as facility location problems, school bus routing, computer communication networks, radio stations, locating radar stations problem etc..

Number Theory is one of the oldest branches of mathematics, which inherited rich contributions from almost all great mathematicians, ancient and modern.

Nathanson [3] was the pioneer in introducing the concepts of Number Theory, particularly, the 'Theory of Congruences' in Graph Theory, and paved the way for the emergence of a new class of graphs, namely "Arithmetic Graphs". Cayley Graphs are another class of graphs associated with elements of a group. If this group is associated with some Arithmetic function then the Cayley graph becomes an Arithmetic graph. The Cayley graph associated with Euler totient function is called an Euler totient Cayley graph.

Products are often viewed as a convenient language with which one can describe structures, but they are increasingly being applied in more substantial ways. Computer Science is one of the many fields in which graph products are becoming common place.

In this section, we present necessary definitions, observations and some useful results that we need for next sections.

Dominating set

A subset D of $V(G)$ is said to be a dominating set of G if every vertex in $V - D$ is adjacent to a vertex in D. The minimum cardinality of a dominating set is called the domination number of G and is denoted by $\gamma(G)$.

Total dominating set

Let G be a graph without isolated vertices. Then a total dominating set D is a subset of V such that every vertex of V is adjacent to some vertex in D.

The minimum cardinality of a total dominating set of G is called the total domination number of G and is denoted by $\gamma_t(G)$.

Euler totient Cayley graph $G(Z_n, \varphi)$ and its properties

For any positive integer n, let $Z_n = \{0,1,2, \ldots . n-1\}$. Then $(Z_n, \oplus)$, where, $\oplus$ is addition modulo n, is an abelian group of order n. The number of positive integers less than n and relatively prime to n is denoted by $\varphi(n)$ and is called Euler totient function. Let S denote the set of all positive integers less than n and relatively prime to n. That is $S = \{r / 1 \leq r < n$ and GCD $(r, n) = 1\}$. Then $|S| = \varphi(n)$. We can see that S is a symmetric subset of the group $(Z_n, \oplus)$

The definition of Euler totient Cayley graph is as follows.

The Euler totient Cayley graph $G(Z_n, \varphi)$ is defined as the graph whose vertex set V is given by $Z_n =$

$\{0,1,2,\ldots.n-1\}$ and the edge set is $E = \{(x,y)/x-y \in S \text{ or } y-x \in S\}$

Some properties of Euler totient Cayley graphs and enumeration of Hamilton cycles and triangles can be found in Madhavi [1] The Euler totient Cayley graph is a complete graph if n is a prime and it is $\varphi(n)-$ regular.

The domination parameters of these graphs are studied by the authors [2] and the following results are required and they are presented without proofs.

Theorem 1.1: If n is a prime, then the domination number of $G(Z_n,\varphi)$ is 1.

Theorem 1.2: If n is power of a prime, then the domination number of $G(Z_n,\varphi)$ is 2

Theorem 1.3: The domination number of $G(Z_n,\varphi)$ is 2, if $n = 2p$ where p is an odd prime.

Theorem 1.4: Suppose n is neither a prime nor $2p$. Let $n = p_1^{\alpha_1}p_2^{\alpha_2}\ldots\ldots p_k^{\alpha_k}$, where $p_1.p_2 \ldots p_k$ are primes and $\alpha_1,\alpha_2,\ldots.\alpha_k$ are integers ≥ 1. Then the domination number of $G(Z_n,\varphi)$ is given by $\gamma(G(Z_n,\varphi)) = \lambda+1$, where λ is the length of the longest stretch of consecutive integers in V, each of which shares a prime factor with n.

Arithmetic V_n graph

Vasumathi and Vangipuram [11] introduced the concept of Arithmetic V_n graphs and studied some of its properties.

Let n be a positive integer such that $n = p_1^{\alpha_1}p_2^{\alpha_2}\ldots\ldots p_k^{\alpha_k}$. Then the Arithmetic V_n graph is defined as the graph whose vertex set consists of the divisors of n and two vertices u,v are adjacent in V_n graph if and only if GCD $(u,v) = p_i$, for some prime divisor p_i of n.

In this graph vertex 1 becomes an isolated vertex. Hence we consider Arithmetic graph V_n without vertex 1 as the contribution of this isolated vertex is nothing when the properties of these graphs and enumeration of some domination parameters are studied.

Clearly, V_n graph is a connected graph. If n is a prime, V_n graph consists of a single vertex. Hence it is a connected graph. In other cases, by the definition of adjacency in V_n, there exist edges between prime number vertices and their prime power vertices and also to their prime product vertices. Therefore each vertex of V_n is connected to some vertex in V_n.

The domination parameters of these graphs are obtained by the authors and the proof of the following theorem can be found in [7].

Theorem 1.5: If $n = p_1^{\alpha_1}p_2^{\alpha_2}\ldots\ldots p_k^{\alpha_k}$, where $p_1, p_2, \ldots p_k$ are primes and $\alpha_1,\alpha_2,\ldots\alpha_k$ are integers ≥ 1 then the domination number of $G(V_n)$ is given by

$$\gamma(G(V_n)) = \begin{cases} k-1 & \text{if } \alpha_i = 1 \text{ for more than one } i \\ k & \text{Otherwise} \end{cases}$$

where k is the one of n.

Cartesian Product Graph

The Cartesian product of graphs is a straight forward and natural construction. According to Imrich and Klavzar [3] Cartesian products of graphs were defined in 1912 by Whitehead and Russell [12] These products were repeatedly rediscover later, notably by Sabidussi [5] in 1960.

Cartesian product graphs can be recognized efficiently in time $O(m\log n)$ for a graph with m edges and n vertices [2, 4].

If G_1 and G_2 are two simple graphs with their vertex sets as $V_1 = \{u_1, u_2, \ldots\ldots\}$ and $V_2 = \{v_1, v_2, \ldots\}$ respectively then the Cartesian product of these two graphs denoted by $G_1 \square G_2$ is defined to be a graph with its vertex set as $V_1 \times V_2$, where $V_1 \times V_2$ is the Cartesian product of the sets V_1 and V_2 and any two distinct vertices (u_1, v_1) and (u_2, v_2) of $G_1 \square G_2$ are adjacent if

(i) $u_1 = u_2$ and $v_1v_2 \in E(G_2)$ or

(ii) $u_1u_2 \in E(G_1)$ and $v_1 = v_2$.

The square symbol $\square$ is the unambiguous notation for the Cartesian product of graphs. It shows visually the four edges resulting from the Cartesian product of two edges.

2. RESULTS ON TOTAL DOMINATING SETS OF CARTESIAN PRODUCT OF $G(Z_n,\varphi)$ WITH $G(V_n)$

In this paper the Cartesian product graph of Euler Totient Cayley graph with Arithmetic V_n graph is considered.

Let G_1 denote the Euler Totient Cayley graph $G(Z_n,\varphi)$ and G_2 denote the Arithmetic graph $G(V_n)$. Then G_1 and G_2 are simple graphs as they have no loops and multiple edges. Hence by the definition of adjacency in Cartesian product, $G_1 \square G_2$ is also a simple graph.

The properties and some domination parameters of these graphs can be found in [8,9,10].

Now we investigate results related to total dominating sets of $G_1 \square G_2$.

Theorem 2.1: If n is a prime, then the total domination number of $G_1 \square G_2$ is 2.

Proof: Suppose n is a prime. Then $G_1 \square G_2$ is a complete graph. In a complete graph, every singleton vertex set is a

minimal a dominating set. So any two vertices in $G_1 \square G_2$, constitutes a total dominating set of $G_1 \square G_2$, because it is a dominating set in which each vertex is dominated by the other vertex. Therefore the total domination number of $G_1 \square G_2$ is 2.

Hence $\gamma_t(G_1 \square G_2) = 2$ ■

Theorem 2.2: Let $n = 2p$ where p is an odd prime, then the total domination number of $G_1 \square G_2$ is 6.

Proof: Let $n = 2p$, p is an odd prime.

Consider the graph $G_1 \square G_2$.

Let $V(G_1) = \{0, 1, 2, \ldots, 2p-1\} = V_1$

$V(G_2) = \{2, p, 2p\} = V_2$ and $V(G_1 \square G_2) = V_1 \times V_2 = V$ be the set of vertices of the graphs G_1, G_2 and $G_1 \square G_2$ respectively.

By using Theorem 1.3 of [6], we may take a dominating set D_1 of G_1 as $D_1 = \{u_{d_1}, u_{d_2}\}$ where $|u_{d_1} - u_{d_2}| = p$

To obtain a dominating set of $G_1 \square G_2$, we proceed as follows.

Consider $D = D_1 \times V_2 = \{u_{d_1}, u_{d_2}\} \times \{2, p, 2p\} = \{(u_{d_1}, 2), (u_{d_1}, p), (u_{d_1}, 2p), (u_{d_2}, 2), (u_{d_2}, p), (u_{d_2}, 2p)\}$

We will now prove that D is dominating set of $G_1 \square G_2$.

Let (u, v) be any vertex in $\langle V - D \rangle$ in $G_1 \square G_2$. Then the vertex u in G_1 is adjacent to either u_{d_1} or u_{d_2}, say u_{d_1} in D_1 as D_1 is a dominating set of G_1. Then by the definition of Cartesian product, the vertex (u, v) in $\langle V - D \rangle$ is adjacent to vertex (u_{d_1}, v) in D. Since (u, v) is an arbitrary vertex in $\langle V - D \rangle$ it follows that D is a dominating set of $G_1 \square G_2$.

We now show that D is a total dominating set of $G_1 \square G_2$ as follows.

Since D is a minimum dominating set of $G_1 \square G_2$, all the vertices in $\langle V - D \rangle$ are adjacent to at least one vertex of D. Then D becomes a total dominating set if every vertex of D is adjacent to at least one vertex of D.

By the definition of Cartesian Product, vertices $(u_{d_1}, 2)$and (u_{d_1}, p) in D are adjacent to the vertex $(u_{d_1}, 2p)$ in D and vice versa. This is because $GCD(2, 2p) = 2$ and $GCD(p, 2p) = p$. Hence in G_2, vertices 2, p are adjacent to vertex $2p$ and vice versa.

In a similar way, we can prove that vertices $(u_{d_2}, 2)$and (u_{d_2}, p) in D are adjacent to vertex $(u_{d_2}, 2p)$ in D and vice versa.

Thus every vertex of V is adjacent to atleast one vertex of D. Thus D becomes a total dominating set with minimum cardinality.

Hence $\gamma_t(G_1 \square G_2) = |D| = 6$ ■

Theorem 2.3: Suppose n is neither a prime nor $2p$. Let $n = p_1^{\alpha_1} p_2^{\alpha_2} \ldots p_k^{\alpha_k}$, where $p_1, p_2, \ldots, p_k$ are primes and $\alpha_1, \alpha_2, \ldots, \alpha_k$ are integers ≥ 1. Then the total domination number of $G_1 \square G_2$ is $(\lambda + 1)|V_2|$ where λ is the length of the longest stretch of consecutive integers in V_1 of G_1 each of which shares a prime factor with n.

Proof: By Theorem 1.4 of [6], it is clear that

$D_1 = \{u_{d_1}, \ldots, u_{d_{\lambda+1}}\}$ is a dominating set of G_1 with cardinality $\lambda + 1$.

Let $D = D_1 \times V_2 = \{u_{d_1}, \ldots, u_{d_{\lambda+1}}\} \times V_2$ where V_2 be the vertex set of G_2. By the definition of Arithmetic graph it is obvious that the vertices in V_2 are primes $p_1, p_2, \ldots, p_k$ and their powers and their products. Suppose

$$D = \{(u_{d_1}, v_1), (u_{d_1}, v_2), \ldots, (u_{d_1}, v_m),$$
$$(u_{d_2}, v_1), (u_{d_2}, v_2), \ldots, (u_{d_2}, v_m),$$
$$\vdots \quad \vdots \quad \vdots$$
$$(u_{d_{\lambda+1}}, v_1), (u_{d_{\lambda+1}}, v_2), \ldots, (u_{d_{\lambda+1}}, v_m)\}$$

We now claim that D is a dominating set of $G_1 \square G_2$.

Let (u, v) be any vertex in $V - D$. Then $u \neq u_{d_i}$ for $i = 1, 2, 3, \ldots, \lambda + 1$ and $v \in V_2$. Since D_1 is a dominating set of G_1, the vertex u must be adjacent to at least one of the vertices of D_1, say u_{d_i}. Since u and u_{d_i} are adjacent, by the definition of Cartesian product the vertex (u, v) is adjacent to vertex (u_{d_i}, v) in D.

Thus all the vertices in $V - D$ are adjacent to at least one vertex in D so that D becomes a dominating set in $G_1 \square G_2$.

Further the dominating set D is also a total dominating set of $G_1 \square G_2$. This is because for each vertex (u_{d_i}, v_x) in D, there exists at least one adjacent vertex (u_{d_i}, v_y) in D such that $1 \leq i \leq \lambda + 1$; $1 \leq x, y \leq m$ where v_x and v_y are adjacent vertices. This will certainly happen because in graph G_2, each vertex v_x is adjacent to at least one vertex v_y as graph G_2 has no isolated vertices. Thus D becomes a total dominating set.

Suppose we delete a vertex, say (u_{d_i}, v) from D for some i, $1 \leq i \leq \lambda + 1$. Since each vertex in G_1 is of degree $\varphi(n)$, vertex u_{d_i} is adjacent to the vertices, say $u_1, u_2, \ldots, u_{\varphi(n)}$ respectively. Then the vertices $(u_1, v), (u_2, v), \ldots, (u_{\varphi(n)}, v)$ are all not dominated by other vertices of $D - \{(u_{d_i}, v)\}$. If so then $u_1, u_2, \ldots, u_{\varphi(n)}$ are also dominated by other vertices of $D_1 - \{u_{d_i}\}$, which implies that D_1 is not a minimum dominating set of G_1, a contradiction.

Therefore D is a minimal total dominating set of $G_1 \square G_2$

Hence $\gamma_t(G_1 \square G_2) = (\lambda + 1)|V_2|$ ■

3. ILLUSTRATIONS

For $n = 4$

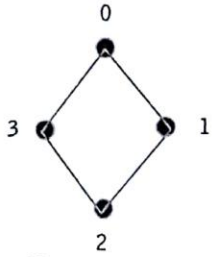

Figure 1
$G_1(Z_4, \varphi)$

Figure 2
$G_2 = G(V_4)$

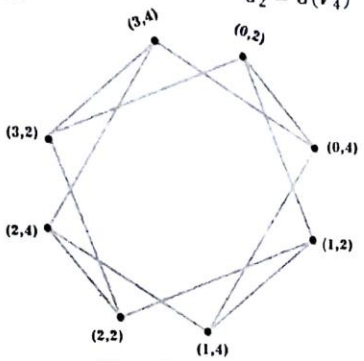

Figure3
$G_1 \square G_2$
Total Dominating Set {(0,2), (0,4), (1,2), (1,4)}

For $n = 6$

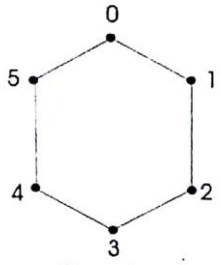

Figure 4
$G_1 = G(Z_6, \varphi)$

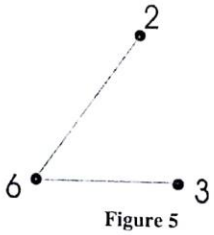

Figure 5
$G_2 = G(V_6)$

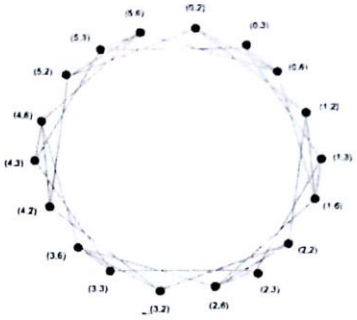

Figure 6
$G_1 \square G_2$
Total Dominating Set {(0,2), (0,3), (0,6), (3,2), (3,3), (3,6)}

For $n = 11$

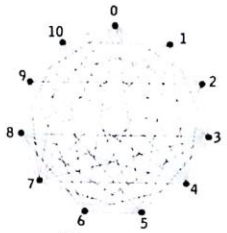

Figure 7
$G_1 = G(Z_{11}, \varphi)$

Figure 8
$G_2 = G(V_{11})$

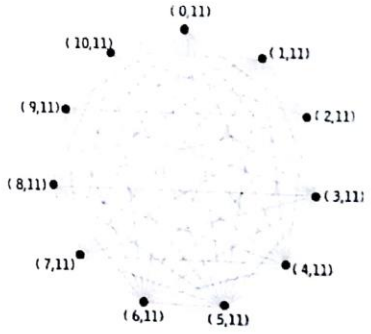

Figure 9
$G_1 \square G_2$
Total Dominating Set {(0,11), (1,11)}

4. CONCLUSION

The dominating sets and total dominating sets of Euler Totient Cayley graphs and Arithmetic Vn graphs are studied by the author. This study is motivated to find the total dominating sets of the Cartesian product graph of Euler Totient Cayley graph with Arithmetic Vn graph. It is useful to other Researchers for further studies of other properties of these

product graphs and their relevance in both combinatorial problems and classical algebraic problems.

5.ACKNOWLEDGEMENT

This work is a part of Minor Research Project of **University Grants Commission** with Ref. No.F **MRP-5510 /15 (SERO/UGC).**

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CONNECTED DOMINATION NUMBER OF LEXICIGRAPHIC PRODUCT GRAPHS OF CAYLEY GRAPHS WITH ARITHMETIC GRAPHS

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Abstract

Nathanson was the pioneer in introducing the concepts of Number Theory, particularly, the "Theory of Congruences" in Graph Theory, thus paving way for the emergence of a new class of graphs, namely "Arithmetic Graphs". Cayley graphs are another class of graphs associated with the elements of a group. If this group is associated with some arithmetic function then the Cayley graph becomes an Arithmetic graph.

In this paper, we present some results related to connected domination number of Lexicographic product graphs of Euler Totient Cayley graphs with Arithmetic V_n graphs.

Keywords : Euler Totient Cayley Graph, Arithmetic V_n Graph, Lexicographic Product Graph. AMS (MOS) Subject Classification: 6905c.

1.INTRODUCTION

Connected Domination Number

S.T. Hedetniemi, R.C. Laskar [3] introduced the connected domination number in graphs. For a survey of connected domination see [5]. It is easy to observe that only connected graphs have a connected dominating set.

A dominating set D of G is said to be a connected dominating set if the induced subgraph $\langle D \rangle$ is connected.

Cardinality of the minimum connected dominating set is called the connected domination number of G and is denoted by $\gamma_c(G)$.

We characterize connected dominating sets of Euler totient Cayley graphs as follows.

Euler Totient Cayley Graph $G(Z_n, \varphi)$ and its Properties

Madhavi [5] introduced the concept of Euler Totient Cayley graphs and studied some of its properties. She gave methods of enumeration of disjoint Hamilton cycles and triangles in these graphs.

ISBN : 978-93-85101-95-3

For any positive integer n, let $Z_n = \{0,1,2,\ldots..n-1\}$. Then $(Z_n,\oplus)$, where, $\oplus$ is addition modulo n, is an abelian group of order n. The number of positive integers less than n and relatively prime to n, is denoted by $\varphi(n)$ and is called Euler totient function. Let S denote the set of all positive integers less than n and relatively prime to n.

That is $S = \{r/\ 1 \leq r < n$ and GCD $(r,n) = 1\}$. Then $|S| = \varphi(n)$.

Now we define Euler Totient Cayley graph as follows.

For each positive integer n, let Z_n be the additive group of integers modulo n and let S be the set of all integers less than n and relatively prime to n. The Euler totient Cayley graph $G(Z_n,\varphi)$ is defined as the graph whose vertex set V is given by $Z_n - \{0,1,2,\ldots.n-1\}$ and the edge set is $E - \{(x,y)/x-y \in S$ or $y-x \in S\}$.

Clearly as proved by Madhavi [5], the Euler totient Cayley graph $G(Z_n,\varphi)$ is

1. a connected, simple and undirected graph,
2. $\varphi(n)$ - regular and has $\frac{n.\varphi(n)}{2}$ edges,
3. Hamiltonian,
4. Eulerian for $n \geq 3$,
5. bipartite if n is even and
6. complete graph if n is a prime.

Arithmetic V_n Graph

Vasumathi and Vangipuram [7] introduced the concept of Arithmetic V_n graphs and studied some of its properties

Let n be a positive integer such that $n = p_1^{\alpha_1}p_2^{\alpha_2}\ldots\ldots p_k^{\alpha_k}$. Then the Arithmetic V_n graph is defined as the graph whose vertex set consists of the divisors of n and two vertices u,v are adjacent in V_n graph if and only if GCD $(u,v) = p_i$, for some prime divisor p_i of n.

In this graph vertex 1 becomes an isolated vertex. Hence we consider Arithmetic graph V_n without vertex 1 as the contribution of this isolated vertex is nothing when the properties of these graphs and enumeration of some domination parameters are studied

ISBN : 978-93-85101-95-3

Clearly, V_n graph is a connected graph. Because if n is a prime, then V_n graph consists of a single vertex. Hence it is a connected graph. In other cases, by the definition of adjacency in V_n, there exist edges between prime number vertices and their prime power vertices and also to their prime product vertices. Therefore each vertex of V_n is connected to some vertex in V_n.

Lexicographic Product Graph $G_1 \circ G_2$

The lexicographic product was first studied by Felix Hausdorff in the year 1914. Later this product was introduced as the composition of graphs by Harary in the year 1959. There has been a rapid growth of research on the structure of this product and their algebraic settings, after the publication of the paper, on the group of the composition of two graph by Haray, F [3]. Geller, D and Stahl [2] determined the chromatic number and other functions of this product in the year 1975. Feigenbaum and Schaffer [1] carried their research on the problem of recognizing whether a graph is a lexicographic product is equivalent to the graph isomorphism problem in the year 1986. Imrich and Klavzar [4] discussed the automorphisms, factorizations and non-uniqueness of this product.

This product is in general non-commutative. But two graphs G and H commute with respect to the lexicographic product if G and H are complete or if both are totally disconnected graphs (For a detailed description, refer [4]).

We know that if G_1 and G_2 are two simple graphs with their vertex sets as $V_1 = \{u_1, u_2, \ldots, u_l\}$ and $V_2 = \{v_1, v_2, \ldots, v_m\}$ respectively then the lexicographic product of these two graphs denoted by $G_1 \circ G_2$ is defined as the graph with vertex set $V_1 \times V_2$, where $V_1 \times V_2$ is the Cartesian product of the sets V_1 and V_2 and any two distinct vertices (u_1, v_1) and (u_2, v_2) of $G_1 \circ G_2$ are adjacent if

(i) $u_1u_2 \in E(G_1)$ or

(ii) $u_1 = u_2$ and $v_1v_2 \in E(G_2)$.

2. RESULTS

Let G_1 denote $G(Z_n, \varphi)$ graph and G_2 denote $G(V_n)$ graph. Then G_1 and G_2 are simple graphs as they have no loops and multiple edges. Hence by the definition of lexicographic product, $G_1 \circ G_2$ is also a simple graph.

ISBN : 978-93-85101-95-3

The domination parameter of these graphs are studied by the author [6] and the following results are required and they are presented without proofs.

Theorem: If n is neither a prime nor 2p then the domination number of $G_1 \circ G_2$ is $\lambda + 1$, where λ is the length of the longest stretch of consecutive integers in V_1 of G_1 each of which shares a prime factor with n.

Now we discuss connected domination number of $G_1 \circ G_2$.

Theorem 2.1: If n is a prime, then the connected domination number of $G_1 \circ G_2$ is 1.

Proof: $G_1 \circ G_2$ is a complete graph if n is a prime. Hence each single vertex set D_c in $G_1 \circ G_2$ is a minimum dominating set. This minimum dominating set D_c becomes minimum connected dominating set also.

Hence the connected domination number of $G_1 \circ G_2$ is **1.**

Again it is interesting to see that dominating set constructed in Theorem 5.3.3 becomes a connected dominating set of $G_1 \circ G_2$.

Theorem 2.2: If $n = p_1^{\alpha_1} p_2^{\alpha_2} \ldots\ldots p_k^{\alpha_k}$, where $\alpha_i \geq 1$, then the connected domination number of $G_1 \circ G_2$ is given by $\gamma_c(G_1 \circ G_2) = \lambda + 1$ where λ is the length of the longest stretch of consecutive integers in V_1 of G_1 each of which shares a prime factor with n.

Proof: Suppose $n = p_1^{\alpha_1} p_2^{\alpha_2} \ldots\ldots p_k^{\alpha_k}$, where $\alpha_i = 1$.

Consider a minimum dominating set of $G_1 \circ G_2$ given in [6] as

$$D_c = \{u_{d_1}, u_{d_2}, \ldots\ldots, u_{d_{\lambda+1}}\} \times \{v_x\} = \{(u_{d_1}, v_x), (u_{d_2}, v_x), \ldots\ldots, (u_{d_{\lambda+1}}, v_x)\},$$

where $u_{d_1}, u_{d_2}, \ldots\ldots, u_{d_{\lambda+1}}$ are consecutive integers in V_1 and v_x is any vertex in V_2.

We complete the proof if we show that the minimum dominating set D_c is connected.

Since $u_{d_1}, u_{d_2}, \ldots\ldots, u_{d_{\lambda+1}}$ are consecutive integers, each u_{d_i} is adjacent to its succeeding vertex $u_{d_{i-1}}$ for $1 \leq i \leq \lambda$ because GCD $(u_{d_i} - u_{d_{i-1}}, n) = 1$. Hence by the definition of Lexicographic Product, each vertex (u_{d_i}, v_x), for $1 \leq i \leq \lambda$ is adjacent to

ISBN : 978-93-85101-95-3

the vertex $(u_{s_{i-1}}, v_t)$. Thus $\langle D_i \rangle$ is connected. Therefore D_i is a connected dominating set with minimum cardinality $\lambda + 1$.

Hence $\gamma_c(G_1 \circ G_2) = |D_i| = \lambda + 1$. ∎

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International Journal of Pure and Applied Mathematics
Volume 117 No. 11 2017, 61-66
ISSN: 1311-8080 (printed version); ISSN: 1314-3395 (on-line version)
url: http://www.ijpam.eu
Special Issue

ijpam.eu

Elementary Properties of Product Graphs of Cayley Graphs With Arithmetic Graphs

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Abstract

Nathanson was the pioneer in introducing the concepts of Number Theory, particularly, the Theory of Congruences in Graph Theory, thus paving way for the emergence of a new class of graphs, namely Arithmetic Graphs. Cayley graphs are another class of graphs associated with the elements of a group. If this group is associated with some arithmetic function then the Cayley graph becomes an Arithmetic graph.

In this paper, we present some results related to elementary properties of product graphs of Euler Totient Cayley graphs with Arithmetic V_n graph.

AMS Subject Classification: 6905c.

Key Words and Phrases: Euler Totient Cayley Graph, Arithmetic V_n Graph, Lexicographic Product Graph.

1 Introduction

1.1 EULER TOTIENT CAYLEY GRAPH $G(Z_n, \phi)$ AND ITS PROPERTIES

Madhavi [1] introduced the concept of Euler Totient Cayley graphs and studied some of its properties. She gave methods of enumeration of disjoint Hamilton cycles and triangles in these graphs.

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modulo n, is an abelian group of order n. The number of positive integers less than n and relatively prime to n, is denoted by $\phi(n)$ and is called Euler totient function. Let S denote the set of all positive integers less than n and relatively prime to n. That is S = $\{r : 1 \leq r \prec n \text{ and } GCD(r,n) = 1\}$.Then $| s | = \phi(n)$.
Now we define Euler Totient Cayley graph as follows.
For each positive integer n , let Z_n be the additive group of integers modulo n and let S be the set of all integers less than n and relatively prime to n. The Euler totient Cayley graph $G(Z_n, \phi)$ is defined as the graph whose vertex set V is given by Z_n={0,1,2,..n-1} and the edge set is E={(x,y):x-y ϵ s or y-x ϵ s }.
Clearly as proved by Madhavi [1], the Euler totient Cayley graph $G(Z_n, \phi)$ is

1. A connected, simple and undirected graph,
2. ϕ(n) - regular and has $\frac{n}{2}\phi$(n) edges,
3. Hamiltonian,
4. Eulerian for $n \succeq 3$,
5. Bipartite if n is even and
6. Complete graph if n is a prime.

1.2 ARITHMETIC V_n GRAPH

Vasumathi [2] introduced the concept of Arithmetic V_n graphs and studied some of its properties.
Let n be a positive integer such that $n = p_1^{\alpha_1} p_2^{\alpha_2} .... p_k^{\alpha_k}$. Then the Arithmetic V_n graph is defined as the graph whose vertex set consists of the divisors of n and two vertices u,v are adjacent in V_n graph if and only if $GCD(u, v) = p_i$, for some prime divisor p_i of n.
In this graph vertex 1 becomes an isolated vertex. Hence we consider Arithmetic graph V_n without vertex 1 as the contribution of this isolated vertex is nothing when the properties of these graphs and enumeration of some domination parameters are studied.
Clearly, V_n graph is a connected graph. Because if n is a prime, then V_n graph consists of a single vertex. Hence it is a connected graph. In other cases, by the definition of adjacency in V_n, there exist edges between prime number vertices and their prime power vertices and also to their prime product vertices. Therefore each vertex of V_n is connected to some vertex in V_n.

1.3 LEXICOGRAPHIC PRODUCT GRAPH $G_1 \circ G_2$

The lexicographic product was first studied by Felix Hausdorff in the year 1914. Later this product was introduced as the composition of graphs by Harary in the

year 1959. There has been a rapid growth of research on the structure of this product and their algebraic settings, after the publication of the paper, on the group of the composition of two graph by Harary [3]. Geller and Stahl [4] determined the chromatic number and other functions of this product in the year 1975. Feigenbaum and Schaffer [5] carried their research on the problem of recognizing whether a graph is a lexicographic product is equivalent to the graph isomorphism problem in the year 1986. Imrich and Klavzar [6] discussed the automorphisms, factorizations and non-uniqueness of this product.
This product is in general non-commutative. But two graphs G and H commute with respect to the lexicographic product if G and H are complete or if both are totally disconnected graphs (For a detailed description, refer [6]).
We know that if G_1 and G_2 are two simple graphs with their vertex sets as $V_1 = \{u_1, u_2, ...u_l\}$ and $V_2 = \{v_1, v_2, ...v_m\}$ respectively then the lexicographic product of these two graphs denoted by $G_1 \circ G_2$ is defined as the graph with vertex set $V_1 \times V_2$, where $V_1 \times V_2$ is the Cartesian product of the sets V_1 and V_2 and any two distinct vertices (u_1, v_1) and (u_2, v_2) of $G_1 \circ G_2$ are adjacent if

1. $u_1u_2 \in E(G_1)$ or

2. $u_1 = u_2$ and $v_1v_2 \in E(G_2)$.

2 Results

Let G_1 denote $G(Z_n, \phi)$ graph and G_2 denote $G(V_n)$ graph. Then G_1 and G_2 are simple graphs as they have no loops and multiple edges. Hence by the definition of lexicographic product, $G_1 \circ G_2$ is also a simple graph.
Now we discuss some properties of $G_1 \circ G_2$.

Theorem 1. *The degree of a vertex in $G_1 \circ G_2$ is given by* $deg_{G_1 \circ G_2}(u_i, v_j) = deg_{G_1}(u_i). \mid V_2 \mid + deg_{G_2}(v_j) = \phi(n). \mid V_2 \mid + deg_{G_2}(v_j)$.

Proof. By the definition of lexicographic product, vertex (u_i, v_j) in $G_1 \circ G_2$ is adjacent to all the vertices of the sets $N_{G_1}(u_i) \times V_2$, and $\{u_i\} \times N_{G_2}(v_j)$, where $N_{G_1}(u_i)$ denotes the open neighbourhood set of u_i in the graph G_1.
So $N_{G_1 \circ G_2}(u_i, v_j) = \{N_{G_1}(u_i) \times V_2\} \cup \{\{u_i\} \times N_{G_2}(v_j)\}$
Now $\mid N_{G_1}(u_i) \mid = deg_{G_1}(u_i) = \phi(n)$, $\mid N_{G_2}(v_j) \mid = deg_{G_2}(v_j)$,
$\mid N_{G_1 \circ G_2}(u_i, v_j) \mid = deg_{G_1 \circ G_2}(u_i, v_j)$
Therefore $\mid N_{G_1 \circ G_2}(u_i, v_j) \mid = \mid \{N_{G_1}(u_i) \times V_2\} \mid + \mid \{\{u_i\} \times N_{G_2}(v_j)\} \mid$
$= \mid N_{G_1}(u_i) \mid\mid V_2 \mid + \mid \{u_i\} \mid\mid N_{G_2}(v_j) \mid$
$= deg_{G_1}(u_i). \mid V_2 \mid + deg_{G_2}(v_j)$.
Hence $deg_{G_1 \circ G_2}(u_i, v_j) = deg_{G_1}(u_i). \mid V_2 \mid + deg_{G_2}(v_j)$.
$= \phi(n) + deg_{G_2}(v_j)$.

□

We now show that $G_1 \circ G_2$ is a simple graph.

Theorem 2. *$G_1 \circ G_2$ is a simple finite graph without isolated vertices.*

Proof. Since G_1 and G_2 are simple finite graphs, by the definition of lexicographic product it follows that $G_1 \circ G_2$ is also a simple finite graph.
We know that G_1 is a graph without isolated vertices. Further if n is a prime then G_2 is a single vertex graph. Otherwise it is a graph without isolated vertices.
Therefore $deg_{G_1}(u_i) \neq 0$ for any i, and
$deg_{G_2}(v_j) = 0$, if n is a prime and $deg_{G_2}(v_j) \neq 0$ otherwise.
Hence by Theorem 2.1.
$deg_{G_1 \circ G_2}(u_i, v_j) = \phi(n).\mid V_2 \mid + deg_{G_2}(v_j).$
$= \phi(n).\mid V_2 \mid + 0$, if n is prime
$= \phi(n).\mid V_2 \mid + deg_{G_2}(v_j)$ otherwise.
Thus $deg_{G_1 \circ G_2}(u_i, v_j) \neq 0$ for any i,j.
Hence $G_1 \circ G_2$ admits no isolated vertex. □

Theorem 3. *The number of vertices and edges in $G_1 \circ G_2$ is given respectively by*

1. $\mid V_{G_1 \circ G_2} \mid = \mid V_{G_1} \mid\mid V_{G_2} \mid$.
2. $\mid E_{G_1 \circ G_2} \mid = \mid V_{G_1} \mid\mid E_{G_2} \mid + \mid V_{G_2} \mid^2 \mid E_{G_1} \mid$.

Proof. Let n_1, n_2, n denote the number of vertices and m_1, m_2, m denote the number of edges of graphs G_1, G_2 and $G_1 \circ G_2$ respectively.
Since $V_1 \times V_2$, it follows that $\mid V \mid = \mid V_1 \times V_2 \mid = \mid V_1 \mid\mid V_2 \mid$
$n = n_1 n_2$.
This implies that $\mid V_{G_1 \circ G_2} \mid = \mid V_{G_1} \mid\mid V_{G_2} \mid$.
We know that $\mid E_{G_1} \mid = m_1 = \frac{1}{2}\sum_{u_i \in V_{G_1}} deg(u_i)$ and

$$\mid E_{G_2} \mid = m_2 = \frac{1}{2}\sum_{v_j \in V_{G_2}} deg(v_j)$$

Now $\mid E_{G_1 \circ G_2} \mid = m = \frac{1}{2}\sum_{i,j} deg(u_i, v_j)$

$$= \frac{1}{2}\{\sum_{i,j}[deg_{G_1}(u_i) \mid V_2 \mid + deg_{G_2}(v_j)]\} \text{ (by Theorem 2.1)}$$
$$= \frac{1}{2}\{(\sum_{i,j}[deg(u_i) \mid V_2 \mid) + \sum_{i,j} deg(v_j)]\}$$
$$= \frac{1}{2}\{\sum_j(\sum_i deg(u_i)) \mid V_2 \mid) + \sum_i(\sum_j deg(v_j))\}$$
$$= \frac{1}{2}\{\sum_j(2m_1)n_2 + \sum_j(2m_2)\}$$
$$= \frac{1}{2}\{(2m_1)n_2 n_2 + (2m_2)n_1\}$$
$$= m_1 {n_2}^2 + m_2 n_1$$
$$= n_1 m_2 + {n_2}^2 m_1$$

Hence $\mid E_{G_1 \circ G_2} \mid = \mid V_{G_1} \mid\mid E_{G_2} \mid + \mid V_{G_2} \mid^2 \mid E_{G_1} \mid$. □

Theorem 4. *$G_1 \circ G_2$ is a complete graph, if n is a prime.*

Proof. Suppose n is a prime. Then G_1 is a complete graph and G_2 is a single vertex graph viz., K_1. Hence by the definition of lexicographic product, $G_1 \circ G_2$ results the same graph as G_1 which is a complete graph.
Hence the Theorem. □

We now examine the property of connectivity of graph $G_1 \circ G_2$.
It is proved by Imrich and Klavzar [6] that the lexicographic product of two graphs is connected if and only if the first graph in the product is connected.
Since G_1 is a connected graph, the following result is an immediate consequence.

Theorem 5. *$G_1 \circ G_2$ is a connected graph.*

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International Journal of Advanced in Management, Technology and Engineering Sciences ISSN NO : 2249-7455

Independent Dominating Sets of Lexicographic Product Graphs of Cayley Graphs with Arithmetic Graphs

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Abstract:
Domination in graphs is the fast growing area in Graph Theory that has emerged rapidly in the last five decades. Domination in graphs has applications to several fields such as facility location problems, School Bus Routing, Computer Communication Networks, Radio Stations, Locating Radar Stations Problem etc. Every branch of mathematics employs some notion of a product that enables the combination or decomposition of its elemental structures. Product of graphs are introduced in graph theory very recently and developing rapidly. An Euler totient Cayley graph is an arithmetic graph constructed using the Euler totient function. In this paper, we consider Lexicographic product graphs of Cayley graphs with Arithmetic graphs and discuss independent domination number of these graphs.
Keywords: Dominating Set, Independent Dominating Set, Lexicographic Product Graph, Euler Totient Cayley Graph, Arithmetic V_u Graph.

I. INTRODUCTION

The theory of domination was formalized by Berge [1] and Ore [2] in 1962. Since then it has developed rapidly and various variations of domination are introduced and studied. The independent domination number and the notation $i(G)$were introduced by Cockayne and Hedetniemi in [3, 4] and later developed by Allan and Laskar [5]. Independent dominating sets have been studied extensively in the literature [6, 7].

A dominating set D of a graph G is a subset of vertex set V of G such that every vertex in $V - D$ is adjacent to at least one vertex in D. The minimum cardinality of a dominating set D of G is called the domination number of G and is denoted by $\gamma(G)$.

A subset of vertices of V of a graph G is called an independent set if no two vertices in it are adjacent. An independent dominating set of $G$is a set that is both dominating and independent in G. The independent domination number of G, denoted by $\gamma_i(G)$, is the minimum cardinality of an independent dominating set.

Lexicographic Product Graph $G_1 \circ G_2$

The lexicographic product was first studied by Felix Hausdorff in the year 1914. Later this product was introduced as the composition of graphs by Harary in the year 1959. There has been a rapid growth of research on the structure of this product and their algebraic settings, after the publication of the paper, on the group of the composition of two graph by Haray, F [8]. Geller, D and Stahl [9] determined the chromatic number and other functions of this product in the year 1975. Feigenbaum and Schaffer [10] carried their research on the problem of recognizing whether a graph is a lexicographic product is equivalent to the graph isomorphism problem in the year 1986. Imrich and Klavzar [11] discussed the automorphisms, factorizations and non-uniqueness of this product.

This product is in general non-commutative. But two graphs G and H commute with respect to the lexicographic product if G and H are complete or if both are totally disconnected graphs.

We know that if G_1 and G_2 are two simple graphs with their vertex sets as $V_1 = \{u_1, u_2, \ldots, u_l\}$ and $V_2 = \{v_1, v_2, \ldots, v_m\}$ respectively then the lexicographic product of these two graphs denoted by $G_1 \circ G_2$ is defined as the graph with vertex set $V_1 \times V_2$, where $V_1 \times V_2$ is the Cartesian product of the sets V_1 and V_2 and any two distinct vertices (u_1, v_1) and (u_2, v_2) of $G_1 \circ G_2$ are adjacent if

(i) $u_1u_2 \in E(G_1)$ or

(ii) $u_1 = u_2$ and $v_1v_2 \in E(G_2)$.

Euler Totient Cayley Graph $G(Z_n, \varphi)$

Madhavi [12] introduced the concept of Euler totient Cayley graphs and studied some of its properties. She gave methods of enumeration of disjoint Hamilton cycles and triangles in these graphs.

For each positive integer n, let Z_n be the additive group of integers modulo n and let S be the set of all integers less than n and relatively prime to n. The Euler totient Cayley graph $G(Z_n, \varphi)$ is defined as the graph whose vertex set V is given by $Z_n = \{0,1,2, \ldots . n-1\}$ and the edge set is $E = \{(x,y)/x - y \in S \text{ or } y - x \in S\}$.

Clearly as proved in [12], the Euler totient Cayley graph $G(Z_n, \varphi)$ is

1. a connected, simple and undirected graph,
2. $\varphi(n)$ - regular and has $\frac{n\varphi(n)}{2}$ edges,
3. Hamiltonian,
4. Eulerian for $n \geq 3$,
5. bipartite if n is even and
6. complete graph if n is a prime.

The independent domination number of these graphs are studied by the authors [13] and the following results are required and they are presented without proofs.

Theorem 1.1: If n is a prime, then the independent domination number of $G(Z_n, \varphi)$ is 1.

Theorem 1.2: The independent domination number of $G(Z_n, \varphi)$ is 2, if $n = 2p$ where p is an odd prime.

Theorem 1.3: Suppose n is neither a prime nor $2p$. Let $n = p_1^{\alpha_1} p_2^{\alpha_2} \ldots \ldots p_k^{\alpha_k}$, where $p_1, p_2, \ldots p_k$ are primes and $\alpha_1, \alpha_2, \ldots . \alpha_k$ are integers ≥ 1, then the independent domination number of $G(Z_n, \varphi)$ is $\frac{n}{p_k}$.

Arithmetic V_n Graph

Vasumathi and Vangipuram [14] introduced the concept of Arithmetic V_n graphs and studied some of its properties.

Let n be a positive integer such that $n = p_1^{u_1} p_2^{u_2} \ldots \ldots p_k^{u_k}$. Then the Arithmetic V_n graph is defined as the graph whose vertex set consists of the divisors of n and two vertices u, v are adjacent in V_n

graph if and only if GCD $(u, v) = p_i$, for some prime divisor p_i of n.

In this graph vertex 1 becomes an isolated vertex. Hence we consider Arithmetic graph V_n without vertex 1 as the contribution of this isolated vertex is nothing when the properties of these graphs and enumeration of some domination parameters are studied.

Clearly, V_n graph is a connected graph. Because when n is a prime, V_n graph consists of a single vertex. Hence it is a connected graph. In other cases, by the definition of adjacency in V_n, there exist edges between prime number vertices and their prime power vertices and also to their prime product vertices. Therefore each vertex of V_n is connected to some vertex in V_n.

The independent domination number of these graphs are obtained by the authors and the proof of the following theorem can be found in [13].

Theorem 1.4: If $n = p_1^{\alpha_1} p_2^{\alpha_2} \ldots\ldots p_k^{\alpha_k}$, where $p_1, p_2, \ldots p_k$ are primes and $\alpha_1, \alpha_2, \ldots, \alpha_k$ are integers ≥ 1, then the domination number of $G(V_n)$ is given by

$$\gamma_i(G(V_n)) = \begin{cases} k-1 & \text{if } \alpha_i = 1 \text{ for more than one } i \\ k & \text{Otherwise.} \end{cases}$$

where k is the core of n.

II. INDEPENDENT DOMINATION IN LEXICO- GRAPHIC PRODUCT GRAPH $G_1 o G_2$

Let G_1 denote $G(Z_n, \varphi)$ graph and G_2 denote $G(V_n)$ graph. Then G_1 and G_2 are simple graphs as they have no loops and multiple edges. Hence by the definition of lexicographic product, $G_1 o G_2$ is also a simple graph.

Now we discuss independent dominating sets of Lexicographic product graphs $G_1 o G_2$.

Theorem 2.1: If $n = p_1^{\alpha_1} p_2^{\alpha_2} \ldots\ldots p_k^{\alpha_k}$, where $\alpha_i > 0$, then the independent domination number of $G_1 o G_2$ is given by

$$\gamma_i(G_1 o G_2) = \gamma_i(G_1)\,\gamma_i(G_2)$$

$$= \begin{cases} \frac{n}{p_k} \cdot (k-1), & \text{If } \alpha_i = 1 \text{ for more than one } i \\ \frac{n}{p_k} \cdot k, & \text{Otherwise.} \end{cases}$$

where k is the core of n.

Proof: Let V_1, V_2 and V denote the vertex sets of the graphs G_1, G_2 and $G_1 o G_2$ respectively. By Theorem 1.3 in [3], it is clear that the elements of the set V_1 can be divided into disjoint sets

$D_i = \left\{ r.p_k + i \;/\; r = 0, 1, 2, \ldots\ldots, \left(\frac{n}{p_k} - 1\right) \right\}$

for $1 \leq i \leq p_k$, such that each D_i is an independent dominating set of G_1 with minimum cardinality $\frac{n}{p_k}$.

Inparticular, let $D_{i_1} = \left\{ 0,\ p_k,\ 2p_k,\ \ldots\ldots,\ \left(\frac{n}{p_k} - 1\right) p_k \right\}$ be an independent dominating set of G_1 with minimum cardinality $\frac{n}{p_k}$.

By Theorem 1.4 in [13], it is clear that

$$\gamma_i(G_2) = \begin{cases} k-1, & \text{If } \alpha_i = 1 \text{ for more than one } i \\ k, & \text{Otherwise} \end{cases}$$

Further we know that if $\alpha_i > 1$, for all i or $\alpha_i = 1$ for only one i, then $D_{i_2} = \{ p_1, p_2, \ldots\ldots, p_k \}$ is an independent dominating set of G_2 with minimum cardinality k, and if $\alpha_i - 1$ for more than one i, then the set $D_{i_2'} = \{ p_1, p_2, \ldots\ldots, p_{i-2}, p_{i-1} \cdot p_i, p_{i-1}, \ldots\ldots, p_k \}$ is an independent dominating set of G_2 with minimum cardinality $k-1$. In order to find an independent dominating set of $G_1 o G_2$ we proceed in two cases:

Case I: Suppose $\alpha_i > 1$ for all i or $\alpha_i = 1$ for only one i. Consider $D = D_{i_1} \times D_{i_2} =$

$$\left\{ 0,\ p_k,\ 2p_k,\ 3p_k, \ldots\ldots,\ \left(\frac{n}{p_k} - 1\right) p_k \right\} \times \{ p_1, p_2, \ldots\ldots, p_k \}$$

$$- \{ (0, p_1), (0, p_2), (0, p_3), \ldots (0, p_k),$$

$$(p_k, p_1), (p_k, p_2), (p_k, p_3), \ldots (p_k, p_k) \ldots\ldots\ldots\ldots$$

$$\left(\left(\frac{n}{p_k} - 1\right)p_k, p_1\right), \left(\left(\frac{n}{p_k} - 1\right)p_k, p_2\right), \left(\left(\frac{n}{p_k} - 1\right)p_k, p_3\right), \ldots \left(\left(\frac{n}{p_k} - 1\right)p_k, p_k\right) \}$$

Suppose $x, y \in D$ such that $x = (ap_k, p_i)$, $y = (bp_k, p_j)$
where $0 \leq a, b \leq \frac{n}{p_k} - 1$, $1 \leq i, j \leq k$.

Vertices ap_k, bp_k are not adjacent because GCD $(ap_k - bp_k, n)$ =GCD $((a-b)p_k, n) \neq 1$.
Further if $ap_k = bp_k$, then p_i, p_j are not adjacent because GCD $(p_i, p_j) = 1$ for $i \neq j$. Hence by the definition of lexicographic product x and y are not adjacent for $x, y \in D$. Thus D becomes an independent set of $G_1 \circ G_2$.

We now claim that D is a dominating set of $G_1 \circ G_2$. Let $(u, v) \in V - D$. Since $D = D_{i_1} \times D_{i_2}$, it follows that $u \in D_{i_1}$ and $v \notin D_{i_2}$ or $u \notin D_{i_1}$ and $v \in D_{i_2}$ or $u \notin D_{i_1}$ and $v \notin D_{i_2}$.

Therefore the following sub-cases arise.

Subcase 1: Suppose $u \in D_{i_1}$ and $v \notin D_{i_2}$.

Since D_{i_2} is a dominating set of G_2, for $v \notin D_{i_2}$, certainly there exists atleast one vertex in $\{p_1, p_2, \ldots, p_k\}$ say p_j such that v and p_j are adjacent to each other. Then by the definition of lexicographic product, (u, v) in $V - D$ is adjacent to (u, p_j) in D.

Subcase 2: Suppose $u \notin D_{i_1}$ and $v \in D_{i_2}$ or $u \notin D_{i_1}$ and $v \notin D_{i_2}$.

Since $u \notin D_{i_1}$, u is adjacent to at least one vertex cp_k, for $0 \leq c \leq \frac{n}{p_k} - 1$, in D_{i_1} as D_{i_1} is a dominating set of G_1. Hence by the definition of lexicographic product, in either of the cases $v \in D_{i_2}$ and $v \notin D_{i_2}$, we have (u, v) in $V - D$ is adjacent to (cp_k, v_l), $\forall\, v_l \in V_2$. In particular (u, v) in $V - D$ is adjacent to (cp_k, p_1), (cp_k, p_2), ……., (cp_k, p_k) in D.

Thus we conclude that every vertex (u, v) in $V - D$ is adjacent to at least one vertex in D.

We now prove that D is minimum. Suppose we remove a vertex (dp_k, p_i) from D. where $0 < d < \frac{n}{p_k} - 1$ and $1 \leq l \leq k$. Then the deleted vertex (dp_k, p_i) is in $V - D$. Further this vertex (dp_k, p_i) is not adjacent to any vertex (sp_k, p_j) of D for $0 \leq s \leq \frac{n}{p_k} - 1$. This is because for $0 \leq d, s \leq \frac{n}{p_k} - 1$, GCD $(dp_k - sp_k, n) \neq 1$. Hence by the definition of adjacency in G_1, vertex dp_k is not adjacent to vertex sp_k. Further if $dp_k = sp_k$, then by the definition of adjacency in G_2 vertex p_i is not adjacent to vertex p_j as GCD $(p_i, p_j) = 1$ for $i \neq j$. Hence by the definition of lexicographic product, vertex (dp_k, p_i) is not adjacent to any vertex (sp_k, p_j) of D. Thus $D - \{(dp_k, p_i)\}$ is not a dominating set. Thus D becomes minimal with cardinality $\frac{n}{p_k} \cdot k$. If a minimal dominating set is formed in any other way, then the cardinality of such a set is not smaller than that of D. This follows from the properties of the prime divisors of a number.

Thus D becomes an independent dominating set with minimum cardinality $\frac{n}{p_k} \cdot k$.

Case 2: Suppose $\alpha_i = 1$ for more than one i. Consider $D' = D_{i_1} \times D_{i_1'}$
$= \{0, p_k, 2p_k, 3p_k, \ldots\ldots (\frac{n}{p_k} - 1)p_k\} \times \{p_1, p_2, \ldots\ldots, p_{i-2}, p_{i-1}, p_i, p_{i+1}, \ldots\ldots, p_k\}$

Proceeding as in Case 1, we can show that D' is an independent dominating set of $G_1 \circ G_2$ with minimum cardinality $\frac{r}{p_k} \cdot (k-1)$.

Therefore $\gamma_i(G_1 \circ G_2) = |D'| = \frac{n}{p_k} \cdot (k-1)$ ■

2. ILLUSTRATIONS

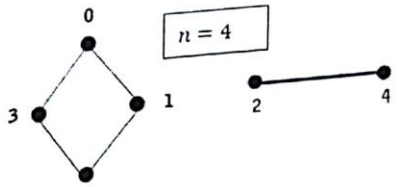


Fig 1: $G_1 = G(Z_4, \varphi)$ Fig 2: $G_2 = G(V_4)$

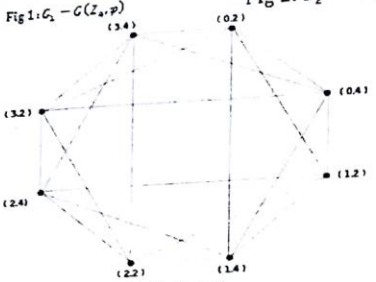
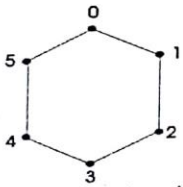


Fig 3: $G_1 \circ G_2$

Minimum Independent Dominating set:

{(0,2), (2,2)} and $\gamma_i = 2$



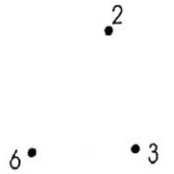


Fig 4: $G_1 = G(Z_6, \varphi)$ Fig 5: $G_2 = G(V_6)$

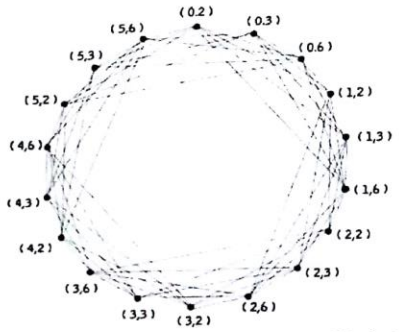


Fig 6: $G_1 \circ G_2$

Minimum Independent Dominating set:

$\{(0,6), (3,6)\}$ and $\gamma_t = 2$

$n = 11$

Fig 7: $G_1 = G(Z_{11}, \varphi)$

Fig 8: $G_2 = G(V_{11})$

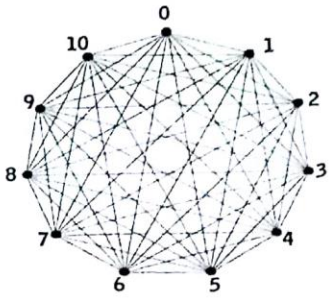


Fig 9: $G_1 \circ G_2$

Minimum Independent Dominating set:

$\{(0,11)\}$ and $\gamma_t = 1$

4. CONCLUSION

Graph Theory is young but rapidly maturing subject. Its basic concepts are simple and can from many different subjects. The purpose of this work is to familiarize the reader with the Cartesian Cayley graph with Arithmetic Vn graph. It is useful other Researchers for further studies of other d product graphs and their relevance in both combinatorial problems and classical algebraic problems.

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17. Published a paper titled "Commutative Regular Rings" in the Global Journal of Pure and Applied Mathematics" with ISSN : 0973-1768

http:// www.ripublication.com

IAETSD JOURNAL FOR ADVANCED RESEARCH IN APPLIED SCIENCES ISSN NO: 2394-8442

Commutative Regular Rings

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ABSTRACT

In this paper we shall introduce the concept of ideals and relationship between idempotent and ideals of a ring with unity 1.Examples for ideals are given. Ideal generated by A, principal right ideal, greatest lower bound of I_1 and I_2, and least upper bound of I_1 and I_2 are introduced .It is proved that $I_1 + I_2$ is a right ideal of R. 2-ring,3-ring and p-ring are defined .And their idempotent are given. Further it is proved that e is an idempotent if and only if 1-e is an idempotent. It is shown that for any idempotent e,$x \in (e)_r \Leftrightarrow ex = x$. It is proved that $I = (e)_r$ and

$J = (1 - e)_r$ are two inverse right ideals, further it is proved that e is unique. The term regular ring is introduced .It is established that an integral domain is regular iff it is a field. It is proved that in a ring R with unity, maximal ideal is a principal ideal. Commutative regular ring is introduced. Further it is proved that every maximal ideal M of a commutative regular ring R with unity 1, is a prime ideal.

Introduction

In this paper we shall introduce the concept of ideals and relationship between idempotents and ideals of a ring with unity 1.

We prove that in a ring R with unity, every maximal ideal is a principal ideal. And we prove that every prime ideal in a commutative regular ring with unity 1 is a maximal ideal.

Preliminary Notes:

Def 1.1: Suppose R is ring with unity 1.

A right (left) ideal I of R is a set $I \sqsubseteq R$ such that

(i) $x \in I, y \in I \Rightarrow x + y \in I$
(ii) $x \in I, z \in R, \Rightarrow xz \in I (zx \in I)$

Note 1.2: $(o)_r, R$ are right ideals

Note 1.3: $IR = \{ar/a \in I, r \in R\}$ is a right ideal and $I R \sqsubseteq I$

Example 1.4: In the ring of 2x2 matrices over a field F with binary operations matrix addition and matrix multiplication A = $\{\begin{bmatrix} a & b \\ 0 & 0 \end{bmatrix} / \ a, b \in F\}$ Is a right ideal but not left ideal.

Example 1.5: In the ring of integers Z, mZ={mn/n ∈ Z} is an ideal of Z.

Note 1.6: The smallest right ideal containing A $\sqsubseteq R$ is called the right ideal generated by A and is denoted by $(A)_r$.

(i) $(A)_r$ is a right ideal of R containing A.
(ii) I is any right ideal of R containing A then $(A)_r \sqsubseteq I$ (or)

$$(A)_r = \bigcap_{\substack{I \text{ is a right} \\ \text{ideal and A} \sqsubseteq I}} I$$

If A= $\{a_1, a_2, \ldots \ldots, a_n\}$ then $(A)_r$ is finitely generated by $a_1, a_2, \ldots \ldots, a_n$ and $a_1, a_2, \ldots \ldots, a_n$ are generators of $(A)_r$

If A= {a} then $(A)_r$ is denoted by $(a)_r$ .And $(a)_r$ is called principal right ideal.

$(a)_r = \{ar+na/r \in R, n \in Z\}$

If R has unity 1, then $(a)_r = \{ar/r \in R,\}$

Similarly $(a)_l = \{ra/r \in R\}$

Note 1.7: The set of all right ideals form a partially ordered set with respect to set theoretical inclusion $I \sqsubseteq J$. This set has a minimum element (o) $=(o)_r$ and a maximum element $(1)_r = R$.

Note 1.8: For any set of right ideals $I_1, I_2, \ldots \ldots$ of a ring R, there exists a maximal right ideal I such that I $\sqsubseteq I_1, I_2, \ldots \ldots$ and $I_1 \cap I_2 \cap \ldots \ldots$ is the maximal right ideal contained in every ideal $I_1, I_2, \ldots \ldots$ and it is denoted by glb $\{I_1, I_2, \ldots \ldots\}$

Note 1.9: For any_ set of right ideals $I_1, I_2, \ldots \ldots$ of a ring R,there exists a minimal right ideal I such that I$\sqsupseteq I_1, I_2, \ldots \ldots$ and it is denoted by lub$\{I_1, I_2, \ldots \ldots\}$

Note 1.10: For the right ideals I_1, I_2 glb (I_1, I_2) is denoted by $I_1 \wedge I_2$ and lub(I_1, I_2) is denoted by $I_1 \vee I_2$.

Note 1.11: The_ set of right ideals form a lattice with ∧, ∨, Zero$(0)_r$,Unity R=$(1)_r$.

Def 1.12: A right ideal G of R is glb(I_1, I_2)

If (i) G⊑ I_1 ,G⊑ I_2 .

(iii) A is an ideal such that A⊑ I_1 ,A⊑ I_2 then A⊑ G.
glb(I_1, I_2) is denoted by $I_1 \wedge I_2$

Def 1.13: If right ideal L of R is lub($\{I_1, I_2\}$)

If (i). $I_1 \sqsubseteq L, I_2 \sqsubseteq L$.

(i) A is an right ideal such that $I_1 \sqsubseteq A, I_2 \sqsubseteq A$then L⊑ A.

Lub$\{I_1, I_2\}$ is denoted by $I_1 \vee I_2$

Note 1.14: $I_1 \vee I_2 = I_1 + I_2 = \{x+y/x \in I_1, y \in I_2\}$

Theorem 1.15: To prove that $I_1 + I_2$ is a right ideal of R.

Proof: (i) Let $x_1 + y_1, x_2 + y_2 \in I_1 + I_2$ where $x_1, x_2 \in I_1, y_1, y_2 \in I_2$

Then $(x_1 + y_1) + (x_2 + y_2) = (x_1 + x_2) + (y_1 + y_2) \in I_1 + I_2$

(ii)Let $x + y \in I_1 + I_2$ where $x \in I_1, y \in I_2$

Let r ∈ R

(x+y)r= xr+yr ∈ $I_1 + I_2$(∵ xr∈ $I_1, yr \in I_2$)

∴ $I_1 + I_2$is a right ideal of R.

Def 1.16: Suppose R is a ring with unity. An element e ∈ R is called idempotent if $e^2 = e$.

Example 1.17: In the ring of integers 0,1 are idempotents.

Example 1.18: A Commutative ring (R,+, · .0,1) is a Boolean ring, if $a^2 = a \; \forall \; a \in R$

In a Boolean ring (2-ring) every element is idempotent.

Example 1.19: A Commutative ring (R,+, · ,0,1) is called a 3-ring

If $a^3 = a, 3a = 0 \; \forall \; a \in R$

In a 3-ring, for every a, a^2 is an idempotent.

For $(a^2)^2 = a^4 = a^3 .a = a.a = a^2$

Example 1.20: A Commutative ring $(R,+, \cdot ,0,1)$ is called a p-ring ,where p is a prime number, if $a^p = a$, $pa = 0 \ \forall a \in R$

In a p-ring, for every a, a^{p-1} is an idempotent.

For $(a^{p-1})^2 = a^{p-1} . a^{p-1} = a^p .a^{-1} . a^{p-1}$

$= a^1.a^{-1}. a^{p-1}$

$= a^0. a^{p-1}$

$= a^{p-1}$

$\therefore (a^{p-1})^2 = a^{p-1}$

Lemme1.21: e is an idempotent if and only if 1-e is an idempotent

Proof: Suppose e is an idempotent

i.e., $e^2 = e$

$\Rightarrow e^2 - e = 0$

$\Rightarrow e - e^2 = 0$

$\Rightarrow e(1 - e) = 0.$

Consider $(1 - e)^2$

$(1 - e)^2 = (1 - e) (1 - e)$

$= 1(1 - e) - e(1 - e)$

$= 1(1 - e) - 0$

$\therefore (1 - e)^2 = (1 - e)$

$(1 - e)$ is an idempotent

Conversely

Suppose 1-e is an idempotent

$\Rightarrow$ 1-(1-e) is an idempotent

$\Rightarrow$ e is an idempotent

Lemme1.22: For any idempotent e, $x \in (e)_r \Leftrightarrow ex = x$.

Proof: suppose $x \in (e)_r$ for any idempotent e

$\Rightarrow x = ey$ for some $y \in R$

Consider $ex = e(ey) = e^2y = ey = x$

$\therefore ex = x$

Conversely

Suppose $ex = x$

Since $ex \in (e)_r$

$\Rightarrow x \in (e)_r$ ($\because ex = x$)

Lemme1.23: I, J are two inverse right ideals if and only if $I = (e)_r, J = (1 - e)_r$ for an idempotent e.

Proof: Given I, J are two inverse right ideals$\Rightarrow I \wedge J = (0)_r, I \vee J = R$

Since $1 \in R \Rightarrow 1 \in I \vee J$

$\Rightarrow 1 = x + y$ where $x \in I, Y \in J$

Claim: $I = (x)_r$

Clearly $(x)_r \sqsubseteq I$

Let $z \in I$

$z = 1.z = (x+y)\, z = xz + yz$

Since $z \in I$, $xz \in I$

$\Rightarrow z - xz \in I$

i.e y $z \in I$

but y $z \in J$

$\Rightarrow$ y $z \in I \cap J = (0)_r$

$\Rightarrow yz = 0$

Hence $z = xz \in (x)_r$

$\Rightarrow I \sqsubseteq (x)_r$

$\Rightarrow I = (x)_r$

Similarly

$J = (y)_r = (1 - x)_r$

$x(1-x) = (1-x)x \in I$

$x(1-x) = (1-x)x \in J$

$\Rightarrow x(1-x) \in I \cap J = (0)_r$

$\Rightarrow x(1-x) = 0$

$\Rightarrow x - x^2 = 0$

$\Rightarrow x^2 = x$

$\Rightarrow$ x is an idempotent

Let x=e

$\therefore I = (e)_r, J = (1 - e)_r$

Conversely,

Suppose that $I = (e)_r, J = (1 - e)_r$

Let $x \in I \cap J$

$\Rightarrow x \in I = (e)_r \Rightarrow ex = x$

And $x \in J = (1 - e)_r \Rightarrow (1 - e)x = x$

$\therefore x = (1 - e)x$

$= x - ex$

$= x - x$

$= 0$

$\therefore x = 0$

$\therefore I \wedge J = (0)_r$

$\because 1 = e + 1 - e \in I \vee J$

$1 \in I \vee J, r \in R$

$\Rightarrow 1r \in I \vee J$

$r \in I \vee J$

$R \sqsubseteq I \vee J$

Clearly $I \vee J \sqsubseteq R$

$\because I \vee J$ is an ideal of R

$\therefore I \vee J = R \Rightarrow$ I and J are inverse right ideals.

Lemme1.24: If I,J are inverse right ideals and $I = (e)_r, J = (1-e)_r$,e is an idempotent then e is unique.

Proof: Suppose f is another idempotent in R such that $I = (f)_r, J = (1-f)_r$

$e \in I = (f)_r \Rightarrow fe = e$ ---------- 1

$\Rightarrow e - fe = 0$

$\Rightarrow (1-f)e = 0$

Replacing e, f by 1-e,1-f

$\Rightarrow (1-(1-f))(1-e) = 0$

$\Rightarrow f(1-e) = 0$

$\Rightarrow f - fe = 0$

$\Rightarrow fe = f$ ---------- 2

Hence e=f

Note 1.25: The following are equivalent

1. $(a)_r = (e)_r$, where e is an idempotent
2. *There* exists x such that axa=a and ax=e,e is an idempotent

Def 1.26: A ring R with unity 1 is called a regular ring if for every $a \in R$ there exists $x \in R$ such that axa=a

Note 1.27: For every element a in a regular ring R,there exists an idempotent e such that ea=a.

Proof: Let a∈R there exists x∈ R such that axa=a

Let e= ax then e is an idempotent and ea = axa =a

∴ ea = a

Example 1.28: Every p-ring, where p is a prime number is a regular ring, where $x= a^{p-2}$

Def 1.29: A commutative ring R, in which a^p =a and pa=0 ∀ a∈R is called a p-ring

Example 1.30: Every field (every skew field) is a regular ring for $a\neq0, x=a^{-1}$

Theorem 1.31: An integral domain is regular if and only if it is a field.

Proof: Suppose R is an integral domain which is regular

Let a∈R and a≠0

∵ R is regular, there exists x∈R such that axa =a

⇒ axa –a=0

⇒ a (xa –1)=0, (ax –1)a=0

⇒ xa –1=0, ax –1=0 (∵ a≠0 and R is an integral domain)

∴xa= 1,ax=1

⇒R is a field

Conversely,

Suppose R is a field

For a≠0, ∃ b∈R∋ $ab = ba = 1$

Aba =1(a) =a

∴ R is an integral domain and regular

Example 1.32: Suppose k is a field $M_n(K)$ is the ring of all nxn square matrices with entries in k, then $M_n(K)$ is a regular ring.

Theorem 1.33: In a ring R with unity,every maximal ideal is a principal ideal.

Proof: Suppose R is a ring with unity

Suppose M is a maximal ideal in R

Suppose A, B are any two ideals in R such that AB⊑M

We have to show that A⊑M or B⊑M

Suppose A not ⊑ M

$\because M \sqsubseteq M + A \sqsubseteq R$

∵ M is maximal

⇒M= M+A or M+A=R

But M≠M+A (∵ A not ⊑ M)

∴ M+A=R

⇒1∈ M+A

⇒1=m+a for some m∈ $M, a \in A$

Let b∈B

b=1b

= (m+a)b

= mb+ab∈M+AB

∵ $AB \sqsubseteq M$

$b \in M$

$B \sqsubseteq M$

⇒ *M is a prime ideal*

Note 1.34: If R is a commutative regular ring with unity for every a∈R there exists x∈R such that $a^2x = a$

Note 1.35: Every Maximal ideal M of a commutative regular ring R with unity 1,

is a prime ideal

Proof: Since R is commutative

$\Rightarrow R/M$ is a field

$\Rightarrow R/M$ is an integral domain

$\Rightarrow M$ is a prime ideal.

$\therefore$P is a maximal ideal

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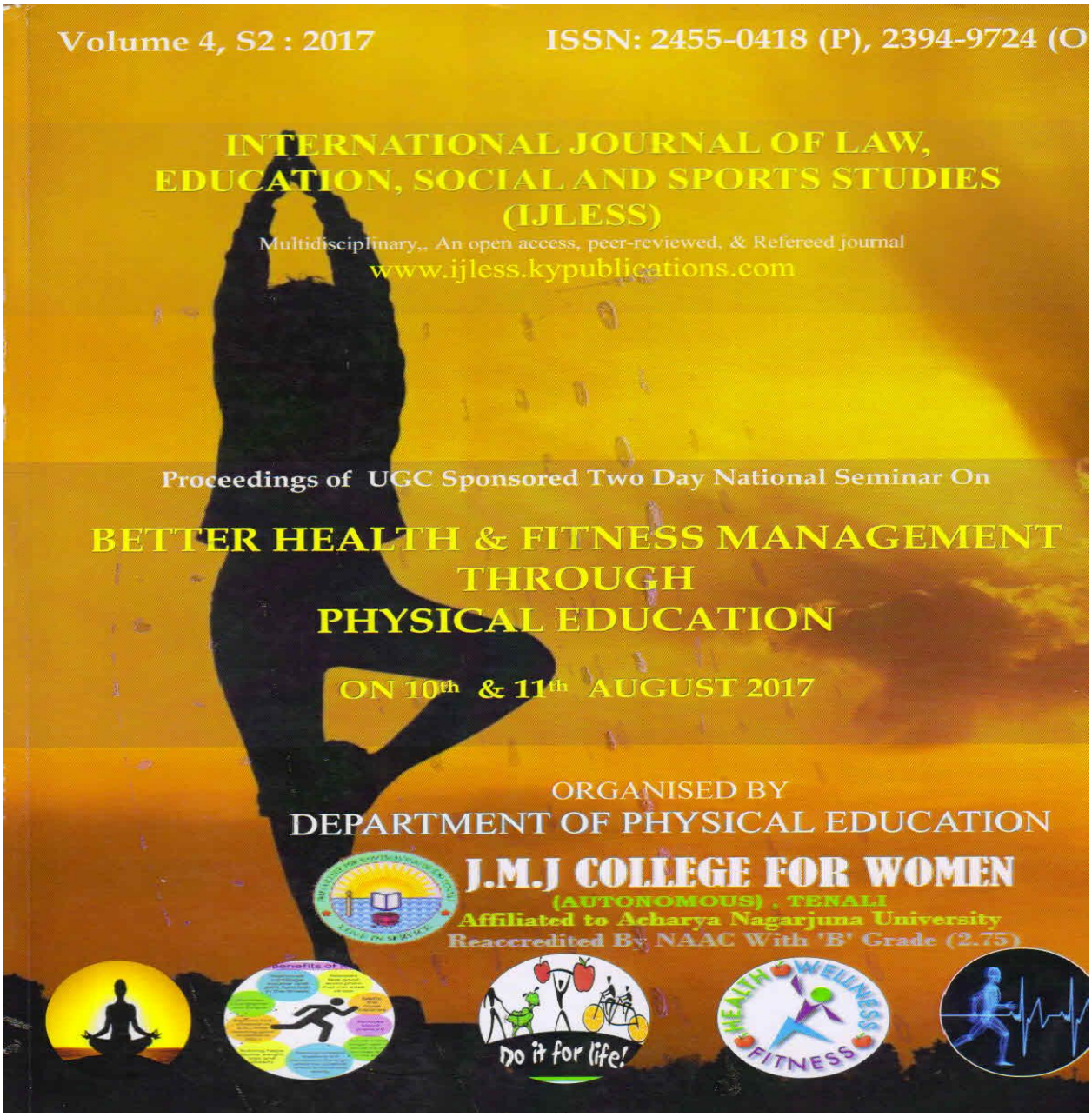
DEPARTMENT OF PHYSICS

18.Presented a paper on 'Better Health and Fitness Management'in National Seminar proceedings on Better Health and Fitness Management Through Physical Education at JMJ College for women ,Tenali in an International Journal of Law,Education,Social and Sports Studies on Better health and Fitness Management with ISSN No.2455-0418 on 10th& 11thAug 2017



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EDUCATION, SOCIAL AND SPORTS STUDIES (IJLESS)
Multidisciplinary, Peer-Reviewed and Refereed Journal
http://www.ijless.kypublications.com
editorijless@gmail.com
ISSN:2455-0418(P), 2394-9724(E); Vol.4.S2.2017

BETTER HEALTH & FITNESS MANAGEMENT

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Abstract
Our nation's people are, in large measure, inactive, unfit, and increasingly overweight. In the long run, this physical inactivity threatens to reverse the decades-long progress we have made in reducing death from cardiovascular diseases and to devastate our national health care budget. In the short run, physical inactivity has contributed to an unprecedented epidemic of childhood obesity that is currently plaguing the India. The percentage of people who are overweight has doubled since the last decade.

Physical activity has been identified as one of our nation's leading health indicators in Healthy People. Enhancing efforts to promote participation in physical activity and sports among people is a critical national priority. Sports and recreation programs that offer a range of developmentally appropriate activities that are accessible and attractive to all people.A community structural environment that makes it easy and safe for people to walk, ride bicycles, and use close-to-home physical activity facilities.

Key Words: Physical activity, Physical Fitness, Benefit, Physical exercise

To increase their levels of physical activity and fitness, people can benefit from-Families who model and support participation in enjoyable physical activity.

School programs—including quality, daily physical education; health education; recess; and extracurricular activities—that help students develop the knowledge, attitudes, skills, behaviours, and confidence to adopt and maintain physically active lifestyles, while providing opportunities for enjoyable physical activity.

Media campaigns that help motivate people to be physically active.

What exactly is physical fitness?

Being fit means you have more energy to do daily tasks, can be more active, and do not tire as easily during the day. Being fit also helps you build a positive self-image and feel better about yourself. You do not have to spend hours in a gym to be physically active. Every time you throw a softball, swim a lap, or climb up a flight of stairs, you are improving your health and fitness level.

Benefits of physical activity

Physical activity has many proven benefits. When you are physically fit, you feel and look better, and you stay healthier. Physical activity can help you to: Prevent high blood pressure, strengthen your bones, Ward off heart disease and other medical problems, relieve stress, stay active as an adult, maintain or achieve an appropriate weight for your height and body build.

A major benefit of physical activity is that it helps to reduce stress. Learning to cope with stress is an important part of healthy living. Family problems, conflicts with friends, and school pressures can cause stress. Major changes in your life, such as moving to a new home or breaking up with someone, are also sources of stress. Exercise helps you relax by causing physical changes inside your body that help it react to and handle stress. Physical activity also has many other health benefits, such as helping to ward off heart disease. Research has shown that your risk factors as an adult for developing heart disease start during your childhood. A lack of

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http://www.ijless.kypublications.com
editorijless@gmail.com
ISSN:2455-0418(P), 2394-9724(E); Vol.4.S2.2017

physical activity is one of the major risk factors influencing heart diseases, such as high blood pressure, and other medical illnesses.

Participation in physical activity and sports can promote social well-being, as well as physical and mental health, among people. Research has shown that students who participate in interscholastic sports are less likely to be regular and heavy smokers or use drugs and are more likely to stay in school and have good conduct and high academic achievement. Sports and physical activity programs can introduce people to skills such as teamwork, self-discipline, sportsmanship, leadership, and socialization. Lack of recreational activity, on the other hand, may contribute to making people more vulnerable to gangs, drugs, or violence.

One of the major benefits of physical activity is that it helps people improve their physical fitness. Fitness is a state of well-being that allows people to perform daily activities with vigour, participate in a variety of physical activities, and reduce their risks for health problems. Five basic components of fitness are important for good health: cardio respiratory endurance, muscular strength, muscular endurance, flexibility, and body composition (percentage of body fat). A second set of attributes, referred to as sport- or skill-related physical fitness, includes power, speed, agility, balance, and reaction time. Although skill-related fitness attributes are not essential for maintaining physical health, they are important for athletic performance or physically demanding jobs such as military service and emergency and rescue service.

Physical fitness is a balance of many areas

To be physically fit, you must work on all aspects of fitness, including the following:

Cardio respiratory endurance (aerobic fitness)—This is the ability of the heart, lungs, and circulatory system to deliver oxygen and nutrients to all areas of your body. When you are active, you breathe harder and your heart beats faster so that your body can get the oxygen it needs. If you are not fit, your heart and lungs must work extra hard during physical activity.

Body composition (body fat)—This is the percentage of body weight that is fat. Overweight people have more body fat in relation to the amount of bone and muscle in their bodies than do people who are physically fit. Overeating, not exercising enough, or both often lead to more body fat. Being overweight increases your risk of diabetes, high blood pressure, and heart attacks.

Muscle strength and endurance—This is the amount of work and the amount of time that your muscles can do a certain activity before they get tired, such as lifting heavy objects or in-line skating.

Flexibility—Flexibility is the ability to move joints and stretch muscles through a full range of motion. For example, people who are very flexible can bend over and touch the floor easily. A person with poor flexibility is more likely to get hurt during physical activity.

What can I do to become more fit?

First, you must make the commitment to become more physically active. Try to do some physical activity every day, whether it is through physical education classes in school or in college an activity on your own. Exercise should be a routine part of your day, just like brushing your teeth, eating, and sleeping. It may help to plan a physical activity with a friend or family member. Most people find that it is more fun to exercise with someone else. More importantly, though, is that you like the exercise or activity. You are more apt to stay in the habit of doing whatever activity you choose if it is one that you enjoy. Now is a good time to pick a "life sport" that you enjoy. Unlike a competitive team sport like football or baseball, a life sport is any kind of physical exercise or activity that you can do throughout your life. Examples of life sports are: Swimming, Tennis, Golf, Walking, Bicycling, Skating, and Jogging.

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ISSN:2455-0418(P), 2394-9724(E); Vol.4.S2.2017

Regular exercise should include aerobic activity. Aerobic activity is continuous. It makes you breathe harder and increases your heart rate. This type of exercise increases your fitness level and makes your heart and lungs work more efficiently. It also helps you maintain a normal weight by burning off excess fat. Examples of aerobic activities are brisk walking, basketball, bicycling, swimming, in-line or ice skating, soccer, jogging, and taking an aerobics or step class. Baseball and football do not involve as much continuous exercise because you are not active the whole time. In general, the more aerobic an activity, the more calories—and eventually fat—you will burn. If you like the exercise, you will want to keep doing it. Anything that involves movement qualifies as exercise. You do not have to be on a sports team, have expensive athletic clothes or shoes, or be good at sports to become more fit. Any type of regular, physical activity is good for your body. Household chores, such as mowing the lawn, vacuuming, or scrubbing, involve exercise and may have fitness benefits, depending on how vigorously you do the chores. The most important thing is that you keep moving.

Be sure to include stretching exercises in your daily routine. Before you do any physical activity, you should stretch out your muscles. This warms them up and helps protect against injury. Stretching makes your muscles and joints more flexible, too. It is also important to stretch out after you exercise to cool down your muscles. Exercise videos, programs on television, and magazines can show you examples of how to stretch out different muscle groups, as well as different exercises you can do. Just about any physical activity will improve fitness. For example, walking is better than riding in a car, and using the stairs is better than taking an elevator. Making small changes like these in your everyday life can make you more physically fit.

Whenever possible, eat three healthy meals a day, including at least two to four servings of fruit and three to five servings of vegetables each day. Limit your intake of fat, cholesterol, salt, and sugar. Also, get enough sleep and take time to do things you enjoy. For even better health, don't smoke, drink alcohol, or do other drugs. Physical activity is just one important part of preventive health care, which should be a part of your daily lifestyle. The activities you decide to do should be enjoyable, use a variety of muscle groups, and include some weight-bearing exercises. If you are not exercising much now, increase your level of activity gradually and have fun! Exercise for a better today and a healthier tomorrow.

How Often Should I Exercise?

Make exercise a part of your lifestyle. Your goal should be to do some type of exercise every day, or at the very least, three to four times a week. Try to do aerobic activity that requires continuous physical activity without stopping for at least 20 to 30 minutes each time. Do the activity as often as possible, but do not exercise to the point of pain because this can lead to injury. Like all things, exercise can be overdone. You may be exercising too much if:

-Your weight falls below what is normal for your age, height, and build
- It starts to interfere with your normal school and other activities
-Your muscles become so sore that you risk injuring yourself.

Exercise is only one part of living healthy

Besides the physical and mental health benefits, regular physical activity can also help you become more self-confident, organize your time better, learn new skills, and meet people with similar interests. To make more time for exercise, limit the amount of time you watch television or play computer or video games.

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Fitness Activity Chart:

Activity	Calories Burned During 10 Minutes of Continuous Activity	
	(35 kg Person)	(60 kg Person)
Basketball (game)	60	102
Cross Country Skiing	23	72
Bicycling (15 km/h)	36	60
Judo	69	118
Running (8 km/h)	60	90
Sitting (complete rest)	9	12
Football (game)	63	108
Swimming (30 m/min)	34	58
Tennis	39	66
Volleyball (game)	35	60
Walking (4 km/h)	23	34
(6km/h)	30	43

Resources must be invested in creative, culturally sensitive, linguistically appropriate programs to give all Indians the opportunities and motivation they need to become more active. Through its effects on mental health, physical activity may help increase students' capacity for learning.

How Our Society Discourages Physical Activity

Behaviour is shaped, in large measure, by one's environment. Our people live in a social and physical environment that makes it easy to be sedentary and inconvenient to be active. Developments in our culture and society over the past few decades that have discouraged youth physical activity include the following:

Community design centredaround the automobile has discouraged walking and bicycling and has made it more difficult for children to get together to play.

Increased concerns about safety have limited the time and areas in which children can play outside.

New technology has conditioned our people to be less active, while new electronic media (e.g., video and computer games, cable and satellite television) have made sedentary activities more appealing.

States & districts have reduced the amount of time, students are required to spend in physical education classes, and many of those classes have so many students that teachers cannot give students the individual attention they need.

Communities have failed to invest adequately in close-to-home physical activity facilities (e.g., parks, recreation centres).

STRATEGIES FOR PROMOTING PARTICIPATION IN PHYSICAL ACTIVITY AND SPORTS AMONG PEOPLE

People in the country cannot become more physically active and fit if they don't have a wide range of accessible, safe, and affordable opportunities to be active. However, opportunities alone are not enough. In 21st century, physical activity is, for the most part, a voluntary behaviour. Our people, therefore, will not increase their levels of physical activity and fitness unless they are sufficiently motivated to do so. Their motivation to be active will depend on the degree to which they find their physical activity experiences to be enjoyable. Enjoyment of physical activity, in turn, will be influenced by the extent to which people

-Can choose to engage in sports and recreational activities that are most appealing to them.

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ISSN:2455-0418(P), 2394-9724(E); Vol.4.S2.2017

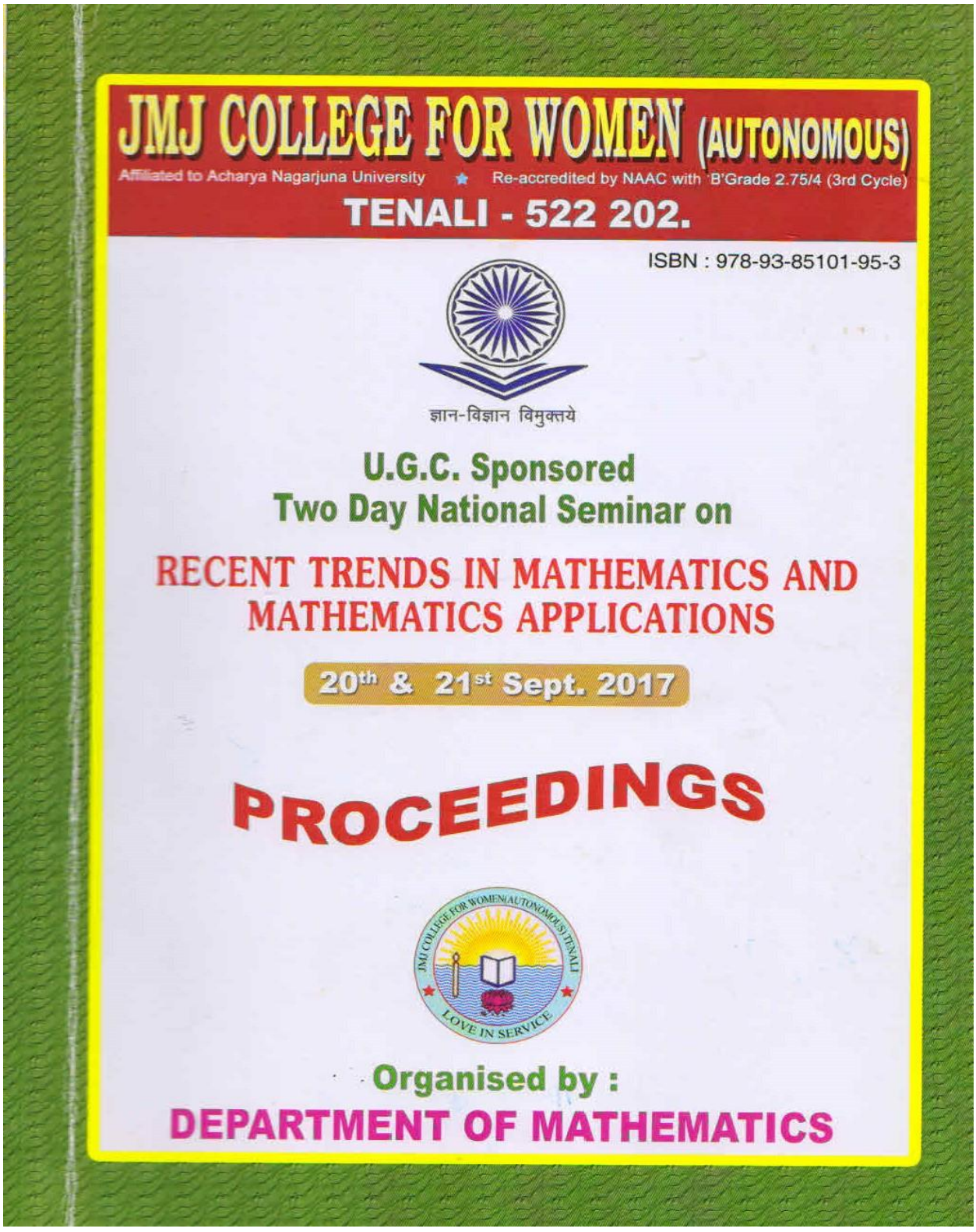
-Are taught necessary skills.
-Develop confidence in their physical abilities.
–Are guided by competent, knowledgeable, and supportive adults.
-Are supported by cultural norms that make participation in physical activity desirable.

To obtain the opportunities and motivation that will enable them to increase their levels of physical activity and fitness, people can benefit from

-Families who model and support participation in enjoyable physical activity.
-School programs—including quality, daily physical education; health education; recess; and extracurricular activities—that help students develop the knowledge, attitudes, skills, behaviours, and confidence to adopt and maintain physically active lifestyles, while providing opportunities for enjoyable physical activity.
-After-school care programs that provide regular opportunities for active, physical play.
-Youth sports and recreation programs that offer a range of developmentally appropriate activities that are attractive to all people.
-A community structural environment that makes it easy and safe for people to walk, ride bicycles, and use close-to-home physical activity facilities.
-Media campaigns that increase the motivation of people to be physically active.

The strategies presented are designed to promote lifelong participation in enjoyable and safe physical activity. Special efforts must be made to ensure that programs are responsive to those in greatest need, including girls and racial/ethnic minorities.

19.Presented a paper on 'Fluid Mechanics Applications' on National Seminar proceedings of 'Recent trends in mathematics and mathematics applications' with ISBN:978-93-85101-95-3 on 20th &21st Sep.2017.



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ISBN : 978-93-85101-95-3

FLUID MECHANICS APPLICATIONS

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ABSTRACT

Fluid-mechanics is an "ancient science" that is incredibly alive today. The modern technologies require a deeper understanding of the behaviour of real ?uids; on the other hand, new discoveries often pose new challenging mathematical problems. The study of these ?ows has been attached with a wide range of mathematical techniques and, today, this is a stimulating part of both pure and applied mathematics. It is needed a knowledge of the Sobolev spaces and of the variational formulation of linear elliptic and parabolic problems.

The science of fluid dynamics describes the motion of liquids and gases and their interaction with solid bodies. It is a broad, interdisciplinary field that touches almost every aspect of our daily lives, and it is central to much of science and engineering. Fluid dynamics impacts defence, homeland security, transportation, manufacturing, medicine, biology, energy and the environment. Predicting the flow of blood in the human body, the behaviour of microfluidic devices, the aerodynamic performance of airplanes, cars, and ships, the cooling of electronic components, or the hazards of weather and climate, all require a detailed understanding of fluid dynamics, and therefore substantial research. The quest for deeper understanding has inspired numerous advances in applied mathematics, computational physics, and experimental techniques.

Key Words : Fluid machinery , Turbo machines, Fluid dynamics, Micro fluidics, Turbulence

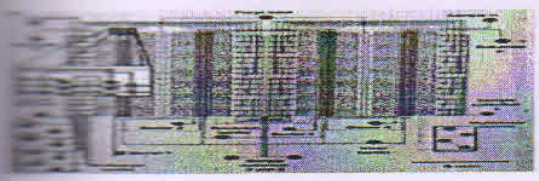
Introduction:

Fluid machinery is used to convert hydraulic energy to mechanical energy or vice versa. It produces two kinds of forces. One causes Power absorbing where the work is done on the fluid. The other is power producing where the work is done by the fluid. Fluid machinery can be classified based on the motion of moving parts.

Fluid dynamics is exciting and fruitful today in part because newly available diagnostic methods for experiments and parallel computers for simulations and analysis allow researchers to probe

ISBN : 978-93-85101-95-3

the full complexity of fluid dynamics in all its rich detail. The outcomes from this future research will have enormous impact. For instance, they will lead to improved predictions of hurricane landfall and strength by understanding the mechanisms that govern their formation, growth, and interaction with the global weather system. They will lead to more efficient vehicles, by reducing the friction between the vehicle surface and the surrounding air. They will lead to a new generation of micro-scale devices that will include combustors to replace batteries, advanced flow control devices to cool electronic systems, and labs-on-a-chip to manipulate and interrogate DNA. Already, the number of channels in micro-fluidic devices is growing at a rate faster than the exponential growth in electronic data storage density.



Micro fluidic device containing 2056 integrated channels. Such devices are revolutionizing biomedical science.

We illustrate the importance of fluid dynamics research by considering five areas of study: Nano and micro-scale fluid dynamics, environmental flows, turbulence, flow control, and biological and biomedical fluid dynamics.

Nano and Micro-Scale Fluid Dynamics:

Advances and applications in fluid dynamics are occurring at a rapid pace; the resulting technology is called microfluidics when the typical sizes of the fluid carrying channels are smaller than 1 millimetre and nanofluidic when the typical sizes are smaller than 1 micron (for reference, the thickness of a human hair is about 100 microns).

Micro and nanofluidic methods will lead to novel technological applications and scientific insights because smaller systems allow flow and reactions to be analysed more rapidly, facilitate manipulation of medically relevant blood cells, and can be mass produced. Microfluidic systems minimize the use of expensive and hard-to-obtain samplesUnderstanding fluid dynamics of small devices will be crucial to advances in science and engineering. For example, scientists have learned how to integrate thousands of small channels with hundreds of individually controlled valves into a single "lab-on-a-chip," thus pointing the way to the kind of large scale integration

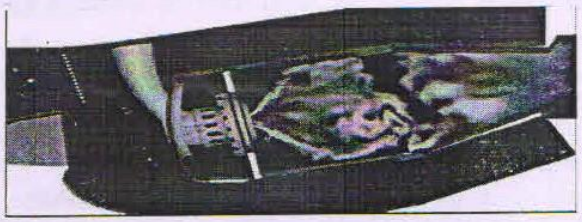
ISBN : 978-93-85101-95-3

that transformed electrical circuit design and led to the computer revolution. Future devices w integrate many distinct micro fluidic components.

Turbulent Flows:

Most matter in the universe is fluid, predominantly in a state of turbulent motion. Billowi smoke stacks, cumulus clouds and waterfalls are visible everyday examples of turbulent flow Though less visible, turbulent flows are ubiquitous in our transportation systems, proce industries and natural environment (the atmosphere, oceans, rivers and even stars). In contrast laminar flows (exemplified by honey pouring from a jar) turbulent flows are chaotic, thre dimensional, and unsteady over a large range of scales. A bumpy aircraft flight may be caused b eddies of atmospheric turbulence which are larger than the aircraft, whereas the drag on the wi and fuselage are caused by turbulent eddies smaller than a millimetre.

In all fields of engineering, computer modelling is playing an increasingly important role addressing questions such as: If we build a device to a design, how will it perform? Or, ho should we design a device to produce the best performance at the least cost? Comput modelling can be used to answer these questions only to the extent that the underlying physics sufficiently well understood for the model to be reliable, accurate and computationally tractabl An important advance in turbulence research is the development of the technique of large-edd simulation (LES). Research on the complicated flow patterns behind trucks can guide improv designs, leading to reduced drag an improved fuel economy.



Computer simulation of a gas-turbi combustor, showing the fuel spray (green)

Flow Control:

"Flow control" denotes a collection of methods to manipulate a fluid flow into a state with desired properties. Successful flow control can lead to enhancement of mixing, augmentation of heat transfer, reduction of noise and pollution, increased lift and manoeuvrability, and reduction

ISBN : 978-93-85101-95-3

industry. These difficulties arise from the wide range of size scales involved (from cell to [illegible] the compliant nature of boundaries in the fluid (moving vesselwalls and deformable cells) [illegible] the inherent complexity of biological fluids (e.g. blood) that are involved in even the [illegible] bio-fluid mechanical problem.

Conclusion:

Research in fluid dynamics is expected to have major impacts on important national [illegible] These include improvements in transportation and energy efficiency, prediction and mitigation [illegible] environmental problems, development of novel technologies based on microfluidics, improvements to security and defence, and major contributions to health. Finally, fluid dynamics research makes a large contribution to the training of future engineers and scientists.

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INTERNATIONAL JOURNAL OF MULTIDISCIPLINARY ADVANCED RESEARCH TRENDS
ISSN : 2349-7408
VOLUME IV ISSUE 2(3), SEPTEMBER, 2017

ETHICS IN HIGHER EDUCATION

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Abstract

Higher education is leadership education. The values and virtues practised in universities heavily influence the future leaders. Many institutions of higher education show excellence not only in academic subjects, as green campuses, with manifold ethics curricula and in their community engagement, but also in the value-orientation of the Board and teaching staff as well as students. The purpose of the present manuscript is to explore one vehicle through which current and future higher education leaders can actively contemplate their values and how their values influence their actions when faced with an ethical challenge.

INTRODUCTION:
ETHICS AND HIGHER EDUCATION

The myth that institutions of higher education are sheltered from the struggles and conflicts of the "real world" is widely accepted even by people who ought to know better—those of us in academic settings who confront, struggle with, bemoan, or try to ignore the serious ethical issues that arise. People outside academia may tease us Ethics and Higher Education about the ivory tower world and our innocence and naiveté. With a twinge of guilt, we in academia accept their teasing because the myth tells us that we are a privileged lot, protected as others are not. Naïve? Perhaps, we think, but isn't it nice that we don't have to get our ethical feet dirty in the moral slime outside our refuge. There is great comfort in the myth."

The aim is to target Ethics in Higher Education as a primary agenda in preparing the youth - future leaders for responsible leadership roles in the larger society upon completion of studies. "Knowledge is Virtue", so wrote Socrates. Virtue is the formation and moulding of character through conducts transmitted and from one generation to the next and considered "good" because they add to the overall good of Society (Aristotle, Nichomechian Ethics).

Ethics Matters

The topic of Ethics, though ancient in its origins, has in our time and clime become a novel and compelling subject, both in its theoretical and practical engagements. Globally, issues of ethics are legion. Worldwide, information is multiplying at a phenomenal rate. Globalization has increased the social space, leading to borderless boundaries on the financial, economic, social, ecological, political and cultural dimensions of traditional societies. The world is changing with unprecedented speed and this is observed in virtually all sectors including within the university walls. Following the financial crisis of 2008 and the collapse of institutions

and even governments, a phenomenon that started in the United States of America in year 2008, people lost jobs, investments and retirement funds. An example of the crisis was the collapse of a world class company ENRON, alongside others and many wondered how this could be possible. The deeper meaning in the fall of this company is the fact that any system or governing structure is only as good as the people who administer it. In the case of ENRON, the need for morally informed corporate governance, founded on solid ethical principles, has been obvious. The few and simple questions to ask for the purposes of this paper include the following but is not necessarily exhausted or even in order of priority, namely:

1. What does education consist of, and how does it take place?
2. How can parents, teachers in schools, the responsible agents in the educational system and institutions within the larger society assist the education of youth and leaders of tomorrow with school curricula that contains Ethics and promotes freedom, truth, responsibility, skills, knowledge and virtue?
3. Is there a link between Ethics and Technology and how do we balance technological innovation with social and organizational motivation?
4. Does diversity and difference in contextually independent realities make a unity on global values and virtues impossible?
5. How can societies and responsible agents systematically strengthen an ethical culture of integrity?

Why a Specific Role for Higher Education?

Higher education in general can and has to play a key role in this process of balancing global and contextual perspectives in building identities through research, teaching and training. Even if open and distance education seems to be delocalised and disconnected from a specific context, it can and has to promote contextual identities by reflecting and researching on it. In a more specific way, ethics in higher education is a central part of this objective.

The currently high reputation of academic institutions as being nonpartial, fair, objective and at the service of the whole community and of the common good of humanity is being threatened in ways that are deeply worrying. The cheating culture is on the increase, academic fraud and plagiarism is becoming more frequent than in the past, albeit partly thanks to the emergence and use of online publications and plagiarism software, corruption in educational institutions has become so widespread that more and more employers no longer trust the validity of academic grades and certificates.

Reasons for and the Effects of Ethical Challenges in Higher Education:

What are the reasons for and the effects of this development? Let me just mention four of them:

1) Pressure: For many parents and societies, higher education seems to be the only valuable goal. The pressure is so high that young persons and their parents use all means at their disposal to get a bachelor or master degree.

2) Finance: in many countries, academic staff is not well paid compared to other sectors such as the private sector. With the minimum income, teachers are tempted to increase income by receiving bribes in the form of money.

3) Privatisation: the boom of new, mainly private institutions of higher education in many countries is a positive sign that there is a need, a market and entrepreneurs and investors who are willing to make the most of the opportunity and to take the risk.

4) Technology: Information and Communication Technologies (ITCs) represent a huge potential for higher education and are obviously the back bone of open and distance learning education.

The Multidimensional Ethic at Work in an Educational Setting

1. The Ethic of Justice (participation): equal access, due process, policy formation and implementation, assessment rights, responsibilities in resource allocation
2. The Ethic of Caring (quality of life): Cultural enrichment, individuality, loyalty, human potential, human dignity, empowerment, environment
3. The Ethic of Critique (Definitions of Value): Hierarchy, privilege, class distinctions and distortions, power definitions, culture of silence and domination

Possible Reasons for Misconduct

Increased cost of research. Cost makes any unsatisfactory result a threat to the researcher's ability. Grants can attract researchers with "wrong motives" who want to make money. Non-tenured faculty and increase pressures. Increased expense of certain kinds of research makes replication less likely. Increased tendency of researchers to deny others access to notes and raw data. Increased tendency to list authors who should not be listed

Strengthening the Ethical Culture of Higher Education: Eight Recommendations:

Individual and Interpersonal Level

Recommendation 1: Promote character education (for students and teachers) as a task of individual and interpersonal self-responsibility to become or remain globally responsible leaders.

Intra-Institutional Level

Recommendation 2: Develop within each educational institution ethics-related policies and respective institutional ethics units as key instruments.

Inter-institutional Level

Recommendation 3: Include ethics in higher education in the accreditation and monitoring policies and training programmes of accreditation institutions and councils such the International Council for Open and Distance Education ICDE.

Political Level

Recommendation 4: Include ethical goals in the Framework for Action Education 2030 related to SDGs. Implement existing national and international legislation, anticorruption conventions, and policies on ethics in public administration to public and private institutions of higher education. Resist political pressure on admissions.

Rating Level

Recommendation 5: Enlarge current rating systems of academic excellence by adding ethical criteria. Develop (Globethics.net with partners) a global ethics rating of institutions of higher education.

Communication Level

Recommendation 6: Strengthen the communication strategy of the institutions for higher education so that integrity, credibility, responsibility and honesty are included.

Spiritual Level

Recommendation 7: Enable spiritual praxis of different faith communities on the campus of institutions of higher education as a foundation for ethical integrity.

Action Level

Recommendation 8: strengthen values-driven behaviour not only by words, but also through individual and collaborative action such as community service.

CONCLUSIONS

In my opinion, higher education must discover and dedicate itself to a triadic relationship, namely with God, earth, and human beings. In other words, education is to develop a threefold relationship: oneness with the Other, rootedness with nature, and relatedness with In short, higher education must reclaim its holistic and integral programme, emphasizing God, creation, and our fellow beings, without which education is neither complete nor compelling. To conclude, responsible leadership in higher education has a challenging call to coexist, cooperate, and celebrate with God, and with all people in the whole world-the key to harmony of life.

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Network security: Scenarioin India

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Abstract :

Earlier, Network breaches target only the banking and the IT sectors, but now every organization big or small are affected by the threats. To handle these situations effectively, consumers, manufacturers and organizations are to be prepared and well aware of such threats. With the rapid growing of the 'Internet of Things' in every sector, they are hence forced to deal with the existence of these threats and risks, there is thus an increase in focus among regulators.

Cyber security in India has come a long way in the past few years and has gained huge importance in recent times with the thrust on Digital India, e-commerce and mobile payments. Development in digital sector is possible only with robust implementation of cyber security by Prime Minister Narendra Modi. "Can we secure the world from the bloodless war? I'm talking about cyber security. Innovation should be a tool to handle cyber security in India. Cyber India with proper network security is my dream," he has said recently. With rapidly growing interconnected business operations and increasing digitization, cyber security challenges are bound to intensify. Effective measures need to be taken to ensure protection against cyberattacks and threats. We need to focus on the basics that will help keep the growth story on course. Earlier, Network Security was known to be a concern only for the IT and banking industr y, has now penetrated every vertical as a serious threat to any business or organization. The consumers, suppliers and the manufacturers as well should make the cyber risks and they should be prepared to deal with the same. While every sector is fast embracing the 'Internet of things', they are forced to challenge the existence of cyber threats, risks and malwares;there is thus an increase in focus among regulators.

From the very past, India has been targeted for political reasons primarily through cyber-attacks and this dynamic shifting trend from this landscape can be credited to the newly and gaining sophistication in technology and increasingvulnerability in the complex systems. The market that is driven by varied forces like the rise of analytics of big data, consistent rise in threats, fall in the availability of customer security software and strong regulatory compliances enforced by the Government, has few, yet giant hurdles to cross, namely, technical expertise and lack of awareness of security concerns.

The Market can be segmented on the basis of Segment (Security Information and Event Management (SIEM), Security Web Gateway (SWG), Identity Governance and Administration (IGA) and Enterprise Content-aware data loss prevention (DLP)), Solution (Encryption, Firewall, Web Filtering, Identity and Access Management (IAM), Data Loss Protection (DLP), Risk and Compliance Management etc.), Service(Network Security, Endpoint Security, Application Security, Content Security, Wireless Security and Cloud Security) and Verticals. The technology is widely being used to protect violation in Aerospace and Defence, Banking and Financial Services, Telecom and IT, Healthcare, Retails, Manufacturing, Government and Public Utilities.

Key Words: cyber security, National Association of Software and Service Companies (NASSCOM), cybercrimes, Organization, National Institute of Standards and Technology (NIST)

INTRODUCTION

Indian companies are known for their quality deliverables. International certifications like ISO 9000 were attained for establishing this reputation. Likewise following international standards in information security will also help companies build credibility in the minds of their customers. Currently, the information security environment in India is a bit complex.National Association of Software and Service Companies (NASSCOM) is the overlooking and governing body for the IT software and services industry in India. Its 1050-member companies are in the business of software development, software services, software products and IT-enabled/BPO services. Indian companies are known for their quality deliverables.

Cyber security is bound to increase as there is an increase in the number of business interconnections. Effective measures need to be taken to ensure protection against cyberattacks and threats. While the nation focuses on growth, our work as technologists, strategists and captains of industry is clearly cut out. We need to focus on the basics that will help keep the growth story on course.

Indian companies have a dynamic security practices comparable to those followed by western companies. Indian companies primarily comply with BS 7799-a global standard that covers all domains of security.Companies sign Service Level Agreements (SLA), have very strict confidentiality and security clauses built into them at the network and data level. Such SLAs also cover all relevant laws that the companies comply with their providers both domestic and foreign to comply to take action in case of any security breaches.

Laws such as the IT Act 2000, Indian Copyright Act, Indian Penal Code Act and the Indian Contract Act, 1972 are passed in order to safeguard the companies operating offshore. Almost all of the companies comply with the standard of the UK Data Protection Act 1998 (DPA) through contractual agreements for the smooth transaction of the company. Companies dealing with US clients have to undergo stringent compliance based upon the segment of the industry. E.g.: Healthcare requires compliance with HIPAA;financial services require compliance with GLBA

Many companies in India go through a SAS 70 Audit. SAS-70 assignments serve as a catalyst for the companies in India to improve the security internally and externally for minimal disruptions from auditors.

Role Of NASSCOM

NASSCOM and ITES BPO industry are working together to create an information security culture in various levels. Indian companies have been escalating to meet the international demands.NASSCOM has not conducted any research on this, but here are a few links, which you may want to independently evaluate and draw conclusions. However as per some independent studies.The ITRC Breach List is consolidated reporting and citing from various media sources and/or notification lists from variousagencies. There are 5,029 reported data breach incidents since 2005which has been tracked since 2005 which involves 675 million records as per estimation. With an average of 45.2% breaches in 2016, there is a need forawareness about such identitytheft among the individuals.

NASSCOM and its member companies are had been striving hard to uphold the data privacy inlegal and enforcement framework to attain data protection. This threat for the breach in data security is not limited to a nation alone, it can affect any nation in the world and the judiciary and any governing bodies has the responsibility to identify and punish the criminals. India is one of the countries where judiciary rules are strict and restricted. We have seen a few cases in the past year, where almost all the accused have been arrested within 24-48 hours of the crime being reported.

NASSCOM has been working hard to amend and enforce the following acts:

1. Assisting the government to take proper action against the culprits and to make laws for the cyber and network breaches accordingly.

2. Providing assistance and training to the Indian law enforcement agencies to deal with the cybercrime and criminals as per the law.

3. To train and create a stream of IT professionals who are suitable for working in the industry.

The Indian IT companies do not want to merely match worldwide standards in security. They want to set the highest standards.

Current Aspect:

Year after year, cyberattacks continue to escalate in frequency, severity and impact. The age-old methods used for the preventing and detecting the assaults by highly trained and skilled aggressive cybercriminals and many organisations are not equipped with the resources to combat the same. The asymmetric nature of cybercrime incentivises it; the cost of committing cybercrimes to intercept and/or modify information, degrade performance of assets, gain unauthorised access to systems, obtain the information from the organisation for either bringing harm or for any personal agenda is very minimal damage compared to the investments required equipping the safeguards against the attacks.

Underestimating the level of risk an organisation is exposed to is usually a fatal mistake. Cyber security impacts all organisations, from fledgling start-ups to billion-dollar multinationals. Over the most recent years network incidents such as WannaCry virus, the compromise of over 10 million user records by the breach of an Indian music streaming service and vulnerability of the routers causes the spying and assaults in popular network companies. Notable cyber incidents over the past year, such as that of the Indian music streaming service that compromised the records of more than 10 million users, or the vulnerability found in the routers of a popular networks company which allows attackers to spy on traffic, testify this. Indian organisations detected 117% more incidents over the previous year, shooting up from an average of 2,895 incidents to 6,284 incidents a year. This is a sharp deviation from the global trend, which saw a 39% increase in security incidents over the previous year.

Financial Aspect:

There is a critical economic loss as the network incidents increased by 135% over the previous year which is much more compared to 20-30% over the years before. Not only has the number of incidents increased, but the average loss resulting from an incident borne by an Indian organisation has also increased by close to 8%. Handling the losses caused due to cyber incidents and evaluation of the factors casing those has been a daunting task for the organisation, and hence, the true cost of cyber incidents is hard to calculate. Some factors that are typically used to estimate the financial loss from cyber incidents include loss of customer business, legal defence services, court settlements, investigations, forensics, and deployment of detection software, services and policies among others.

External& Internal Breach Aspect:

External factors dominating the news headlines are playing a vital role in the attacks relating to the network. Agents like terrorist hacks, hacktivists, etc. have been all over the media over the previous years. However, it is important to understand that security breaches by insiders—employees, vendors and business partners with authorised access—can be even more harmful. Though several organisations are not ready to deal with these threats.

The trend over the years also shows the same results as security incidents caused by insiders have dominated those caused by external actors. Though the trend has been declining over the last three years due to improvements in internal access controls, it appears that in the last 12 months, the number of incidents caused by insiders have once again increased due to the inability of the existing basic identity and access management controls to prevent modern techniques like social engineering used by attackers to exfiltrate confidential information.

Unintentional breaches can be avoided by ensuring that employees are aware of the organisation's security and privacy policies, procedures and consequences of not adhering to them. Employee training and awareness is an important component and should be carried out by the organisations.

Year over year there is a swift increase of the nature of the cyber threats evolution. Criminal organisations are expected to become more sophisticated, mature and be able to migrate their activities online at a greater pace. Outsourcing activity among Indian organisations is also expected to rise with more and more organisations focussing on their core business, thereby creating more complex and interconnected networks with suppliers, vendors, partners and other third parties, making them more prone to cyberattacks and data leakages.

And hence, it is imperative for Indian organisations to gear up for the cyber security challenge by formulating security strategies and implementing technology solutions to monitor and manage security risks.

Development Aspect:

Recent advances in computer science and technologies are providing powerful opportunities for organisations to transform their cyber security programmes and create a holistic system of integrated safeguards. It all starts with a strategy and an underlying foundation based on risks. A vast majority of Indian organisations (81%) have adopted a security framework or, more often, an amalgam of frameworks, mostly with very good results. The two most frequently implemented guidelines are ISO 27001 (53%) and the US National Institute of Standards and Technology (NIST) Cyber Security Framework. These guidelines enable organisations to identify and prioritise risks, detect and mitigate security incidents, gauge the maturity of their cyber security practices and better communicate and collaborate internally and externally. At the same time, around three-fourths of the respondents said that their organisations have an overall information security strategy in place.

Frameworks such as the NIST Cyber Security Framework and ISO not only bring together leading practices from across industry sectors and serve to improve risk-based security, but alsoprovide a platform for internal communication and external collaboration. Organisations are also leveraging risk based guidelines to improve the security performance of third-party partners, which is a keyconcern. They have found that frameworks can enable companies to more easily exchange information with business partners and suppliers, and communicateexpectations and concerns about the services they provide.

Current Situation:

In today's rapidly evolving threat landscape, threat actors are becoming more sophisticated, breaching the defences of business ecosystems and leaving reputational, financial and competitive damage in their wake. Organisations recognise its importance and have invested accordingly in the technological advances. Vulnerability scanning tools have seen an increase in adoption and are up from 57% to 62%. Intrusion detection tools have increased from 55% to 62%. Other major categories which have gained importance are malicious code detection tools, malware software and use of virtual desktop interface (VDI). Some organisations are exploring the use of data analytics for identity and access management to monitor employee usage patterns and flag outliers. In this scenario, the data analysis solution looks for patterns around the employee access entitlements and then identifies unwanted access. Organisations are already realising the benefits of advanced technologies to improve their information security environment and a sizeable number of them (53%) have listed implementation of newer technologies as their top priority in the next 12 months.

In today's interconnected ecosystem, the compliance of third parties to relevant security policies and procedures is important to maintain the overall security posture of the organisation. Surprisingly, we noted that 50% of companies do not ensure that third parties comply with their privacy policies, and around 40% of total organisations do not have established baseline standards for third parties.

As more businesses share more data with an expanding roster of partners and customers, it makes sense for them to swap intelligence on cyber security threats and responses. Indeed, overthe past three years, the number of organisations embracing external collaboration has steadily increased. These collaborations have proven to be highly beneficial for all parties. Most organisations say external collaborations allows them to share and receive more actionable information from industry peers, as well as government agencies such as CERT(Computer Emergency Response)-In.

Counter Measures:

Many say that information sharing has improved their threat awareness and intelligence. Organisations that do not collaborate often cite the lack of information sharing framework and standards as well as incompatible data formats and platforms among public and private entities as the reason. Another weakness is that cyber security updates are not communicated at network speed. Policies and regulations on data privacy

vary widely across the globe, and some organisations also worry that sharing certain types of data can violate the privacy of customers, employees and other individuals. And, of course, validation of intelligence is a concern for all. In India, the CERT-In function at the national level to coordinate cyber security emergency response and facilitate communication between other CERTs. CERT-In also issues guidelines, advisories and vulnerability notes to help organisations strengthen cyber security. The National Cyber Coordination Centre (NCCC) was recently approved by the government to coordinate intelligence gathering between agencies and handle issues related to national security.

Technological change continues to disrupt how organisations compete and create value in ways that often alter operating models. Some of the most significant business trends today, including the explosion of data analytics, the digitisation of business functions, and a blend of service offerings across industries, have expanded the use of technologies and data that is creating more risk than ever before.

The ecosystem of Internet-connected devices, operational tools and facilities is poised to soar in the coming years. Research firm IDC(International Data Corporation) predicts that the number of devices connected to the Internet will reach 30 billion in 2020, up from an estimated 10.3 billion last year. The Government of India recently launched the Digital India Programme and the Smart Cities Mission. Digital India aims at transforming India into a digitally empowered society while the smart city concept aims at developing 100 smart cities in India. These initiatives will boost the IoT(Internet of Things) industry in India. Citizens and business leveraging this technology will serve as a fillip to this industry. IoT has indeed come a long way from being a futuristic concept just a few years ago to transforming into real products, services, and applications. Smart watches, fitness bands and trackers, smart glasses, self-driving cars and drones are just the beginning of the endless possibilities.

As IoT continues to expand, analysis of machine-to-machine (M2M) data will become critical. In this type of data-centric environment, the importance of strong encryption cannot be underestimated. The security and privacy risks have been highly publicised. Hackers can hijack connected cars and control them remotely; digital snoopers can infiltrate home surveillance systems and monitor the behaviour of residents; and threat actors can compromise connected medical equipment and potentially impact the health and safety of patients. Vulnerabilities left unattended can result in grave repercussions from business losses to catastrophic establishment attacks.

Conclusion

An advanced and enhanced information security programme will not only enable companies to better protect themselves against cyber threats in the future, but also help create competitive advantages and foster trust among customers and business partners. The challenge, of course, is that it is exceedingly difficult to predict the future of cyber security when many aspects of its present state are uncertain and continually shifting. Nonetheless, we believe there are some assumptions that organisations should consider while preparing to enhance their cyber security over the next five years. First, any discussion of the future should be predicated on the premise that personal lives will be increasingly digitised, creating even greater avalanches of data that can be collected, analysed and potentially compromised. Businesses too will continue to generate and share more information about people and processes, and IoT will unleash a torrent of (M2M) data. Amid this escalation of data, individual and corporate identity, and privacy will begin to converge. In this type of data-centric environment, the importance of strong encryption cannot be underestimated. It's safe to assume that future threat actors will wield an attack kit of technically sophisticated tools and tactics. For governments and businesses, espionage and political hacking will merge as hacking techniques will become highly nuanced and aggressive. At the same time, increasingly brazen attacks by nation-state and politically motivated hacktivists will result in economic sanctions or possibly even cyber warfare. In fact, it's not entirely unlikely that a catastrophic cybersecurity incident will precipitate demand and support for government-controlled identity management. Furthermore, governments are working to improve their ability to trace and directly attribute intrusions to responsible threat actors. An empty indictment of individual cybercriminals or governments hasn't worked in the past and similarly will be ineffective in the future. Enforceable international treaties will be a necessity. Authentication and identity management are the juggernauts that pose the greatest perils to cyber

security and promise the greatest payoffs. Mustering the right defences will require new solutions based on big data, cloud computing and heuristic approaches. Forward-thinking companies are already shifting away from traditional perimeter defences in favour of cloud-enabled cyber security based on real-time analysis of data and user-behaviour patterns. Thinking ahead can help organisations stimulate discussion, explore possible scenarios and develop a strategy for cyber resilience. Doing so will help businesses build a forward-looking cyber security programme that is based on the right balance of technologies, processes and people skills—all supplemented with an ample measure of innovation. With these components in place, organisations are likely to be better prepared for the future of cyber security.

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DEPARTMENT OF ZOOLOGY

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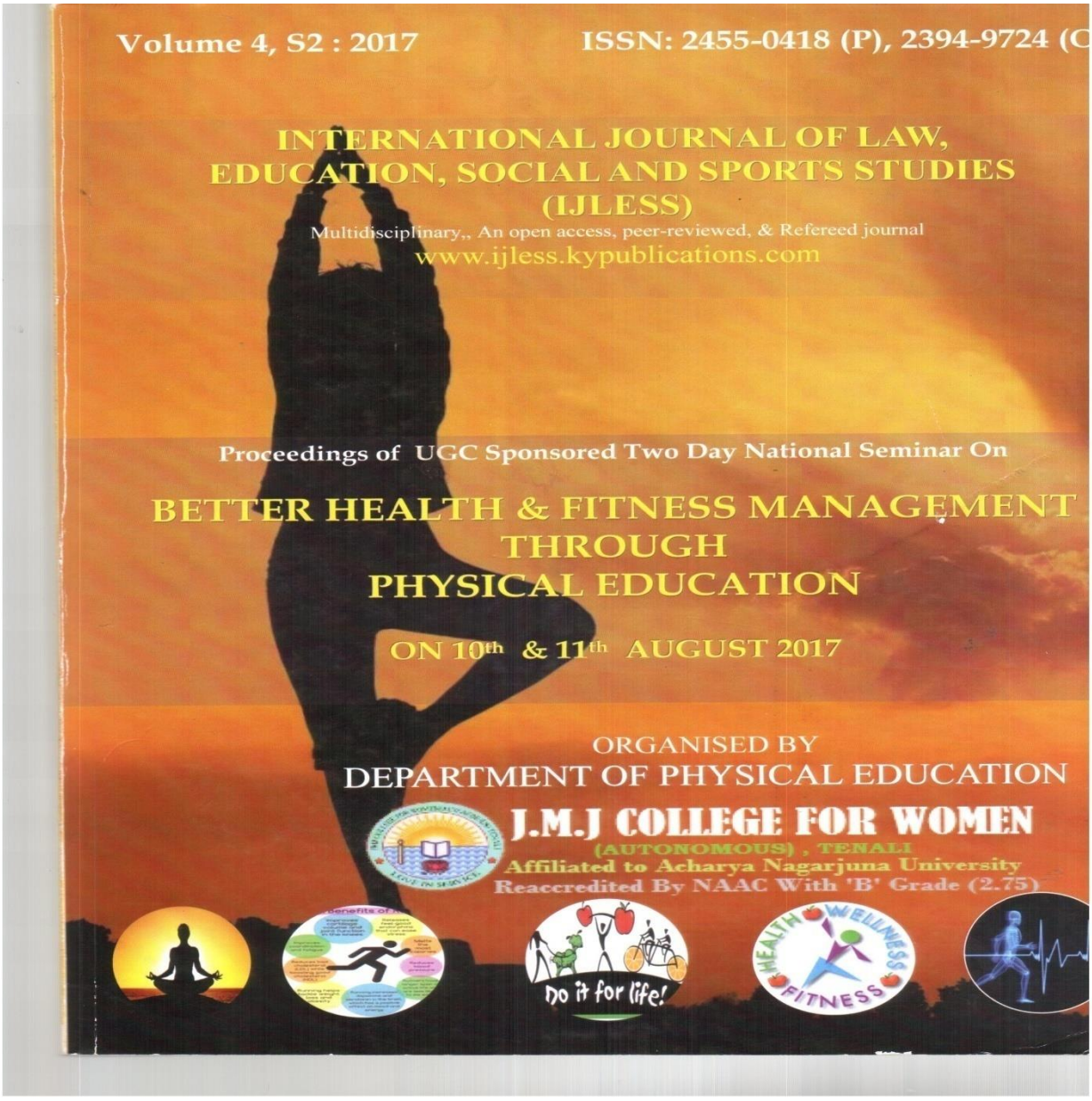

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http://www.ijless.kypublications.com
editorijless@gmail.com
ISSN:2455-0418(P), 2394-9724(E); Vol.4.S2.2017

MODERN TRENDS IN FITNESS

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Abstract
From the ancient to modern times, the nature of fitness activities has varied. We can choose any form of exercise that is suitable for our particular need. Watchers of fitness trends say that the road to better health is paved with new possibilities along with some old ones that are poised to make a comeback. Educated, certified and experienced fitness professionals; strength training; fitness programmes for older adults; exercise and weight loss; children and obesity; personal training; core training; group personal training; Zumba and other dance workouts; functional fitness; yoga; comprehensive health promotion programmes at worksite; boot-camp; outdoor activities; reaching new markets; spinning; sport-specific training; worker incentive programmes; wellness coaching; and physician referrals are among the fitness trends included in worldwide surveys. However, trends related to fitness in India could be the same or different. Hence, the present paper makes an attempt to analyze the latest fitness trends in India. It can be concluded from the analysis of data regarding recent fitness trends in India that yoga dominates the fitness activity list, followed by numerous other activities including running, Zumba and sh'bam, boot camp, boxing, kickboxing, cycling, swimming, TRX, bi-pocalypse, ballet, biking, bokwa fitness, dance-iso-bic, masala bhangra, outdoor activities, Pilates, planks, pull-ups, sofa workouts, stairs Workouts, tabata training, and twerking. The body weight/ gym-specified/ strength training as well as high intensity interval training dominate the preferred workouts; followed by mixed work-outs, cross training work-outs, express work-outs, functional fitness, natural body movements, personalized training, and stay-at-home workouts. General areas that featured in the latest fitness trends in India demonstrates that the fitness is making an impact on all sections of the society be it children, women, older adults, senior citizens, worksite fitness. Fitness is becoming the lifestyle of the masses. People are doing exercise for weight-loss, combining diet with exercising; prefer sweating, making groups participate in fitness activities and wellness programmes. Technology is another area which has a high impact on the lives of people. They are using wearable technology for workout tracking and following numerous mobile friendly apps.

Keywords: fitness, India, survey, obesity;

Introduction: For centuries, the human race struggled to overcome food scarcity, disease, and a hostile environment. With the onset of the industrial revolution, the great powers understood that increasing the average body size of the population was an important social and political factor. The military and economic might of countries was critically dependent on the body size and strength of their young generations, from which soldiers and workers were drawn. Moving the body mass index (BMI) distribution of the population from the underweight range toward normality had an important impact on survival and productivity, playing a central role in the economic development of industrialized societies. Historical records from developed countries indicate that height and weight increased progressively, particularly during the 19th century. During the 20th century, as populations from better-off countries began to approach their genetic potential for longitudinal growth, they began to gain proportionally more weight than height, with the resulting increase in

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Multidisciplinary, Peer-Reviewed and Refereed Journal
http://www.ijless.kypublications.com
editorijless@gmail.com
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average BMI. By the year 2000, the human race reached a sort of historical landmark, when for the first ti human evolution the number of adults with excess weight surpassed the number of those who underweight. Excess adiposity/body weight is now widely recognized as one of today's leading health th in most countries around the world and as a major risk factor for type 2 diabetes, cardiovascular disease, hypertension. Although obesity did not attract the attention of the mass media until recent decades prevalence in industrialized countries began to increase progressively early in the last century. By the 19 life insurance companies were already using body weight data to determine premiums, having identifie association between excess weight and premature death. In the early 1950s, Breslow proposed a direct between the increasing prevalence of obesity and the also-increasing rates of cardiovascular disease in th population, a theme that was reemphasized by the US government in reports in the 1960s and 1970s. C evidence of the alarming trend in obesity rates was provided by the regular, nationally representative sur performed from the 1960s on. These data showed the continuing rise in obesity prevalence over the pas years. By the year 2000, 65 percent of the adult population had a BMI (weight/height ^{2}) above 25, an percent had a BMI above 30.

Top 22 Trends

1. Wearable Technology

Topping the list is wearable technology like **fitness trackers**, pedometers and heart rate monitors. The ma for these products is booming and shows no signs of slowing down; in fact, sales are expected to hit ove billion during 2017.But if you're buying wearable technology to lose weight, you might want to hold of recent study found that overweight participants in a randomized clinical trial who wore a wearable de actually lost less weight than another group who followed the same food and fitness plan without a fitn tracker. This might be because people overeat after seeing exactly how much they exercised or moved t day or the exact opposite — someone who didn't break a sweat one day might have gotten discouraged. that doesn't mean technology isn't useful for reaching your health goals. While I wouldn't recommend wear wireless devices beyond a short workout due to the exposure to **electromagnetic radiation**, using y Smartphone to track your workouts or how much you're eating can help you gauge patterns. If you're a d geek, you can mine through days, weeks or even months of info to notice patterns in your habits. O caveat: long-term use of wireless networks may have adverse effects on your health and increase the risk things like oxidative stress, headaches and a decrease in cognition, while exposure to lights and technolo right before bedtime can disrupt sleep patterns and decrease quality sleep. Use your judgment on how mu you rely on the devices and remove them — or at least put them into airplane mode— when it's time to rest

1. Body weight training. Yep, the secret is out. Bodyweight training is one of top exercise trends, and for go reason. With money woes still a concern for many as we enter the New Year, inexpensive fitness progra seem to be very popular. Because body weight training does not require a lot of equipment, basically you u your own body as the weights to strengthen your core muscles; it can be an inexpensive way to whip yours into shape. This form of training can be found in most gyms and fitness clubs and many of the programs a designed to be much more than just push-ups and pull-ups.

2. High-intensity interval training. High intensity and fast-paced, this workout usually calls for short bursts high-intensity exercise followed by a short recovery time. Due to its efficiency at burning calories and buildi muscles it has become a favorite in the world of fitness; some health professionals warn however that there an increased chance of injury with this type of exercise.

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http://www.ijless.kypublications.com
editorijless@gmail.com
ISSN:2455-0418(P), 2394-9724(E); Vol.4.S2.2017

ated, certified, and experienced fitness professionals. As the fitness industry continues to grow in nd bounds, especially here in the U.S., there has been a surge in demand for fitness professionals who he top of their field. More colleges and universities are now offering accreditation and certification ns for specialties in health and fitness. Maybe you can check off two new resolutions at the same time fit while starting a new career path.

ngth training. Strength training is not just a "guy" thing or just for athletes in training. All men and and even children can benefit from building stronger bones as well as controlling their weight and ng energy levels. This type of training includes body weight, resistance tubing, free weights and weight es. Strength training is seeing its time in the limelight. While people, particularly women, sometimes y from the weight room, strength training is critical to keeping our bodies healthy, especially as we elps preserve muscle mass and increase your metabolism to burn more calories even when you aren't out. One study found that in 10 weeks, inactive adults could see an increase in lean weight of more pounds and a reduction in fat weight of nearly 4 pounds, while increasing metabolic resting rate by 7

Personal training. As we all know, fitness programs are not one size fits all. While your friend might e pulsing beat and comradely of a spin class, you might have more lone wolf tendencies and prefer a olitary form of exercise. Hiring a personal trainer to design a custom fit plan tailored to your wants and as well as to be your personal cheering section might be just what you need to stay on track with your ion. This exercise trend references the amount of college students studying kinesiology, an indication ey're planning on going into health fields. But you don't have to be a college student to take on your ealth "personal training." Increasing health literacy is critical to preventing health problems and ng those that might arise. Being on this site is an awesome first step. Continuing to learn more about food, treating ailments through natural remedies and improving your physical fitness through exercise maintaining a healthy lifestyle.

rcise and weight loss. If you are trying to lose inches off your waist as well as tone your body, then ms that combine exercise and weight loss might be the best option for you. Look for programs that ce the important balance between healthy eating and exercise. One study found that when ants thought of an exercise as pleasant, they had increased aerobic capacity and improved their l health. And another discovered that incorporating laughter into physical activity programs for older mproved their mental health, aerobic endurance and confidence in their ability to exercise. So whether y yoga, **Cross fit**, **barre** or just riding your bike, enjoy it! That's an exercise trend that will never go out

. Name-say hey to another of 2017's fitness trends. Yoga certainly isn't new, but it's just as popular as nd it should be because the **benefits of yoga** are vast. It helps to decrease anxiety and stress, improves uality, allows blood to flow through the body better, helps digestion and so much more. In fact, ng **yoga changes your brain**. It increases the "chill-out" neurotransmitter in your brain, a chemical low supply for people who suffer from depression and anxiety. It also helps counteract chronic pain. unroll your mat? This beginner's guide to yoga can help you find a style that suits you best. Yoga in all ntinues to be a favorite in the fitness community. Could it be its ability to continually invent itself that ractive? Yogis can do traditional forms like Vinyasa yoga or fly high with more modern versions like ga.

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8. Fitness programs for older adults. Age is just a number right? Fitness programs designed for the 60+ c are a growing part of the fitness industry. If you are a baby boomer who wants to stay fit and active, but d want to be stuck in a class with twenty-something gymnasts, there are many fitness programs that designed with you in mind.

9. Functional fitness. In many physical therapy programs, functional fitness is used to help a patient impr balance and coordination as well as strength and endurance by repeating physical activities of everyday life

10. Group personal training. Group training makes trying a new exercise, like spinning or boot camp, a fun. Having an experienced instructor can help keep you motivated and push you to go that extra And bringing along a friend or making new ones in class has an effect, too. A little friendly competition increase motivation to work harder, like in this exercise bike study. Participants either exercised al exercised with a partner or exercised with a partner and were told that test results were based on who weakest. While the solo riders were on the bike for 10.6 minutes, the ones with a partner stayed on for minutes. And the ones who were told their performance relied on their partner? They stayed on for double amount of time, or 21.9 minutes. So grab a friend and get to class. Training two or three people at the s time in a small group is becoming a popular solution for those looking for more individualized attention t you would get in a larger class, but without the higher cost of one on one session with a personal trainer.

11. Worksite health promotion. With the rising cost of healthcare, 2015 will see companies offering m health and fitness programs and services to keep their employees healthy.

12. Outdoor activities. It seems the call of the outdoors will never go out of style. If you prefer feeling the on your face and the wind at your back, maybe outdoor activities like running, hiking or skiing might be w you to need to get the blood pulsing again.

13. Wellness coaching. Wellness coaching incorporates health promotion, disease prevention, rehabilitation. Some personal trainers offer wellness coaching as part of their services.

14. Circuit training. Circuit training, a group fog 6 to 10 exercises that are completed in a sequence, is s similar to high-intensity training, but is performed at a lower level of intensity.

15. Core training. This type of training focuses on strengthening the muscles of the abdomen, thorax, and b by exercising the hips, lower back, and abdomen. Common equipment used includes exercise balls, BOSU b wobble boards, and foam rollers.

16. Sport-specific training. Many athletes look for programs that help develop their sport-specific skills throwing in baseball to increase strength and endurance during the off season.

17. Children and exercise for the treatment/prevention of obesity. With the increasing rate of obe especially here in the United States, a focus has been placed on programs that help children maintain heal lifestyles. Keep your kids active in 2015.

18. Outcome measurements. No matter what fitness regimen you choose, one thing you will notice in 201 the emphasis on outcome measurements. Healthcare professionals will be holding themselves m accountable for their ability to produce the desired health benefits for their clients. Look for clubs and stu that track the results of their programs.

19. Worker incentive programs. This survey suggests that many more companies are considering offe incentive programs to their workers for healthy behavior change in another effort to reduce healthcare cost

20. Boot camp. More and more men and women are favoring this military style training that inclu cardiovascular, strength, endurance and flexibility drills. This is a great option if you prefer intense, hig structured workouts.

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Volume.4. S2.2017 (August) ISSN:2455-0418 (Print)
2394-9724 (online)

International Journal of Law, Education, Social and Sports Studies (IJLESS)
Multidisciplinary, Peer-Reviewed and Refereed Journal
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Proceedings of UGC Sponsored Two Day National Seminar On

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ON 10th & 11th AUGUST 2017

Organized by
DEPARTMENT OF PHYSICAL EDUCATION
J.M.J COLLEGE FOR WOMEN
(AUTONOMOUS) , TENALI
Affiliated to Acharya Nagarjuna University
Reaccredited By NAAC With 'B' Grade (2.75)

KY PUBLICATIONS
Guntur-522002, A.P.,India
www.kypublications.com

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EDUCATION, SOCIAL AND SPORTS STUDIES (IJLESS)
Multidisciplinary, Peer-Reviewed and Refereed Journal
http://www.ijless.kypublications.com
editorijless@gmail.com
ISSN:2455-0418(P), 2394-9724(E); Vol.4.S2.2017

SPIRITUAL LIFE ENHANCES PSYCHOLOGICAL WELLBEING AND PROSPERITY IN LIFE

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Abstract
Psychological wellbeing influences the physical health, working strength, as health is wealth even economy of individual family, society and country. The Commission on the Measurement of Economic Performance and Social Progress initiated by the French government and chaired by Joseph Stiglitz, 2009 argued that self-reported wellbeing should also be taken into account. Psychological wellbeing related tobehavior and mind, embracing all aspects of conscious and unconscious experience as well as thought.Spiritual life enhances Psychological wellbeing.Understanding and incorporating **Self-acceptance**, Self-**growth** especially spiritually **gives a Purpose and meaning** to live in **Autonomy, Connectedness; Mastery** – is a catalyst for further motivation and brings greater wisdom, self-awareness, and psychological well-being (Joe Wilner (2011). Psychological Well-Being is a significant predictor of Subjective Well-Being (SWB) improves, and Happiness energizes employee SWB (Burns, Richard A. and Machin, M. Anthony; 2009).

Key words:Psychological wellbeing, Spiritual life, **Self-acceptance,** Self-**growth, Autonomy,**

Introduction

Psychological wellbeing a social, cognitive Process, includes perception, cognition, attention, emotion (affect),intelligence, phenomenology, motivation (conation), brain functioning, and personality. The psychologists are involved in some kind of therapeutic role, practicing in clinical, counseling or school settings and are employed in industrial and organizational settings, or in other areas such as human development and aging, sports, health, and the media, as well as in forensic investigation and other aspects of law. Cognitive psychology will be developed with genetically base influenced by the environment to which an individual is exposed to.

Organizations and research of Psychological wellbeing

The *American Association for Humanistic Psychology*, formed in 1963: stands for respect for the worth of persons, in exploration of new aspects of human behavior. e.g., love, creativity, self, growth, organism, basic need-gratification, self-actualization, higher values, being, becoming, spontaneity, play, humor, affection, naturalness, warmth, ego-transcendence, objectivity, autonomy, responsibility, meaning, fair-play, transcendental experience, peak experience, courage, and related concepts. (A. J. Sutich,1963)

The name industrial and organizational psychology (I–O) (1960) and became enshrined as the Society for Industrial and Organizational Psychology, Division 14 of the American Psychological Association, in 1973 (Laura L. Koppes,2003) with the goal to optimize human potential in the workplace; to reach their target markets, and the organization of their company (Steven Williams, 2005).In 2010 *Clinical Psychological Review* published a special issue devoted to positive psychological interventions have been limited in scope, but their effects are thought to be superior to that of placebos, especially with regard to helping people with body image problems.

School of Military Psychology

During World War I, when Robert Yerkes established the School of Military Psychology at Fort Oglethorpe in Georgia, to provide psychological-training for military staff military. (Nancy Tomes, 2008; Robert M. Yerkes,

INTERNATIONAL JOURNAL OF LAW,
EDUCATION, SOCIAL AND SPORTS STUDIES (IJLESS)
Multidisciplinary, Peer-Reviewed and Refereed Journal
http://www.ijless.kypublications.com
editorijless@gmail.com
ISSN:2455-0418(P), 2394-9724(E); Vol.4.S2.2017

1918) now includes psychological screening, clinical psychotherapy, suicide prevention, and treatment for post-traumatic stress, as well as other aspects of health and workplace psychology such as smoking cessation (Joshua N. Friedlander, 2005).

Theories and measurements of Psychological well-being

Psychological wellbeing refers to subjective wellbeing (Diener, 2000); "Hedonic" wellbeing refer to the subjective feelings of happiness and "Eudiamonic" wellbeing refer to the purposeful aspect of PWB and Carol Ryff has developed a very clear model that breaks down Eudaimonic wellbeing into six key parts based on Aristotle's Nicomachean Ethics, "where the goal of life isn't feeling good, but is instead about living virtuously". 1) Self-acceptance: positive attitude towards oneself and accepting various aspects of self.2) Personal growth: insight into own potential, sense of development, and open to new and challenging experiences. 3) Purpose in life: holds goals and beliefs that affirm sense of direction and feels that life has a purpose and meaning.4)Environmental mastery: capability to manage complex environment, and mold environment to suit needs.5)Autonomy: Exhibits self-direction that is often guided by his / her- own socially accepted conventional internal standards and resists unsavory social pressures.6)Positive relations with others: Has warm, satisfying, trusting personal relationships and is capable of empathy and intimacy.

A recent review of well-being measures grouped into four broad groups of Hedonic Eudiamonic, Quality of Life and Wellness measures. Cantril Ladder is used to evaluate Life evaluation referring peoples' thoughts about the quality of their lives; Hedonic wellbeing referring everyday feelings such as happy, sad, and angry.(Kahneman D*et.al;*2004). Eudemonic wellbeing focuses on judgments about the meaning and purpose of one's life; (Ryff CD, Singer BH, Dienberg Love G.2004) .Psychological well-being is very much tied to the basic human needs fulfillment, delineated in Self-determination theory; or the need for purpose as popularized by Daniel Pink along with autonomy and mastery; or the Alderfer's ERG theory emphasizing needs of Growth and Relatedness, all of these need satisfactions lead to psychological well-being. Nico at Mappalicious has a good write-up on the same with traits of low and high scorers on each dimension mentioned.

Psychological wellbeing of People around the World

In the UK, the Office for National Statistics is driving a national debate over measuring wellbeing, (Seaford C. Policy 2011) the Gallup-Heathway's Wellbeing Index Poll interviews 1,000 US adults every day about wellbeing, and similar initiatives are taking place in other countries. (Harter JK, Gurley VF2008).Older populations, although less healthy and less productive are more satisfied with their lives, and experience less stress, worry, and anger than do middle-aged people. Psychological wellbeing Patterns are not universal across populations. Gallup's World Poll, (survey began in 2006, residents of more than 160 countries, 98 percent of the world's population, using random nationally representative samples, typically of 1,000 individuals in each country). In Middle East, the countries of the former Soviet Union, and sub-Saharan Africa — life evaluation declines steadily with age, at least in the period 2006-2010; lower In the transition countries, than in the Anglo countries, and the elderly do particularly badly, the opposite of the Anglo countries. Worry increases with age in the transition countries, and decreases in the Anglo countries. However, cross-national surveys such as the Gallup World Poll, and longitudinal cohort's studies of ageing in China, India, South Korea, Brazil, and the WHO Study on Global Ageing and Adult Health (SAGE) are beginning to redress the balance. The implications of this new knowledge about psychological wellbeing for economic and health policy have yet to be established.

Importance of Physical Health for Psychological Wellbeing

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EDUCATION, SOCIAL AND SPORTS STUDIES (IJLESS)
Multidisciplinary, Peer-Reviewed and Refereed Journal
http://www.ijless.kypublications.com
editorijless@gmail.com
ISSN:2455-0418(P), 2394-9724(E); Vol.4.S2.2017

Psychological wellbeing is associated with **increased risk** of **physical illness depression** and life **stress** with premature **mortality**, coronary heart **disease**, diabetes, disability and other chronic conditions. (Nov 6, 2014). Treating symptoms associated with anxiety and depression in cancer patients improved survival time; high blood pressure, heart attack, diabetes, digestive health, recovery post-operation and mental health (Kelly Anderson, 2016). Psychological well-being of young people influences talent development environments in sports (athlets), (Ivarsson, A et al ,2014) .

Tips to improve physical health and Psychological well-being

Physical health and psychological wellbeing are interdependent and they sustain with Spiritual development, with prayer and meditation enhancing energy levels and transform an individual to live peacefully, friendly, happily with love and harmony in the society with values which is important for strengthened individual, society, country and world. Doing **exercise** yoga, swimming, spending time with friends and family bring**s** you a sense of calm as happiness strengthens us.**Sound mind, sound body helps you to sleep well and** on average, 8 hours of sleep per night Irrespective of gender and age is**essential, for maintaining good health.** Early to bed and early to rise makes a man healthy and wealthy. Avoid caffeine, alcohol, cigarettes, other substances and heavy exercise stick to **Balanced diet.**

Qualities to wellbeing: PERMA i.e. 1) Positive Emotion, 2) Engagement, 3) Relationships, 4) Meaning and 5) Achievement are five separate qualities constitute a set of positive emotional skills and attitudes that can lead children to higher achievement and success in life, better physical health, better relationships, more resilience against depression and anxiety, and even better conduct. (Dr. Martin Seligman, the "father" of positive psychology)

Insight into a Human being and Psychological well-being

Each Human being has to nourish his body and spirit as God created man with mud and breathed the Holy Spirit (Genesis2:8). As the spiritual life is neglected, human values (Infinity, Eternity, Silence, Peace, Unity, Truth, Goodness, Knowledge, Power, Beauty, Love and Bliss) are reduced impacting Psychological wellbeing. Hence People are suffering with the works of the flesh(Galathians-5:16-23), namely Adultery, Fornication, Uncleanness, Idolatry, Licentiousness, Sorcery, Hatred, Contentious, Jealousies, Out bursts of wrath Selfish ambitions, Dissensions, Heresies, Envy, Murders, Drunkenness, Revelries which drives the person away from blissful life. Society Phasing Burning problems of the families like isolated and split- families due to jobs and divorces; attention to carrier and money; neglected children and elders; increased-care centers and old age homes.

Solutions from the Holy Bible to Psychological well-being

Integrate human life with the Spirit by Prayer Pluck the Fruits of Holy Spirit **(**Galathians-5:16-23) love, joy, peace, kindness, faithfulness, goodness, gentleness long suffering, and self-control to guide, to light our path, shine like sun and shower like rain. The problems of the individual, family and the society can be solved. Teach a child how he should live, and he will remember it all his life. (Proverbs 22:6). Reverence for the lord gives confidence and security to a man and his family. Do you want to avoid Death? Reverence for the lord is a fountain of life (Proverbs14:26-27).Peace is what I leave with you; it is my own peace that I give you. I do not give it as the world does. Do not be worried and upset; do not be afraid (John14; 27).

Conclusion

Parents, preachers and teachers must drive the children and youth to grow spiritually for Psychological well-being, and to follow God's new Commandment - Love one another as it is essential for every person`s Psychological well-being since Love is eternal (I Corinthians 13:4-8).. As I have loved you, so you must love one

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EDUCATION, SOCIAL AND SPORTS STUDIES (IJLESS)
Multidisciplinary, Peer-Reviewed and Refereed Journal
http://www.ijless.kypublications.com
editorijless@gmail.com
ISSN:2455-0418(P), 2394-9724(E); Vol.4.S2.2017

another (John 13:34).For god loved the world so much that he gave his only son, so that everyone who believes in him may not die but have eternal life(John 3:16).Love your life partner and children. You can forgive a person if you love more and you can love if you forgive that person. Everyone have to avoid "Negative values" which are rooted in ego, ignorance, and falsehood.

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24. Mrs.M.Adilakshmi and Mrs.M.Aruna Department of zoology attended One day UGC sponsored National Seminar on " Social responsibility and Ethics in Higher Education" **on 1**/9/17 organized by IQAC, VSR & NVR College, Tenali, **and published a paper on " Teacher social responsibility". With ISSN no: 2349-7408** IJMART, volume IV,Issue 2(2) September 2017

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INTERNATIONAL JOURNAL OF MULTIDISCIPLINARY ADVANCED RESEARCH TRENDS
ISSN : 2349-7408
VOLUME IV ISSUE 2(2), SEPTEMBER, 2017

PROFESSIONAL ETHICS OF TEACHERS IN EDUCATIONAL INSTITUTIONS

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ABSTRACT

Institutions of higher education have a major role to play in preparing the younger generation for a propitious future. Apart from imparting quality education, they need to instill high ethical values and practices amongst the student fraternity. Most professionals have internally enforced codes of practice that members of the profession must follow to prevent exploitation of the client and to preserve the integrity of the profession. Ethics is the word that refers to morals, values, and beliefs of the individuals, family or the society. The word has several meanings. Basically it is an activity and process of inquiry. Secondly, it is different from non-moral problems, when dealing with issues and controversies. Thirdly, ethics refers to a particular set of beliefs, attitudes, and habits of individuals or family or groups concerned with morals. Fourth, it is used to mean 'morally correct'. The study on ethics helps to know the people's beliefs, values, and morals, learn the good and bad of them, and practice them to maximize their well-being and happiness. It involves the inquiry on the existing situations, form judgments and resolve the issues. In addition, ethics tells us how to live, to respond to issues, through the duties, rights, responsibilities, and obligations. In religion, similar principles are included, but the reasoning on procedures is limited. The principles and practices of religions have varied from to time to time (history), region (geography, climatic conditions), religion, society, language, caste and creed.

Keywords: Professional Ethics, Education, Values, Teacher, Moral standards

Introduction

Teaching is the noblest of all professions. Some professional organizations may define their ethical approach in terms of a number of discrete components. Typically these include: Honesty, Integrity,Transparency, Accountability, Confidentiality, Objectivity, Respect, Obedience to the law, Loyalty. Professional ethics encompass the personal, organizational, and corporate standards of behaviour expected by professionals. In order to maintain there professional status, teachers have to own certain responsibilities both as individual and as members of a respectable profession. In this era of modernization and globalization, it seems like India has lost its value based society and has been transformed into a materialistic society. It is the result of thinking and behaviour of the human being. Now the crisis is why this transformation took place and how we can set it back in place. Education is the major agency that can be used to make any changes, hence if only the teacher or management changes their mindset from commercialized ideas to value based thoughts, can we set things right. This can be accomplished by setting examples to others by living a life with values and ethics, for which one should be taught about his profession and its ethics. Every profession is expected to evolve a set of ethical

principles to guide the conduct and behaviours of its members. The ethical principles provide the basis to differentiate between desirable and undesirable professional conduct and behaviour. Ethics deals with moral principles, which are usually accepted voluntarily by an individual or a group. The code of professional ethics may be defined as a set of self imposed professional ideals and principles, necessary for the attainment of professional excellence and self- satisfaction. A code of professional ethics is generally based on two principles, namely, professional integrity and ideals of service to the society.

Objectives:

- To discuss the Need/importance Roles and responsibilities of the teacher: Historical Perspective.
- To discuss the Concept of Professional Ethics.
- To discuss the Educational Implications.

Important Roles and Responsibilities of the Teacher Historical Perspective: In ancient India, the teacher enjoyed a very high status and position in the society. The following hymn shows that the teacher was identified with the trinity of Gods for his intellectual and spiritual qualities: Guru Brahma guru Vishnu guru diva Maheshwarah, Guru Sakshathparam Brahma tasmay shri gurve namah (Reference for the hymn) the teacher is essentially a spiritual being, who receives salutations generally reserved for God and he is the embodiment of the Bliss. During the ancient period, there was no formal written code of conduct in India, especially for the teachers, but their duties and responsibilities are reflected in many ancient texts. The teacher taught the students by precept and by setting personal example- humility and simplicity were his greatest virtues. Taittiriya Aranyaka states that the teacher must put his heart and soul in the act of teaching. According to the Satpatha Brahmana, the teacher was bound to reveal everything to his pupil who at any rate lived with him. Katha Upanishad lays special stress on the indispensability of the teacher, who was expected to be in possession of essential qualities, viz., profundity of learning, clairvoyant vision and intellectual regeneration. He was regarded as the builder, guide and leader of the society. After the initiation ceremony, the preceptor treated the pupil like his own son and considered it his sacred duty to impart intellectual and spiritual education of a higher order to his disciples. To command his pupils" respect, he put forth before them the ideal of high learning and excellent moral character. The teachers of medieval India, both in Madras as and Pathshalas continued to enjoy high social, status and commanded respect from his pupils by virtue of their vast knowledge of the religious texts and their noble character. Later on, during the British period, the position of the teacher gradually declined due to the indifferent attitude and defective educational policy of the East India Company and the British Crown towards the education of the Indians. The teacher was considered as a low paid government employee and, therefore, was not provided respectable services and working conditions. A number of thinkers and educationists in modern India have expressed their views concerning the roles and responsibilities of the teacher.

According to Swami Vivekananda, The only true teacher is he who can immediately come down to the level of the students, and transfer his soul to the student's soul and see through the student's eyes and hear through his ears and understand through his mind. Such a teacher and none else can really teach. A teacher's work should be guided primarily by love and not by any selfish motive, such as money or name and fame. The teacher should impart man-making and character-building education to his students, through his good conduct and ideal behaviour. Tagore says, A teacher can never truly teach unless he is still learning himself. A lamp can never light another lamp unless it continues to burn its own flame. The teacher who has Professional Ethics of Teachers in Educational Institutions come to an end of his subject, who has no living traffic with his students, can only load their minds; he cannot quicken them." Mahatma Gandhi, (Young India, 24 January 1925) emphasized that „the teacher himself must possess the virtues that he wants to inculcate in the students. This means that the teacher must practise these virtues himself, otherwise his words will have no effect." He further highlighted (Young India, April 1929) that „the teacher should be able to establish a heart to heart contact with the students..." The teacher and the students should be in constant communication with each other. In fact, the teachers have to fashion the hearts of the students rather than their brains. About the ethical duties of the teacher, Sri Aurobindo says, "The teacher is not an instructor or task-master; he is a helper and guide. His business is to suggest and not to impose. He does not impart knowledge to him; he shows him how to acquire knowledge for himself. He does not call forth the knowledge that is within, he only shows him where it lies and how it can be habituated to raise to the surface." From the above discussion, it is evident that, from ancient India to the present day India, there is a difference in the status and position of the teachers. The author claims that, this is due to the lack of professional ethics in the teaching community and the Educational Institutions. First, let us understand what it is and how we can nurture it. Concept of Professional Ethics: Every profession, in order to regulate its terms, conditions, norms and quality of service rendered, has its own professional ethics, which is different from general ethics. In the term professional ethics, the word "ethics" adds to the professional obligation that a profession abides by. Professional ethics is a combination of two words, Professional + Ethics. Here, Professional means an expert, specialized, qualified, proficient, skilled, trained, practiced, certified, proficient, skilled, trained, licensed, mature etc. So, Professional is a term denoting a level of knowledge and skills possessed by an individual or required of an individual to perform an assignment, that is attained through extensive education and training. Secondly, Ethics means principles, morals, beliefs, moral principles, moral values, moral code etc. Indeed the word Ethics is derived from the word Ethos, which means character. In this way, Ethics is a science of character, habits of activity, or behaviour of human beings. It evaluates human habits, character and voluntary determinations and discusses their property or otherwise. In the words of Mackenzie, „Ethics can be defined as the study of what is right or good in conduct Status of professional ethics as per the reviews Over the past few decades, the need for making the teaching profession self-regulatory, by evolving a code of professional ethics for teachers has been articulated from time to time by various commissions and committees on education. In pursuance

of the recommendations of the National Policy on Education (1986, 1992), a Code of Professional Ethics for Teachers was jointly developed by the NCERT and the All India Federation of Primary and Secondary School Teachers" Organizations. The preamble to the code reiterates the resolve of the country's teachers to uphold their professional integrity, strive to enhance the dignity of the profession and to take suitable measures to curb professional misconduct. The professional obligations of a teacher relating to the following are included in the code: (1) Teacher in relation to the pupils, Professional Ethics of Teachers in Educational Institutions (2) Teacher in relation to parents and guardians, (3) Teacher in relation to the society and the nation, (4) Teacher in relation to profession, colleagues and professional organizations, and (5) Teacher in relation to the management and administration. Thirty principles related to these areas of a teacher's work serve as guidelines for the teachers" conduct. The primary source of these principles is the spirit of the constitution of our republic. However, the obligations of a teacher enunciated in the scriptures of ancient and medieval times, the views of educational thinkers and the thanking of various educational commissions and committees have guided the content of the code. The code highlights that a teacher is not only a purveyor of knowledge for the cognitive development of pupils but is also a democratic and socializing agent, responsible for helping children to gain social and emotional maturity and become useful and self-supporting citizens. He is expected to teach the students after making a thorough preparation, and refrain from accepting remuneration for coaching or tutoring his own students. He should be just and impartial to all his students irrespective of their caste, creed, sex, status, religion, language and place of birth. He should set a standard of dress, speech and behaviour which should be worthy of example to the students; establish cordial relations with parents and guardians of pupils; cooperate with the head of the institution and with the management to ensure smooth running of the institution in accordance with the prescribed norms; avoid making derogatory statements about colleagues, children and their parents; and refrain from taking part in activities which spread feeling of hatred or disaffection among different communities, religious or linguistic groups. National Policy on Education (1986, 1992) had also envisaged that the teacher organizations would also evolve a suitable mechanism for the observance of the code by the teachers. There are reports that the code has been discussed extensively in the meetings, seminars and workshops organized by the teacher organizations and have been formally adopted by them. But suitable mechanism for its observance is yet to be evolved, for which the National Council for Educational Research and Training (NCERT) is providing professional assistance and logistic support to the teacher organizations University Grants Commission (UGC) in collaboration v/with A1FUCTO (All India Federation of University and College Teacher Organization) formed a task force, which has prepared a code of professional ethics for the University and College teachers (UGC, 1989). The report of the task force adopted by the commission has been sent to all the University Vice Chancellors and College Principals for its implementation. The preamble to the code reiterates that the goal of higher education in our country is to produce leaders of society and economy in all areas of manifold activities, with a commitment to the ideals of patriotism, democracy, secularism, socialism, and peace. Higher education should

strive for academic excellence and progress of arts and science. In view of this, rights and responsibilities of teachers are indicated in the code. The professional obligations of a teacher in higher education institutions are enlisted in seven parts - 1) Teachers and their responsibilities; 2) Teachers and the Students; 3) Teachers and colleagues; 4) Teachers and authorities; 5) Teachers and non-teaching staff; 6) Teachers and guardians; and 7) Teachers and Society. Thirty-eight ideals related to these areas of a teacher's work serve as guidelines for a teacher's professional behaviour. The professional ethics, such as mobility, caste, age, inefficient Principals, locality from where the teacher comes, and bureaucratic. This calls out for an assessment of professional ethics prevailing in the country and to take measures to its adherence. Educational Implications: If the teacher bears good professional ethics in relation to his profession, the ethics are automatically transformed to the coming generations. The deteriorating status of the profession will gain back its potential status. An effective use of the professional ethics has the power to stop the so called terrorism in the world. Professional ethics will help in the spread of peace and international understanding across the Globe. Professional ethics will fight against Corruption and lead to a Hygienic life.

Conclusion

We believe that a day will come soon, when all the people will have sophisticated modern gadgets, western lifestyle and materialistic attitudes, but would die for any sign of values in family and society at large. Instead, come lets join hands and sow the seeds of moral ethics right now or else we will remain blind folded till the end.

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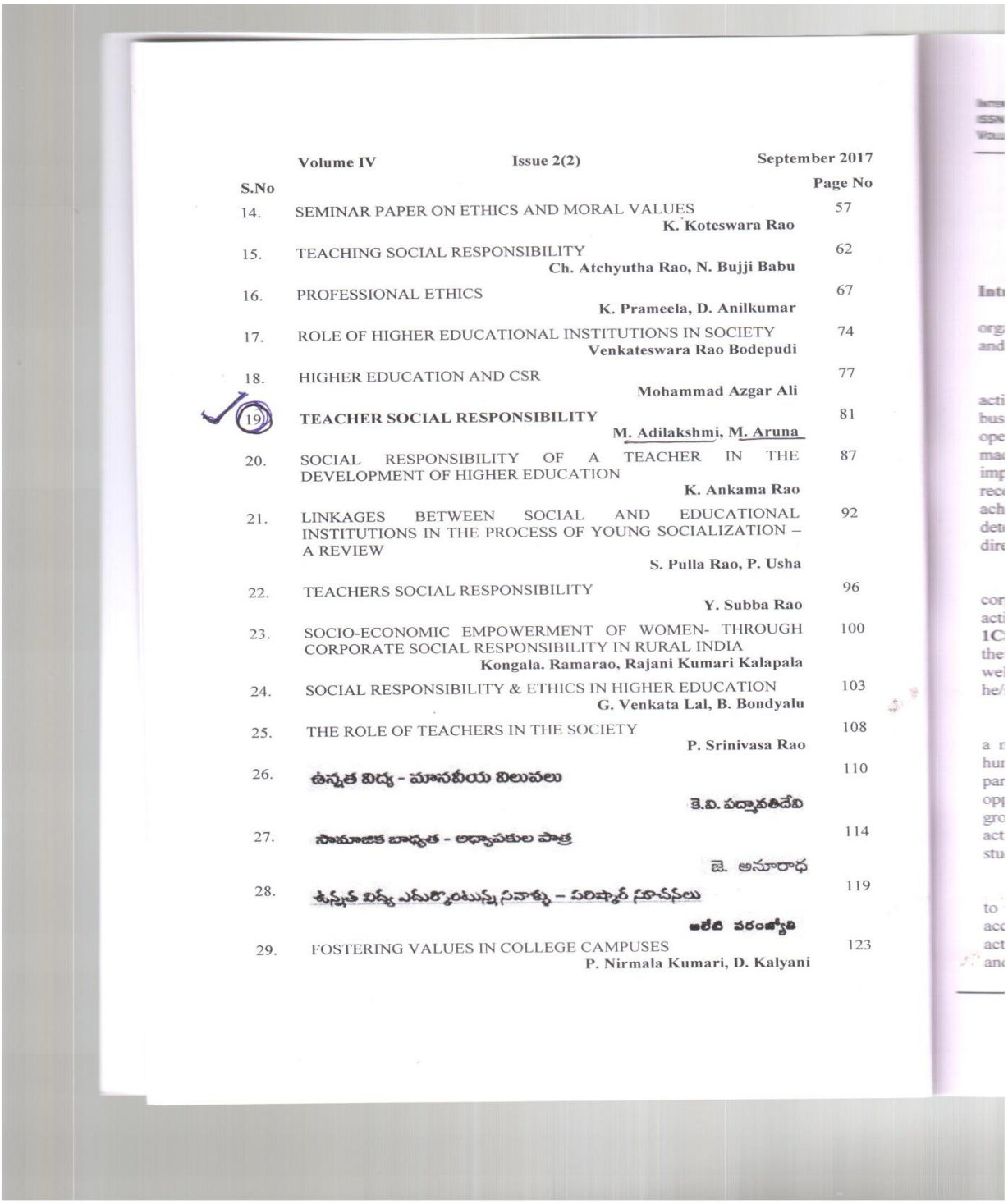
25. Mrs.M.Aruna and Mrs.M.Adilakshmi Department of zoology attended One day UGC sponsored National Seminar on " Social responsibility and Ethics in Higher Education**" on 1**/9/17 organized by IQAC, VSR & NVR College, Tenali, **and published a paper on "Professional Ethics in Teachers of Educational institutions". With ISSN no: 2349-7408** IJMART, volume IV,Issue 2(2) September 2017



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If we want to see the children, irrespective of their social standing, to be literate and aware of their basic rights and grow up as educated citizens of India, we must come forward to teach them. It is our social responsibility to share our wealth of knowledge with the less privileged sections of society. Every individual's contribution can bring about a significant positive change in the current state of illiteracy in our country. If each and every one of us from the teaching community comes forward devotedly to work for this social cause, we can easily reach our aim of freeing the nation from the shackles of illiteracy.

Students can learn skills to help them work productively in a group, as well as skills in organizing, problem-solving, consensus-building and decision-making. They can learn skills to help them think critically, to inquire, to engage in dialogue and listen well. They can learn skills in conflict resolution. Students can gain understanding as well. They can learn about our global interdependence--socially, economically and ecologically. They can apprehend the complexity of many public issues and multiple points of view on these issues. They can learn about the power of individuals and groups to make a difference. They can consider possible solutions. And they can learn a great deal in the process of working inside and outside of school to promote those solutions. Even if social responsibility can't be taught directly as knowledge, it can be "caught" in a variety of ways--through observations of the behavior of parents, friends and others; through reading and discussions; through a sense of injustice that demands personal action. It can also be caught through schools that encourage community service in some form or through immersion in a class project that, whatever its success, can transform a person's life

Make Your Classroom More Democratic and Participatory

Think about how to give your students more say in the curriculum and what happens in your classroom. Are you willing to let students determine classroom rules/guidelines and consequences? How can students share their ideas about reading assignments, areas of study, and homework? Think about ways to get more students to participate. Mix up your teaching strategies to get more students to contribute to the conversation: try small groups, pairs, fishbowls, collaborative groups, and micro-labs. Students who are usually quiet in class can sometimes be motivated to participate through activities that involve writing, theatre, or art.

Teach students to Solve Conflicts

Conflict is part of life. In fact, conflict often makes life interesting and can lead to greater understanding and deeper connections between people. Unfortunately, conflict in schools often causes disharmony, fighting, or even violence. That's where social and emotional skill-building comes in. Having these skills will help students navigate their social world, and help them do better academically. Begin by helping your class develop a sense of community by doing team-building activities and collectively determining the classroom rules.

- Teach active listening and practice to cut down on the number of conflicts.
- When conflicts do arise, don't brush them under the rug; use them as an opportunity to teach skills and promote healthy relationships.
- Help students learn concrete problem-solving and negotiation strategies. Teach them how to stand up for what they need without putting down the other person in the conflict.
- Be aware that sometimes prejudice and stereotyping are the root causes of conflict. To address this, integrate concepts of diversity and intercultural understanding into your curriculum as much as possible.

Address Controversial Issues

We live in a world filled with controversy. It is all around us, and it is compelling. Students are usually passionate about the hot topics of the day, and will want to discuss them in school. Be both proactive and reactive: Bring up difficult or controversial topics yourself, and also respond to their questions. If students' questions come up at a moment when you don't have time for a long conversation, don't just change the subject. Acknowledge the question and come back to it if you can. Let the students know that nothing is off-limits. Be sure to bring parents into the loop: Let them know what you're doing and be sensitive about what topics might hit particularly close to home.

Ask Essential Questions & Promote Dialogue

When you begin a new area of study, determine what students know and don't know by listing and analyzing their questions. Start off by discussing content questions -- who, what, where, why, and when. But eventually get students to dig deeper until they reach some "essential questions." Help students explore their own opinions as well as others' points of view. Do an "opinion continuum".

Develop Social Action Projects

Find ways to encourage your students to take action on issues that concern them. This not only fosters active citizenship and builds students' leadership skills, it provides an antidote to feelings of powerlessness or apathy. Actions can range from activist projects like letter writing, protesting, or testifying, to service-oriented projects like raising money or working at a local organization to help a group of people. Making the leap from investigation to action can be a powerful experience for young people.

Measuring Social Responsibility

Socially responsible citizenship has long been an important school purpose, but teachers and schools have cut back on developing citizenship skills because accountability sanctions now rely solely on academic test scores. A widening achievement gap in social responsibility and other curricular areas, particularly in schools serving disadvantaged students, can only impede the equity goals of U.S. education. Some precedents suggest ways we might measure social responsibility in

school. Early National Assessment of Educational Progress (NAEP) scores reported on how students were developing social responsibility and other citizenship skills and on their character development, emotional and physical health, and basic academic proficiency. In England, an accountability system for schools has combined testing with school visitation, in which inspectors judge a broad range of outcomes.

The Schools We Mean to Be

Most students think about social justice issues, whether schools encourage this focus or not, and they look to the adults in their lives to help them decide what to do about them. Educators should encourage authentic conversations about difficult issues, embrace the question, What can we do about it? and teach students to act. Teachers can introduce students to social justice by having them write a Social Action Autobiography, which will help clarify how the students have acted for the good of others in the past. Students can read books that highlight how young people have solved social problems, and they can collaborate on projects locally, nationally, or internationally. Including social justice projects in the social studies curriculum develops skills that are fundamental to a rigorous standards-based education.

The Window into Green

The goal of environmental education is to create a citizenry that is knowledgeable about the biophysical environment, aware of ways to help solve environmental problems, and motivated to work toward their solution. Today environmental issues are more complex and urgent than ever, but the schools have not met the challenge of preparing young people to make good decisions about these issues.

Democracy at Risk

Students can learn the habit of democracy through observation and imitation and in coursework that requires them to reflect on practice, read what others have thought, and develop alternative ideas. Schools need to scour the day for options that should belong to both learners and teachers as they practice the trade of democracy. .

Lighting the Moral Imagination

Teachers encourage students to make connections between the Holocaust and other periods in history characterized by violent repression and the choices, students will confront in their own lives. Facing History's materials and lessons follow a sequence of study that guides learners through five stages: forming identity; exploring membership; studying history; exploring judgment, memory and legacy; and choosing participation.

Unlearning the Lessons of Privilege

Howard conducted a six-year study of how students in four elite schools viewed their place in the world and their roles as learners and citizens. Howard suggests ways teachers might communicate alternative lessons. His strategies include: (1) model honesty and acceptance of failure; (2) encourage openness to diverse perspectives; (3) connect to students' enthusiasms; (4) encourage collaboration; and (5) develop students' critical awareness of the world outside their privileged group.

Schools of Conscience

At a time when the United States faces unprecedented challenges at home and abroad, public schools must do far more to prepare young people to be engaged, ethical advocates of "liberty and justice for all." This article explores what makes some people behave ethically—even at the risk of their own lives—and asserts that developing moral habits of the heart is the central mission of schools. It describes "schools of conscience" that support students in their search for meaning while teaching them the civic principles and virtues necessary for sustaining the common good in a democracy.

Obstacles to citizenship and social responsibility in schools

"We don't believe in politics," a Virginia high school student wrote recently in a prize-winning essay for The Nation. She undoubtedly speaks for many young people (as well as plenty of adults) who feel powerless in a world of overwhelming problems and cynical, often with good reason, about politics and politicians. A teacher who seeks to develop socially responsible citizens will not have an easy time. But turned-off students are not the only challenge. Others may include:

- curricula that provide neither guidance on how to promote socially responsible citizenship nor the time necessary for it
- administrators who may be more concerned with orderly classrooms than with thesubstance of the teaching and learning that takes place in them
- teachers whose view of citizenship and social responsibility is confined to flag pledges, voting, philanthropy, completing assignments and obedience
- teachers who are fearful about promoting active citizenship (sometimes with good reason)
- parents and community members who think a school's primary function is to get students to memorize facts and score well on tests so they can get into college.
- parents and community members who may protest student involvement in controversial public issues.

Conclusion

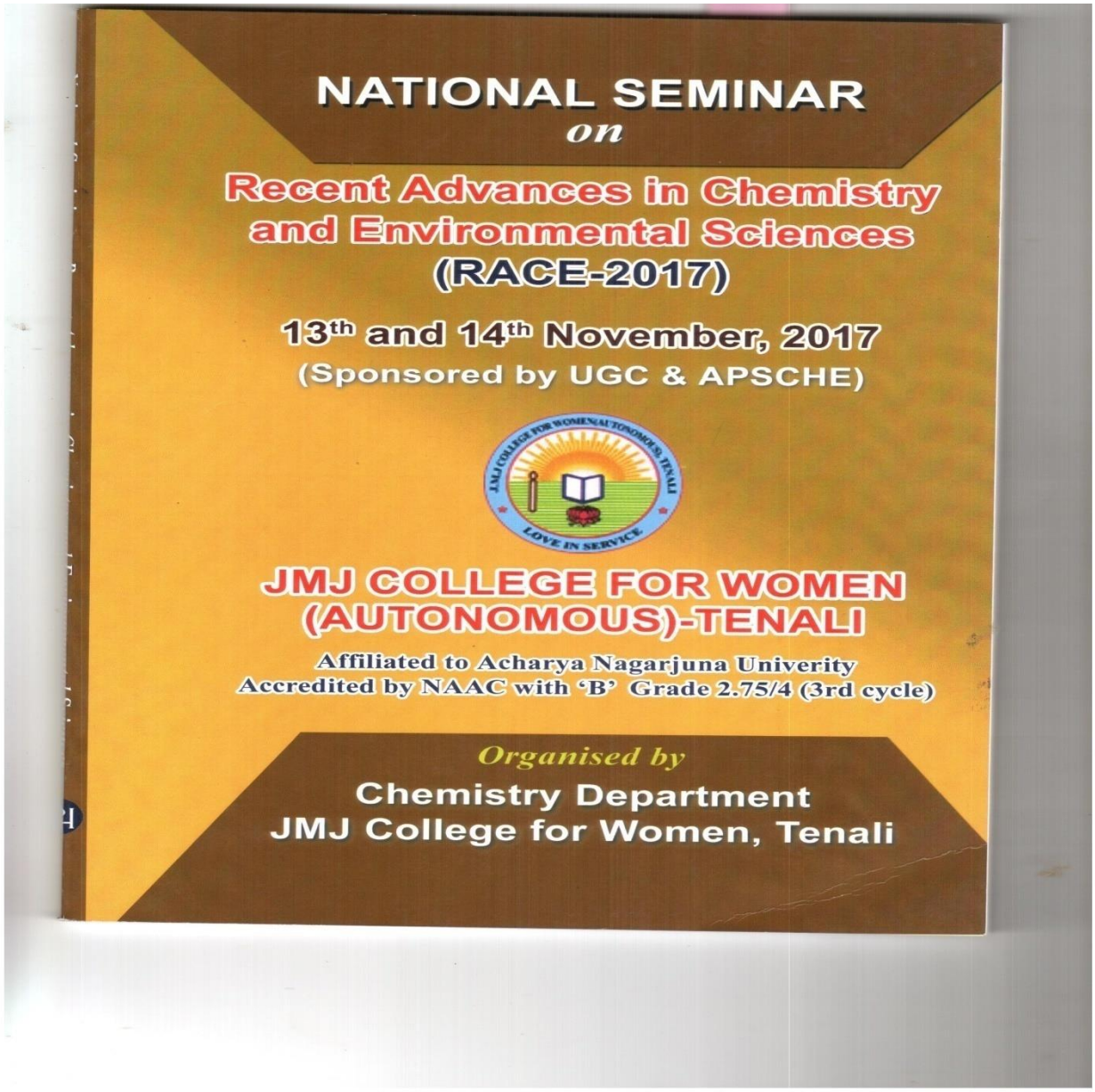
What will be gain by being a part of this social responsibility?

- An exciting, never-to-be-forgotten adventurous journey.
- The enormous satisfaction of helping disadvantaged children and knowing that we made a difference to them.
- The ability to set challenges for ourselves and the contentment of achieving them.
- New skills, more confidence, creativity and a greater understanding of different sections of the society.
- Invaluable personal and professional development.
- We also gain self confidence to push ourselves to our own limit to make children smile.
- To see our vision of a literate, educated and skilled generation of the 'Have Nots' come alive within our lifetime.
- An entry in our resume that will put us head and shoulders above most others in the job market.
- And the best of all- An unforgettable experience!
- Not to forget that we have a hand in shaping a better generation of young India

8 tips for a teacher

1. Don't tell the student "slow down" or "just relax"
2. Don't complete words for the student or talk for him or her.
3. Help all members of the class learn to take turns talking and listening. All students — and especially those who stutter — find it much easier to talk when there are few interruptions and they have the listener's attention.
4. Expect the same quality and quantity of work from the student who stutters as the one who doesn't.
5. Speak with the student in an unhurried way, pausing frequently.
6. Convey that you are listening to the content of the message, not how it is said.
7. Have a one-on-one conversation with the student who stutters about needed accommodations in the classroom. Respect the student's needs, but do not be enabling.
8. Don't make stuttering something to be ashamed of. Talk about stuttering just like any other matter.

26. **Ms. M. Arunaand M.Adilaksmi** faculty of Zoology attended UGC and APSCHE sponsored two day National seminar on "Recent advances in chemistry and Environmental sciences" organized by Dept. of chemistry on 13th and 14th November 2017 at JMJ college for women,Tenali and published a paper on "**Chemical Biology"**



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Chemical Biology

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Abstract:

Chemical biology is a scientific discipline spanning the fields of chemistry, biology, and physics. It involves the application of chemical techniques, tools, and analysis, and often compounds produced through synthetic chemistry, to the study and manipulation of biological systems. Chemical biologists attempt to use chemical principles to modulate systems to either investigate the underlying biology or create new function. Research done by chemical biologists is often closer related to that of cell biology than biochemistry. Proteomics investigates the proteome. Biochemists study the chemistry of bio molecules and regulation of biochemical pathways within cells and tissues, e.g. cAMP or cGMP, while chemical biologists deal with novel chemical compounds applied to biology.

Key words: Techniques, Research, bio molecules

Introduction

Some forms of chemical biology attempt to answer biological questions by directly probing living systems at the chemical level. In contrast to research using biochemistry, genetics, or molecular biology, where mutagenesis can provide a new version of the organism or cell of interest, chemical biology studies probe systems in vitro and in vivo with small molecules that have been designed for a specific purpose or identified on the basis of biochemical or cell-based screening. Chemical biology is one of many interfacial sciences that are characteristic of a general trend away from older, reductionist fields toward those whose goals are to achieve a description of scientific holism. In this sense, it is related to other fields such as proteomics. Chemical biology has scientific, historical and philosophical roots in medicinal chemistry, supramolecular chemistry (particularly host-guest chemistry), bioorganic chemistry, pharmacology, genetics, biochemistry, and metabolic engineering.

Proteomics

Proteomics investigates the proteome, the set of expressed proteins at a given time under defined conditions. As a discipline, proteomics has moved past rapid protein identification and has developed into a biological assay for quantitative analysis of complex protein samples by comparing protein changes in differently perturbed systems. Current goals in proteomics include determining protein sequences, abundance and any post-translational modifications. Also of interest are protein-protein interactions, cellular distribution of proteins and understanding protein activity. Another important aspect of proteomics is the advancement of technology to achieve these goals.

Enrichment techniques

Samples for Proteomics contain a myriad of peptide sequences, the sequence of interest may be highly represented or of low abundance. However, for successful MS analysis the peptide should be enriched within the sample. Reduction of sample complexity is achieved through selective enrichment using affinity chromatography techniques. This involves targeting a peptide with a distinguishing feature like a biotin label or a post translational modification. Interesting methods have been developed that include the use of antibodies, lectins to capture glycoprotein's, immobilized metal ions to capture phosphorylated peptides and suicide enzyme substrates to capture specific enzymes.

Affinity tags

Chemical synthesis of affinity tags has been crucial to the maturation of quantitative proteomics. iTRAQ, Tandem mass tags (TMT) and Isotope-coded affinity tag (ICAT) are protein mass-tags that consist of a covalently attaching group, a mass (isobaric or isotopic) encoded linker and a handle for isolation. Varying mass-tags bind to different proteins as a sort of footprint such that when analyzing cells of differing perturbations, the levels of each protein can be compared relatively after enrichment by the introduced handle. Other methods include SILAC and heavy isotope labelling. These methods have been adapted to identify complexing proteins by labelling a bait protein, pulling it down and analyzing the proteins it has complexed.

Enzyme probes

To investigate enzymatic activity as opposed to total protein, activity-based reagents have been developed to label the enzymatic ally active form of proteins (see Activity-based proteomics). For example, serine hydrolase- and cysteine protease-inhibitors have been converted to suicide inhibitors. This strategy enhances the ability to selectively analyze low abundance constituents through direct targeting. Structures that mimic these inhibitors could be introduced with modifications that will aid proteomic analysis- like an identification handle or mass tag.

Glycobiology

While DNA, RNA and proteins are all encoded at the genetic level, there exists a separate system of trafficked molecules in the cell that are not encoded directly at any direct level: sugars. Thus, glycobiology is an area of dense research for chemical biologists. For instance, live cells can be supplied with synthetic variants of natural sugars in order to probe the function of the sugars in vivo. Carolyn Bertozzi, previously at University of California, Berkeley, has developed a method for site-specifically reacting molecules the surface of cells that have been labelled with synthetic sugars.

Combinatorial chemistry

Chemical biologists used automated synthesis of many diverse compounds in order to experiment with effects of small molecules on biological processes. More specifically, they observe changes in the behaviours of proteins when small molecules bind to them. Such experiments may supposedly lead to discovery of small molecules with antibiotic or chemotherapeutic properties. These approaches are identical to those employed in the discipline of pharmacology.

Molecular sensing

Chemical biologists are also interested in developing new small-molecule and bio molecule-based tools to study biological processes, often by molecular imaging techniques. The field of molecular sensing was popularized by Roger Tsien's work developing calcium-sensing fluorescent compounds as well as pioneering the use of GFP, for which he was awarded the 2008 Nobel Prize in Chemistry. Today, researchers continue to utilize basic chemical principles to develop new compounds for the study of biological metabolites and processes.

SiRNA-A tool in chemical biology

SiRNA or small interfering RNAs owe their origins to the difficulties the scientific community faced utilizing classical and reverse genetics methods in studying gene expression. Disrupting genes to study their functions is not always optimal; neither is mapping mutations back to their genes easy. The whole process is expensive as well as time-consuming, which is why a lot of effort has been devoted to develop methods to silence gene expression in sequence specific manner using nucleic acids. They have the potential to be powerful tools in the field of chemical biology to study the chemistry of gene expression in therapeutic targets of bacteria and viruses.

Employing biology

Many research programs are also focused on employing natural bio molecules to perform a task or act as support for a new chemical method or material. In this regard, researchers have shown that DNA can serve as a template for synthetic chemistry, self-assembling proteins can serve as a structural scaffold for new materials, and RNA can be evolved in vitroto produce new catalytic function.

Protein misfolding and aggregation as a cause of disease

A common form of aggregation is long, ordered spindles called amyloid fibrils that are implicated in Alzheimer's disease and that have been shown to consist of cross-linked beta sheet regions perpendicular to the backbone of the polypeptide. Another form of aggregation occurs with prion proteins, the glycoproteins found with Creutzfeldt-Jakob diseaseand bovine spongiform encephalopathy. In both structures, aggregation occurs through hydrophobic interactions and water must be excluded from the binding surface before aggregation can occur. A movie of this process can be seen in "Chemical and Engineering News". The diseases associated with misfolded proteins are life-threatening and extremely debilitating, which makes them an important target for chemical biology research.

Chemical synthesis of peptides

In contrast to the traditional biotechnological practice of obtaining peptides or proteins by isolation from cellular hosts through cellular protein production, advances in chemical techniques for the synthesis and ligation of peptides has allowed for the total synthesis of some peptides and proteins. Chemical synthesis of proteins is a valuable tool in chemical biology as it allows for the introduction of non-natural amino acids as well as residue specific incorporation of "posttranslational modifications" such as phosphorylation, glycosylation, acetylation, and even ubiquitination.

ISBN : 978-93-85101-29-8

Protein design by directed evolution

One of the primary goals of protein engineering is the design of novel peptides or proteins with a desired structure and chemical activity. Because our knowledge of the relationship between primary sequence, structure, and function of proteins is limited, rational design of new proteins with enzymatic activity is extremely challenging. Directed evolution, repeated cycles of genetic diversification followed by a screening or selection process, can be used to mimic Darwinian evolution in the laboratory to design new proteins with a desired activity.

Several methods exist for creating large libraries of sequence variants. Among the most widely used are subjecting DNA to UV radiation or chemical mutagens, error-prone PCR, degenerate codons, or recombination. Once a large library of variants is created, selection or screening techniques are used to find mutants with a desired attribute. Common selection/screening techniques include fluorescence-activated cell sorting (FACS), mRNA display, phage display, or in vitro compartmentalization. Once useful variants are found, their DNA sequence is amplified and subjected to further rounds of diversification and selection. Since only proteins with the desired activity are selected, multiple rounds of directed evolution lead to proteins with an accumulation beneficial traits.

Use in biological systems

As mentioned above, the use of bio orthogonal reactions to tag bio molecules requires that one half of the reactive "click" pair is installed in the target molecule, while the other is attached to an optical probe. When the probe is added to a biological system, it will selectively conjugate with the target molecule.

The most common method of installing bio orthogonal reactivity into a target bio molecule is through metabolic labelling. Cells are immersed in a medium where access to nutrients is limited to synthetically modified analogues of standard fuels such as sugars. As a consequence, these altered bio molecules are incorporated into the cells in the same manner as their wild-type brethren. The optical probe is then incorporated into the system to image the fate of the altered bio molecules. Other methods of fictionalization include enzymatic ally inserting azides into proteins, and synthesizing phospholipids conjugated to cyclooctynes Discovery of bio molecules through met genomics

The advances in modern sequencing technologies in the late 1990s allowed scientists to investigate DNA of communities of organisms in their natural environments, so-called "eDNA", without culturing individual species in the lab. This met genomic approach enabled scientists to study a wide selection of organisms that were previously not characterized due in part to an incompetent growth condition. These sources of eDNA include, but are not limited to, soils, ocean, subsurface, hot springs, hydrothermal vents, polar ice caps, hyper saline habitats, and extreme pH environments. Of the many applications of met genomics, chemical biologists and microbiologists such as Jo Handelsman, Jon Clardy, and Robert M. Goodman who are pioneers of met genomics, explored met genomic approaches toward the discovery of biologically active molecules such as antibiotics.

Protein phosphorylation

Posttranslational modification of proteins with phosphate groups has proven to be a key regulatory step throughout all biological systems. Phosphorylation events, either phosphorylation by protein kinases or dephosphorylation by phosphatases, result in protein activation or deactivation. These events have an immense impact on the regulation of physiological pathways, which makes the ability to dissect and study these pathways integral to understanding the details of cellular processes. There exist a number of challenges-namely the sheer size of the phosphoproteome, the fleeting nature of phosphorylation events and related physical limitations of classical biological and biochemical techniques-that have limited the advancement of knowledge in this area. A recent review provides a detailed examination of the impact of newly developed chemical approaches to dissecting and studying biological systems both in vitro and in vivo.

Metal complexes in medicine

Metal complexes have many characteristics that can be advantageous in drug design. In comparison to organic-based medicines, metal complexes have many more Coordination Numbers, geometries, and oxidation/reduction states that can be used to make structures that interact with targets in unique ways unavailable to most organic molecules. In addition, the cationic metal is advantageous in complexing with charged targets within biological systems like the phosphate backbone of DNA. Targets of metal-based medicines include DNA, proteins, and enzymes. Each target tupe is described in turn below.

Metal complexes targeting DNA

DNA has been the primary target of metal complexes due to the ability of cationic metal interacting with the anionic backbone of DNA. The anticancer chemotherapy drug cisplatin covalently binds to DNA, which disrupts transcription and leads to programmed cell death. Assuming early detection, cisplatin cures almost all cases of testicular cancer. This drug, however, has severe side effects and great effort is being made to improve drug delivery including attachment to single walled carbon nanotubes, encapsulation in proteins cages, among other clever strategies.

Another major effort for anticancer metal-based drugs centres around stabilization of the G-quadruplex of DNA. In general, these drugs have a non-covalent interaction with the G-quadruplex as well as a planar positively charged structure.

Metal complexes targeting enzymes and proteins

Though DNA has been a primary target for inorganic medicines, enzymes, and proteins also can be modulated through interactions with these compounds. Metal complexes can interact with the amino acids with the highest reduction potential (histidine, cysteine, and selenocysteine). Metals used in such complexes include gold, platinum, ruthenium, vanadium, cobalt and others. Several new potential therapeutic complexes are currently in the process of discovery and investigation.

Chemical approaches to stem-cell biology

Advances in stem-cell biology have typically been driven by discoveries in molecular biology and genetics. These have included optimization of culture conditions for the maintenance and

differentiation of pluripotent and multipotent stem-cells and the deciphering of signaling circuits that control stem-cell fate. However, chemical approaches to stem-cell biology have recently received increased attention due to the identification of several small molecules capable of modulating stem-cell fate in vitro. A small molecule approach offers particular advantages over traditional methods in that it allows a high degree of temporal control, since compounds can be added or removed at will, and tandem inhibition/activation of multiple cellular targets.

Fluorescence for assessing protein location and function

Fluorophores and techniques to tag proteins

Organisms are composed of cells that, in turn, are composed of macromolecules, e.g. proteins, ribosomes, etc. These macromolecules interact with each other, changing their concentration and suffering chemical modifications. The main goal of many biologists is to understand these interactions, using MRI, ESR, electrochemistry, and fluorescence among others. The advantages of fluorescence reside in its high sensitivity, non-invasiveness, safe detection, and ability to modulate the fluorescence signal. Fluorescence was observed mainly from small organic dyes attached to antibodies to the protein of interest. Later, fluorophores could directly recognize organelles, nucleic acids, and important ions in living cells.

Applications of DNA microarrays in chemical biology

Planar surfaces functionalized with single- or double-strand nucleic acids have enabled researchers to address a variety of salient biological and biochemical questions in recent years. The general architecture of modern DNA microarrays reflects the historical progression from the sequence-specific probing of whole chromosomes immobilized on glass slides (as early as 1961 with fluorescent in situ hybridization) and the low-density porous membrane arrays available since the early 1990s, to the high-density (102-104 features/mm2) solid support platforms that exist today. The massively parallel processing capabilities of these picomolar-range contemporary arrays provide for the generation of large data sets and multiplexed analysis. Furthermore, several top-down and bottom-up assembly methodologies provide researchers with the option for "in-house" production of arrays from custom oligonucleotide libraries or the use of commercial genome chips, notably those developed by Affymetrix and Agilent Technologies.

Conclusion

Chemical Biology Approaches to Characterize Protein Targets. Affinity chemo proteomics can be used to identify the targets of compounds that have shown activity in a phenotypic or pathway screen. Mutagensis is important target validation approach is to generate a catalytically-dead target protein to tease apart the role of the enzymatic and scaffolding functions Genotype-tissue expression project (GTEx) has generated a database of mRNA expression levels across multiple tissues. Metabolomics in combination with clickable chemical reporters can enable chemo proteomic methods to be applied to substrate identification, as shown recently for protein lipidation.The development of a computational protein design method, metamultistate design, enables the design and validation.

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27.**Ms. Ch. Sarojani** attended a National Seminar on" Humanism – Essential for Ideal Society and Blissful life" (NSHMU-2017) in KBN College, Vijayawada- Presented a paper with title" **Biblical path to enhance human values to lead blissful life."** on 30.6.2017,ISSN NO:2277-8160Volume 9,No:50, pg.no.114-116 IF 4.547,K value 80.26

IF : 4.547 | IC Value 80.26 VOLUME-6, ISSUE-9, Special Issue September-2017 • ISSN No 2277 - 8160

Original Research Paper Zooolgy

Biblical path to enhance human values to lead blissful life

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ABSTRACT Though our India is progressing successfully in Science and Technology it is phasing problems in humanitarian point of view due to the deteriorating human values. Parents, preachers and teachers have to play a vital role in driving the children and youth into the path to lead blissful life by fulfilling the spiritual life. They must remember that their prime duty is to enlighten the young minds for the healthy and prosperous society i.e. the god's kingdom. One shall guide and transfer the blessings of the god Almighty to thousands of generations as a legacy but not the curse which suffers four generations in all aspects.

KEYWORDS : blissful life, spiritual life, blessings of the god Almighty, the god's kingdom.

INTRODUCTION:

Though our India is progressing successfully in Science and Technology it is phasing problems in humanitarian point of view due to the deteriorating human values. Parents, private Educational Institutes are forgetting that ``The aim of education is the knowledge, not of facts but of values (William S. Burroughs); by which character is formed, strength of mind is increased, the intellect is expanded, and one can stand on one's own feet (Swami Vivekananda)"and neglecting the languages meant for imparting moral values. So Government has introduced Ethics and Human Values also as a subject at Intermediate and under graduate level. There is an urge to concentrate on the development of spiritual and human values in the society. Values are born internally by imparting spiritual Knowledge.

Insight into a Human being:

Each Human being has to nourish his body and spirit as God created man with mud and breathed the Holy Spirit (Genesis2:8). But least importance is given to the spiritual life than that of physical life. Hence there is reduction in the human values. Life values derive from 12 eternal values of existence which constitute the unique properties of pure spiritual consciousness: Infinity, Eternity, Silence, Peace, Unity, Truth, Goodness, Knowledge, Power, Beauty, Love and Bliss. Out of these 12, 1200 or 12,000 values arise. Each of these values expresses one aspect or dimension of a higher spiritual principle in life. For example, all values related to integrity, honesty, accuracy and objectivity issue from Truth. All values issuing from goodwill, benevolence, compassion and magnanimity issue from Goodness.

Indian spiritual tradition:

In the Indian spiritual tradition, the ultimate spiritual reality is referred to as Sat-Chit-Ananda or Being-Consciousness-Bliss. The ultimate spiritual reality is pure Being. The Being is Conscious. The Consciousness of that Being is Bliss. Infinity, Eternity, Peace, Silence, Unity and Truth are aspects of pure Being. Knowledge, Goodness and Power are aspects of Consciousness. Beauty, Love and Joy are the aspects of Bliss.

Suffering with the works of the flesh (Galathians-5:16-23):

People are suffering with the works of the flesh, namely Adultery, Fornication, Uncleanness, Idolatry, Licentiousness, Sorcery, Hatred, Contentious, Jealousies, Out bursts of wrath Selfish ambitions, Dissensions, Heresies, Envy, Murders, Drunkenness, Revelries which drives the person away from blissful life.

The individuals are longing for love, peace, happiness, friendship; becoming victims of unrest, depression, aggravation, stress; lacking proper relationship with god and family; afflicted with increased - cheating, scorning; suicidal attempts are increasing because of banter loneliness.

Society Phasing Burning problems of the families like isolated and split- families due to jobs and divorces; attention to carrier and money; neglected children and elders; increased-care centers and old age homes; incurable diseases; drunkenness, drug-addiction and adultery .The society is becoming shoddier with depleted values and practicing bribery at all levels, over exploiting, giving more importance to artificial things than that of the humanity because of breaking god's laws.

Without values or beliefs, we would be mechanical-like beings, driven here and there by the vicissitudes of life. Without values, we would be creature-like, compelled to action solely by our urges and passions. In this inhuman existence, there would be little consideration for truths we hold dear, let alone implement them to ennoble and enrich our lives. In this reality devoid of values, we would live unconscious lives, without meaning or purpose. On the other hand, when we take to values, we live a purposeful and dynamic existence -- i.e. we become *truly human*.

Values are actually a very special power in the universe. Values are actually *spiritual skills* -- a divine gift that comes to us from the infinite Source of things. The highest of principles -- such as Oneness, Love, Beauty, and others -- descend from the heavens, and are reinterpreted as values by our minds. For example, the spiritual principle of Oneness is recognized by our minds as values of cooperation, integration, teamwork, and others, great *human* values. Likewise, the universal principle of Love expresses through values of goodness, selflessness, self-givingness, openness, tolerance, respect for others; while Oneness, Love, Beauty, and Truth are some of higher *spiritual* values that they derive from. At certain points, the human and spiritual values come together and blend into one another, expressing through *spiritualized human values* such as selflessness, self-givingness, and gratitude.

The last twenty-five years has seen an explosion in an interest in values. Tom Peters' book 'In Search of Excellence' started the ball rolling for values in the workplace. Religious leaders speak of family values, nations speak of moral values, spiritual teachers speak of the highest values of gratitude, benevolence, and self-givingness; even self-surrender to the Divine. Values drive us, motivate us, move life, move us forward -- enabling progress even evolution. Values are what enable life to take the Next Step -- whether they drive our own individual lives in a positive direction; improve the economic, social, and cultural conditions of a nation; or move society forward in its never-ending ascending path of progress.

Values Origin - from Life and from Spirit:

Society acquires values by experience and passes them on to future generations as cultural guidelines for action. They discover that cleanliness is essential for heath. Punctuality and regularity of action are essential for success in agriculture. Honesty and truthfulness are essential in trade. Loyalty and patriotism are essential for the

integrity and defense of the community. Responsibility, generosity and self-sacrifice are the bedrocks of the family.

Powers of Values to Accomplish:

Values enhance accomplishment. **Cleanliness** attracts prosperity; **Punctuality** regularizes our activities to use time in a best way. **Efficiency** improves conversion of energy into result with perfection or **Quality** enhances economic status and gains attention. **Harmony** improves coordination and prevents the scattering of energies necessary for accomplishment. **Honesty** makes a person reliable and thereby brings more clients. **Freedom** helps to bring out the creativity helps bring out new ideas and opportunities so that progress keeps growing. **Discipline** Helps to control and channelize activities and energies without wastage. **Authority** helps accomplish by extracting work through unquestioned obedience. **Soft speech** helps by conserving energy. **Trust gives** more opportunities for people to interact and work together. **Safety** at the work place improves productivity. **Organization** coordinates and connects people, money, market, technology and product. **Systems** makes routine work fall into a pattern and thereby speeds up work. **Secrecy** ensures accomplishment by keeping confidential matters under cover. **Hard work** energizes the physical plane where results come. (N. Asokan, MSS).

Solutions from the Holy Bible to establish values -Prayer :

To establish these values in one's life is a full-time pursuit, which is prayer. It is to integrate human life with the Spirit. Prayer with praising and love gives strength and spirit, grace, protection, light, blessings.

Fruits of Holy Spirit (Galathians-5:16-23):

Holy Spirit guides us, lights our path, shines like sun and showers like rain and gives the fruits like love, joy, peace, kindness, faithfulness, goodness, gentleness long suffering, and self-control. The problems of the individual, family and the society can be solved.

Ten Commandments to restore the values to lead blissful life (Exodus, 20:3-17):

1. Worship no god but me. You shall have no other Gods before me.
2. You shall not make yourself any carved image, or any likeness of anything is in heaven above, or that is in earth beneath, or that is in the water under the earth. You shall not bow down to them nor serve them. For I, the LORD your God, am a jealous God, visiting the iniquity of the fathers on the children to the third and the fourth generations of those who hate me; but showing mercy to thousands, to those Who love me and keep my commandments.
3. You shall not take the name of the LORD your God in vain, for the LORD will not hold him guiltless who takes His name in vain.
4. Remember the Sabbath day, to keep it holy. Six days you shall labor and do all your work, but the seventh day is the Sabbath of the LORD your GOD. In it you shall do no work, you, nor your son, nor your daughter, nor your manservant, nor your maidservant, nor your cattle, nor your stranger who is within your gates. For in six days the LORD made the heaven and the earth, the sea, and all that is in them, and rested on the seventh day. Therefore the LORD blessed the Sabbath day and hollowed it.
5. Honor your father and your mother; that your days may be long upon the land which the LORD your God is giving you.
6. You shall not murder.
7. You shall not commit adultery.
8. You shall not steal.
9. You shall not bear false witness against your neighbor.
10. You shall not covet your neighbor's house; you shall not covet your neighbor's wife, or his manservant, or maidservant, or his ox, or his donkey, or anything that is your neighbors.

If you obey the Lord your God and do everything he commands he will make you his own people as he has promised. Then all the people on earth will see that the Lord has chosen you to be his own people, and they will be afraid of you. The Lord will give you many children, many cattle, and abundant crops in the land that he promised your ancestors to give you. He will send rain in season from his rich store house in the sky and bless all your work, so that you will not have to borrow from any. The Lord your God will make you the leader among the Nations and not a follower; you will always prosper and never fail if you obey faithfully all his commands that lam giving you today (Deuteronomy 28:9-13).

We can develop spiritual powers like Harmony, Self-Givingness, (spiritual) Peace, Equality, (divine) Beauty, (divine) Love, Truth, Integral Knowledge, and others. We know of practical values in life like honesty, self-reliance, openness, tolerance, organization, maximum utilization, attention, continuous improvement, simplicity, respect for the individual, etc. We can associate each human value to their appropriate spiritual power.

Responsibilities of parents, preachers and teachers:

They must be ideal in following the God's laws; their Word with god's Holy Spirit must show the light and must work like salt to the children and youth to practice in their life because Lord is full of compassion and pity, not easily angered and shows great love and faithfulness. He keeps his promise for thousands of generations and forgive evil and sin; but he will not fail to punish children and grandchildren to the third and fourth generation for the sins of their parents (Exodus34:6-8).Hence each individual must be aware of these things and must Passover the blessings of the Lord to the next generations but not the curse. Moreover cowards, traitors, perverts, murderers, the immoral, those who practice magic, those who worship idols, and all liars – the place for them is the lake burning with fire and Sulphur which is the second death(Revelation 21:8).

Responsibilities of an individual:

God's new Commandment - Love one another. As I have loved you, so you must love one another (John 13:34).For god loved the world so much that he gave his only son, so that everyone who believes in him may not die but have eternal life(John 3:16).Love your life partner and children. Love is patient and kind; it is not jealous or conceited or proud; love is not ill-mannered or selfish or irritable; love does not keep a record of wrongs; love is not happy with evil, but is happy with the truth. Love never gives up; and its faith, hope, and patience never fail. Love is eternal (I Corinthians 13:4-8). You can forgive a person if you love more and you can love if you forgive that person. Train up the youth the way they should go.

CONCLUSION:

By fulfilling the spiritual life every one can lead blissful life and one shall guide and transfer the blessings of the god almighty to thousands of generations as a legacy but not the curse which suffers four generations in all aspects. Parents, preachers and Teachers must remember that their prime duty is to enlighten the young minds for the healthy and prosperous society i.e. the god's kingdom.

Children, it is your duty to obey your parents, for this is the right thing to do. ``Respect your father and mother" is the first commandment that has a promise added: so that all may go well with you, and you may live a long time in the land. Parents do not treat your children such away as to make them angry. Instead, bring them up with Christian discipline and instruction.

Slaves obey your human masters with fear and trembling; and do it with a sincere heart, as though you were serving Christ (god).Remember that the Lord will reward everyone, whether slave or free, for the good work he does.

Masters behave in the same way towards your slaves and stop using threats. Remember that you and your slaves belong to the same Master in the heaven, who judges everyone by the same standard

(Ephesians 6:1-9).
Everyone have to avoid "Negative values" which are rooted in ego, ignorance, and falsehood.

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10) John 3:16
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28.**Ms. Ch. Sarojani** attended UGC sponsored National Seminar on "Women Empowerment Media, Cinema and theater- Prospects and Challenges" held on 21and 22July, 2017 in KBN College, Vijayawada and presented a paper with title **"Cyber savagery against women-present scenario".** ."ISSN NO:2277-8160Volume 9,No:17, pg.no.114-116 IF 4.547,K value 80.26

IF : 4.547 | IC Value 80.26 Volume-6, Issue-9, Special Issue September-2017 • ISSN No 2277 - 8160

Original Research Paper Zoology

CYBER SAVAGERY AGAINST WOMEN - PRESENT SCENARIO

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ABSTRACT Because of gender inequality millions of women and girls even small children at least one among three around the world are subjected to deliberate violence without discrimination of race, culture, region not only by both genders. The facilities of the Internet, mobile information and communications technologies (ICTs) and the social media paved new ways to target them easily and quickly. Cyber savagery against women and girls became a global problem with serious implication for societies, economies and person's life. Hence, steps should be taken at the international level to provide a complete justice to the victims by way of compensatory remedy and offenders to be punished with highest type of punishment to anticipate the criminals of cyber crime (Dhawesh Pahuja); and to achieve sustainable development that puts gender equality and the empowerment of women. Records and daily news revealing the physical and sexual harassment phased by some Women publicly, exposed to trauma and loss without complaint inside the walls routinely. However, some reported and succeeded in punishing the culprit focusing light to stop and to fight against.

KEYWORDS : Gender inequality, Cyber savagery, global problem

Introduction

Cyber savagery against women and girls and marginalized genders and sexualities is rampant, in contrast to Internet's initial premise of equal opportunity and neutrality, as elsewhere in the world because today's flawed internet reflects the offline world we live in, where women and marginalized communities are abused, harassed, threatened, stalked and violated on a daily basis. Cyber savagery against women and girls increased at global level hence effective legal and social controls to prevent attitudes and criminal behavior online; implementation of laws and passing new resolutions, amendments is necessary to protect and to empower younger generations from the culprit. International and national laws and trans-national collaborative alliances are slowly evolving. As 57% of American women are experiencing online harassment A collective global effort, led by the United Nations system, has put in place the pillars for a 21st century sustainable development paradigm that include a goal on gender equality priorities for the next 15 years, which places women's access to technology for their empowerment as one of the core indicators for progress.

Types of Cyber savagery against women

Various cyber savageries committed against individuals and society at large specially targeting women are Harassment via e-mails (blackmailing, threatening, bullying, and even cheating via email creating problem quite often when posted from fake ids.), Cyber-stalking("pursuing stealthily";following a person's movements across the Internet by posting messages (sometimes threatening) on the bulletin boards, entering the chat-rooms frequented by the victim, constantly bombarding the victim with emails etc.), Cyber pornography(pornographic websites; pornographic magazines), Defamation(publishing defamatory matter about someone on a website or sending it as e-mails to all of that person's friends.), Morphing(editing the original picture by unauthorized user or fake identity again re-posted/uploaded on different websites by creating fake profiles) and Email spoofing(misrepresents its origin).

Impact of Cyber savagery against women

It is an adverse impact on the exercise of and advocacy for free speech, a fundamental right and its preservation requires vigilance by everyone, online and offline, hence the establishment of a Cyber Civil Rights Initiative (CCRI) through international collaboration is necessary to ensure a safe Internet moreover the Human Rights Council's recognition that human rights apply offline as well as online.

Threats of rape, death, and stalking put a premium on emotional bandwidth and put a stress on financial resources directly or indirectly as needs for health care, judicial and social services rise and productivity goes down with the sense of peace and security required for business to thrive.

Fewer women than men access the Internet today, 450 million new female Internet users could come online within the next three years. (Intel's 2013 report, `Women and the Web'). Hence Ellen Pao, (on February, 2015) former CEO of the online forum Reddit expressed grave concerns about the tensions between balancing freedom of expression with privacy and protection of Internet users.

Cyber savagery against women and girls in India

Nearly 50 per cent of women in major Indian cities have experienced online abuse. Online harassment as one of "most traumatic experience" for women especially Indians are the second biggest sharers of personal information on the Internet, which makes women in India soft targets of a variety of crimes that includes sexual defamation.(Dr Shalini Kashmiria).

Freedom House, an independent, non-partisan watchdog organization dedicated to the expansion of freedom and democracy around the world is running a campaign against online abuse and harassment that women face especially on social media websites and for a secure and safe internet for all with **#DigitalHifazat** – name courtesy Raju Tai (Freedom on the Net 2016).

Freedom House's Hyperlinkers project taken up both qualitative and quantitative research, along with analyzed reports of media involving online harassment of high profile women; a survey of 500 social media users, women under 35 living in major cities, and educated to college level or above.; and interviews with ten of the respondents. They found that Online abuse is a serious issue in India, 36% of respondents who had experienced harassment online took no action at all; 28% intentionally reduced their online presence after suffering online abuse. 15 % reported that it lead to mental health issues like depression, stress, and insomnia.

Victims are more likely to block abuse than to report it, yet blocking is ineffective against organized, sustained campaigns using multiple accounts. Assailants readily exploit mechanisms to report abuse, alleging their victims have violated platform guidelines to disable their accounts. Thirty percent of survey respondents said they were not aware of laws to protect them from online harassment. Only a third of respondents had reported harassment to law enforcement; among them, 38 percent characterized the response as "not at all helpful."

IT Acts

Even though India is one of the very few countries to enact IT Act 2000 to combat cyber crimes, issues regarding women still remain

untouched in this Act. The said Act has termed certain offences as hacking, publishing of obscene materials in the net, tampering the data as punishable offences. But the grave threat to the security of women in general is not covered fully by this Act. (Debarati Halder)

Recently Manish Kathuria was arrested in India by the New Delhi Police due to Cyber stalking an Indian lady, Ms Ritu Kohli by illegally chatting on the Web site MIRC using her name. He used obscene and obnoxious language, and distributed her residence telephone number, inviting people to chat with her on the phone. A case was slammed under Section 509 of the Indian Penal Code for outraging the modesty of Ritu Kohli (Indianchild, 2005). In another case, an engineering and management graduate, facing prosecution in a dowry harassment case, was arrested by Delhi police for sending obscene e-mails in his wife's name to several persons. In June 2000, a man was arrested by the Delhi police for assuming the identity of his ex-employer's wife in a chat channel an encouraging others to telephone net (Mishra, 2001).

Morphing amounts to violation of I.T. Act, 2000 and attracts sec. 43 & 66 of the said Act. The violator can also be booked under IPC also. A Delhi-based beautician grievance the police that her photograph was flashed on a porno portal along with her mobile number.(The Times of India, October).

A student of Air Force Balbharati School Delhi, teased by all his classmates for having a pockmarked face, decided to get back at his tormentors and he scanned photographs of his classmates and teachers, morphed them with nude photographs and put them up on a website that he uploaded on to a free web hosting service (cyber pornography). It was only after the father of one of the class girls featured on the website objected and lodged a complaint with the police that any action was taken.

The Mumbai police arrested the Swiss couple for pornography who gathered slum children and then would force them to appear for obscene photographs and uploaded them to websites specially designed for paedophiles.

One in every 500 cases is reported are Email spoofing (Duggal). Most cases go unreported because people are "petrified of adverse publicity" (Borwankar). Maximum number of cyber crimes related to obscenity occurred in Mumbai last year; five cases in 2005; out of 40 cases in 2006 only ten were registered, 30 obscenity-related cases and 67 hacking cases in Delhi (nine registered), 30 cases in Bangalore; Chennai, Hyderabad and Pune reported few obscene crimes but saw a greater incidence of hacking.

According to the National Crime Records Bureau India is witnessing a steady increase of cyber crime to 63.7% in 2013 as compared to 2012 (from 3,477 cases in 2012 to 5,693 cases in 2013; 749 cases to seek out revenge against divorced women by former husbands across the country.) Girls and Women have gone missing after meeting up friends that they have made on the social media Eg. Abducted (boy had forcibly taken her to a hotel and assaulted her) one reported from Kottayam in Kerala; 29 cases registered In Kerala. Cyber forgery accounted for 55.9% (747 out of total 1,337 IPC cases) and cyber fraud 38.7% (518 out of 1,337 IPC cases) were the major cases reported under IPC category for cyber crimes. 56.7% of the offenders under IT Act were in the age group 18-30 years (1,190 out of 2,098 persons) and 50.1% of the offenders under IPC Sections were in the age group 30-45 years (603 out of 1,203 persons). During 2013, 21.8% of cyber crimes was reported for fraud/ illegal gain (1,240 out of 5,693 cases) followed by eve-teasing/ sexual-harassment with 19.6% (1,116 cases) and greed/ money with 14.4% (821 cases). Similarly in 13.2% cases of cyber crime, suspects were 'neighbours / friends & relatives' (749 out of 5,693) [Vicky Nanjappa 2015, 9:18 (IST)].

Cyber savagery against women and girls in Hyderabad

According to National Crime Records Bureau (NCRB), Andhra Pradesh's six convictions under the IT Act, 2000, which covers cybercrime against women, is said to be the highest for any state in the country, registered a steep increase during 2013.

Provisions of the IT Act 2000 relating to cyber crime and offences against women in India and the loopholes of the said Act

Unfortunately even though Chapter XI of t the IT Act deals with the offences such as Tampering with computer source documents (s.65), Hacking with computer system (s66), publishing of information which is obscene in electronic form (s.67) Access to protected system (s70), Breach of confidentiality and privacy (s. 72), Publication for fraudulent purpose(s.74) IT Act 2000 still needs to be modified. It does not mention any crime specifically as against women and children.

Problems associated with Cyber-Crimes, are Jurisdiction, Loss of evidence, Lack of cyber army and Cyber savy judges who are the need of the day. Kerela high Court has accepted a P.I.L., through an email. Today with the growing arms of cyberspace the territorial boundaries seems to vanish thus the concept of territorial jurisdiction as envisaged under S.16 of C.P.C. and S.2.of the I.P.C. will have to give way to alternative method of dispute resolution.

Again, under no section in IT ACT 2000, Obscenity – personal viewing – Is an offence, in fact like in IPC 292 again if it is proved that you have published or transmitted or caused to be published in the electronic form only then under Section 67 it can be an offence. IT Act 2000 does not mention the typical cyber crimes like cyber stalking, morphing and email spoofing as offences.

However, some reported and succeeded in punishing the culprit E.g. `a Twitter troll was jailed in September 2014 and a porn site operator sentenced to 18 years in prison in February 2015; One person was suspended from his community college, and another lost a part-time job with the New York Yankees when the doxing case involving a former Major League Baseball pitcher was made public.

Measures to block the access of Online Child Sexual Abuse Materials (CSAM) in India

An inter-ministerial committee, constituted by Ministry of Electronics and Information Technology (MeitY) has issued an order dated. 18.04.2017 to Internet Service Providers (ISPs) to adopt and implement Internet Watch Foundation (IWF) resources on or before 31.07.2017 to prevent the distribution and transmission of Online CSAM into India.

Conclusion

"There is one universal truth, applicable to all countries, cultures and communities: violence against women is never acceptable, never excusable, and never tolerable." United Nations Secretary-General Ban Ki-moon (2008). "Our work to eliminate violence against women is central to our commitment to promote gender equality and the empowerment of women, both of which are integral to sustainable development." Helen Clark, UNDP Administrator, Statement on the International Day for the Elimination of Violence against Women (2014).

Educating (sensitizing) the next generation of ICT users, irrespective of gender, through their parents, teachers and wider communities, as well as police authorities and the justice systems and providing place and implement safeguards to secure safe online spaces is necessary to abolish cyber savagery against female. Safety measures like women's shelters, crisis centers, help lines have to be evolved to suppress cyber savagery against women and girls in the digital world also with attention and active participation of industry (digital gatekeepers), civil society and governments; a broad-based societal action, engaging all stakeholders.

Preventive measures

Prevention is always better than cure. Identification of exposures through education will assist responsible companies and firms to

meet these challenges. Avoid disclosing any personal information, sending any photograph, credit card number to strangers via e-mail or while chatting; watch on the sites that your children are accessing, to prevent any kind of harassment or depravation in children; web site owners must adopt some policy to prevent cyber crimes ;web servers running public sites must be physically separately protected from internal corporate network; strict statutory laws need to be passed by the legislatures keeping in mind the interest of netizens.

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29.**Ms. Ch. Sarojani** faculty of Zoology attended two day UGC sponsored National Seminar on" Recent trends in Mathematics and Mathematic Applications" from 20.9.17 to 21.9.2017 in JMJ college for Women, Tenali and presented and published a paper on" **Advanced applications of Mathematics in understanding Biosciences"** with ISBN No: 978-93-85101-95-3 page no-248 to 254

International Journal of Zoology and Applied Biosciences
Volume 3, Issue 2, pp: xxx-xxx, 2018
UGC Approved Journal No. 46511
ISSN: 2455-9571
http://www.ijzab.com
Research Article

EFFECT OF CADMIUM ON ENZYMATIC PARAMETERS OF FRESHWATER CATFISH, *HETEROPNEUSTES FOSSILIS*

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Article History: Received 19th February 2018; Accepted 24th April 2018; Published ….. April 2018

ABSTRACT

Quantitative assessment of enzymes is a reliable indicator of stress imposed on the organism by environmental pollutants such as heavy metals. The activities of Acetylcholinesterase (AChE), alkaline phosphatase (ALP) and acid phoshatase (ACP) enzymes in liver, brain, gill and serum are used as stress indicators. The significant changes in activities of these enzymes in blood plasma indicate tissue impairment caused by stress. In the present study, significant changes were observed in AChE, ALP and ACP activities in liver, brain, gill and serum of *Heteropneustes fossilis* fish exposed to cadmium when compared to the control group. In this study, the AChE activity was inhibited moderately by sub-lethal concentration of cadmium. During 21 days treatment among the tissues tested, the gill AChE was more inhibited than any other tissue AChE. Alkaline phosphatase activities of cadmium treated fish under various sub-lethal concentrations were significantly decreased in liver and increased in brain, gill and serum. Acid phosphatase activities of cadmium treated fish under various sub-lethal concentrations were significantly increased in liver, brain, gills and serum.

Keywords: *Heteropneustes fossilis,* Acetylcholinesterase, Alkaline phosphatase, Acid phoshatase, Cadmium.

INTRODUCTION

Fish are mostly used in the evaluation of aquatic systems quality and some of their physiological changes can be considered as biological markers of environmental pollution (Dautremepuits *et al*., 2004). They have a great potential to serve as sensitive indicators, signaling exposure and understanding the toxic mechanisms of stressors in aquatic ecosystems (Vutukuru *et al*., 2006). The impact of metals as well as other pollutants on aquatic biota can be evaluated by enzymatical assays which are used to detect and evaluate the potential toxicological effects of chemicals on aquatic organisms.

The freshwater catfish, *Heteropneustes fossilis* is an important group of food fishes in India. This stinging catfish (*H. fossilis*) is commercially important and valuable food species also in many Asian countries (Akand *et al*., 1991). *H. fossilis*, commonly known as Shing or Singhi is a popular catfish in India and found naturally in lakes, ponds, swamps and marshes, ditches, floodplains and in muddy rivers. It is characterized by an accessory respiratory organ (air breathing organ) which enables it to exist for hours when out of water or in indefinitely oxygen-poor water and even in moist mud (Akand *et al*., 1991). So, this species is very potential in seasonal water bodies of India.

In recent years, there has been a rapid development of enzymatic biomarkers. This is not only due to advances in biochemistry but also to modern methods of measurement. The measurement of fish cellular enzymes is an indicator of health condition and has been used as diagnostic tool in monitoring programs of aquatic pollution (Fernandes *et al*., 2008). Phosphatases and Acetylcholinesterases are good indicators of stress condition in the biological systems (Verma *et al*., 1980). Acid and alkaline phosphatases are general enzymes present in almost all the tissues. They are hydrolytic enzymes concerned with the process of transphosphorylation and have an important role in the general energetics of an organism. They are associated

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with the transport of metabolites, with metabolism of phospholipids, phosphoproteins, nucleotides and carbohydrate, and with synthesis of proteins (Srivastava *et al*., 1995). Acid phosphatase is a lysosomal enzyme that hydrolyses the ester linkage of phosphate esters and helps in autolysis of cell after its death. Alkaline phosphatase (ALP) is a membrane-bound enzyme related to the transport of various metabolites (Lin *et al*., 1976). It has also been proposed as a good biomarker in ecotoxicology because of its sensitivity to metallic salts (Boge *et al*., 1992). Alterations in acid phosphatase (ACP) and alkaline phosphatase (ALP) activities in tissues and serum have been reported in fish species (Atli & Canli, 2007; Jyothi & Narayan, 2000; Rogers *et al*., 2003).

Acetylcholine is synthesized in neurons soma by combining choline with acetyl (originating from acetyl-CoA) *via* choline acetyl transferase (ChAT). Synthesized acetylcholine is transported to the nerve ends *via* axonal transport and released to the synaptic space (Mesulam *et al*., 2002). Acetylcholinesterase is responsible for hydrolysis of acetylcholine and therefore important for cholinergic neuronal system (Nachmansohn & Wilson, 1951). The inhibition of Acetylcholinesterase causes accumulation of acetylcholine in the neuromuscular synapses and nerve synapses creates abnormal results, the most important one is the over activity of muscle tissues (Roex *et al*., 2003). This over activity in fish leads to changes of behavior such as hyperactivity and anorexia as well as physiological effects such as asphyxia, potentially conducive to death (Beauvais *et al*., 2000).

ALP is a polyfunctional enzyme, present in the plasma membrane of all cells. It hydrolyses a broad class of phosphomonoester substrates, and acts as a transphosphorylase at alkaline pH is 9. It also acts as an early marker of cell differentiation in the osteogenic lineage in bivalve mollusc (Mouri *et al*., 2002). ALP activity has been reported to be sensitive to heavy metal pollutants (Regoli & Principato, 1995). In *Venus gallina* alkaline phosphatase activity is implicated in shell formation (Carpene & Vašák, 1989). ALP in serum and haemocytes of *C. farreri* were more important than any other enzymes in immune defense (Zhang *et al*., 2005).

Acid phosphatase is a major marker enzyme, material to be hydrolyzed is taken into lysosomes by endocytosis and the enzymes catalyze the hydrolysis of most of the major polymeric compounds as well as foreign bodies entered into animal body. Lysosomal enzymes are mainly acid hydrolases and ACP is known to hydrolyse the phosphomonoesters which are produced by hydrolysis of other major phosphates of the cell. Heavy metals accumulate to a relatively high concentration in lysosomes and destabilizing its membrane integrity followed by release of stored lysosomal hydrolases into the haemolymph thereby increasing the activity of the enzyme in haemolymph. The above explanation justifies the hyper activity of ACP as observed at high concentration of metals and the extended period of exposure.

MATERIALS AND METHODS

Collection of fishes

The freshwater catfish, *Heteropneustes fossilis* (Bloch) with a size range of 16-20 cm and, weighing 54 ±4 g irrespective of their sex, have been chosen as the test organism in the present study. The fishes were collected from the domestic fish market located at Guntur city ($16^0$20' N $80^0$27' E and 31 m elevation), Guntur district, Andhra Pradesh, India.

Acclimatization

Fishes were acclimatized to the laboratory conditions in large fiber glass tanks with unchlorinated ground water for 3 to 4 weeks at a room temperature of 28 ± 2^oC. As these catfishes are benthic in nature, overcrowding was avoided by keeping small numbers of fishes in each tank. Water was changed on alternate days. Tanks were covered with fish netting to prevent the escape of fishes.

Selection of sub-lethal concentrations

In the present study $1/10^{th}$ of the 96h LC_{50} value was taken as sub-lethal concentration (A). The two other doses, B & C, used were a reduction in concentration of the sub-lethal concentration (A) in a graded manner. The half concentration of the sub-lethal concentration A (50 % reduction) was used as the second dose (B) while the third dose (C) was 50 % reduction in concentration of the second dose B (Kayode *et al*., 2016).

Estimation of Enzymatic activities

1. Assay of tissue and serum Acetylcholinesterase activity (AChE): Acetylcholinesterase activity in liver, brain, gill and serum was estimated as per the method of (Ellman *et al*., 1961). The principle underlying in this assay is that the substrate acetylthiocholine when hydrolysed by the enzyme Acetylcholinesterase yields thiocholine. This, on subsequent combination with DTNB forms the yellow anion 5-thio-2nitrobenzoic (TNB) acid which absorbs strongly at 412 nm.

Brain, liver and gill tissues of both test and control fish were dissected out and were isolated in ice-cold condition for further studies. The tissues were thoroughly washed in normal saline and homogenized (10%, w/v) for 1 min in sodium phosphate buffer (50 mM, pH 7.5) containing 0.2% Triton X-100 using homogenizer with teflon-coated pestle under ice cold condition. The homogenates were kept in ice for about 10 min and then centrifuged at 10,000 rpm for 30 min in a refrigerated high-speed centrifuge to solubilize

AChE. The clear cell free supernatant of each tissue homogenate was collected and used for determination of AChE activity.

AChE activity was determined using the Ellman's reagent DTNB 5,5-Dithiobis (2-nitrobenzoic acid) and acetylthiocholine iodide as substrate (Ellman *et al.,* 1961). Supernatant/serum of 50µl was taken for assay and 2.3 ml of 0.5 mM DTNB and 100 µl of 2.6 mM acetylthiocholine iodide was added. The rate of change of absorbance was measured at 412nm. Blank and samples were taken to make sure that there was no non-specific esterase or other background activity. Protein was estimated as described by Lowry et al, (1951)allowing the calculation of AChE as U (µmol/min) /mg protein.

2. Estimation of tissue and serum Alkaline Phosphatase (ALP): About 10% homogenate of gill, liver and brain were prepared in 0.33 M sucrose solution and centrifuged at 1000 rpm for 15 min. The supernatant obtained was used as the enzyme source. 1.5 ml of carbonate-bicarbonate buffer, 1.0 ml of substrate and 0.1 ml of magnesium chloride and requisite amount of the enzyme source were mixed together. The reaction mixture was incubated at 37^{o}C for 15 minutes. The reaction was terminated by adding 0.l ml of folin's phenol reagent. Controls were incubated without adding enzyme source and enzyme source were added after the addition of folin's phenol reagent. 1ml of 15% sodium carbonate solution was added and incubated for further 10 minutes at 37°C. The blue colour developed was read at 640 nm against a blank. Standards also were treated similarly. The enzyme activity was expressed as micromoles of phenol liberated per hour/ mg protein.

3. Estimation of tissue and serum Acid Phosphatase (ACP): Both serum and tissue phosphatase activity was determined following the method by Cabrera & Anon Suarez, (1963)

Liver, brain and gill of both control and test fishes were homogenized in isotonic sucrose and were centrifuged at 5000 rpm for 15 minutes. Supernatant obtained was the source of enzymes. 0.5 ml of p-nitro phenyl phosphate was mixed with equal volume of 0.1 M phosphate buffer (pH 4.8). The enzyme was added and incubated for 30 minutes at room temperature. The reaction was arrested by adding 4ml of 0.1 N NaOH. The absorbance of solution was measured spectrophoto-metrically at 410 nm. The amount of p-nitro phenol liberated by the acid phosphatase per hour/ mg protein gives the specific activity. Protein was determined as per the method by Lowry *et al.* (1951).

Statistical analysis of the data

The mean and Standard Deviations (SD) were calculated by following the method of (Pillai & Sinha, 1968).

SD was calculated by using the formula:

$$StandardDeviation = \frac{\sqrt{Ex^2 - \frac{(Ex)^2}{\mathrm{n}}}}{n-1}$$

Where

'x^{2}' is the sum of square of deviations from the mean

'n' is the number of individual observations.

The significance of the deviations from Normal was calculated by calculating student's t-test by using the formula:

$$t = \frac{\bar{x}_1 - \bar{x}_2}{\sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}}$$

Where

$\bar{x}_1$ is the mean of first set of observations,

$\bar{x}_2$ is the mean of second set of observations,

$s_1^2 + s_2^2$ are squares of standard deviations of the first and second set of observations, and n_1 and n_2 are number of the first and second sets.

RESULTS AND DISCUSSION

Cadmium interacts with legends in proteins, particularly enzymes and may inhibit their biochemical and physiological activities (Passow *et al*., 1961). They have strong affinity to bond with the amino acid molecules of protein and may cause changes in enzyme structure. The most obvious consequences of these changes are the inhibition of enzymes.

Acetylcholinesterase (AChE) activity

The calculated values of Acetylcholinesterase activity and percent change over control after exposure to sub-lethal concentrations of cadmium for 7, 14 and 21 days were given in Tables 1 to 4 and Figure 1 to 3.

Acetylcholinesterase activities of the fish exposed to various sub-lethal concentrations of cadmium were significantly decreased. The Acetylcholinesterase activity in the liver, brain, gill and serum showed a continuous decrease as the exposure progressed (Table 4.4.1). Maximum decrease was observed at the highest concentration of cadmium (A) on 21st day exposure. Decrement of the enzyme activity was more intense as the time of exposure increased. In this study, the AChE activity was inhibited moderately by sub-lethal concentration of cadmium. During 21 days treatment among the tissues tested, the gill AChE was more inhibited than any other

tissue AChE. No significant changes were observed in the measured variables of fish maintained in uncontaminated water (control) (Table 4).

The enzyme Acetyl cholinesterase (AChE) which catalyses the hydrolysis of acetylcholine is ubiquitous in the animal kingdom (Walker & Thompson, 1991). It is a well characterized enzyme in vertebrates because of its critical catalytic function at the cholinergic synapses. Acetylcholinesterase is a potential cell membrane marker enzyme (Severson *et al.*, 1972; Steck, 1974; Watts & Pierce, 1978) that hydrolyzes the neurotransmitter acetylcholine to acetic acid and choline (Chuiko, 2000). Several studies have shown that high levels of AChE inhibition are needed to cause significant mortality of aquatic species in both acute and chronic exposures (Ansari & Kumar, 1984).

Acetylcholinesterase (AChE) activity is considered of great interest in evaluating the effects of exposure to neurotoxic compounds in aquatic animals (Cajaraville *et al*., 2000). It is an enzyme involved in the synaptic transmission of nerve impulses and is inhibited by neurotoxic compounds (Bocquené *et al*., 1998). However, the responsiveness of AChE to other chemicals including metals has also been reported by Leinio & Lehtonen, (2005). Several studies showed the potential use of this enzyme activity as a useful biomarker for detecting general physiological stress in aquatic organisms caused by exposure to contaminants (Rank *et al*., 2007). The results of the present study showed significant inhibition of AChE activity after the exposure of *H. fossilis* to cadmium compared to control. The significant responses indicated that the AChE activity decreased to reach a minimum by the end of 21 days treatment. This inhibition may be the result of a neurotoxic effect due to cadmium toxicity. Similar observations have been reported in silver catfish, *Rhamdia quelen* exposed to Cadmium (Pretto *et al*., 2010). Beldi *et al*,(2006) reported that heavy metal pollution and decreases AChE activity in *Donax trunculus* from industrialized areas and harbour sectors in the gulf of Annaba.

The present study revealed that there was a significant decrease of AChE in the liver, brain, gills and serum when they were exposed to increased concentration of cadmium and extended duration of time. The present results confirm that AChE can be used as a sensitive enzyme marker. Acetylcholinesterase, due to its rate of hydrolysis towards the substrate acetylcholine iodide, confirms its presence in *H. fossilis* is highly sensitive and is recommended as a useful biomarker in bio-monitoring studies.

Alkaline phosphatase activity (ALP)

The calculated values of alkaline phosphatase activity and percent change over control exposed to sub-lethal concentrations of cadmium for 7, 14 and 21 days are given in Tables 5 to 8. The alkaline phosphatase activity in the liver, brain, gill and serum showed a continuous increase as the exposure progressed. Maximum increase was observed at the highest concentration of cadmium (A) at 21 days exposure. Enhancement of the enzyme activity was more intense as the time of exposure increased.

The alkaline phosphatase is composed of several isoenzymes that are present in practically all tissues of the body, especially in cell membranes. It catalyses the hydrolysis of monophosphate esters and has a wide substrate specificity. The functional activity of this enzyme was found to increase during the exposure with heavy metals as an adaptive response in mitigating the metal toxicity (Kopp & Hetesa, 2000).

In the present study, the level of alkaline phosphatase activity increased in the, liver, brain, gill tissue and serum of *H. fossilis* when exposed to cadmium. This result suggests that increased level of alkaline phosphatase might be due to the toxicity effect of cadmium. These increased activities can be attributed to the destruction of cell membrane and lysosomes, which in turn lead to hepatic damage (Thirumavalavan, 2010). The present results are in agreement with (Shalaby & Abbassa, 2007) who obtained a significant increase in ALP in kidney of catfish, *Hetropneustes* sp. after toxication with Cd. In contrast to above results, decreased activity of ALP in liver was obtained by (Sastry & Subhadra, 1985). This decrease may be due to the damage and dysfunction of the liver. Characterization and effect of heavy metals on ALP was made by Mazorra *et al*, (2002) in the clam, *Scrobicularia plana,* and mercury showed highest inhibitory effects on ALP activity in various tissues analysed. ALP, which is sensitive to metals, gives a better picture of the general metabolic condition of the organisms (Regoli & Principato, 1995; Xiao *et al*., 2002).

Acid phosphatase activity (ACP)

The mean±SD values of acid phosphatase activity and percent change over control after exposed to sub-lethal concentrations of cadmium for 7,14 and 21 days are given in Tables 9 to 12.

Acid phosphatase activities of cadmium treated fish under various sub-lethal concentrations were significantly increased in liver, brain, gills and serum. Increment of the enzyme activity was more intense as the time of exposure increased. Maximum increase was observed at the highest concentration of cadmium at 21 days exposure.

Table 1. Effect of Cadmium on the Acetylcholinesterase activity (U (µmol/min) /mg protein) in the tissues /serum of *H. fossilis* under exposure to sub-lethal concentrations**.**

Tissue /serum	Treatments											
	Control			A			B			C		
	7th day	14th day	21st day	7th day	14th day	21st day	7th day	14th day	21st day	7th day	14th day	21st day
Liver	0.1506± 0.022	0.1507± 0.028	0.1508± 0.014	0.0954± 0.032	0.0768± 0.044	0.0542± 0.012	0.1122± 0.026	0.0926± 0.018	0.0806± 0.016	0.1276± 0.014	0.1108± 0.012	0.0956± 0.010
Brain	0.4902± 0.041	0.4904± 0.021	0.4900± 0.018	0.2888± 0.046	0.2466± 0.022	0.2056± 0.022	0.4028± 0.012	0.3642± 0.010	0.3022± 0.022	0.4356± 0.066	0.3986± 0.056	0.3576± 0.048
Gill	0.2635± 0.016	0.2636± 0.010	0.2634± 0.016	0.1826± 0.036	0.1245± 0.066	0.0965± 0.024	0.2046± 0.022	0.1722± 0.062	0.1448± 0.026	0.2146± 0.082	0.1964± 0.022	0.1656± 0.066
Serum	0.3274± 0.024	0.3272± 0.044	0.3269± 0.042	0.2196± 0.046	0.1654± 0.066	0.1244± 0.076	0.2536± 0.066	0.2122± 0.044	0.1864± 0.028	0.2896± 0.064	0.2525± 0.012	0.2246± 0.042

*Each value is represented as mean ± SD (n=5); Values are significant at $p<0.05$ (based on t-test).

A = Sub-lethal conc. (2.068 ppm); B = 50% SL of A (1.034 ppm); C = 50% SL of B (0.517 ppm).

Table 2. Changes in specific activity levels of Acetylcholinesterase (U (µmol/min)/ mg protein) and % change over the control in different tissues/serum of *H. fossilis* exposed to sub-lethal concentrations of Cadmium for 7 days.

Tissue / serum	Treatments						
	Control	A	% Change	B	% Change	C	% Change
Liver	0.1506±0.022	0.0954±0.032	36.65	0.1122±0.026	25.50	0.1276±0.014	15.27
Brain	0.4902±0.041	0.2888±0.046	41.09	0.4028±0.012	17.82	0.4356±0.066	11.14
Gill	0.2635±0.016	0.1826±0.036	30.70	0.2046±0.022	22.35	0.2146±0.082	18.58
Serum	0.3274±0.024	0.2196±0.046	32.93	0.2536±0.066	31.70	0.2896±0.064	11.54

*Each value is represented as mean ± SD (n=5); Values are significant at $p<0.05$ (based on t-test).

Table 3. Changes in specific activity levels of Acetylcholinesterase (U (µmol/min) /mg protein) and % change over the control in different tissues/serum of *H. fossilis* exposed to sub-lethal concentrations of Cadmium for 14 days.

Tissue / serum	Treatments						
	Control	A	% Change	B	% Change	C	% Change
Liver	0.1507±0.028	0.0768±0.044	49.04	0.0926±0.018	38.55	0.1108±0.012	26.48
Brain	0.4904±0.021	0.2466±0.022	49.71	0.3642±0.010	25.73	0.3986±0.056	18.72
Gill	0.2636±0.010	0.1245±0.066	52.77	0.1722±0.062	34.67	0.1964±0.022	25.49
Serum	0.3272±0.044	0.1654±0.066	49.45	0.2122±0.044	35.15	0.2525±0.012	22.83

*Each value is represented as mean ± SD (n=5); Values are significant at $p<0.05$ (based on t-test).

Table 4. Changes in specific activity levels of Acetylcholinesterase (U (µmol/min) /mg protein) and % change over the control in different tissues/serum of *H. fossilis* exposed to sub-lethal concentrations of Cadmium for 21 days.

Tissue /serum	Treatments						
	Control	A	% Change	B	% Change	C	% Change
Liver	0.1508±0.014	0.0542±0.012	64.06	0.0806±0.016	46.55	0.0956±0.010	36.60
Brain	0.4900±0.018	0.2056±0.022	58.05	0.3022±0.022	38.33	0.3576±0.048	27.02
Gill	0.2634±0.016	0.0965±0.024	63.36	0.1448±0.026	45.03	0.1656±0.066	37.13
Serum	0.3269±0.042	0.1244±0.076	61.95	0.1864±0.028	42.98	0.2246±0.042	31.29

*Each value is represented as mean ± SD (n=5); Values are significant at $p<0.05$ (based on t-test).

Table 5. Effect of Cadmium on the alkaline phosphatase activity (U (µmol/h) /mg protein) in the tissues/serum of H. fossilis under exposure to sub-lethal concentrations.

Tissue /serum	Treatments											
	Control			A			B			C		
	7th day	14th day	21st day	7th day	14th day	21st day	7th day	14th day	21st day	7th day	14th day	21st day
Liver	1.1608± 0.012	1.1607± 0.018	1.1608± 0.012	1.5554± 0.012	1.7064± 0.024	1.9220± 0.024	1.3022± 0.016	1.4926± 0.018	1.6806± 0.010	1.1976± 0.014	1.2808± 0.022	1.4956± 0.016
Brain	0.9212± 0.041	0.9214± 0.021	0.9212± 0.012	1.8888± 0.016	2.4986± 0.020	2.9056± 0.028	1.2008± 0.012	1.6612± 0.016	2.0022± 0.022	1.0356± 0.016	1.2960± 0.056	1.6570± 0.028
Gill	0.7635± 0.022	0.7638± 0.016	0.7634± 0.016	1.0126± 0.030	1.8745± 0.016	2.3565± 0.020	0.9846± 0.020	1.5422± 0.026	1.8248± 0.026	0.8146± 0.082	0.8264± 0.012	1.2650± 0.018
Serum	5.5374± 0.034	5.5372± 0.014	5.5369± 0.012	6.5116± 0.018	7.1651± 0.026	8.1214± 0.016	6.2236± 0.016	6.7022± 0.014	7.2864± 0.020	5.9896± 0.024	6.3825± 0.010	6.9246± 0.012

**Each value is represented as mean ± SD (n=5); Values are significant at $p<0.05$ (based on t-test).

A = Sub-lethal conc. (2.068 ppm); B = 50% SL of A (1.034 ppm); C = 50% SL of B (0.517 ppm).

Table 6. Changes in specific activity levels of alkaline phosphatase (U (µmol/h)/ mg protein) and % change over the control in different tissues/serum of H. fossilis exposed to sub-lethal concentrations of Cadmium for 7 days.

Tissue /serum	Treatments						
	Control	A	% Change	B	% Change	C	% Change
Liver	1.1608±0.012	1.5554±0.012	33.99	1.3022±0.016	12.18	1.1976±0.014	3.17
Brain	0.9212±0.041	1.8888±0.016	105.03	1.2008±0.012	30.35	1.0356±0.016	12.41
Gill	0.7635±0.022	1.0126±0.030	32.62	0.9846±0.020	28.95	0.8146±0.082	6.69
Serum	5.5374±0.034	6.5116±0.018	17.59	6.2236±0.016	12.39	5.9896±0.024	8.16

*Each value is represented as mean ± SD (n=5); Values are significant at $p<0.05$ (based on t-test).

Table 7. Changes in specific activity levels of alkaline phosphatase (U (µmol/h) /mg protein) and % change over the control in different tissues/serum of H. fossilis exposed to sub-lethal concentrations of Cadmium for 14 days.

Tissue / serum	Treatments						
	Control	A	% Change	B	% Change	C	% Change
Liver	1.1607±0.018	1.7064±0.024	47.01	1.4926±0.018	28.59	1.2808±0.022	10.34
Brain	0.9214±0.021	2.4986±0.020	171.17	1.6612±0.016	80.29	1.2960±0.056	40.65
Gill	0.7638±0.016	1.8745±0.016	145.41	1.5422±0.026	101.91	0.8264±0.012	8.19
Serum	5.5372±0.014	7.1651±0.026	29.39	6.7022±0.014	21.03	6.3825±0.010	15.26

*Each value is represented as mean ± SD (n=5); Values are significant at $p<0.05$ (based on t-test).

Table 8. Changes in specific activity levels of alkaline phosphatase (U (µmol/h) /mg protein) and % change over the control in different tissues/serum of *H. fossilis* exposed to sub-lethal concentrations of Cadmium for 21 days.

Tissue /serum	Treatments						
	Control	A	% Change	B	% Change	C	% Change
Liver	1.1608±0.012	1.9220±0.024	65.57	1.6806±0.010	44.77	1.4956±0.016	28.84
Brain	0.9212±0.012	2.9056±0.028	215.41	2.0022±0.022	117.34	1.6570±0.028	79.87
Gill	0.7634±0.016	2.3565±0.020	208.68	1.8248±0.026	139.03	1.2650±0.018	65.70
Serum	5.5369±0.01	8.1214±0.016	46.67	7.2864±0.020	31.59	6.9246±0.012	25.06

*Each value is represented as mean ± SD (n=5); Values are significant at $p<0.05$ (based on t-test).

Table 9. Effect of Cadmium on acid phosphatase activity (U (µmol/h) /mg protein) in the tissues/serum of H. fossilis under exposure to sub-lethal concentrations.

Tissue /serum	Treatments											
	Control			A			B			C		
	7th day	14th day	21st day	7th day	14th day	21st day	7th day	14th day	21st day	7th day	14th day	21st day
Liver	1.2602± 0.032	1.2605± 0.048	1.2602± 0.032	1.3676± 0.044	1.5808± 0.024	1.8956± 0.036	1.3022± 0.046	1.4926± 0.028	1.6806± 0.040	1.2754± 0.032	1.3964± 0.034	1.4520± 0.024
Brain	0.9842± 0.041	0.9844± 0.022	0.9844± 0.042	1.9880± 0.032	2.5960± 0.026	2.9746± 0.040	1.2356± 0.044	1.6416± 0.032	2.1220± 0.032	1.0656± 0.056	1.3260± 0.028	1.8544± 0.040
Gill	0.7950± 0.046	0.7948± 0.046	0.7950± 0.056	1.0526± 0.040	1.8645± 0.034	2.2580± 0.032	0.9960± 0.032	1.6220± 0.052	1.9280± 0.036	0.8240± 0.032	0.8546± 0.032	1.2356± 0.032
Serum	5.3374± 0.044	5.3370± 0.024	5.3372± 0.042	6.3814± 0.038	7.0861± 0.028	7.8714± 0.024	6.0980± 0.042	6.6028± 0.044	7.1984± 0.044	5.8886± 0.022	6.2828± 0.042	6.8256± 0.044

*Each value is represented as mean ± SD (n=5); Values are significant at p<0.05 (based on t-test).

A = Sub-lethal conc. (2.068 ppm); B = 50% SL of A (1.034 ppm); C = 50% SL of B (0.517 ppm).

Table 10. Changes in specific activity levels of acid phosphatase (U (µmol/h) /mg protein) and % change over the control in different tissues/serum of H. fossilis exposed to sub-lethal concentrations of Cadmium for 7 days.

Tissue /serum	Treatments						
	Control	A	% Change	B	% Change	C	% Change
Liver	1.2602±0.032	1.3676±0.044	8.52	1.3022±0.046	3.33	1.2754±0.032	1.21
Brain	0.9842±0.041	1.9880±0.032	101.99	1.2356±0.044	25.54	1.0656±0.056	8.27
Gill	0.7950±0.046	1.0526±0.040	32.40	0.9960±0.032	25.28	0.8240±0.032	3.65
Serum	5.3374±0.044	6.3814±0.038	19.56	6.0980±0.042	14.25	5.8886±0.022	10.33

*Each value is represented as mean ± SD (n=5); Values are significant at p<0.05 (based on t-test).

Table 11. Changes in specific activity levels of acid phosphatase (U (µmol/h) /mg protein) and % change over the control in different tissues/serum of H. fossilis exposed to sub-lethal concentrations of Cadmium for 14 days.

Tissue /serum	Treatments						
	Control	A	% Change	B	% Change	C	% Change
Liver	1.2605±0.048	1.5808±0.024	25.41	1.4926±0.028	18.41	1.3964±0.034	10.78
Brain	0.9844±0.022	2.5960±0.026	163.71	1.6416±0.032	66.76	1.3260±0.028	34.70
Gill	0.7948±0.046	1.8645±0.034	134.59	1.6220±0.052	104.08	0.8546±0.032	7.52
Serum	5.3370±0.024	7.0861±0.028	32.77	6.6028±0.044	23.72	6.2828±0.042	17.72

*Each value is represented as mean ± SD (n=5); Values are significant at p<0.05 (based on t-test).

Table 12. Changes in specific activity levels of acid phosphatase (U (µmol/h) /mg protein) and % change over the control in different tissues/serum of *H. fossilis* exposed to sub-lethal concentrations of Cadmium for 21 days.

Tissue /serum	Treatments						
	Control	A	% Change	B	% Change	C	% Change
Liver	1.2602±0.032	1.8956±0.036	50.42	1.6806±0.040	33.36	1.4520±0.024	15.22
Brain	0.9844±0.042	2.9746±0.040	202.17	2.1220±0.032	115.56	1.8544±0.040	88.38
Gill	0.7950±0.056	2.2580±0.032	184.03	1.9280±0.036	142.52	1.2356±0.032	55.42
Serum	5.3372±0.042	7.8714±0.024	47.48	7.1984±0.044	34.87	6.8256±0.044	27.89

*Each value is represented as mean ± SD (n=5); Values are significant at p<0.05 (based on t-test).

In the present study, the acid phosphatase activity of liver, gill, brain and serum of *H. fossilis* increased in all the three sub-lethal concentrations of cadmium. This increased level of acid phosphatase might be due to the toxic effect of cadmium. The increased level of acid phosphatase activity suggested the involvement of lysosomes in metal toxicity. These results are in agreement with those of (Shalaby & Abbassa, 2007) who found that sub-lethal concentration of Cadmium caused significant increase in ACP of common carp after 7 and 15 days. Sastry & Subhadra, (1985)who also found a significant increased in ACP in kidney of catfish. *Hetropneustes* sp. after toxication with cadmium. The increased concentration of ACP on blood serum indicates impairement of parnchymatous organs. In addition, the increased plasma ACP may be attributed to the hepatocellular damage or cellular degradation by the heavy metals (Yamawaki *et al*., 1986).

Acid phosphatases are hydrolytic lysosomal enzymes and are released by the lysosomes for the hydrolysis of foreign material; hence it has a role in certain detoxification functions. Increase in acid phosphatase enzyme activity in all the three sub-lethal concentrations might be due to increase in protease activity which causes damage to the lysosomal membrane, thus permitting the leakage of lysosomal enzyme into cytoplasm. Alteration in the enzyme activity is due to adverse effect of xenobiotics on the cell and its organelles. In contrast to above results, decreased acid phosphatase activity in *Sarotherodon mossambicus* exposed to cadmium has earlier been recorded by Ruparelia *et al*, (1992). Gill *et al*, (1991) reported that the hepatic, bronchial and renal acid phosphatase activities were decreased in *Barbus conchonius* toxicated with Cadmium.

CONCLUSION

The heavy metal toxicity seriously impairs various metabolic functions of the fish *H. fossilis*, reflected as alterations in various enzymatical constituents. The activities of acetyl cholinesterase (AChE), alkaline phosphatase (ALP) and acid phoshatase (ACP) enzymes in liver, brain, gill and serum are used as stress indicators. In the present study, there were significant changes in AChE, ALP and ACP activities in liver, brain, gill and serum of fish exposed to cadmium compared to the control group.

The apparent sensitivity of ACP and ALP exhibited through fluctuating activity patterns suggests that analysis of these enzymes at different time periods can be used as biomarkers in metal pollution. In agreement with the observations of other workers, the data obtained once again confirm the reliability of choosing AChE activity pattern as an enzyme marker to assess metal stress.

ACKNOWLEDGEMENT

The authors express sincere thanks to the Head of the Department of Zoology and Aquaculture, Acharya Nagarjuna University for the facilities provided to carry out this research work

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International Journal of Zoology Studies

International Journal of Zoology Studies
ISSN: 2455-7269
Impact Factor: RJIF 5.14
www.zoologyjournals.com
Volume 3; Issue 1; January 2018; Page No. 132-141

Effect of cadmium on Haematological changes in a freshwater catfish, *Heteropneustes fossilis*

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Abstract
Toxic pollutants such as heavy metals are particularly harmful to aquatic life. They can take up metals concentrated at different levels in their different body organs. Thus heavy metals acquired through the food chain as a result of pollution are potential chemical hazards and threatening consumers. The effects of exposure to any hazardous substance depend on the dose, exposure time, the mode of exposure, personal habits, traits, and presence of other chemicals. Therefore it is important to monitor heavy metals in aquatic environment, especially in fish. Increased loads of heavy metals in waste water may increase the risk of ground water contamination. The present work is designed to evaluate effect of cadmium on haematological parameters of *Heteropneustes fossilis*. The main haematological alteration resulting from exposure of *H. fossilis* to various concentrations of cadmium for 7, 14 and 21 days include significant decrease in haematocrit and haemoglobin concentration and in red blood cell counts. The white blood cell counts increased followed by a change in the composition as seen from the differential white blood cell counts. MCHC exhibited a significant decline when compared to control fishes. MCV and MCH values were found to exhibit a significant rise in treated fish than in control fish. The changes in the hematological parameters indicated that they can be used as indicators of cadmium related stress in fish on exposure to elevated levels in the water.

Keywords: *Heteropneustes fossilis,* cadmium, haematological parameters, in haematocrit and haemoglobin

1. Introduction
Fishes have been recognized as good accumulators of organic and inorganic pollutants (Eneji *et al.,* 2011) [11]. Aquatic organisms such as fish and shell fish accumulate metals to concentrations many times higher than present in water or sediment. They can take up metals concentrated at different levels in their different body organs. Thus heavy metals acquired through the food chain as a result of pollution are potential chemical hazards and threatening consumers (Sani, 2011) [37]. At low levels, some heavy metals such as copper, cobalt, zinc, iron and manganese are essential for enzymatic activity and many biological processes. Other metals, such as cadmium lead are not known to have essential role in living organisms and are toxic even at low concentrations. The essential metals also become toxic at high concentrations. The consequence of heavy metal pollution can be hazardous to man through his food (Sani, 2011) [37].
Fish is the most susceptible of the aquatic animals to these metals. It is cheap, easy to get and is consumed in different forms such as boiling, frying in deep oil, smoking, sun drying amongst others. The physical and chemical environment in which the fish resides appears to influence the rate of bioaccumulation of trace elements in fish. Fish is generally appreciated as one of the healthiest and cheapest source of protein and it has amino acid composition higher in cysteine than most other sources of protein. The effects of exposure to any hazardous substance depend on the dose, exposure time, the mode of exposure, personal habits, traits, and presence of other chemicals (Adekola *et al*., 2007) [1]. Therefore it is important to monitor heavy metals in aquatic environment, especially in fish. Increased loads of heavy metals in waste water may increase the risk of ground water contamination. The major anthropogenic sources of heavy metals include waste water run-off from roads, industrial wastes, from mining, manufacturing and metal finishing plants. The present work is designed to evaluate effect of cadmium on haematological parameters of *Heteropneustes fossilis.*
The freshwater catfish, *Heteropneustes fossilis*) is an important group of food fishes in India. This stinging catfish (*H. fossilis*) is commercially important and valuable food species also in many Asian countries (Akand *et al.,* 1991) [3]. *H. fossilis*, commonly known as Shing or Singhi is a popular catfish in India and found naturally in lakes, ponds, swamps and marshes, ditches, floodplains and in muddy rivers. It can survive at a reduced oxygen level (Stickney, 1979) [48]. It is characterized by an accessory respiratory organ (air breathing organ) which enables it to exist for hours when out of water or in indefinitely oxygen-poor water and even in moist mud (Akand *et al*., 1991) [3]. So, this species is very potential in seasonal water bodies of India.

2. Material and Methods
Collection of fishes
The freshwater catfish, *Heteropneustes fossilis* (Bloch) with a size range of 16-20 cm and, weighing 54 ±4 g irrespective of their sex, have been chosen as the test organism in the present study. The fishes were collected from the domestic fish market located at Guntur city ($16^0$20’ N $80^0$27’ E and 31 m elevation), Guntur district, Andhra Pradesh, India.

Acclimatization
Fishes were acclimatized to the laboratory conditions in large

fiber glass tanks with unchlorinated ground water for 3 to 4 weeks at a room temperature of 28 ± 2°C. As these catfishes are benthic in nature, overcrowding was avoided by keeping small numbers of fishes in each tank. Water was changed on alternate days. Tanks were covered with fish netting to prevent the escape of fishes.

Selection of sub-lethal concentrations

In the present study 1/10th of the 96h LC_{50} value was taken as sub-lethal concentration (A). The two other doses, B & C, used were a reduction in concentration of the sub-lethal concentration (A) in a graded manner. The half concentration of the sub-lethal concentration A (50 % reduction) was used as the second dose (B) while the third dose (C) was 50 % reduction in concentration of the second dose B (Kayode *et al.,* 2016) [23].

Haematological studies

After determining 96 h LC_{50} value, 3 sub-lethal concentrations (A, B, C) of Cadmium chloride were taken and 10 fishes were introduced in each concentration. For each sub-lethal exposure, five replicates were maintained. The water was changed every day in the control and renewed in the treatment group, so that the concentration of cadmium chloride remained the same during the experimental period. *Heteropneustes fossilis* was exposed to sub-lethal concentration of Cadmium for 21 days. At the end of 7th, 14thand 21st day sampling was done. At the end of the exposure period, blood was taken by the following method. The fish were caught very gently using a small dip net, one at a time with least disturbance. Each fish was held and wrapped with a clean, dry towel and the posterior half of its body was blotted with a clean coarse filter paper. Blood from the Control and Cadmium chloride treated fishes were obtained by severance of caudal peduncle and collected in Eppendorf tubes containing 1 % of Ethylene diamine tetra acetic acid (EDTA) as anticoagulant (Mgbenka *et al.,* 2003) [26]. Haematological parameters were estimated by standard methods as described by Hesser (1960) [18] and Blaxhall and Daisley (1973) [5].

Red Blood Corpuscular (RBC) Count

Red blood Corpuscles (RBC) count was done with a Neubauer chamber as described by Sohn and Henry (1969) [46]. The pipette with red glass bead was used for charging the counting chamber. All counts were done in triplicate.

Procedure

The blood was taken in a vial containing Ethylenediamine tetra acetic acid (EDTA) as anticoagulant. Blood was drawn up to 0.5 mark in RBC pipette and immediately, the diluting fluid (Hayem's solution) was drawn up to the 101 mark (thus the dilution is 1:200). Pipette was shaken thoroughly and diluted blood was charged into the counting chamber, after discarding two drops. The solution was allowed to settle for few seconds and the number of RBCs was counted in five small squares of the RBC column under high power microscope and the number of RBCs per cubic mm was calculated.

$$\text{RBC (millions)} = \frac{\text{No. of cells X Dilution factor X Depth factor}}{\textit{Area counted}}$$

Estimation of Haemoglobin (Hb) content

Haemoglobin was determined by the Cyanmethemoglobin method (Dacie and Lewis, 1968)[9]. In this method, all types of Hb will be converted first to methemoglobin and then to cyanomethemoglobin which can be measured colorimetrically. Blood sample of 0.02 ml was pipetted into 5 ml of Drabkin's reagent (commercial name Aculute by Glaxo). It was shaken well and allowed to stand for 10 minutes. Sometimes a jelly like substance was seen in the solution formed by the ruptured cell walls of RBCs. It can be removed by centrifugation. Optical density was measured at 540 nm in a spectrophotometer against a reagent blank. Using a commercial cyanmethemoglobin standard, a standard graph was prepared from which the values of Hb can be read directly as g/dl.

Estimation of Packed Cell Volume (PCV)

PCV was estimated by employing the microhaematocrit method (Snieszko, 1960) [45]. Heparinized, non-clotted blood was collected in unheparinized even bored capillaries. It was allowed to run 1/2 to 3/4 lengths of capillary tube and the tubes were sealed with sealing wax on opposite sides. The tubes were then transferred to a high speed microhaematocrit centrifuge and were placed in the grooves of capillary head. They were centrifuged in the centrifuge at 12000 rpm for 5 minutes. PCV was measured directly on a microhaematocrit reader associated with the centrifuge as volume present.

White Blood Corpuscles (WBC) Count

WBCs were counted according to the method described by Donald Hunter and Bomford (1963) [10].

Procedure

Blood was collected in vials containing EDTA as anticoagulant. The blood was drawn up to 0.5 mark of WBC pipette and immediately diluted fluid, Turk's solution was drawn up to l 1 marks above the bulb. Solution was mixed thoroughly and was allowed to stand for 2 minutes. Solution was expelled and a drop of fluid was allowed to flow under the cover slip. It was allowed to stand for 2 minutes and the WBCs were counted in the 4 comer square millimeters. The number of WBCs per cubic millimeter was calculated accordingly.

$$\text{WBC (millions)} = \frac{\text{No. of cells X Dilution factor X Depth factor}}{\textit{Area counted}}$$

Calculation of RBC constants

Based on the results of the tests which measure total RBC, Hb and PCV several calculations have been derived which give quantitative information about the red blood corpuscles. These values are called RBC constants.

Mean Corpuscular Volume (MCV)

The mean corpuscular volume is the volume of the average cell or the average cell volume of all the RBCs.

$$MCV\ (\mu m3) = \frac{PCV\ \%}{RBC\ in\ million}\ X\ 10$$

Mean Corpuscular Haemoglobin (MCH)
MCH is the amount of Hb in the average RBC or average amount of Hb per cell in all the red cells.

$$MCH\ (pg) = \frac{Hb\ \left(\frac{g}{dl}\right)}{RBC\ in\ million}\ X\ 10$$

Mean Corpuscular Haemoglobin Concentration (MCHC)
MCHC is the portion of the average RBC containing haemoglobin or the concentration in the average cell.

$$MCHC\ (\%) = \frac{Hb\ \left(\frac{g}{dl}\right)}{PCV\ (\%)}\ X\ 100$$

3. Results and Discussion

Haematology deals with the study of blood and embraces various aspects of physiological, pathological as well as the biochemical characteristics of the blood. Fish haematology is a tool to assess the status of general health. A number of blood parameters such as total RBC count, total WBC count, hemoglobin (Hb) content, packed cell volume (PCV), mean cell volume (MCV), mean cell hemoglobin (MCH) and mean cell hemoglobin concentration (MCHC) have been used as indicators of metal pollution in the aquatic environment. In the last three decades, studies on fish blood has gained increasing importance for fishery biologists and ichthyologists for regular monitoring of health of the fish stocks and to develop an information database about inter-specific and intra-specific variations in blood characteristics under exposure to heavy metals.

The results of the present investigation showed various anomalies in the blood of *H. fossilis* during prolonged exposure to cadmium. The mean±SD values of hematological parameters of control and treated fish under sub-lethal concentrations of Cadmium exposed for 7, 14 and 21 days are depicted in Table 1. Significant changes were not observed in the measured variables of fish maintained in uncontaminated water (control). The main haematological alteration resulting from exposure of *H. fossilis* to various concentrations of cadmium for 7, 14 and 21 days included significant decrease in haematocrit and haemoglobin concentration and in red blood cell counts and an increase in white blood cell counts (Table1). MCHC exhibited a significant decline when compared to control fishes. MCV and MCH values were found to exhibit a significant rise in treated fish than in control fish.

Table 1: Cadmium induced changes in Hematological parameters of *H. fossilis*

Treatments	Exposure period	Experiment						
		RBC (millions)	Hb (g/dl)	PCV (%)	WBC (millions)	MCV (μm^3)	MCH (pg)	MCHC (%)
Control	7th Day	3.10±0.112	10.52±0.16	38.94±1.16	3.72±0.160	119.80±3.26	33.93±1.22	27.01±0.34
	14th Day	3.11±0.342	10.64±0.68	38.98±1.18	3.78±0.226	121.15±4.12	34.21±1.02	27.29±0.64
	21th Day	3.11±0.645	10.72±0.12	38.98±0.96	3.78±0.468	121.92±2.62	34.46±1.46	27.50±0.46
A	7th Day	2.08±0.342	8.28±0.34	37.18±0.84	3.98±0.234	199.42±2.88	39.80±1.20	22.27±0.48
	14th Day	1.66±0.112	7.02±0.48	35.06±0.82	4.09±0.146	260.60±3.12	42.28±1.16	20.02±0.74
	21th Day	1.22±0.126	5.72±0.34	32.88±0.68	4.24±0.248	367.86±3.78	46.88±1.28	17.39±0.66
B	7th Day	2.42±0.246	9.64±0.28	38.18±0.66	3.90±0.106	164.38±4.12	39.83±0.86	25.27±0.78
	14th Day	1.98±0.242	8.16±0.46	36.68±0.96	3.98±0.426	210.50±3.46	41.21±0.96	22.24±0.84
	21th Day	1.78±0.422	7.20±0.68	35.26±0.88	4.08±0.346	240.78±2.86	42.69±1.08	20.41±0.56
C	7th Day	2.76±0.116	9.82±0.24	38.85±0.86	3.82±0.420	140.76±2.68	35.57±1.28	25.27±0.86
	14th Day	2.48±0.112	9.10±0.26	37.86±0.68	3.88±0.268	160.72±2.78	36.69±1.02	24.03 ±0.66
	21th Day	2.04±0.246	8.46±0.42	36.24±0.84	3.96±0.262	202.15±3.26	41.47±0.98	23.34±0.82

*Each value is represented as mean ± SD (n=5); Values are significant at p<0.05 (based on t-test)
A = Sub-lethal conc. (2.068 ppm)**; B =** 50% SL of A (1.034 ppm)**; C =** 50% SL of B (0.517 ppm)

Red Blood corpuscles (RBC)
The present study reveals that there is a significant reduction in RBC of fish after 7, 14 and 21 days of exposure to sub-lethal concentrations of cadmium than in the control fish. The number and percent change in RBC of *H. fossilis* exposed to sub-lethal concentrations of cadmium for 7, 14 and 21 days are given in Table 2 and Figure 1. The maximum percent change of total RBC count was found in treatment- A for 21days (60.77%) and minimum in treatment-C for 7 days (10.96%). The total RBC count was found to decrease with an increase in dosage and duration.

The reduction of RBC at sub-lethal level of cadmium might be due to the destruction of mature RBCs and inhibition of erythrocyte production due to the reduction of haemo synthesis affected by pollutants (Hussein *et al.,* 2011). Gill and Epple (I993) [15] found a significant reduction in RBC in American eel (*Anguilla rostrata*) after exposure to 150 µg Cd/L. Karuppaswamy *et al.* (2005) [26] found a significant decrease in total erythrocyte count in air breathing fish, *Channa punctatus* after exposure to sub lethal dose of Cadmium. The decrease in RBC count may be attributed to haematopathology or acute haemolytic crisis that result in severe anemia in most vertebrates including fish species exposed to different environmental pollutants.

Annune *et al.* (1994) [4] reported a non-significant decrease and swelling of red blood cells in *Oreochromis niloticus*. Flos *et al.* (1987) [12] and Soundararajan *et al.* (2014) [47] stated that the swelling of red blood cells (erythrocytes) may be due to an increase in protein and carbon dioxide in the blood. The decrease in the total erythrocyte count (TEC) may be due to the cytotoxic effect of heavy metal compounds on the erythropoietic tissue. Such a disturbance in bone marrow leads to alteration of cell cycle and reduction in erythropoeisis (Tariq *et al.,* 2006) [49].

Table 2: Changes in RBC and percent change over the control in the blood of *H. fossilis* exposed to sub-lethal concentrations of Cadmium for 7, 14 and 21 days

S. No	Exposure Period	Parameter : RBC(millions)						
		Treatments						
		Control	A	% Change	B	% Change	C	% Change
1	7th Day	3.10±0.112	2.08±0.342	32.90	2.42±0.246	21.93	2.76±0.116	10.96
2	14th Day	3.11±0.342	1.66±0.112	46.62	1.98±0.242	36.33	2.48±0.112	20.25
3	21th Day	3.11±0.645	1.22±0.126	60.77	1.78±0.422	42.76	2.04±0.246	34.40

*Each value is represented as mean ± SD (n=5); Values are significant at p<0.05 (based on t-test)

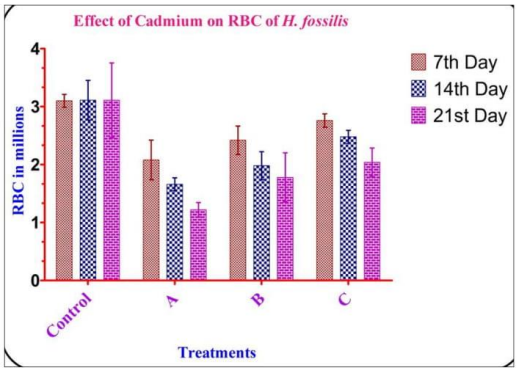

Fig 1: Changes in RBC in the blood of *H. fossilis* exposed to sub-lethal concentrations of Cadmium for 7, 14 and 21 days

Haemoglobin (Hb) content

In this study, Hb content significantly decreased in fish exposed to sub-lethal concentration of cadmium for 7, 14 and 21 days than that of control fish. The Hb content and percent changes of effected fish Hb are tabulated in Table 3 and Figure 2. The maximum percent change of Hb content was found in treatment- A for 21days (46.64%) and minimum in treatment-C for 7 days (6.65%). The total Hb concentration was found to decrease with an increase in dosage and duration. These results may be due to cumulative response of cadmium toxicity towards excessive red cell destruction there by lead to anemic to protect the fish against infections under cadmium stress (Kaoud *et al.,* 2011) [20].

According to the results obtained from the present study, Hb seems to be the best blood indicator of environmental stress. Khalesi *et al.* (2014) [4] and Cazenave *et al.* (2005) [8] suggested that the increase in Hb concentration could be a reliable first indicator of an adaptational improvement in the oxygen transporting capacity of the blood. In addition to behavioral and morphological adjustments, fish could respond to low oxygen levels by adjusting several physiological and biochemical parameters (Val *et al.,* 1998) [51]. Reduction in haemoglobin concentration may probably be due to production of reactive oxygen species under the influence of heavy metal cadmium which results in destruction of the red blood cell membrane and its function (Tariq, 2006) [49]. The observed depletion in the haemoglobin values in the fish could also be attributed to the lysing of erythrocytes. The significant reduction in these parameters is an indication of severe anemia caused by exposure of the experimental fish to cadmium in the water (Kaoud *et al.,* 2011) [20].

Soundararajan *et al.* (2014) [47] reported the reduction in Hb content of *Heteropenustes fossilis* exposed to zinc. Similarly the decreased amount of Hb could be corroborated with previous investigations in *Oreochromis mossambicus* exposed to copper and zinc (Senthamilselvan, 2015) [40]. Pamila *et al.* (1991) [32] have reported that the reduction in Hb content might be due to the inhibitory effect of toxic substance on the enzyme systems involved in the synthesis of hemoglobin. Joshi *et al.* (2002) [19] have reported that heavy metal exposure decreased Hb due to impaired intestinal absorption of iron. Karuppasamy *et al.* (2005) [22] observed a significant decrease in Hb in *Channa punctatus* exposed to cadmium. The changes in Hb may be due to immunological reactions to produce antibodies to cope up with the stress induced by cadmium (Vijay Ramdas, 2013) [52].

Table 3: Changes in Hb and percent change over the control in the blood of *H. fossilis* exposed to sub-lethal concentrations of Cadmium for 7, 14 and 21 days

S. No	Exposure Period	Parameter : Hb g/dl						
		Treatments						
		Control	A	% Change	B	% Change	C	% Change
1	7th Day	10.52±0.16	8.28±0.34	21.29	9.64±0.28	8.36	9.82±0.24	6.65
2	14th Day	10.64±0.68	7.02±0.48	34.02	8.16±0.46	23.31	9.10±0.26	14.47
3	21th Day	10.72±0.12	5.72±0.34	46.64	7.20±0.68	32.84	8.46±0.42	21.08

*Each value is represented as mean ± SD (n=5); Values are significant at p<0.05 (based on t-test)

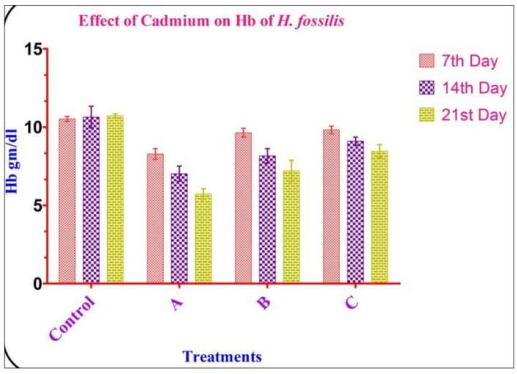

Fig 2: Changes in Hb in the blood of *H. fossilis* exposed to sub-lethal concentrations of Cadmium for 7, 14 and 21 days

Packed Cell Volume (PCV)

The present study reveals that the fish exposed to cadmium showed significant decline in PCV. Calculated values of PCV in control and treated fish along with percent change over control are given in Table 4 and Figure 3. The total PCV percentage was found to decrease with increase in dosage and duration. The maximum percent change of packed cell volume was found in treatment-A for 21days (15.64 %) and minimum in treatment-C for 7 days (0.23 %).

The decrease in PCV may be due to the disturbances that occurred in both metabolic and hemopoietic activities of the fish exposed to sub-lethal concentrations of cadmium (Santhakumara *et al.,* 2000) [38]. Mazon *et al.* (2002)[25], Kuruppasamy *et al.* (2005) [22], Gupta *et al.* (2009) [16] and Sharma and Langer (2014) [12] reported that hemopoietic organs get impaired by toxicity resulting in slower erythropoiesis and thereby lead to reduction in PCV.

The present results are in agreement with the earlier works reported (Kuruppasamy, 2000; Tyagi and Srivastava, 2005; Gupta, 2008; Olanike *et al.,* 2008, Witeska *et al.,* 2010 and Kaoud *et al.,* 2011) [21, 50, 17, 29, 55, 20]. Joshi *et al.* (2002) [19] and Sandeep *et al.* (2013) [36] suggested that decrease in PCV is due to hemodilution mechanism because of gill damage or impaired osmoregulation and impaired intestinal absorption of iron. However, Witeska (2005) [52] in *Cyprinus carpio* and Caravalho and Fernandes (2006) [7] in *Prochilodus lineatus* observed copper induced blood alternations, characterized by an increase in PCV. They suggested that heavy meals induced a hypoxic condition in fish that stimulates the spleen for RBC production and release of stored erythrocytes into the circulation. Similar result has also been reported earlier by Ghazaly (1992) [13], Palackova *et al.* (1994) [31] and Wilson and Taylor (1993) [53].

Table 4: Changes in PCV and percent change over the control in the blood of *H. fossilis* exposed to sub-lethal concentrations of Cadmium for 7, 14 and 21 days

S. No	Exposure Period	Parameter : PCV %						
		Treatments						
		Control	A	% Change	B	% Change	C	% Change
1	7th Day	38.94±1.16	37.18±0.84	4.51	38.18±0.66	1.95	38.85±0.86	0.23
2	14th Day	38.98±1.18	35.06±0.82	10.05	36.68±0.96	5.90	37.86±0.68	2.87
3	21th Day	38.98±0.96	32.88±0.68	15.64	35.26±0.88	9.54	36.24±0.84	7.03

*Each value is represented as mean ± SD (n=5); Values are significant at p<0.05 (based on t-test)

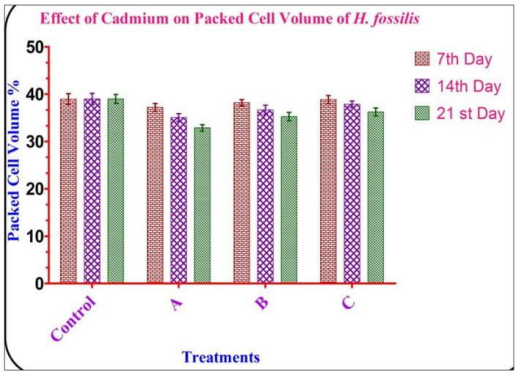

Fig 3: Changes in PCV in the blood of *H. fossilis* exposed to sub-lethal concentrations of Cadmium for 7, 14 and 21 days

The Packed cell volume (PCV) appears to be positively correlated with erythrocyte count. Fall in the number of red blood cells followed by PCV confirms anemia in *Heteropneustes fossilis*. The probable mechanisms for developing anemia in *Heteropneustes fossilis* could be due to the loss of erythrocytes as compensatory erythropoiesis could not be observed, which was reflected in the absence of immature erythrocytes in the peripheral blood.

In the present study, similar pattern of reduction in RBC, Hb and PCV indicates anaemic stage of experimental fish caused due to decreased erythropoietic activity or increased destruction of blood cells. The reduction in red blood cell count and haemoglobin percentage indicates the occurrence of acute anaemia (Prasanta Nanda, 1997) [33].

White Blood Corpuscles (WBC)

The results of the present study i.e. calculated values for total WBC in control and exposed fish along with percent change over control are given in Table 5 and Figure 4. The total WBC was found to increase with increase in dosage and duration. The maximum percent change of WBC was found in treatment-A for 21days (12.16%) and minimum in treatment-C for 7 days (2.65%).

Leucocytes or WBC are cells of immune system which play a key role in both non-specific and specific immune responses in protecting the body against foreign substances. Review of literature shows two opposite lines of response of leucocytes

to different heavy metals. One group of researchers reported increase in WBC in fish in response to heavy metal toxicity (Buthelezi, 2000; Singh and Tandon, 2009; Raina and Sachar, 2014 and Sharma and Langer, 2014) [6, 43, 34, 42]. Increase in WBC count can be attributed to a stimulation of the immune system in response to tissue damage caused by heavy metals. Moraes (2007) [27] stated that one of the most elementary ways to assess the immune system is to explore changes in the WBC count.

The other group researchers advocated decrease in WBC in response to heavy metals in fish (Witeska, 2005; Oliveira *et al.,* 2006; Olanike, 2007; Olanike *et al.,* 2008; Safahieh *et al.,* 2010 and Witeska *et al.,* 2010) [54, 30, 28, 29, 35, 55]. The decline in WBC count is due to release of epinephrine during stress because of heavy metal toxicity and weakening of the immune system (Olanike, 2007) [27]. The results of the present study are in accordance with first group of researchers who have observed increase in WBC of fish on exposure to cadmium.

Table 5: Changes in WBC and percent change over the control in the blood of *H. fossilis* exposed to sub-lethal concentrations of Cadmium for 7, 14 and 21 days

S. No	Exposure Period	Parameter : WBC (millions)						
		Treatments						
		Control	A	% Change	B	% Change	C	% Change
1	7th Day	3.72±0.160	3.98±0.234	6.98	3.90±0.106	4.84	3.82±0.420	2.65
2	14th Day	3.78±0.226	4.09±0.146	8.02	3.98±0.426	5.29	3.88±0.268	2.69
3	21th Day	3.78±0.468	4.24±0.248	12.16	4.08±0.346	7.94	3.96±0.262	4.76

*Each value is represented as mean ± SD (n=5); Values are significant at p<0.05 (based on t-test)

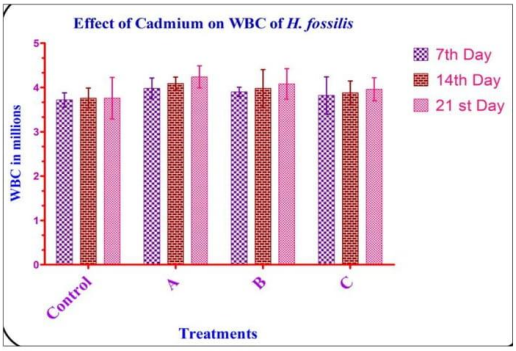

Fig 4: Changes in WBC in the blood of *H. fossilis* exposed to sub-lethal concentrations of Cadmium for 7, 14 and 21 days

Mean Corpuscular Volume (MCV)

MCV (µm3) values were found to exhibit significant rise in treated fish exposed to various sub-lethal concentrations of cadmium for 7, 14 and 21 days than in control fish. The MCVs and their percent changes are represented in Table 6 and Figure 5. The total MCV was found to increase with increase in dosage and duration. The maximum percent change of MCV was found in treatment-A for 21days (201.72%) and minimum in treatment-C for 7 days (17.50%).

Mean corpuscular volume (MCV) is one of the important blood parameters which gives an indication of the status of size of RBC. In the present study a marked increase in MCV was observed which can be attributed to reduction in total erythrocyte count because MCV and total erythrocyte count exhibit inverse relationship with each other. This is in agreement with the works of Shah (2006) [41] in *Tinca tinca*, Olanike (2007) [29] in *Clarias gariepinus*, Afaq (2009) [2] in *Cirrhinus mrigala*, Gupta *et al.* (2009) [16] in *Labeo boga*, Sandeep *et al.* (2013) [36] in *Labeo rohita*, and Sharma and Langer (2014) [42] in *Garra gotyala*. The increase in MCV may be due to the enlargement of RBCs as a result of hypoxic condition or osmotic disturbances and uptake of electrolytes and water into the cells accompanied by acidification of cytoplasm of RBC or macrocytic anemia in fishes exposed to metal pollution (Sinha *et al.,* 2000) [44].

Table 6: Changes in MCV and percent change over the control in the blood of *H. fossilis* exposed to sub-lethal concentrations of Cadmium for 7, 14 and 21 days

S. No	Exposure Period	Parameter : MCV(µ m^3)						
		Treatments						
		Control	A	% Change	B	% Change	C	% Change
1	7th Day	119.80±3.26	199.42±2.88	66.46	164.38±4.12	36.89	140.76±2.68	17.50
2	14th Day	121.15±4.12	260.60±3.12	115.10	210.50±3.46	73.75	160.72±2.78	32.66
3	21th Day	121.92±2.62	367.86±3.78	201.72	240.78±2.86	97.49	202.15±3.26	65.80

*Each value is represented as mean ± SD (n=5); Values are significant at p<0.05 (based on t-test)

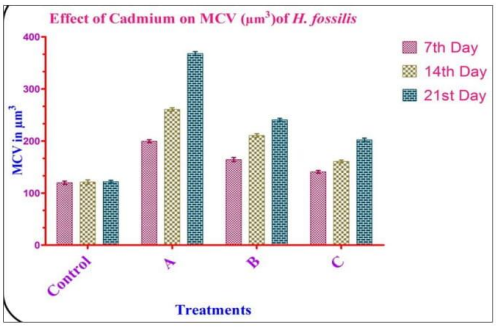

Fig 5: Changes in MCV in the blood of *H. fossilis* exposed to sub-lethal concentrations of Cadmium for 7, 14 and 21 days

Mean Corpuscular Haemoglobin (MCH)

The present study reveals that the fish exposed to cadmium showed significant increase in MCH. Calculated values for MCH in control and exposed fish along with percent change over control are given in Table 7 and Figure 6. The total MCH was found to increase with increase in dosage and duration. The maximum percent change of WBC was found in treatment-A for 21days (36.04%) and minimum in treatment-C for 7 days (4.83%).

MCH represents the average weight of haemoglobin in RBC. MCH exhibited an increasing trend in all exposure periods of sub-lethal concentrations. These results are in line with the findings of Sandeep *et al.* (2013) [36], Raina and Sachar (2014) [34] and Sharma and Langer (2014) [42]. Such changes in MCH may either be due to the increased lysis of RBCs or reduction in cellular blood iron thereby resulting in reduced Hb synthesis (Sharma and Langer, 2014). In contrast to the above results, no significant effects of metal toxicity on MCH have been observed by Oliveira *et al.* (2006) [30], Carvalho and Fernandes (2009) [7] and Safahieh *et al.* (2010) [35] in fish.

Table 7: Changes in MCH and percent change over the control in the blood of *H. fossilis* exposed to sub-lethal concentrations of Cadmium for 7, 14 and 21 days

S. No	Exposure Period	Parameter : MCH (pg)						
		Treatments						
		Control	A	% Change	B	% Change	C	% Change
1	7th Day	33.93±1.22	39.80±1.20	17.30	39.83±0.86	17.39	35.57±1.28	4.83
2	14th Day	34.21±1.02	42.28±1.16	23.59	41.21±0.96	20.46	36.69±1.02	7.25
3	21th Day	34.46±1.46	46.88±1.28	36.04	42.69±1.08	23.88	41.47±0.98	20.34

*Each value is represented as mean ± SD (n=5); Values are significant at p<0.05 (based on t-test)

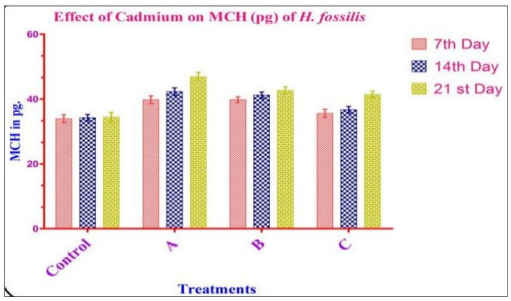

Fig 6: Changes in MCH in the blood of *H. fossilis* exposed to sub-lethal concentrations of Cadmium for 7, 14 and 21 days

Mean corpuscular Haemoglobin Concentration (MCHC)

In the present investigation, significant decrease in MCHC was noticed in fish exposed to cadmium than in control. The MCHC values and percent changes are presented in Table 8 and Figure 7. The total MCHC was found to decrease with increase in dosage and duration. The maximum percent change of MCHC was found in treatment-A for 21days (36.76%) and minimum in treatment-C for 7 days (6.44%).

MCHC is the indication of average concentration of haemoglobin in RBC cells, calculated based on Hb and PCV. Decrease in Hb and PCV coupled with increase in MCV might be the reason for the decreased MCHC.

Table 8: Changes in MCHC and percent change over the control in the blood of *H. fossilis* exposed to sub-lethal concentrations of Cadmium for 7, 14 and 21 days

S. No	Exposure Period	Parameter : MCHC %						
		Control	Treatments					
			A	% Change	B	% Change	C	% Change
1	7th Day	27.01±0.34	22.27±0.48	17.55	25.27±0.78	6.44	25.27±0.86	6.44
2	14th Day	27.29±0.64	20.02±0.74	26.64	22.24±0.84	18.50	24.03±0.66	11.95
3	21th Day	27.50±0.46	17.39±0.66	36.76	20.41±0.56	25.78	23.34±0.82	15.13

*Each value is represented as mean ± SD (n=5); Values are significant at p<0.05 (based on t-test)

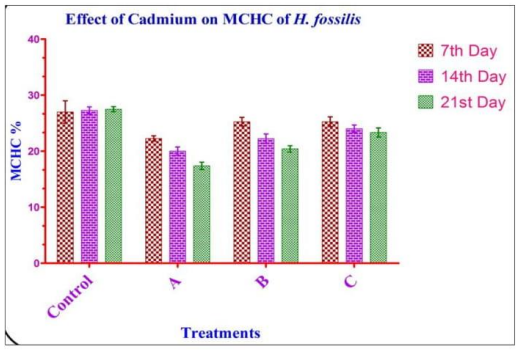

Fig 7: Changes in MCHC in the blood of *H. fossilis* exposed to sub-lethal concentrations of Cadmium for 7, 14 and 21 days

The present results are in line with the findings of Sandeep *et al.* (2013) [36], Raina and Sachar (2014) [34] and Sharma and Langer (2014) [42]. Such changes in MCHC may be either due to the increased lysis of RBCs or reduction in cellular blood iron thereby resulting in reduced Hb synthesis (Sharma and Langer, 2014) [42]. The low concentration of MCHC during the treatment might have resulted from decrease in Hb synthesis due to toxic action or swelling of erythrocytes by which blood oxygen transport capacity is increased when fish were subjected to less effective gas exchange (Saravanan *et al.,* 2011) [39]. Alterations in MCV, MCH and MCHC clearly indicated that the fish are under chemical stress, which lead to pathological condition in the tissues. Gill *et al.* (1991) [14] have also studied the haematology of different fish in response to different chemical stresses and the present observations corroborate with their findings.

4. Conclusion

The circulatory system of fish is in close association with the external environment and with every tissue. It is sensitive to foreign stimuli and reflects the homeostasis of the animal. Thus haematological studies helped to check the systemic responses during stress conditions due to cadmium. The main haematological alteration resulting from exposure of *H. fossilis* to various concentrations of cadmium for 7, 14 and 21 days include significant decrease in haematocrit and haemoglobin concentration and in red blood cell counts. The white blood cell counts increased followed by a change in the composition as seen from the differential white blood cell counts. MCHC exhibited a significant decline when compared to control fishes. MCV and MCH values were found to exhibit a significant rise in treated fish than in control fish. The changes in the hematological parameters indicated that they can be used as indicators of cadmium related stress in fish on exposure to elevated levels in the water.

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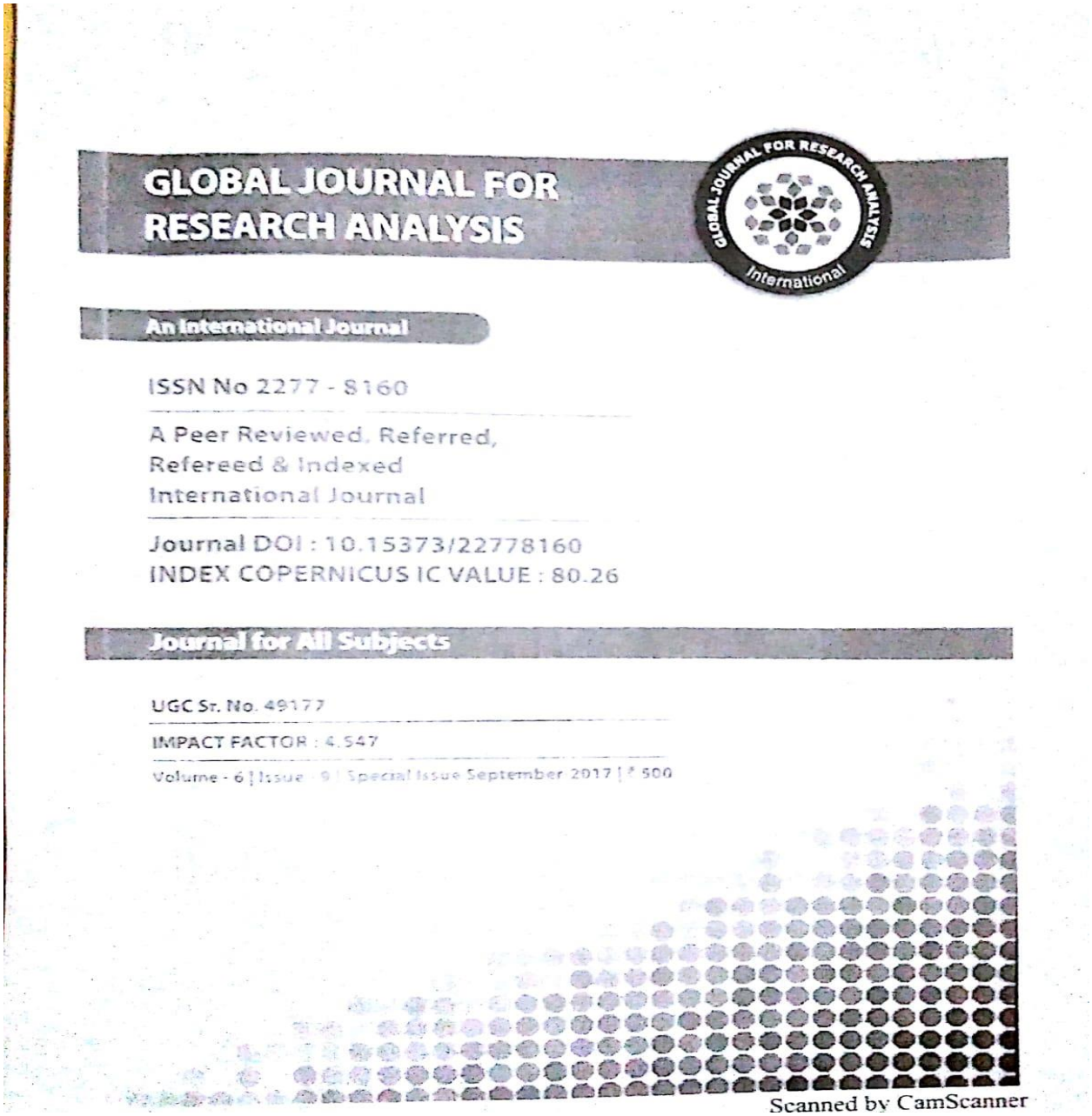
DEPARTMENT OF HOMESCIENCE

31. Ms. P. Hemalatha presented a paper on **"Gender Equality and Empowerment in India"** a UGC National seminar jointly organized by Krishna university and K.B.N college, Vijayawada. on "Women Empowerment: media, Cinema and theater- prospects & Challenges" on 21&22-7-2017 and published in Global journal for research Analysis an International Journal ISSN No2277-8160 UGC Sr.No.49177,Volume-6|Issue-9|Special Issue September-2017.



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Special Issue September-2017 • ISSN No 2277 - 8160

Original Research Paper

Sociology

GENDER EQUALITY AND WOMEN EMPOWERMENT IN INDIA

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ABSTRACT Gender equality is a general issue rather than a women's issue which has to be looked carefully because of its impact on several spheres of lives in the society. A woman has the right to be first recognized as human being before various roles are expected of her in the domestic and public arenas. In this regard, the gender discrimination which the women experience in everyday life and which is usually accepted and justified as socially legitimate have to be questioned and placed at a centre stage.

The real differences are biological. Gender identity, gender role and gender attributions are learnt behaviour. So, culturally determined differentials need not be permanent and they can be changed. Investing in women's capacity building is an investment for future as they are the influencing factors of future generations as mothers.

When women are healthy, educated and free to take the opportunities life affords them, children thrive and countries flourish, reaping the double dividend for women and children. Gender equality and well being of children go hand in hand. When women are empowered to live full productive lives, children prosper, when women are denied equal opportunities in society children suffer.

Women empowerment helps to break the cycle of poverty. It helps women do delay in their marriages, chose the timing and spacing of their pregnancies, access to active voice and information, complete their education and gain knowledge and skills they need to participate in the economy and their country's development.

This paper throws light on need of gender equality and its role in women empowerment and its influence on family, society in turn on the national development.

KEYWORDS :

Development is a human centred process. People are both the ends as well as the means in the process. Development in its wider perspective embraces all aspects of community life. The accept goals of any nation includes optimal production, full employment, attainment of socio-economic equity and sustainable human development. Human Resource Development applies equally to both women and men in policy. But the real situation is entirely different. Here comes the gender inequality or gender discrimination.

Development is about people and societies. It is not a matter of money or capital but of the capacity of a society to tap the route of creativity, to free and empower people to exercise their intelligence and their individual and collective efforts to achieve a better life. As development is human centred process there is need to become equal partners for both men and women.

There is need to understand the real meaning of power and empowerment in such a manner that men are not isolated from the process leading to equality. Women who are empowered socially, economically and politically would add to economic growth and overall development of the nation and they themselves bring more women in to the fold of better opportunities and choices.

There are many facets of gender discrimination, the first and foremost is the family where the child is born, then the school where the child is educated and finally the society in which the child is grown up. In the family, the female child is discriminated in cases like traditions of the family, household chores, treatment in general and so on. After moving out of the house with hardships, the school too lets them down by not letting them use the educational advantage. Finally the society, which is the web of gender bias continues the same. The norms, customs and traditions of the society made by the people just consider the women to be the weaker sex.

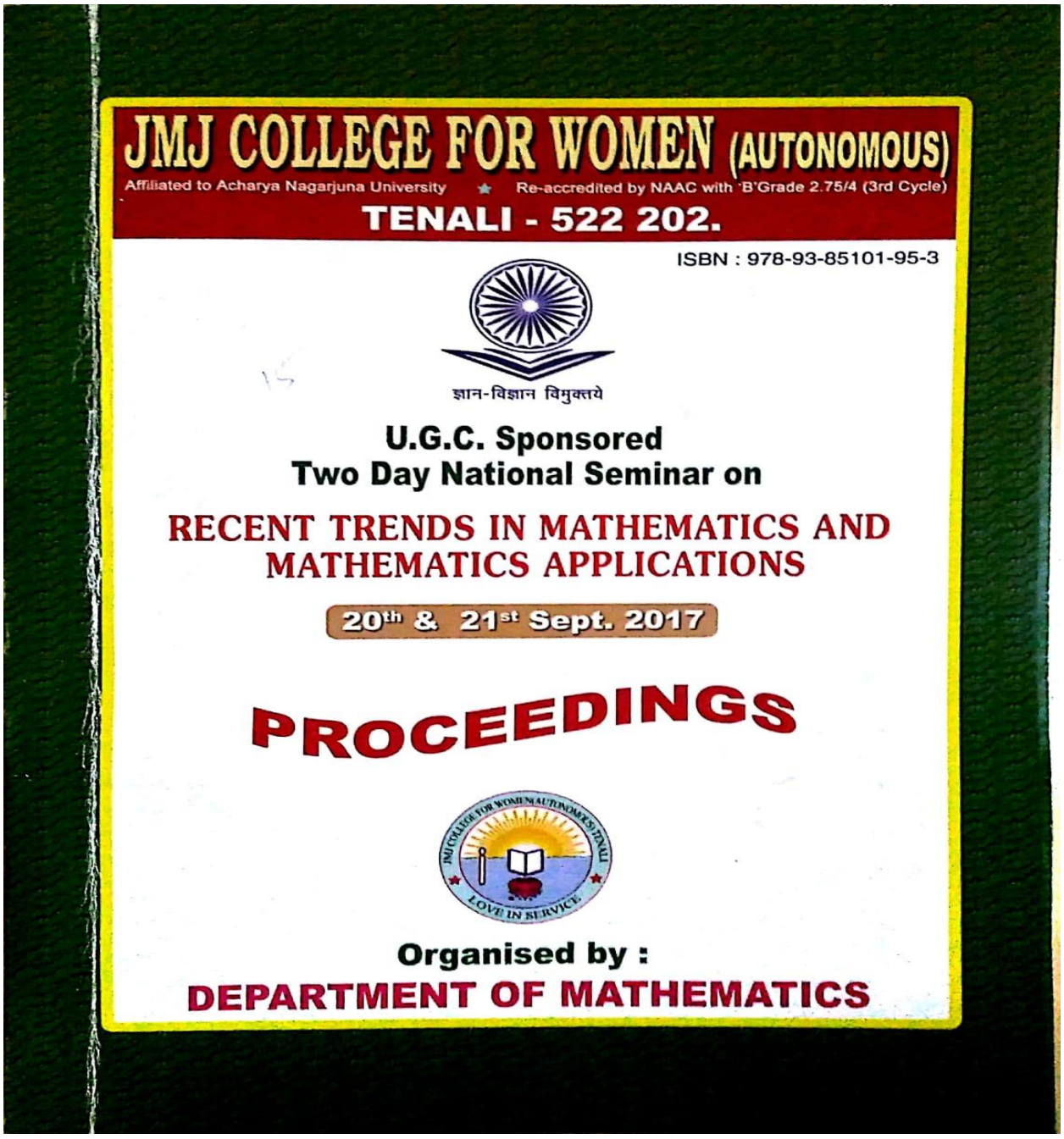
The subject of gender justice is very vital so far as the Indian society is concerned. Men do not accept women as their equal partners and the women themselves have not realized that they are equal to men. The status of women needs to be uplifted by sensitizing people against gender bias. Inorder to strike the goals of democratic citizenship to make the pronouncements concerning women's educational opportunities are not far reaching. To utilize the of half of human resources we need to develop appropriate that are nothing but education.

Discrimination against the girl child in Indian society is age old continuing concept of modern age. The current interest in women education, status and development is very different from the feminist movement, which was only a negative social [illegible] positive attempt order, to develop and harness women's The vast economic changes around the world due to and scientific development have generated a women's status, role of education and development quality of life.

Family structures and social values function such grow upon looking themselves as inferior and subservient to much less of everything such as less opportunities, property, status, power and virtually no choice. qualities of submissiveness, meekness and self socialization process reinforces these stereotypes at all society moulding her in and to be prisoner of her gender retaliate against the implicit and explicit injustice. women are to become an equal partner with man in social change and development, this is the time to child her rightful share of human dignity and opportunity.

Women play a key role even in sustainability of throughout the world. But the fruits of development unequally among the regions, classes, groups, men and Women form an integral part of every society and often underestimated and discriminated in Effective and meaningful involvement of women in making is absolutely essential. If their strength and energy are to be harnessed along with their knowledge they have to be mainstreamed and empowered to choose ways of development. They can exercise their choices vantage position of power, prestige etc. Development are right for women are not always inconsonance economic goals of the nation and the world.

32. Ms. P. Hemalatha, presented paper on **"Application of Mathematics in Home science"** in UGC sponsored Two Day National seminar on "Recent Trends in Mathematics and Mathematics Applications " organized by Dept. of Mathematics, JMJ college for Women, Tenali during 20th 21st September 2017.



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ISBN : 978-93-85101-95-3

APPLICATION OF MATHEMATICS IN HOME SCIENCE

***Ms. P. Hemalatha **R. Yamini**

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Home science is the science of a home and it includes all the things that concern the person, home, family members and resources. It is the education for "better living" and the core of this education is the family ecosystem. It also deals with reciprocal relations between the family and its natural and man-made environments. It aims at getting maximum satisfaction for the person and their family members through the efficient and scientific use of your resources. It gives the person all the knowledge of the scientific procedures involved in making a home beautiful. Home science integrates the application of various sciences and humanities to improve human environment, family nutrition, management of resources and child development.

Home Science draws an important part of its content from pure science disciplines such as physics, chemistry, biology, physiology and hygiene. It also draws its content equally from economics, sociology, anthropology, psychology, community development, communication, media and technology. Thus, making it an interdisciplinary field which draws from the strengths of science and arts courses. This combination of science and art holds true in all the areas of Home Science.

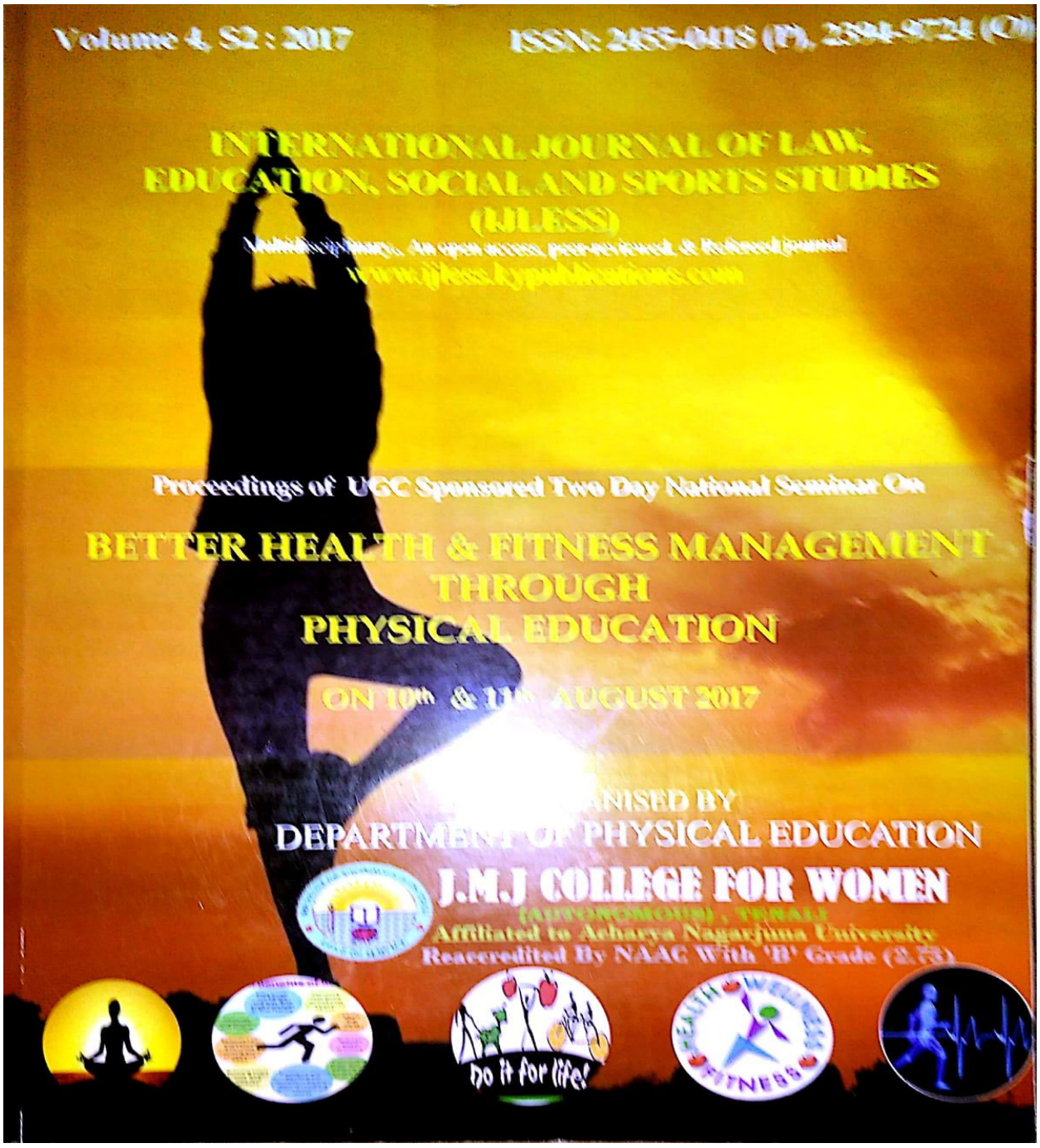
The interpersonal communication amongst family members; the family that you care for; the food that you eat; the house that you live in; the clothes that you wear; the resources that you use; the environment around you and the skills and environment that can lead to successful career.

A professional home scientist requires a combination of knowledge from several specializations. Today home science is aimed at preparing professional workers like teachers, nurses, dieticians, researchers, social workers, designers, administrators. etc. Therefore the interdisciplinary approach of home science has taken a new dimension.

Life Span Development or child development has interdisciplinary connectors with child psychology, paediatrics, social work, extension, family welfare, adult education and nutrition. Physiology collaborates with physicians and specialists from different specialties like neurology, nephrology, cardiology, skin, orthopaedics etc. Food, Nutrition and Health has interdisciplinary collaboration with biochemistry, microbiology, dietetics, physicians and specialists in social medicine etc. Home Management is concerned with housing, management, interior designing, soil, structural engineering, energy, carpentry, furnishing etc. Fundamentals of Textiles and Clothing have interdisciplinary approaches to textiles chemistry, weaving, textile designing, fashion designing, garment production industries, and chemicals dyes etc. Communication Skills works in collaboration with media, advertising, extension and information dissemination.

The subject human physiology and anatomy is ancillary to understand the subject nutrition and dietetics. To understand anatomical structure and physiological mechanisms, to have a better idea about anatomical postures, directions, plains and sections, body cavities the knowledge of mathematics is essential.

33. Ms.P.Memalatha, presented paper on**"NUTRITIONAL STATUS AND PHYSIOLOGICAL WELLBEING"** in UGC sponsored Two Day National seminar on "Better Health & Fitness Management through Physical Education" organized by Dept. of physical education, JMJ college for Women, Tenali. 10 to 11th August-2017



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INTERNATIONAL JOURNAL OF LAW, EDUCATION, SOCIAL AND SPORTS STUDIES (IJLESS)
Multidisciplinary, Peer-Reviewed and Refereed Journal
http://www.ijless.kypublications.com
editorijless@gmail.com
ISSN:2455-0418(P), 2394-9724(E); Vol.4.S2.2017

NUTRITIONAL STATUS AND PSYCHOLOGICAL WELLBEING

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ABSTRACT

Well being is a dynamic concept that includes subjective, social, and psychological dimensions as well as health related behaviors. The factors which contribute to an individuals psychological wellbeing are contentment, happiness positive relationships with others personnel mastery etc. Mental health is a level Psychological well being, or an absence of a mental disorder. Mental health includes our emotional, psychological and social well-being. It affects how we think, feel and act it also helps determined how we handle stress, relate to others, and make choices.

Like an expensive car our brain functions best when it gets only premium fuel. Eating high –quality foods that contain lots of vitamins, minerals and antioxidant nourishes the brain and protects it from oxidative stress –the waste (free radicals) produced when the body uses oxygen which can damage cells.

The food we eat is associated with our mood, behaviour, and cognition. Just like the heart, stomach and liver, the brain is an organ that is acutely sensitive to what we eat and drink. The body of evidence linking diet with mental health is growing at a rapid pace. Saturated fats, transfats and processed foods are to be cautiously consumed to stop damage to brain cells.

The Mental Health Care Bill 2016 passed by the RajyaSabha recently brings the rights of patience with mental problems to the centre stage. Jahoda 1958 has identified 6 indicators of mental health such as a positive attitude towards self growth, self actualization, integration, autonomy, perception of reality and environmental mastery.

This paper highlights the role of nutrition in Psychological Well being of the person and how it influences the quality of life. It also explores on the type of foods that helps for proper brain functioning.

Psychological wellbeing often known as Good Mental Health or Emotional Health etc. If you have good mental health you can make the most of your potential, hope with life, play a full part in your family, work place, community etc. mental health or psychological wellbeing is needed dot every one irrespective of age. We all have times when we feel down, stressed or frightened. Most of the time those feeling passed, but some times they developed into a more serious problem. It does not always stay the same. It can change as circumstances change and as you move through different stages in your life.

What we eat may affect how we feel. Food can also have a long lasting effect on our mental health. Our brain needs a number of nutrients in order to stay healthy and function well, just like the other organs in your body. A diet that is good for physical health is also good for mental health. Psychological wellbeing is one of the main dimensions of the quality of life which has been used in nutritional studies.

Nutrients that the brain needs and dietary sources		
Nutrient	**Effect of deficiency**	**Dietary sources**
Vitamin B1	Poor concentration and attention	Whole grains, vegetables
Vitamin B3	Depression	Whole grains, vegetables
Vitamin B5	Poor memory; stress	Whole grains, vegetables
Vitamin B6	Irritability; Poor memory; stress; depression	Whole grains, Bananas
Vitamin B12	Confusion ; poor memory; psychosis	Meat, fish dairy products, eggs

34. Ms.R. Yamini, presented paper on **"Balanced diet & Physical Fitness"** in UGC sponsored Two Day National seminar on "Better Health & Fitness Management through Physical Education" organized by Dept. of physical education, JMJ college for Women, Tenali. 10 to 11th August-2017

INTERNATIONAL JOURNAL OF LAW, EDUCATION, SOCIAL AND SPORTS STUDIES (IJLESS)
Multidisciplinary, Peer-Reviewed and Refereed Journal
http://www.ijless.kypublications.com
editorijless@gmail.com
ISSN:2455-0418(P), 2394-9724(E); Vol.4.S2.2017

BALANCED DIET AND PHYSICAL FITNESS

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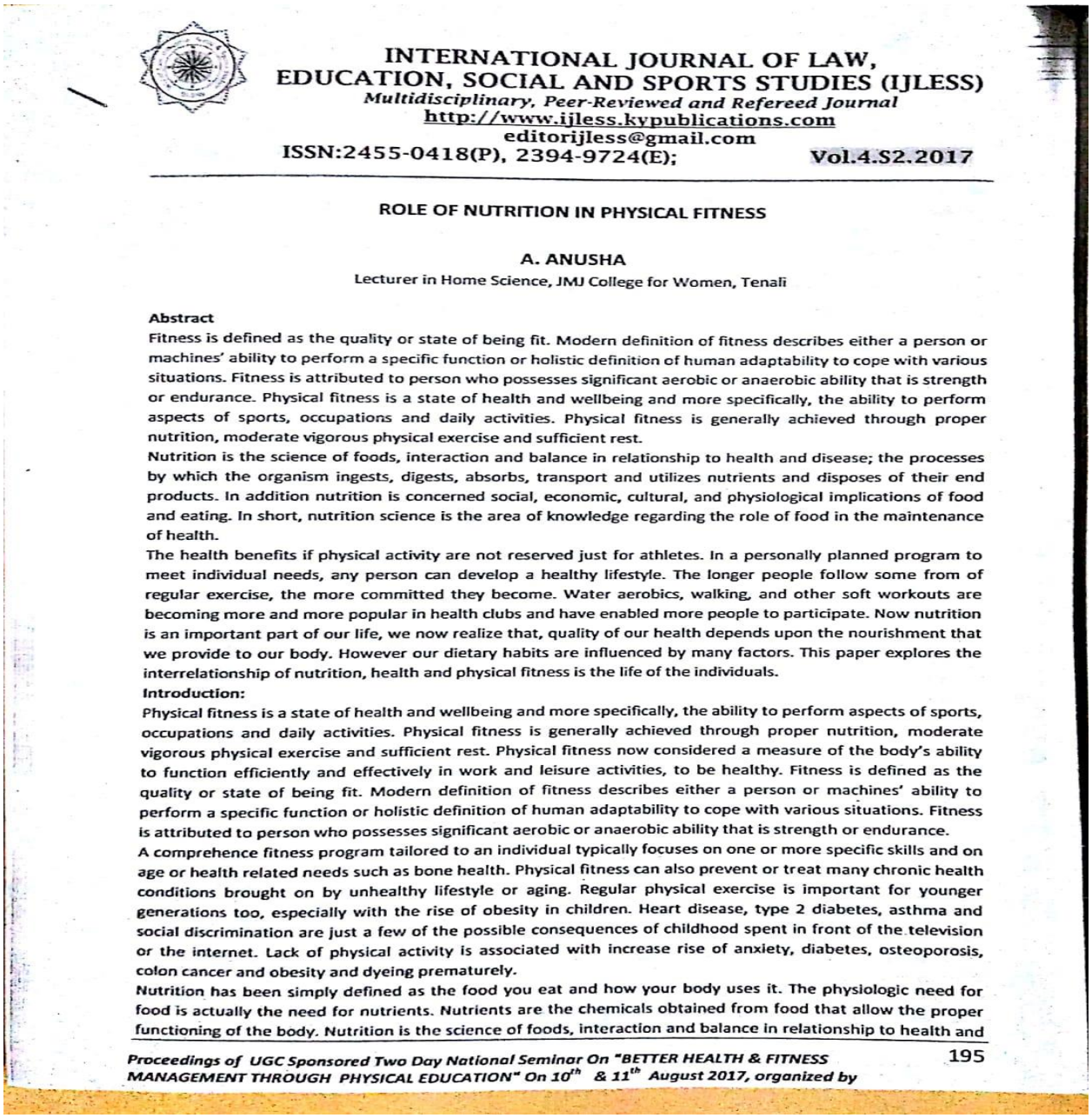
ABSTRACT
Balanced diet and regular physical activity are the building blocks of good health. By eating right food and being active we can maintain a healthy life style. Here we will focus more on a healthy diet as what we eat largely affects our health. A balanced diet must contain all the macro and micro nutrients which we need and in the right proportions. People generally take excess of macro nutrients and too little of micro nutrients which will affect their health status. It is more essential for children for proper growth and development .Nutrition plays an important role not only in physical health but also on mental health. Nutrition in infants and children appears to affect health in later life.
Regular exercise and the consumption of a healthy diet can lead to a host of benefits, including increased energy, happiness, health and even a long life. Exercise and diet are pivotal to determining a person's overall health, and making them both part of your lifestyle can make a dramatic difference in how you look and feel.
For children and young people evidence indicates that sixty minutes of activity on most days will help them achieve healthy growth and development. There is strong evidence that a more active and fitter population would have lower rates of obesity, cardiovascular disease, type 2 diabetes, some cancers and fewer mental health problems.
Being active can also improve your personal appearance, encourage fun with family and friends, maintain the ability to live independently, and enhance fitness for sports. Regular exercise will maintain the performance of your lungs and heart Exercise will also improve muscle strength, increase joint flexibility and improve endurance. This paper explores on the composition of Balanced diet and its effect on Fitness and Health status of individual

Introduction
Balanced diet and regular physical activity are the building blocks of good health. Poor eating habits and too little physical activity can lead to being overweight and bring along related health problems. By eating right food and being active we can maintain a healthy life style. Here we will focus more on a healthy diet as what we eat largely affects our health. A balanced diet must contain all the macro and micro nutrients which we need and in the right proportions. People generally take excess of macro nutrients and too little of micro nutrients which will affect their health status. It is more essential for children for proper growth and development .Nutrition plays an important role not only in physical health but also on mental health. Nutrition in infants and children appears to affect health in later life. Breast feeding may help increase immunity and reduce some allergies. Generally, a healthy diet consists of healthy vegetables, fresh fruits, low or non-fat dairy products and whole grains. You must also include protein from meat, fish, eggs, poultry and nuts and limit your consumption of sugar, salt and fat.
Research evidence: The 2006 European Commission Green Paper Promoting Healthy Diets and Physical Activity highlighted that important lifestyle choices pre-determining health risks at adult age are made during childhood and adolescence. The report emphasised that it is vital for children to be guided towards healthy behaviours .Recent data collected for the Health Behaviour in School-aged Children survey in Wales indicated that 22 per cent of 15 year old boys and 17 per cent of 15 year old girls are overweight or obese. Early intervention is important as eating habits can become established in early childhood.

35. Ms. A. Anusha, presented paper on **"Role of Nutrition in Physical Fitness"** in UGC sponsored Two Day National seminar on "Better Health & Fitness Management through Physical Education" organized by Dept. of physical education, JMJ college for Women, Tenali. 10 to 11th August-2017



INTERNATIONAL JOURNAL OF LAW, EDUCATION, SOCIAL AND SPORTS STUDIES (IJLESS)
Multidisciplinary, Peer-Reviewed and Refereed Journal
http://www.ijless.kypublications.com
editorijless@gmail.com
ISSN:2455-0418(P), 2394-9724(E); Vol.4.S2.2017

ROLE OF NUTRITION IN PHYSICAL FITNESS

A. ANUSHA
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Abstract
Fitness is defined as the quality or state of being fit. Modern definition of fitness describes either a person or machines' ability to perform a specific function or holistic definition of human adaptability to cope with various situations. Fitness is attributed to person who possesses significant aerobic or anaerobic ability that is strength or endurance. Physical fitness is a state of health and wellbeing and more specifically, the ability to perform aspects of sports, occupations and daily activities. Physical fitness is generally achieved through proper nutrition, moderate vigorous physical exercise and sufficient rest.
Nutrition is the science of foods, interaction and balance in relationship to health and disease; the processes by which the organism ingests, digests, absorbs, transport and utilizes nutrients and disposes of their end products. In addition nutrition is concerned social, economic, cultural, and physiological implications of food and eating. In short, nutrition science is the area of knowledge regarding the role of food in the maintenance of health.
The health benefits if physical activity are not reserved just for athletes. In a personally planned program to meet individual needs, any person can develop a healthy lifestyle. The longer people follow some from of regular exercise, the more committed they become. Water aerobics, walking, and other soft workouts are becoming more and more popular in health clubs and have enabled more people to participate. Now nutrition is an important part of our life, we now realize that, quality of our health depends upon the nourishment that we provide to our body. However our dietary habits are influenced by many factors. This paper explores the interrelationship of nutrition, health and physical fitness is the life of the individuals.

Introduction:
Physical fitness is a state of health and wellbeing and more specifically, the ability to perform aspects of sports, occupations and daily activities. Physical fitness is generally achieved through proper nutrition, moderate vigorous physical exercise and sufficient rest. Physical fitness now considered a measure of the body's ability to function efficiently and effectively in work and leisure activities, to be healthy. Fitness is defined as the quality or state of being fit. Modern definition of fitness describes either a person or machines' ability to perform a specific function or holistic definition of human adaptability to cope with various situations. Fitness is attributed to person who possesses significant aerobic or anaerobic ability that is strength or endurance.
A comprehence fitness program tailored to an individual typically focuses on one or more specific skills and on age or health related needs such as bone health. Physical fitness can also prevent or treat many chronic health conditions brought on by unhealthy lifestyle or aging. Regular physical exercise is important for younger generations too, especially with the rise of obesity in children. Heart disease, type 2 diabetes, asthma and social discrimination are just a few of the possible consequences of childhood spent in front of the television or the internet. Lack of physical activity is associated with increase rise of anxiety, diabetes, osteoporosis, colon cancer and obesity and dyeing prematurely.
Nutrition has been simply defined as the food you eat and how your body uses it. The physiologic need for food is actually the need for nutrients. Nutrients are the chemicals obtained from food that allow the proper functioning of the body. Nutrition is the science of foods, interaction and balance in relationship to health and

DEPARTMENT OF ECONOMICS

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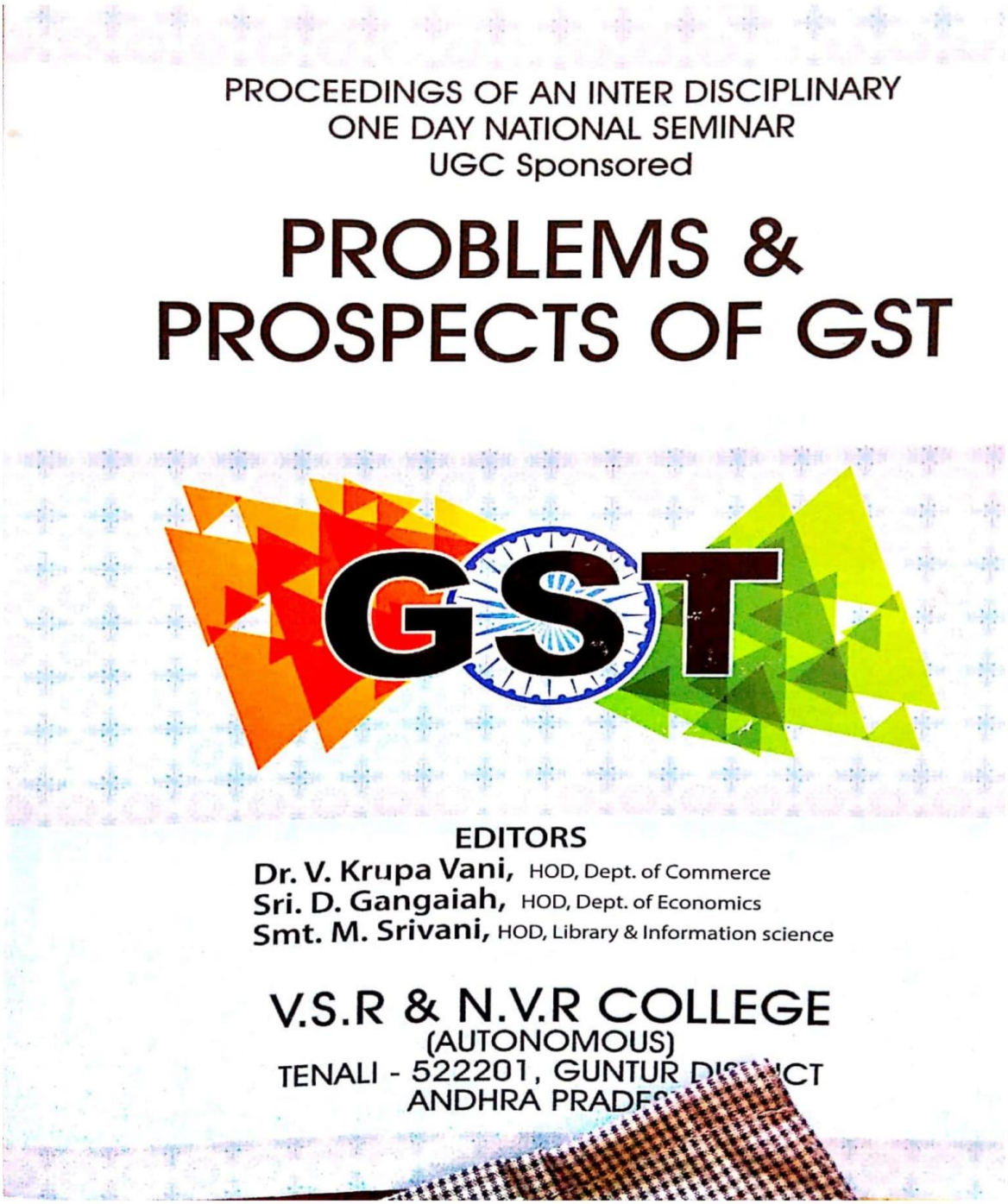

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GOODS AND SERVICES TAX IN INDIA: OPPORTUNITIES AND CHALLENGES

Dr.G.Sudhakaraiah, T.Arogyamma

(Lecturer in Commerce,JMJ College for Women (A), Tenali,Guntur)

(Lecturer in Economics,JMJ College for Women (A), Tenali,Guntur)

INTRODUCTION

Introduction of the Value Added Tax (VAT) at the Central and the State level has been considered to be a major step and an important step forward in the globe of indirect tax reforms in India. If the VAT is a major improvement over the pre-existing Central excise duty at the national level and the sales tax system at the State level, then the Goods and Services Tax (GST) will indeed be an additional important perfection the next logical step towards a widespread indirect tax reforms in the country. Initially, it was conceptualized that there would be a national level goods and services tax. There would be a "Dual GST" in India, taxation power both by the Centre and the State to levy the taxes on the Goods and Services. Almost 150 countries have introduced GST in some form. While countries such as Singapore and New Zealand tax virtually everything at a single rate, Indonesia has five positive rates, a zero rate and over 30 categories of exemptions. In China, GST applies only to goods and the provision of repairs, replacement and processing services. Under the GST scheme, a person who was liable to pay tax on his output, whether for provision of service or sale of goods, is entitled to get input tax credit (ITC) on the tax paid on its inputs.

OBJECTIVES OF GST

One of the main objectives of GST would be to eliminate the cascading impact of taxes onproduction and distribution cost of goods and services. The exclusion of cascading effects i.e.tax on tax will significantly improve the competitiveness of original goods and services which leads to beneficial impact to the GDP growth. It is felt that the GST would serve asuperior reason to achieve the

objective of streamlining indirect tax regime in India which can remove cascading effects in supply chain till the level of final consumers only when all such above mentioned indirect taxes are completely included in GST. It is understood that alcohol, tobacco and petroleum products will not been closed by GST as alcohol and tobacco are considered as Sin Goods and governments do not like to allow free trade on these property.

CHALLENGES

1. With respect to Tax Threshold

The threshold limit for turnover above which GST would be levied will be one area which would have to be strictly looked at. First of all, the threshold limit should not be so low to bother small scale traders and service providers. It also increases the allocation of government resources for such a petty amount of revenue which may be much more costly than the amount of revenue collected. The first impact of setting higher tax threshold would naturally lead to less revenue to the government as the margin of tax bases, second it may have on such small and not so developed states which have set low threshold limit under current VAT regime.

2. With respect to nature of taxes

The taxes that are generally included in GST would be excise duty, countervailing duty, cess, service tax, and state level VATs among others. Interestingly, there are numerous other states and union taxes that would be still out of GST.

3. With respect to number of enactments of statutes

There will two types of GST laws, one at a centre level called 'Central GST (CGST)' and the other one at the state level - 'State GST (SGST)'. As there seems to have different tax rates for goods and services at the Central Level and at the State Level, and further division based on necessary and other property based on the need, location, geography and resources of each state.

4. With respect to Rates of taxation

It is true that a tax rate should be devised in accordance with the state's necessity of funds. When ever states feel that they

need to raise greater revenues to fund the increased expenditure, then, ideally, they should have power to decide how to increase the revenue.

5. With respect to tax management and Infrastructure

It depends on the states and the union how they are going to make GST a simple one. Success of any tax reform policy or managerial measures depends on the inherent simplifications of the system, which leads to the high conformity with the administrative measures and policies.

OPPORTUNITIES

1. An end to cascading effects

This will be the major contribution of GST for the business and commerce. At present, there are different state level and centre level indirect tax levies that are compulsory one after another on the supply chain till the time of its utilization.

2. Growth of Revenue in States and Union

It is expected that the introduction of GST will increase the tax base but lowers down the tax rates and also removes the multiple point This, will lead to higher amount of revenue to both the states and the union.

3. Reduces transaction costs and unnecessary wastages

If government works in an efficient mode, it maybe also possible that a single registration and single compliance will suffice for both SGST and CGST provided government produces effective IT infrastructure and integration of such infrastructure of states level with the union.

4. Eliminates the multiplicity of taxation

One of the great advantages that a taxpayer can expect from GST is elimination of ultiplicity of taxation. The reduction in the number of taxation applicable in a chain of transaction will help to clean up the current mess that is brought by existing indirect tax laws.

5. Reduces the corruption

It is one of the major problems that India is overwhelmed with. We cannot expect anything substantial unless there exists a political will to root it out. This will be a step towards corruption free Indian Revenue Service.

Salient features of the GST model

(i) The GST shall have two components: one levied by the Centre (referred to as Central GST), and the other levied by the States (referred to as State GST). Rates for Central GST and State GST would be approved appropriately, reflecting revenue considerations and acceptability.

(ii) The Central GST and the State GST would be applicable to all transactions of goods and
services made for a consideration except the exempted goods and services.

(iii) The Central GST and State GST are to be paid to the accounts of the Centre and the states individually.

(iv) Since the Central GST and State GST are to be treated individually, taxes paid against the Central GST shall be allowed to be taken as input tax credit (ITC) for the Central GST and could be utilized only against the payment of Central GST.

(v) Each taxpayer would be allotted a PAN-linked taxpayer identification number with a total of14/15 digits. This would bring the GST PAN-linked system in line with the prevailing PAN-based system for Income tax, facilitating data exchange and taxpayer compliance.

IMPACT OF GOODS AND SERVICES TAX:

I. Food Industry

The application of GST to food items will have a significant impact on those who are living under subsistence level. But at the same time, a complete exemption for food items would drastically shrink the tax base. Food includes grains and cereals, meat, fish and poultry, milk and dairy products, fruits and vegetables, candy

and confectionary, snacks, prepared meals for home consumption, restaurant meals and beverages.

II. Housing and Construction Industry

In India, construction and Housing sector need to be included in the GST tax base because construction sector is a significant contributor to the national economy.

III. Financial Services

In most of the countries GST is not charged on the financial services. Example, In New Zealand most of the services covered except financial services as GST. Under the service tax, India has followed the approach of bringing virtually all financial services within the ambit of tax where consideration for them is in the form of an explicit fee. GST also include financial services on the above grounds only.

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To be in sync with the best International practices, domestic supply of software should also attract G.S.T. on the basis of mode of transaction. Hence if the software is transferred through electronic form, it should be considered as Intellectual Property and regarded as a service. Implementation of GST will also help in uniform, simplified and single point Taxation and there by reduced prices.

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There will be three categories of Small Enterprises in the GST regime. Those below threshold need not register for the GST Those between the threshold and composition turnovers will have the option to pay a turnover Those above threshold limit will need to be within frame work of GST Possible downward changes in the threshold in some States consequent to the introduction of GST may result in obligation being created for some dealers. In this case considerable assistance is desired.

CONCLUSION

GST is the most logical steps towards the comprehensive indirect tax reform in our country since independence. GST is leviable on all supply of goods and provision of services as well combination thereof. All sectors of economy whether the industry, business including Govt.departments and service sector shall have to bear impact of GST. All sections of economy viz., big, medium, small scale units, intermediaries, importers, exporters, traders, professionals and consumers shall be directly affected by GST... One of the biggest taxation reforms in India the Goods and Service Tax (GST) is all set to integrate State economies and boost overall growth. GST will create a single, unified Indian market to make the economy stronger. Experts say that GST is likely to improve tax collections and Boost India's economic development by breaking tax barriers between States and integrating India through a uniform tax rate. Under GST, the taxation burden will be divided equitably between manufacturing and services, through a lower tax rate by increasing the tax base and minimizing exemptions.

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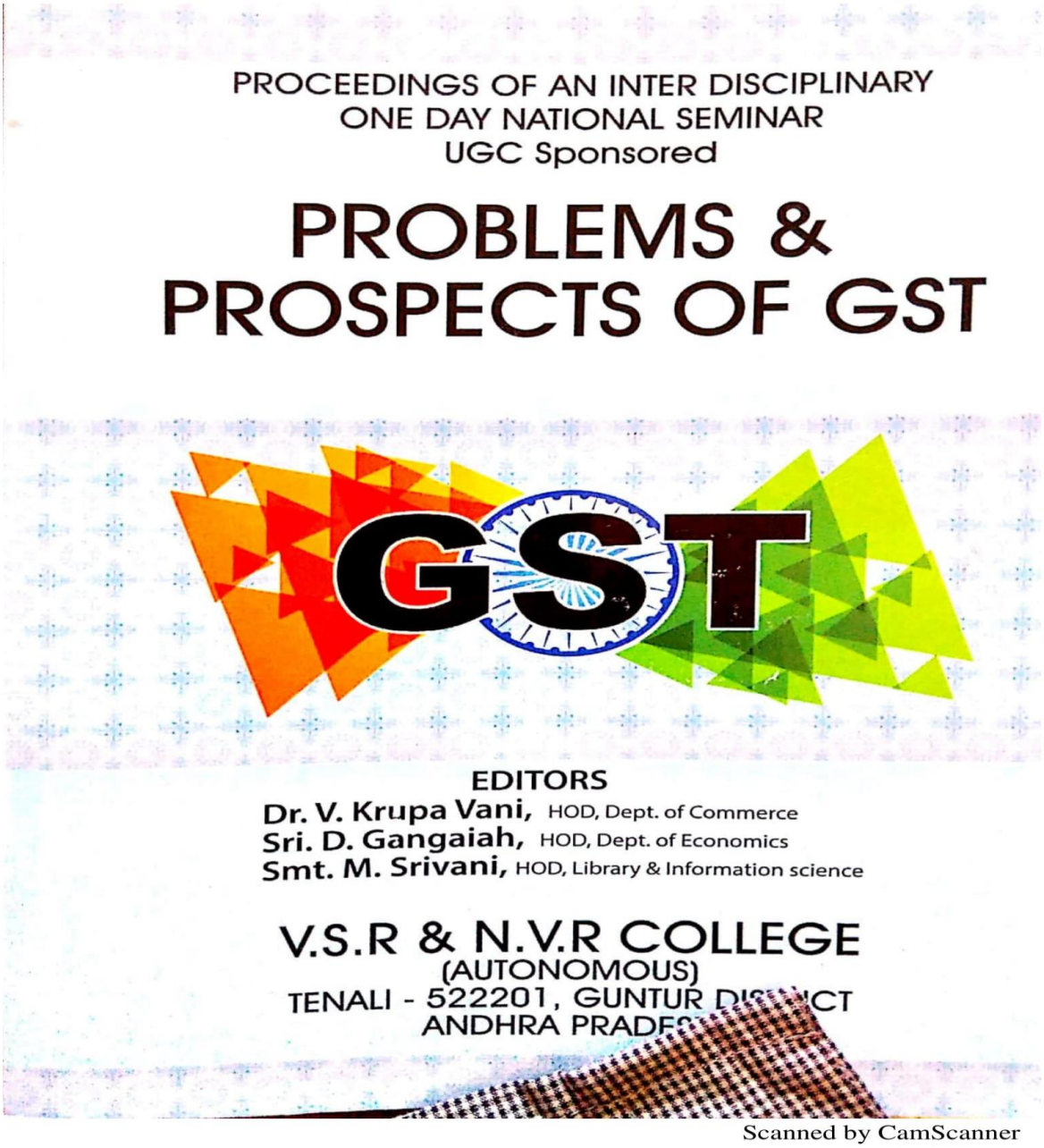

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GOODS AND SERVICES TAX IN INDIA: OPPORTUNITIES AND CHALLENGES

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INTRODUCTION

Introduction of the Value Added Tax (VAT) at the Central and the State level has been considered to be a major step and an important step forward in the globe of indirect tax reforms in India. If the VAT is a major improvement over the pre-existing Central excise duty at the national level and the sales tax system at the State level, then the Goods and Services Tax (GST) will indeed be an additional important perfection the next logical step towards a widespread indirect tax reforms in the country. Initially, it was conceptualized that there would be a national level goods and services tax. There would be a "Dual GST" in India, taxation power both by the Centre and the State to levy the taxes on the Goods and Services. Almost 150 countries have introduced GST in some form. While countries such as Singapore and New Zealand tax virtually everything at a single rate, Indonesia has five positive rates, a zero rate and over 30 categories of exemptions. In China, GST applies only to goods and the provision of repairs, replacement and processing services. Under the GST scheme, a person who was liable to pay tax on his output, whether for provision of service or sale of goods, is entitled to get input tax credit (ITC) on the tax paid on its inputs.

OBJECTIVES OF GST

One of the main objectives of GST would be to eliminate the cascading impact of taxes onproduction and distribution cost of goods and services. The exclusion of cascading effects i.e.tax on tax will significantly improve the competitiveness of original goods and services which leads to beneficial impact to the GDP growth. It is felt that the GST would serve asuperior reason to achieve the

objective of streamlining indirect tax regime in India which can remove cascading effects in supply chain till the level of final consumers only when all such above mentioned indirect taxes are completely included in GST. It is understood that alcohol, tobacco and petroleum products will not been closed by GST as alcohol and tobacco are considered as Sin Goods and governments do not like to allow free trade on these property.

CHALLENGES

1. With respect to Tax Threshold

The threshold limit for turnover above which GST would be levied will be one area which would have to be strictly looked at. First of all, the threshold limit should not be so low to bother small scale traders and service providers. It also increases the allocation of government resources for such a petty amount of revenue which may be much more costly than the amount of revenue collected. The first impact of setting higher tax threshold would naturally lead to less revenue to the government as the margin of tax bases, second it may have on such small and not so developed states which have set low threshold limit under current VAT regime.

2. With respect to nature of taxes

The taxes that are generally included in GST would be excise duty, countervailing duty, cess, service tax, and state level VATs among others. Interestingly, there are numerous other states and union taxes that would be still out of GST.

3. With respect to number of enactments of statutes

There will two types of GST laws, one at a centre level called 'Central GST (CGST)' and the other one at the state level - 'State GST (SGST)'. As there seems to have different tax rates for goods and services at the Central Level and at the State Level, and further division based on necessary and other property based on the need, location, geography and resources of each state.

4. With respect to Rates of taxation

It is true that a tax rate should be devised in accordance with the state's necessity of funds. When ever states feel that they

need to raise greater revenues to fund the increased expenditure, then, ideally, they should have power to decide how to increase the revenue.

5. With respect to tax management and Infrastructure

It depends on the states and the union how they are going to make GST a simple one. Success of any tax reform policy or managerial measures depends on the inherent simplifications of the system, which leads to the high conformity with the administrative measures and policies.

OPPORTUNITIES

1. An end to cascading effects

This will be the major contribution of GST for the business and commerce. At present, there are different state level and centre level indirect tax levies that are compulsory one after another on the supply chain till the time of its utilization.

2. Growth of Revenue in States and Union

It is expected that the introduction of GST will increase the tax base but lowers down the tax rates and also removes the multiple point This, will lead to higher amount of revenue to both the states and the union.

3. Reduces transaction costs and unnecessary wastages

If government works in an efficient mode, it maybe also possible that a single registration and single compliance will suffice for both SGST and CGST provided government produces effective IT infrastructure and integration of such infrastructure of states level with the union.

4. Eliminates the multiplicity of taxation

One of the great advantages that a taxpayer can expect from GST is elimination of ultiplicity of taxation. The reduction in the number of taxation applicable in a chain of transaction will help to clean up the current mess that is brought by existing indirect tax laws.

5. Reduces the corruption

It is one of the major problems that India is overwhelmed with. We cannot expect anything substantial unless there exists a political will to root it out. This will be a step towards corruption free Indian Revenue Service.

Salient features of the GST model

(i) The GST shall have two components: one levied by the Centre (referred to as Central GST), and the other levied by the States (referred to as State GST). Rates for Central GST and State GST would be approved appropriately, reflecting revenue considerations and acceptability.

(ii) The Central GST and the State GST would be applicable to all transactions of goods and
services made for a consideration except the exempted goods and services.

(iii) The Central GST and State GST are to be paid to the accounts of the Centre and the states individually.

(iv) Since the Central GST and State GST are to be treated individually, taxes paid against the Central GST shall be allowed to be taken as input tax credit (ITC) for the Central GST and could be utilized only against the payment of Central GST.

(v) Each taxpayer would be allotted a PAN-linked taxpayer identification number with a total of14/15 digits. This would bring the GST PAN-linked system in line with the prevailing PAN-based system for Income tax, facilitating data exchange and taxpayer compliance.

IMPACT OF GOODS AND SERVICES TAX:

I. Food Industry

The application of GST to food items will have a significant impact on those who are living under subsistence level. But at the same time, a complete exemption for food items would drastically shrink the tax base. Food includes grains and cereals, meat, fish and poultry, milk and dairy products, fruits and vegetables, candy

and confectionary, snacks, prepared meals for home consumption, restaurant meals and beverages.

II. Housing and Construction Industry

In India, construction and Housing sector need to be included in the GST tax base because construction sector is a significant contributor to the national economy.

III. Financial Services

In most of the countries GST is not charged on the financial services. Example, In New Zealand most of the services covered except financial services as GST. Under the service tax, India has followed the approach of bringing virtually all financial services within the ambit of tax where consideration for them is in the form of an explicit fee. GST also include financial services on the above grounds only.

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CONCLUSION

GST is the most logical steps towards the comprehensive indirect tax reform in our country since independence. GST is leviable on all supply of goods and provision of services as well combination thereof. All sectors of economy whether the industry, business including Govt.departments and service sector shall have to bear impact of GST. All sections of economy viz., big, medium, small scale units, intermediaries, importers, exporters, traders, professionals and consumers shall be directly affected by GST... One of the biggest taxation reforms in India the Goods and Service Tax (GST) is all set to integrate State economies and boost overall growth. GST will create a single, unified Indian market to make the economy stronger. Experts say that GST is likely to improve tax collections and Boost India's economic development by breaking tax barriers between States and integrating India through a uniform tax rate. Under GST, the taxation burden will be divided equitably between manufacturing and services, through a lower tax rate by increasing the tax base and minimizing exemptions.

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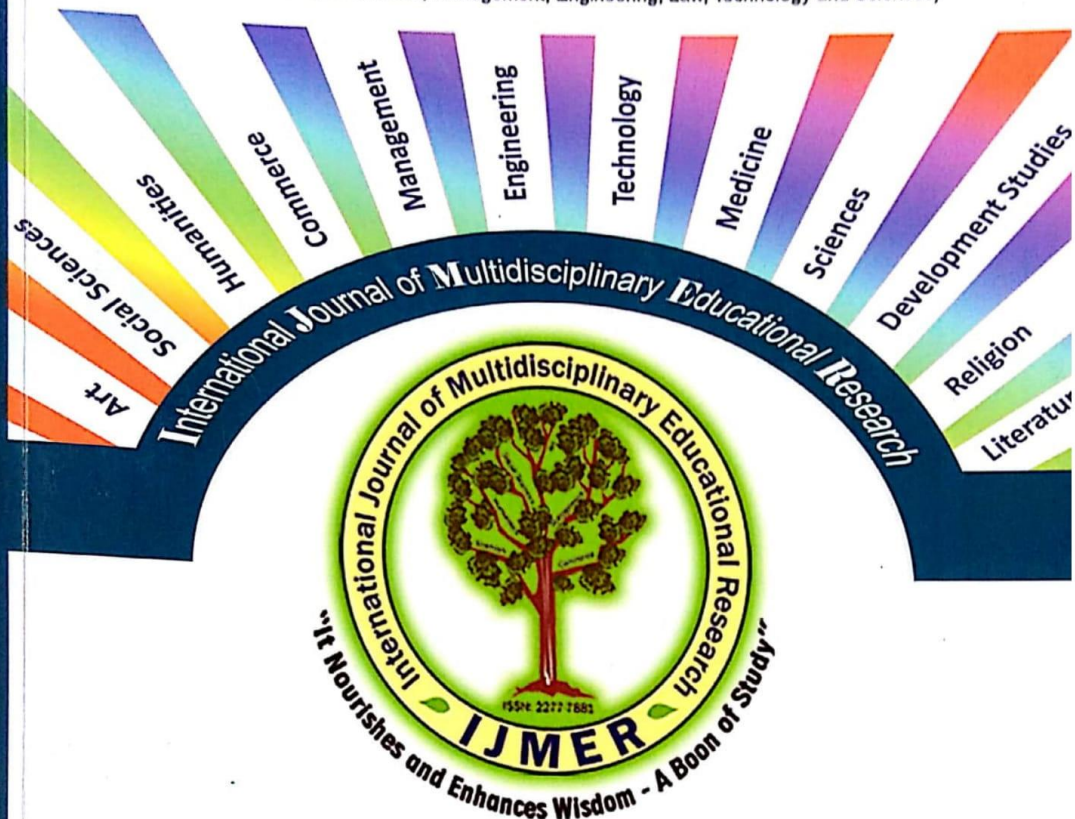
ISSN: 2277-7881
IJMER, Volume 6, Issue 8(7), August 2017
Impact Factor: 4.527, IC Value: 5.16, ISI Value :2.286

International Journal of Multidisciplinary Educational Research®

(Humanities, Social Science, Commerce, Management, Engineering, Law, Technology and Sciences)



Monthly - International Journal of Multidisciplinary Educational Research

Indexed & Listed at :
Ulrich's Periodicals Directory @, ProQuest.U.S.A
International Regd. &
Peer Reviewed

Editor-in-Chief
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SHGs promoted by SBI and Syndicate Bank in Kadapa, YSR District

State Bank of India and Syndicate Bank play a very important role in promoting SHGs with a wide geographical spread across three revenue divisions in the **YSR district.**

Table .1

Classification of selected SHGs – Bank-wise

Sl. No.	Bank Name	Revenue of Divisions			Total
		Kadapa	Rajampet	Jammala-madugu	
1	State Bank of India	16 (64)	11 (65)	19 (68)	46 (66)
2	Syndicate Bank	9 (36)	6 (35)	9 (32)	24 (34)
	Total	25 (100)	17 (100)	28 (100)	70 (100)

Note: Figures in parentheses represent percentages of column totals

Source: Field data.

Table .1 portrays that the classification of selected bank linked SHGs revenue division wise in Kadapa, YSR District. It is clear that 70 sample SHGs are break up of in to two banks (State Bank of India 46 SHGs and Syndicate Bank 24 SHGs) i.e., 2:1 ratio of each revenue division, namely, Kadapa, Rajampeta, and Jammalamadugu.

Socio-demographic Profile of the Selected SHG-Members

Socio-demographic profile of the selected sample SHG members is studied in respect of three specific dimensions i.e., age, marital status and educational status. Table .2 depicts the classification of SHG members based on community and age wise.

Table .2

Distribution of SHG Members on the basis of Community and Age

Sl. No.	Community	Age less than 23	Age 23-33	Age 33-43	Age 43-53	Age 53-63	Age Above 63	Total
1	OC	9 (5)	60 (33)	44 (25)	37 (21)	19 (10)	11 (6)	180 (100) [25]
2	BC	22 (10)	81 (35)	50 (22)	41 (18)	25 (11)	9 (4)	228 (100) [31]
3	SC	15 (10)	38 (26)	49 (33)	13 (9)	26 (18)	7 (4)	148 (100) [20]
4	ST	11 (12)	33 (36)	18 (20)	18 (20)	7 (8)	4 (4)	91 (100) [12]
5	Minority	3 (9)	26 (30)	21 (25)	20 (24)	6 (7)	4 (5)	85 (100) [12]
	Total	65 (9)	238 (32)	182 (25)	129 (18)	83 (11)	35 (5)	732 (100) [100]
t-value								5.423*
Degree of freedom								4
't' Table value at 5% level								2.776

Note: 1. Figures in parentheses ( ) are percentages of row totals.

2. Figures in parentheses [ ] are percentages of column totals

3.*Significant at 5 per cent level.

Source: Field data.

Table 2 reveals a total of 732 members in the sample SHGs. Among them BC members (31 per cent) occupy first place followed by OC (25 per cent), (20 per cent), ST and Minority (12 per cent each) members. When age factor of members in selected SHGs is taken into consideration those in the age group of 23-33 years is higher than those of other age groups with 32 per cent in all the categories except se

category. Members in the age group of above 63 years are lower than the rest of the age groups as they constitute only five per cent. 't' calculated value of SHG members based on community 5,423 which is more than the table value of 2.776 at five per cent level of significance for 4 degrees of freedom. Hence, null hypothesis is rejected. SHG Members on Education Basis

Table .3 shows distribution of SHG members on the basis of community with Education basis.

Table .3

Distribution of SHG Members on the basis of Community with Education basis

Sl. No.	Commu-nity	Illite-rate	Neo-literate	Primary Educa-tion	High School	Inter-mediate	Gradu-ate	Total
1	OC	59 (33)	32 (18)	44 (24)	28 (15)	10 (6)	7 (4)	180 (100) [25]
2	BC	103 (45)	31 (13)	59 (26)	21 (9)	8 (4)	6 (3)	228 (100) [31]
3	SC	54 (36)	28 (19)	34 (23)	19 (13)	10 97)	3 (2)	148 (100) [20]
4	ST	34 (37)	12 (13)	21 (23)	13 (14)	7 (8)	4 (5)	91 (100) [12]
5	Minority	22 (26)	16 (19)	19 (22)	18 (21)	7 (8)	3 (4)	85 (100) [12]
Total		272 (37)	119 (16)	177 (24)	99 (14)	42 (6)	23 (3)	732 (100) [100]

Note: 1. Figures in parentheses ( ) are percentages of row totals.

2. Figures in parentheses [ ] are percentages of column totals

Source: Field data.

It is obvious that (in sample SHGs more than one third per cent of the members are illiterates) the percentages of illiterates is the highest constituting 37 per cent, followed by those with primary education 24 per cent, neo-literates 16 per cent, those with high school education 14 per cent, intermediate qualification 6 per cent and the least 3 per cent are graduates. Coming to the community wise analysis of education status more or less 30 per cent of group members are illiterates except BC and vice-versa.

SHG Members on Marital Status

Marital status of members in sample SHGs is incorporated in table .4 a maximum of 92 per cent of SHG members are married. Only a negligible per cent i.e., one per cent is divorced, five per cent of SHG members and widowed and two per cent of the members are married. Divorce instances could be observed in the category of OC.

Table .4
Distribution of SHG Members on the basis of Community-wise Marital status

Sl. No.	Community	Un-married	Married	Widowed	Divorced	Total
1	OC	5 (3)	168 (93)	6 (3)	1 (1)	180 (100) [25]
2	BC	3 (1)	212 (93)	13 (6)	-	228 (100) [31]
3	SC	2 (1)	134 (91)	12 (8)	-	148 (100) [20]
4	ST	2 (2)	85 (93)	4 (5)	-	91 (100) [12]
5	Minority	-	80 (94)	5 (6)	-	85 (100) [12]
	Total	12 (2)	679 (92)	40 (5)	1 (1)	732 (100) [100]

Note: 1. Figures in parentheses ( ) are percentages of row totals.

2. Figures in parentheses [ ] are percentages of column totals

Source: Field data.

Group Constitution

Group constitution indicates the various factors involved in the constitution of the group i.e., purpose of formation, age of the group and the details of linkage with banks. Table .5 shows purpose behind the formation of Bank linked SHGs.

Table .5
Purpose behind the formation of Bank linked SHGs

Sl.No.	Purpose of formation	Bank name		Total
		State Bank of India	Syndicate Bank	
1	For the purpose of savings	14 (31)	6 (25)	20 (29)
2	To get the bank loan	22 (48)	11 (46)	33 (47)
3	Banking activities	8 (17)	5 (21)	13 (18)
4	Any other purpose	2 (4)	2 (8)	4 (6)
Total		46 (100)	24 (100)	70 (100)

Note: Figures in parentheses represent percentages of column totals.

Source: Field data.

Purpose behind the formation of Bank linked SHG is presented in table.5 a maximum of 47 per cent of Bank linked SHGs are formed for the purpose of getting loans from the bank, followed by 29 per cent for the purpose of savings, 18 per cent for banking activities and 6 per cent for other purpose. In both banks the major purpose identified by around 50 per cent of the group members is getting bank loans, followed by savings, activities and other purposes. Table .6 shows age of the selected SHGs based on bank linked states.

Table .6

Age of Selected SHGs Based on Bank listed status

Bank Name	Age of SHG in Years									Total
	2	3	4	5	6	7	8	9	10 and above	
State Bank of India	-	-	-	1 (25) [2]	9 (25) [20]	7 (41) [15]	12 (80) [26]	3 (75) [7]	14 (82) [30]	46 (66) [100]
Syndicate Bank	1 (100) (4)	-	1 (100) [4]	3 (75) [13]	2 (18) [9]	10 (59) [41]	3 (20) [13]	1 (25) [4]	3 (18) [13]	24 (34) [100]
Total	1 (100) (1)	-	1 (100) [1]	4 (100) [6]	11 (100) [16]	17 (100) [24]	15 (100) [22]	4 (100) [6]	17 (100) [24]	70 (100) [100]

Note: 1. Figures in parentheses ( ) are percentages of row totals.

2. Figures in parentheses [ ] are percentages of column totals

Source: Field data.

Age of the selected SHGs since their formation is classified on the basis of SHGs link with bank and the detailed are presented in table 4.6. It could be observed from the table that 98 per cent of selected SHGs fall in the age group of five to ten years. In the case of SHGs link with State Bank of India maximum number of groups are falling in the age group of six to ten years and in the case of SHGs link with Syndicate Bank maximum number of groups are falling in the age group of five to ten years.

Meetings of SHGs

To develop the group into well managed Self Help Group, the members should evolve rules and regulations, which are to be adopted, after

discussions with all the members for compliance in full. One of the rules that all members have to comply with is regarding meetings i.e. the group should meet regularly in a common place at a scheduled time. This helps them to become closer for understanding each other difficulties in a better way. Full attendance and good participation of all the members in all the group meetings would make it easy for the SHGs to stabilize. Minutes register is kept upto date. For the purpose of studying the performance of SHG it is essential to study the SHGs meetings in terms of their periodicity, attendance, participation and maintenance of minute's register. The regularity in conducting the meetings and the attendance during meetings gives an indication about groups functioning.

Community wise SHG Meetings

As the frequency of meetings increases, it gives scope for a lot of interaction, better understanding and awareness among the members. The following table.7 represents the prediction of meeting in selected SHGs on community wise. It is observed that, 37 per cent of the selected SHGs conduct meetings on quarterly basis, followed by 30 per cent on monthly basis, 19 per cent twice a month and 14 per cent on weekly basis.

Table .7

Periodically of Meetings in Selected SHGs – Community-wise

Sl. No.	Meetings periodically	Community						Total
		OC	BC	SC	ST	Minority	Mixed Caste	
1	Weekly	-	-	1 (20)	2 (40)	1 (33)	6 (11)	10 (14)
2	Monthly	-	-	3 (60)	2 (40)	1 (33)	15 (28)	21 (30)

3	Twice in a month	2 (100)	-	-	-	-	11 (21)	13 (19)
4	Quarterly	-	2 (100)	1 (20)	1 (20)	1 (34)	21 (40)	26 (37)
Total		2 (100)	2 (100)	5 (100)	5 (100)	3 (100)	53 (100)	70 (100)

Note: Figures in parentheses represent percentages of column totals.

Source: Field data.

As per community-wise analysis, a cent per cent of SHGs are conducting meeting twice a month and on quarterly basis by OC and BC category members respectively. They are followed by SCs 60 per cent on monthly basis, STs 40 per cent on weekly basis and on monthly basis. Regarding Minorities in SHGs are conducting meetings weekly, Monthly, Quarterly with an equal share of 33 per cent. Definitely it could be a healthy sign since micro finance is originally meant for socially and economically downtrodden people belonging to SCs and STs.

Bank-wise SHG Meetings

The periodicity of meetings in selected SHGs categorized in bank-wise is shown table 8.

Table .8
Periodicity of Meetings in Selected SHGs - Bank-wise

Sl. No.	Meetings Periodicity	Bank-wise		Total
		State Bank of India	Syndicate Bank	
1	Weekly	8 (17)	2 (8)	10 (14)
2	Monthly	15 (33)	6 (25)	21 (30)

3	Twice in a month	7 (15)	6 (25)	13 (19)
4	Quarterly	16 (35)	10 (42)	26 (37)
Total		46 (100)	24 (100)	70 (100)

Note: Figures m parentheses represent percentages of column totals.

Source: Field data.

SHGs meetings are being conducted on quarterly basis both in Syndicate Bank and SBI, followed by monthly basis and weekly basis in SBI and twice a month in Syndicate Bank. The least twice in a month in SBI and weekly in Syndicate Bank. In both the banks the overall frequency of conducting meetings is higher on quarterly basis only (i.e. 37 per cent) which is a positive indicator.

Adherence to Scheduled Meetings on Community-wise

The table.9 represent whether the SHGs meetings are being conducted exactly on time and place as per schedule categorized on community basis or not 46 per cent of selected SHGs stick to scheduled time and place as they fall in 80-90 per cent regularity, 33 per cent of selected SHGs recorded 90-100 per cent regularity conducting meetings as per scheduled time and place. And the rest (21 per cent) are less than 80 per cent. From the analysis it can be known that nearly 80 per cent of the SHGs almost stick to the scheduled time and place in conducting the meetings, which facilitates exchange of information among the members.

Table .9
Adherence to Scheduled Meetings in SHG - Community wise

Sl. No.	Scheduled meetings are held in	Community						Total
		OC	BC	SC	ST	Minority	Mixed Caste	
1	Less than 80%	-	-	3 (60)	1 (20)	1 (33)	10 (19)	15 (21)
2	80-90%	1 (50)	2 (100)	1 (20)	1 (20)	2 (67)	25 (47)	32 (46)
3	90-100%	1 (50)	-	1 (20)	3 (60)	-	18 (34)	23 (33)
Total		2 (100)	2 (100)	5 (100)	5 (100)	3 (100)	53 (100)	70 (100)

Note: Figures in parentheses represents percentages of Column Totals.

Source: Field data.

Adherence to Scheduled Meetings on Bank-wise

Whether the meetings with respect to Bank wise SHGs are conducted exactly as per the predetermined scheduled or not is presented in table 10. 50 per cent of SHGs linked with State Bank of India and 38 per cent SHGs linked with Syndicate Bank are conducting meetings as per schedule and fall into the category of 80-90 per cent. Further it is noticed that 33 per cent of SHGs linked with the banks are conducting meetings as per schedule, which is to the extent of 90-100 per cent

Table .10
Adherence to Scheduled Meetings in SHGs – Bank-wise

Sl.No.	Scheduled meetings are held in	Bank-wise		Total
		State Bank of India	Syndicate Bank	
1	Less than 80%	8 (17)	7 (29)	15 (21)

2	< 80-90%	23 (50)	9 (38)	32 (46)
3	< 90-100%	15 (33)	8 (33)	23 (33)
Total		46 (100)	24 (100)	70 (100)

Note: Figures in parentheses represent percentages of column totals.
Source: Field data.

Thus 83 per cent of SHGs linked with SBI, 71 per cent of SHGs linked with Syndicate Bank, are conducting meetings as per schedule. Hence Banks did not have any authority on the SHGs, to force conducting of their meetings regularly.

Adherence to Scheduled Meetings on Age of the SHG Basis

It is generally expected that as the age of SHG increases there will be regularity in conducting of meetings as per schedule. This is because the members of the groups realize the importance of attending the meetings for exchange of information, awareness and learning.

Conclusions

✓ Micro finance is a successful empowerment tool which has covered almost 10 crore households in the country. It is also important to note that 86 per cent of the groups are exclusively identified as women groups, which is a big push to the women empowerment programme.

✓ Self-Help Group-Bank Linkage Programme (SHG-BLP) is the most appropriate vehicle to ensure welfare and equity in the country with help and support given by NABARD.

✓ NABARD undertook several financial and promotional measures like refinance, creation of micro finance development and equity fund, grant support to banks for promotion and nurturing of SHGs and

special initiatives for scaling up of SHGs in order to promote the status of SHG-BLP in the country.

✓ Unlike the priority sector lending by commercial banks, credit delivery through SHG-BLP proved to be a least-cost and economically sustainable channel for reaching the unreached poor.

✓ Southern region states in India have lions share in SHG-Bank linkage, savings, loans disbursements and outstanding loans.

Suggestions

- NABARD should focus more on north and north eastern region where the spread of SHG-Bank linkage programme is very less. Special initiatives are required to be undertaken in the form of more grants to commercial banks for promoting and nurturing SHGs in these regions. Pilot projects like SHG post office linkage programme, which is launched in Tamilnadu can also be initiated in north and north eastern regions. .
- With regard to the spread of SHGs linked and loans disbursed bank-wise, the share of co-operative banks is very less in comparison with the share of commercial banks and regional rural banks. This indicates that serious efforts are needed to be put in SHGBLP by the co-operative banks. Special incentives should be designed and given to the co-operative banks to perform well in extending the concept of SHGBLP to rural areas.
- Monthly meetings in SHGs need to be conducted to bring intimacy among the members to create awareness and familiarize various activities to be undertaken by SHG. The leaders of the SHGs should take initiation in identifying and encouraging the non-participant and inactive members in the group and encourage them by undertaking activities of pot luck, exhibitions and showcasing the abilities of each member in the meeting.

- The span in between of the two audits should be reduced and audit should be made at least once in a year rather than once in two years or more. Know whether books are maintained properly or not and also avoid manipulations if any.
- Selection of leaders must be made on rotation basis rather than on election and nomination in order to make effective functioning and developing the individual leadership skills among the group members.

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International Journal of Multidisciplinary Educational Research
ISSN : 2277-7881; Impact Factor – 4.527; IC Value:5.16; ISI Value:2.286
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NATURE AND DIMENSIONS OF WILLFUL AND NON-WILFUL DEFAULT AND THE IMPACT OF CO-OPERATIVE CREDIT POLICY ON DEFAULT – A CASE STUDY OF NELLORE DISTRICT IN A.P.

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Abstract

In India, the vital role of agriculture arises out of the position, the agrarian sector occupies in the overall economy of the country. Agriculture is the largest sector of economic activity and has a crucial role to play in the country's economic development by providing food and raw materials and employment to a very large proportion of population, capital for its own development and surpluses for national economic development. Thus, the importance of agriculture despite rapid industrialization has not in any way diminished. It has become necessary raw materials, but to highly modernize agriculture so as to throw up surpluses to be made available for investment in the other sectors of economy as well.

Keywords: Agriculture, Economic development, Industrialization, Raw materials

Introduction

Agriculture occupies a prominent place and plays a crucial role in the economies of developing countries. Agricultural development seems to be far more complex than that of industry. Agricultural credit markets in developing countries are characterized by dichotomy i.e., the co-existence of institutional as well as non-institutional sectors. The cost and availability of credit in these two sectors differs considerably. Small farmers have restricted access to organized sector who are forced to borrow from non-institutional agencies at sky-high rates of interest1.

In order to sustain and accelerate the production in agriculture, supply of adequate credit and its use in proper direction are of prime importance. One of the most disquieting features of the institutional credit in India is the incidence of ever-increasing over dues. The high

level of over dues restricts the capacity of lending institutions to recycle funds, besides threatening the prospects of continued flow of external credit for agricultural development. Agricultural loans are overdue because of willful default and circumstantial or genuine default. In the overdue of co-operative credit institutions majority of the large farmers are considered to be willful defaulters, while the default of small farmers is mostly due to natural causes. What factors contribute to willful and non-willful default? Who are the willful defaulters and what is their incidence in different regions of the district? what is the nature and dimensions of willful and non-willful default? To seek answers to these and other related questions. 30 defaulted and 15 non-defaulted borrowers were interviewed and the results are incorporated in this article.

Need For The Present Study

The organization of co-operative credit societies has been one of the important policy measures adopted since the beginning of this century. Even after the entry of commercial banks in the field of agricultural finance, the government policy is to encourage the co-operatives as the primary organizations financing agricultural development. They are known for their ineffective operation. There is a stagnation in co-operative credit flow. The main reason for this is the mounting overdues which are clogging the process of credit recycling. A part from natural calamities which might contribute to an insignificant share of default, a major segment is primarily due to willful default especially on the part of the better off sections of rural economy with a view to benefiting from expected write off from interest or principal either in part or in full. Un willful default is easier to control through proper relaxation in recovery during times of distress. It is, however, the willful default that is difficult to control without building up public opinion against its pernicious effects. A monolithic approach for all the regions in the country may not be suitable. Areas specific studies on the causes, effects and remedies of overdues will throw more light on these issues and thereby help policy formulation.

Objectives Of The Study

The specifics objectives of the present study are:

i. To study the relationship between the extent of default and the socio-economic characteristics of defaulters.

ii. To analyse the income and asses structure of defaulting and non-defaulting borrowers.

Hypotheses

The following hypotheses are posited for testing.

i. Co-operative overdues are not related to socio-economic factors like size of holding. Family size, extent of irrigation, literacy, occupation and community.

ii. There is no significant difference exists in the income and asses levels of defaulted and non-defaulted members of sample borrowers.

Sample Design

A major portion of short and medium term agricultural credit in Nellore district is channelized by primary Agricultural Credit Societies (PACS). Therefore, a detailed investigation of the working of some of the primary societies has been taken up. The period of the study relates to the period commencing from 2005-2006 and extends up to the co-operative year ended in March 2015.

The study covers wide range of population spread over the district a two stage sampling plan has been considered to be more suitable and flexible Selection of PACS formed the first stage and selection of defaulters and non-defaulters formed the second stage.

The first stage units (PACS) are selected randomly from 99 Primary Agricultural Credit Societies in the district. The district is divided into three revenue regions. Namely , Gudur, Nellore and Kavali regions respectively. From each region 5 PACS are selected for field investigation on consideration of proximity and better familiarity.

As the main focus of the present study is to probe into the causes of overdues at the individual borrowers level. The list of all defaulters and non-defaulters from 15 sample PACS is obtained and pos-stratified into four groups based on the extent of land holding. The groups consist of the defaulters and non-defaulters in following way.

Group 1 – Marginal Farmers – Below 2.5 acres

Group II – Small Farmers – Between 2.5 to 5 acres

Group III – Medium Farmers – Between 5 to 10 acres

Group IV – Large Farmers – Above 10 acres

In the second stage, stratified random sampling technique is applied to select the defaulters and non-defaulters. Two defaulted and one non-defaulted members from the marginal as well as small farmers group and four defaulted and two non-defaulted members from the medium as well as large farmers group have been selected from each society. Thus 30 defaulted and 15 non-defaulted members have been selected from the sample societies.

Asset Level, Loan Size, And Income Level

The ownership of asses provides owners with an advantages in the financial markets in terms of volume and cost of loans. An increase in the share of wealth with high signal and collateral value will enable larger borrowings 3 . the level of assets and loan size and income level of sample borrowers are presented in table1.

Table 1

Category-Wise Average Income, Assets And Debt Of Sample Defaulted And Non-Defaulted Borrowers

Farm Category	Assets		Income		Debt	
	D	ND	D	ND	D	ND
Marginal	128700	141600	24103	33354	8387	9372
Small	232100	259400	47966	41019	13290	15333
Medium	455168	579366	57425	73216	18307	19535
Large	846425	1115583	101221	141387	24593	23172

ND = Non-defaulter D = Defaulter

Source: Sample data

There is a positive relationship between asset level and debt accumulation and income generation. In case of defaulters the correlation co-efficient between assets versus income is 0.9812 and assets versus debt is 0.9787. the similar relationship exists in non-

defaulters also. The correlation co-efficient are 0.9979 and 0.9230 respectively. Thus, in terms of this relationship. There is no basic difference between defaulters and non-defaulters. The medium and large farmers have better access to credit markets because of their better asses status and income generation. The dispersion of assets measured by CV is higher (76.49 per cent for defaulters and 87.02 percent for non-defaulters) than the debt (42.97 per cent and 35.17 per cent) and income (55.89 per cent and 68.14 per cent) respectively. ANOVA is calculated for the data and the results are shown in table 2.

Table 2

Anova Results

Source of variation	Degrees of freedom	Sum of squares	Mean square	F_c	F_t
ASSETS					
Between Columns	1	235.0112	235.0112	3.3731@	10.13
Between rows	3	8515.4143	2838.4714	40.7400*	9.28
Residual or Error	3	209.0187	69.6729	-	-
Income					
Between Coloumns	1	4.2486	4.2486	2.2138@	10.13
Between rows	3	98.0817	32.6939	17.0360	9.28
Residual or Error	3	5.7573	1.9194	-	-
DEBT					
Between Coloumns	1	0.0098	0.0098	0.9159@	10.13
Between rows	3	2.4624	0.8208	76.7103*	9.28
Residual or Error	3	0.0322	0.0107	-	-

F_C = F

* Significant at 5% level
calculated value

@ Not significant at 5% level.

$F_t = F$ table value

Source: Table I

The null hypothesis viz., there is no significant difference in the assets and income levels of defaulted and non-defaulted members of sample borrowers is accepted as the calculated 'F'. Values are lower than the table values. However, the difference between categories of borrowers is significant. Hence the said null hypothesis in this case is rejected.

In case of debt there is no significant difference between defaulted and non-defaulted members where as significant difference between different farm categories is found. With the help of the data in table 1. Gini-Co-efficient. Which is an aggregative measure of inequality is calculated. Gini-Co-efficient is calculated for assets, Income and debt in case of default members 0.36, 0.37 and 0.43 respectively. In the case of non-default members the Gini-Co-efficient of assets, income and debt are 0.43, 0.45 and 0.41 respectively.

Influence Of Socio-Economic Factors

Here an attempt is made to identify the key socio-economic factors of borrowers through χ^2 test and the results are presented in table 3.

Socio-Economic Factors and Value of χ^2 of Sample Defaulters and Non-Defaulters

S.No.	Factors	Between NWD and WD	Between Degrees ND and WD (χ^2)	χ^2 Table of freedom	Source value at 5% level
1.	Land	14.0495*	1.744*	3	7.815
2.	Education	13.3060*	1.5113*	3	7.815
3.	Caste	5.5319 @	1.5974@	2	5.991
4.	Amount borrowed	12.4757*	5.629@	3	7.815
5.	Family size	5.3783@	8.5080*	2	5.991

6.	Occupation	1.4605@	0.8642@	1	3.841
7.	Irrigation status of holding	0.2948@	0.2579@	1	3.841

* Significant at 5% level @ = Not significant at 5% level

Source: Sample data

The table presented above reveals that there is no significant relationship among the various socio-economic factors like caste, family, size, occupation and irrigation status of holding of non-willful defaulters (NWD) and willful defaulters (WD). However, a significant relationship exists among socio-economic factors like land. Education and amount borrowed of non-willful defaulters and willful defaulters in case of non-defaulters and willful defaulters there exists significant relationship in family size at 5 per cent level. The other socio-economic factors like land, education, caste, amount borrowed. Occupation and irrigation status of holdings are not significant at 5 per cent level.

Taxonomy Of Defaulters

In the present study,the objective of classifying farmer borrowers of co-operative societies into willful and non-willful defaulters on the basis of their repaying capacity. A number of socio-economic factors viz., operational size of holding (H). Family consumption expenditure (C) . Gross income from agriculture (A) . Initial amount of loan borrowed (L), proportion of working members to total members (T). Amount of annual income other than agriculture (O), and the proportion of politically influential members to total members (P) are identified as examined with the help of regression analysis. The results of regression analysis are presented in table 4.

Multiple Linear Regression Analysis Results (Willful Defaulters)

Variable	Regression co-efficient	't' value	Multiple R^2	Percentage contribution (R_i^2)
Constant	7418.5972	2.0745*	0.2010*	-

			(16707)@	
H	401.7663	2.8453**	-	14.96
C	0.0469	0.5519 @	-	0.44
A	-0.0057	0.2046@	-	0.78
L	-0.0291	0.6802@	-	0.11
T	14.1271	0.4589@	-	0.03
O	-0.0058	0.0532@	-	0.18
P	-46.2801	1.2599@	-	3.64
Y	-	-	-	-

* Significant at 5% level ** Significant at 5% level

@ Not significant at 5% level.

Note: Figure is parenthesis indicate F-value

Y = Average amount of loan overdue

Source: Sample data.

It is observed from the results of multiple linear regression analysis that 0. 2010 per cent of variation in average amount of loan overdues is explained by the various socio-economic factors of willful defaulters chosen for the study. The corresponding F-value is 1.6707, which is significant at 5 per cent level. This indicates that the multiple linear regression model is adequate for the present study. There is significant positive effect of operational size of holdings on average amount of loan overdues. The corresponding t-value is given by 2.8453, which is highly significant at 1 per cent level. Also it is found that out of 20.10 per cent of the variation. 14.92 per cent contribution is made by economic factor namely operational size of holding of the willful defaulters. The contributions made by the proportion of politically influential members to total members and gross income from agriculture are 3.64 and 0.78 per cent respectively. The balance 0.76 per cent of the variation in loan overdues is contributed by remaining socio-economic factors. Multiple linear regression analysis results (non-willful defaulters) are shown in table 5.

Table 5

Multiple Linear Regression Analysis Results (Non-Willful Defaulters)

Variable	Regression co-efficient	't' value	Multiple R^2	Percentage contribution (R_i^2)
Constant	3014.9985	1.5835@	0.3940 (4.8700)**	-
H	412.2670	4.4218**	-	24.46
C	0.0741	0.9863@	-	4.70
A	-0.0125	0.4941@	-	2.09
L	0.0156	0.4422@	-	6.12
T	4.4177	0.2502@	-	0.41
O	0.0511	0.7539@	-	1.27
P	-19.0612	0.7539@	-	1.27
Y	-	-	-	-

** Significant at 1% level
* Significant at 5% level

Note: Figure is parenthesis indicate F-value

Y = Average amount of loan overdue

Source: Sample data.

Results of multiple linear regression analysis furnished in table 5 reveal that 39.40 per cent of the variation in average amount of loan overdues is explained by the various socio-economic characteristics of non-willful defaulters. The corresponding F-value works out to 4.87 which is highly significant at 1 per cent level. This shows that the given multiple linear regression model is valid for the present study. There is a significant positive effect of operational size of holdings borrowed by non-willful defaulters on average amount of loan overdues. The corresponding t-value is given 4.42, which is highly significant at 1 per

cent level. Also it is found that out of 39.40 per cent of the variation, 24.46 per cent is contributed made by operational size of holdings by the non-willful defaulters. The contribution to the variation in overdues made by initial amount of loan borrowed. Family consumption expenditure and gross income from agriculture are given by 6.12 per cent. 4.70 per cent and 2.09 per cent respectively. The remaining 2.03 per cent of the variation in average loan overdues is contributed by other socio economic characteristics of non-wilful defaulters. Correlation co-efficient between average loan overdues and socio-economic characteristics of defaulters is presented in table 6.

Table 6

Correlation Co-Efficient Between Average Loan Overdues And Socio-Economic Characteristics Of Defaulters

Variable	Willful		Non-willful	
	R	't' value	R	't' value
H	0.3863	3.0776**	0.4379	5.3800**
C	0.30662	0.4875@	0.1773	1.9899*
A	0.0883	0.6514@	0.1001	1.1112@
L	0.0309	0.2272@	0.2272	2.5769**
T	0.0179	0.1316@	-0.0091	0.1005@
O	-0.0425	0.3126@	0.0933	1.0350@
P	-0.1907	1.4276@	-0.0963	1.0686@

* Significant at 5% level ** Significant at 1% level

@ Not Significant at 5% level

Source: Sample data.

From the results of simple correlation co-efficient between average loan overdues and other socio-economic factors, it is observed that there is a significant positive correlation between operational size of holding and average loan overdues in the case of both willful and non-willful defaulters. The corresponding t-values are highly significant at 1 per cent level. Further, it is observed that in case of non willful

defaulters there is a positive significant correlation between family consumption expenditure and average loan overdues at 5 per cent level and initial loan borrowed and average loan overdues at 1 per cent level.

Suggestions for Reducing willful defaulters:

There has been a growing tendency to use farm credit as on instrument for achieving short-term populist objectives. Government measures such as write off of agricultural dues, concession/ relief announced by political functionaries from public plat forms, stay orders on legal process of recovery, disbursement of loans /assets at the hands of political dignitaries in Loan Melas etc... have vitiated the recovery climate. Central as well as state governments should evolve a concrete and highly effective policy for the recovery of dues and take the firm and objective view in respect of "willful defaulters". Mass programmes for disbursement of loans such as Loan Melas should be stopped as they have deleterious effects on the functioning of credit agencies. Hence, the need for whole-hearted efforts to improve means, by the government. The promptness to payback loans by the members can be ensured to a great extent by making the societies evolve a moral code to be strictly abided by all the members. The loan recovery position in the co-operative societies can be improved if the employees of the societies attempt it sincerely and the Board of Directors and other policy makers help the employees in their efforts.

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International Journal of Multidisciplinary Educational Research
ISSN: 2277-7881; Impact Factor – 4.527; IC Value:5.16; ISI Value:2.286
Volume 6, Issue 10(2), October 2017

CASUES AND EXTENT OF CO-OPERATIVE OVERDUES IN PRIMARY AGRICULTURAL CREDIT SOCIETIES IN NELLORE DISTRICT OF ANDHRA PRADESH

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Abstract

Credit is considered as life blood of every development activity. Science credit is linked with trust or confidence, overdues hit at the very root of the functioning of credit institutions. Nevertheless , the phenomena of default co – exists with farm financing, but in recent years it has cropped up as a chronic disease and the rate of growth of overdues has been increasing. The causes for overdue are multiple and they can be classified into two viz.., internal and external. Overdues are often the result of a combination of various factors as stated above. The different factors which lead to overdues under both the categories are discussed in this article.

Keywords: Credit, Overdues, Internal and External factors

Introduction

Agriculture occupies a prominent place and a crucial role in the economics of developing countries. Agriculture development seems to be far more complex than that of industry. Agricultural credit markets in developing countries are characterized by dichotomy i.e., the co-existence of institutional as well as non-institutional sectors. The cost and availability of credit in these two sectors differs considerably. Small farmers have restricted access to organized sector, who are forced to borrow from non-institutional agencies at sky-high rates of interest[1].

In India, the vital role of agriculture arises out of the position, the agrarian sector occupies in the overall economy of the country. Agriculture is the largest sector of economic activity and has a crucial role to play in the country's economic development by providing food and raw materials and employment to a very large proportion of

population, capital for its own development and surpluses for national economic development. Thus, the importance of agriculture despite rapid industrialization has not in any way diminished. It has become necessary not only to achieve self-sufficiency in matters of food and agricultural raw materials, but to highly modernize agriculture so as to throw up surpluses to be made available for investment in the other sectors of economy as well[2].

Objectives

The specific objectives of the present study are:

i. To study the relationship between the extent of default and the socio-economic characteristics of defaulters.

ii. To analyze the income and asset structure of defaulting and non-defaulting borrowers.

iii. To examine the nexus between size of holdings and default and ability to repay a nd default.

Hypotheses

The following hypotheses are posited for testing.

i. There is no significant difference in nature and extent of overdoes among different sample societies located in different revenue regions of Nellore district.

ii. Co-operative overdues are not related to socio-economic factors like size of holding, family size, extent of irrigation, literacy, occupation and community.

Sampling Design

A major portion of short and medium term agricultural credit in Nellore district is channelized by Primary Agricultural Credit Societies (PACS). Therefore, a detailed investigation of the working of some of the primary societies has been taken up. The period of the study relates to the period commencing form 1997-98 and extends up to the co-operative year ended in March 2007.

The study covers wide range of population spread over the district a two stage sampling plan has been considered to be more suitable and flexible. Selection of PACS formed the First stage and selection of defaulters and non-defaulters formed the second stage.

The first stage units (PACS) are selected randomly from 199 Primary Agricultural Credit Societies in the district. The district is divided into three revenue regions. There are 65, 68 and 66 PACS in the Gudur, Nellore and Kavali regions respectively. From each 5 PACS are selected for field investigation on consideration of proximity and better familiarity.

As the main focus of the present study is to probe into the causes of overdues at the individual borrowers lefel, the list of all defaulters and no-defaulters from 15 sample PACS is obtained and post-stratified into four groups based on the extent of land holding. The groups consist of the defaulters and non-defaulters in the following way.

Group I – Marginal Farmers – Below 2.5 acres

Group II – Small Farmers – Between 2.5 to 5 acres

Group III – Medium Farmers – Between 5 to 10 acres

Group IV – Large Farmers – Above 10 acres

In the second stage, stratified random sampling technique is applied to select the defaulters and non-defaulters. Two defaulted and one non-defaulted members from the marginal as well as small farmer group and four defaulted and two non-defaulted members from the medium as well as large farmers grouphave been selected from each society. Thus 180 defaulted and 90 non-defaulted members have been selected from the sample societies.

Extent Of Overdues At Defaulter Level

In order to assess the overdues at the farm level, all the 270 borrowers were interviewed, among them 180 were defaulters and their distribution on the basis of level of default is indicated in Table 1

Table 1

Defaulters And The Sum Defaulted

(with interest as on 31-01-2007)

Size-group of Loan Rs.	No. of Defaulters	Amount defaulted Rs.	Percentage of defaulters	Percentage of amount defaulted
0-2500	18	40057	10.00	2.60
2500-5000	31	142929	17.22	9.24
5000-7500	44	298417	24.45	19.30
7500-10000	42	402680	23.33	26.04
10000 and above	45	662126	25.00	42.82
Total	180	1546209	100.00	100.00

Source: Sample data

Table 1 shows that there is a positive relationship between the amount defaulted and the size of the loan (r=0.9898). this is but natural 10.00 per cent of defaulters account for only 2.60 per cent of amount defaulted in the size group of 0-2500, 17.22 percent of defaulters are in the size group of 2500-5000 defaulted, 9.24 per cent, 24.45 per cent of defaulters representing the size group of 5000-7500 defaulted, 19.30 per cent and 23.33 per cent of defaulters are in the size group of 7500-10000 defaulted 26.04 per cent. But in the case of last size group i.e., 10000 and above account for 25.00 per cnet of defaulters and their default percentage is 42.82 percnet. Average amount defaulted by all 180 defaulters works out to 8590.05. It is explicitly clear that there is a skewed distribution in the amount defaulted. The co-efficient of skewness 0.4912 and C.V. is (69.86). Region-wise distribution of defaulters and the quantum of default are presented in table 2

Table 2

Region –Wise Distribution Of Defaulters And Quantum Of Default

Amount borrowing Rs.	Number of Defaulters			Amount Defaulted (Rs.)		
	Gudur	Nellore	Kavali	Gudur	Nellore	Kavali
0-2500	8	5	5	15256	10248	14553
2500-5000	12	10	9	47643	55700	39586
5000-7500	15	12	18	96459	92486	109472
7500-10000	10	14	17	117262	139390	146028
10000 and above	15	19	11	175143	298707	188276
Total	60	60	60	451763	596531	497615

Source: Sample date

The average amount of default in Nellore region is Rs. 9942.18, which is high compared to other two, Gudur (7529.38) and Kavali (8298.58) regions respectively. ANOVA is computed for the data shown in Table 2 and the results are presented in the following table 3.

Table 3

Anova Results

Sources variation	Degrees of Freedom	Sum of squares	Mean of squares	F_c	F_t	
					5%	1%
Between columns	2	21.8498	10.9249	0.8768	4.46	8.65
Between rows	4	778.2188	194.5547	15.6146	3.84	7.01
Error	8	99.6790	12.45898	-	-	-
Total	14	899.7476	-	-	-	-

* Significant at 5% level $F_c = F$ calculated value

@ Not significant at 5% level. $F_t = F$ table value

It is clear from the ANOVA results that there is no significant difference in the level of default among the three regions. But, there is a significant difference between levels of borrowing. Farm category-wise distribution of defaulters and extent of default are presented in Table 4.

Table 4 clearly indicate that the percentage of willful defaulters to total defaulters increases with the size of holding (r=0.9416) and willful defaulters' overdues is also increasing with the size of holding (r= 0.9789). The same relationship exists between the size of holding and willful defulters' overdues to defaulters overdues (r=0.9789). 16.67 per cent of marginal farmers account for 7.29 per cent of overdues and 2.35 per cent of amount willfully defaulted, 16.67 per cent of small farmers account for 14.61 per cent of overdues and 10.37 per cent of amount vilfully defaulted and 33.33 per cent of medium farmers had a share of 32.21 per cent of overdues and 29.96 per cent of amount willfully defaulted. 23.33 per cent of large farmers accounts for 45.89 per cent of overdues and 57.32 per cent of amount willfully defaulted. We find that there is a positive relationship between the size of holidng and level of overdues (r=0.9980). Similar relationship exists between the size of holding and willful defaulters overdues (r=0.9718). Hence, the formulated hypothesis viz., there is no significant difference in the level of default between the different size groups of farmers is rejected.

Table – 4

Category	Defaulters	Wilful defaulters	(3) as % of (2)	Defaulters' overdues	Willful defaulters overdues	6 as % of (5)	Average amount overdues	
							Defaulters	Wilful deafulters
1	2	3	4	5	6	7	8	9
Marginal	30 (16.67)	2 (3.39)	6.67	112633 (7.29)	13200 (2.35)	11.72	3754.43	6600.00
Small	30 (16.67)	8 (13.56)	26.67	225874 (14.61)	58139 (10.37)	25.71	7529.13	7267.38
Medium	60 (33.33)	20 (33.90)	33.33	498086 (32.21)	168042 (29.96)	33.74	8301.43	8402.1
Large	60 (33.33)	29 (49.15)	48.33	709616 (45.89)	321482 (57.32)	45.30	11826.93	11085.59
Total	180 (100.00)	59 (100.00)	32.77	1546209 (100.00)	560863 (100.00)	36.27	8590.05	9506.15

Causes For Default: Borrowers Perspectives

Crop loan delinquency is a function of a multiplicity of variables analysed in terms of certain socio economic and attitudinal factor in the proceeding sections. The data collected from the sample investigation regarding the defaults has been summarized into six categories as shown in Table 5.

There are a multiplicity of causes for loan default. The classifications of causes is also quite varied. We propose to follow the pattern adopted by Nirmal Sande Rathna and hence the causes of default are set out into six categories as shown in Table 5.

(a) Defects in Farm Production

Poor productive conditions of the farming enterprise often make it difficult to repay. This defect is also expressed in terms of "non-viable farm units", which often reders to the small size of farms. The implication is that farmers are unable but willing to repay[3]. The data shows that defects in farm production was one of the important factors to which 16.69 per cent of the respondents attributed their defaults and the default amount was 12.78 per cent. Small and marginal farmers

with inadequate access to farm inputs and extension services come under this group. Their income is meager to meet their subsistence needs rather than the repayment of loans.

(b) Variability in Income

The farmer may be unable to repay his loan in a particular season owing to crop failure due to natural clalmities or the destruction of a crop by theft, fire or other hazards. His inability to repay may also be caused by a sudden fall in prices or the unmarketability of his produce[4]. Farmers in this category are normally able and willing to repay. Defaulters in this category are thus abnormal and presumably 17.78 per cent of the defaulters have not repaid due to crop failures and their default amount was 16.42 per cent. The agricultural statistics on crops during these seasons indicate a lower rate of failure than that implied in the interview results. The farmer's tendency not to accept responsibility for the delinquency but to throw the blame on natural calamities under market failures is a common experience. But in view of the incidents cited and the observations made in the field visists, the tenacity of the farmers' argument cannot be assailed.

Table 5

Category Of Defaulters And The Amount Defaulted

Category of default	Defaulters	Percentage	Amount defaulted	Percentage
Defects in farm production	30	16.67	197669	12.78
Variability in incomes	32	17.78	253840	16.42
Defects in the credit organization	23	12.78	166937	10.80
Attitudinal conditions	26	14.44	249316	16.12

Misallocation	34	18.89	316849	20.49
Miscellaneous	35	19.44	361598	23.39
Total	180	100.00	1546207	100.00

Source: Sample data

(c) Defects in the credit organization:

The farmer in this category is able to repay and willing to do so, but since the organization giving credit does not force him to repay, he does not. The farmer may believe that he will neither suffer penal interest rates nor endanger his subsequent borrowing by his default, loopholes which enable a defaulter to borrow subsequently and abandoning attempts to collect earlier defaults would support this belief. Sometimes the staff of the credit agency itself might even encourage borrowers not to repay[5]. Deficiencies in credit organization accounted for 12.78 per cent of defaulting borrower, their default amount being 10.80 per cnet.

(d) Attitudinal Conditions

Those farmers who do not want to repay loans despite their ability to repay fall into this category. They do not consider government funds as loans, but often as grants. This cause is generally closely linked with defects in the credit organizations policies, such as abandoning efforts to collect arrears under earlier schemes and the lack of effective sanction on borrowers who do not return loans. 14.44 per cent of the defaulters felt no obligation to repay, their default amount was 16.12 per cent. These defaulters stated that they xonsidered loans outright grants, expected the defaults to be written-off.

(e) Misallocation

This category includes the farmers who use the loan for purpose other than those stated in the application. Those farmers invested loan amount for other activites in which they had failed or even though successful, they face a problem of liquidity to repay in time. Other misallocations include the use of borrowed funds for ceremonial needs,

a sudden illness or death or repayment of loans from other sources. About 20.49 per cent of the loan amount was unpaid because 18.89 per cent of the defaulters have used the money for unauthorized expenditures such as unforeseen expenses connected with a illness or death, legal and ceremonial expenditure, settlement of debts from other sources involving high rates of interest or for other activities which were either not profitable or illiquid.

(f) Miscellaneous

Other reasons not easily categorized under the fore-going heads account for 19.44 per cent of defaulters and 23.39 per cent of default amount. They include malpractives of cooperative officials and political interference is also included in this category. Some of these could be the cases of willful defaulters and this is in fact a "Don't know" category.

Table 6 depicts the particulars of factors contributing to default by size of borrowing.

Table 6

Classification Of Defaulters By Size Of Borrowing

Size of borrowing Rs.	Number of defaulters						
	Defects in Farm Production	Variability in Incomes	Defects in the credit organization	Attitudinal conditions	Misallocation	Miscellaneous	Total
0-2500	8	3	2	2	1	2	18
2500-5000	7	9	6	4	3	2	31
5000-7500	5	8	8	4	9	10	44
7500-10000	6	7	3	9	8	9	42
10000 and above	4	5	4	7	13	12	45
Total	30	32	23	26	34	35	180

Source: Sample data

It is evident from the table 6 that 75.00 per cent of defaulters come from the ranks of borrowers of less than Rs.10000 and the remaining 25.00 per cent of borrowers' sums are above Rs.10000. Chi-square (χ^2) test is applied for the data to test the association between the size-group of borrowings and causes of default. The χ^2 calculated value 29.95 which is significant at 5 per cent level. Hence, we conclude that there is no association between the size group of borrowings and causes of the default.

$$E(A1\ B1) = \frac{(A1)(B1)}{N} = \frac{9 \times 8}{60} = 1.2$$

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DEPARTMENT OF COMPUTER SCIENCE

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ISBN : 978-93-85101-95-3

GRAPH THEORY IN COMPUTER SCIENCE

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Abstract

The field of mathematics plays vital role in various fields. One of the important mathematics is graph theory which is used in structural models. This structural of various objects or technologies lead to new inventions and modifications in the environment for enhancement in those fields. The field graph theory started its from the problem of Koinsberg Bridge in 1735. This paper gives an overview applications of graph theory in heterogeneous fields to some extent but mainly the computer science applications that uses graph theoretical concepts. Graph concepts are widely used to study and model various applications, in different include, study of molecules, construction of bonds in chemistry and the study of Similarly, graph theory is used in sociology for example to measure actors' explore diffusion mechanisms. Graph theory is used in biology and conservation where a vertex represents regions where certain species exist and the edges migration path or movement between the regions.

Introduction:

Graph theoretical ideas are highly utilized by computer science applications. research areas of computer science such data mining, image segmentation, image capturing, networking etc., For example a data structure can be form of tree which in turn utilized vertices and edges. Similarly modeling topologies can be done using graph concepts. In the same way the most important of graph coloring is utilized in resource allocation, scheduling. Also, paths circuits in graph theory are used in tremendous applications say traveling database design concepts, resource networking. This leads to the algorithms and new theorems that can be used in tremendous applications.

History of Graph theory:

The origin of graph theory started with the problem of Koinsber bridge problem lead to the concept of Eulerian Graph. Euler studied the bridge and constructed a structure to solve the problem called Eulerian of tree, (a connected graph without cycles) was implemented by Gustav and he employed graph theoretical ideas in the calculation of currents in or circuits. In 1852, Thomas Gutherie found the famous four color Thomas. P. Kirkman and William R.Hamilton studied cycles on the concept called Hamiltonian graph by studying trips that visited

978-93-85101-95-3

1913, H.Dudeney mentioned a puzzle problem. Eventhough the four color problem nted it was solved only after a century by Kenneth Appel and Wolfgang Haken. is considered as the birth of Graph Theory.

tions of Graph theory:

oretical concepts are widely used in Operations Research. For example, the alesman problem, the shortest spanning tree in a weighted graph, obtaining an atch of jobs and men and locating the shortest path between two vertices in a is also used in modeling transport networks, activity networks and theory of he network activity is used to solve large number of combinatorial problems. The lar and successful applications of networks in OR is the planning and scheduling plicated projects. The best well known problems are PERT (Project Evaluation hnique) and CPM (Critical Path Method). To represent the method of finite raph is used. Here, the vertices represent the positions and the edges represent

and graph theory:

role of graph theory in computer applications is the development of graph Numerous algorithms are used to solve problems that are modeled in the form These algorithms are used to solve the graph theoretical concepts which intern e the corresponding computer science application problems.

ithms are as follows:

path algorithm in a network 2. Finding a minimum spanning tree

graph planarity 4. Algorithms to find adjacency matrices.

to find the connectedness 6. Algorithms to find the cycles in a graph

for searching an element in a data structure (DFS, BFS) and so on.

puter languages are used to support the graph theory concepts. The main goal ages is to enable the user to formulate operations on graphs in a compact and

theoretic languages are

- To find a spanning tree in the given graph.

aph Theoretic Language

aph Algorithm Software Package

ension of LISP

Extension of LISP

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6. IGTS – Extension of FORTRAN

7. GEA – Graphic Extended ALGOL (Extension of ALGOL)

8. AMBIT – To manipulate digraphs

9. GIRL – Graph Information Retrieval Language

10. FGRAAL – FORTRAN Extended Graph Algorithmic Language [7]vertices rep the positions and the edges represent the moves.

Graph Theory in OR:

Graph theory is a very natural and powerful tool in combinatorial operations re Some important OR problems that can be solved using graphs are given here. A ne called transport network where a graph is used to model the transportation of com from one place to another. The objective is to maximize the flow or minimize th within the prescribed flow. The graph theoretic approach is found more efficient fo types of problems though they have more constraints.

Graph coloring and GSM mobile phone networks:

Groups Special Mobile (GSM) is a mobile phone network where the geographical this network is divided into hexagonal regions or cells. Each cell has a commu tower which connects with mobile phones within the cell. All mobile phones com the GSM network by searching for cells in the neighbours. Since GSM operate four different frequency ranges, it is clear by the concept of graph theory that f colors can be used to color the cellular regions. These four different colors are proper coloring of the regions. Therefore, the vertex coloring algorithm may be assign at most four different frequencies for any GSM mobile phone network.

The concept is as follows: Given a map drawn on the plane or on the surface of a the four color theorem assets that it is always possible to color the regions of a ma using at most four distinct colors such that no two adjacent regions are assigned color. Now, a dual graph is constructed by putting a vertex inside each region of and connect two distinct vertices by an edge iff their respective regions share segment of their boundaries in common. Then proper coloring of the dual gra proper coloring of the original map. Since, coloring the regions of a planar equivalent to coloring the vertices of its dual graph and vice versa. By coloring regions using four color theorem, the four frequencies can be assigned to th accordingly.

Graph algorithm in computer network security:

The vertex cover algorithm is used to simulate the propagation of stealth worm computer networks and design optimal strategies to protect the network against Simulation was carried out in large internet like virtual network

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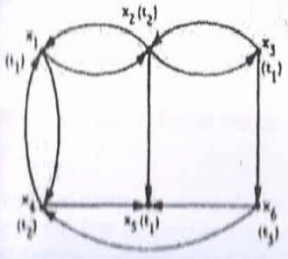
ology routing has big impact on worm propagation. The importance of finding propagation is to hinder them in real time. The main idea here is to find a minimum in the graph whose vertices are the routing servers and the edges are the between the routing servers. Then an optimal solution is found for worm and a network defense strategy is defined. In a graph G, a set of edges g is said if every vertex in G is incident on atleast one edge in g. The set of edges that graph G is said to be an edge covering or a covering subgraph or simply a covering A spanning tree in a connected graph is a covering. A Hamiltonian circuit is also

model for fault tolerant computing systems:

on graph theory where it is used to model the fault tolerant system. Here, the represented as S and the algorithm to be executed by S is known as A. Both S presented by means of graphs whose nodes represent computing facilities. It is the algorithm A is executable by S if A is isomorphic to a sub graph of S. These the computing facility of a particular computation and the interconnection This model is applied directly to the minimum configuration or structure achieve fault tolerance to a specified degree. The model is represented in the ility graph. A facility graph is a graph G whose nodes represent system facilities edges represent access links between facilities. A facility here is said to be a software components of any system that can fail independently. Hardware clude control units, arithmetic processors, storage units and input/output Software facilities include compilers, application programs, library routines, systems etc. Since each facility can access some other facilities, the real time represented as a facility graph. The following is a labeled directed facility ity types are indicated by numbers in parentheses.

dicates the types of facilities accessed by other facilities. The node x1 accesses and x4. Similarly, the node x5 with facility type t1 access the facility types t3, nodes x6, x2 and x4 respectively.



ISBN : 978-93-85101-95-3

Graph theory in symbol recognition:

Here, the we have discussed the "Symbol Recognition by Error tolerant sub graph matching between region adjacency graphs" (The region adjacency graph is one in which costs are associated with both nodes and arcs, implying that an update of these costs must be included in the given algorithm as node costs change due to the connecting two regions Ri and Rj. The graphs shown below are the segmented graph, the region adjacency graphs and the dual graph respectively)

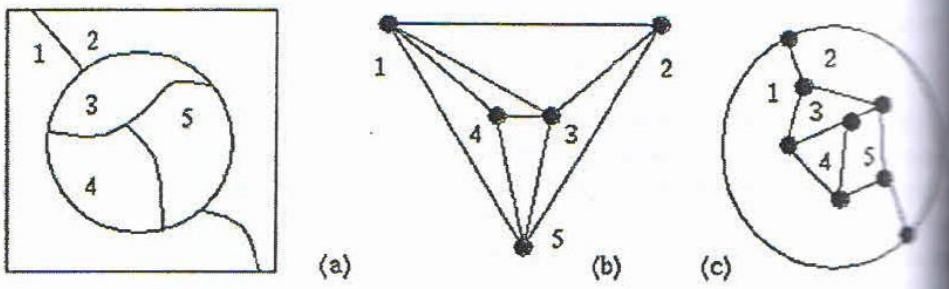


Fig: Segmented graph, Region adjacency graph and its dual graph

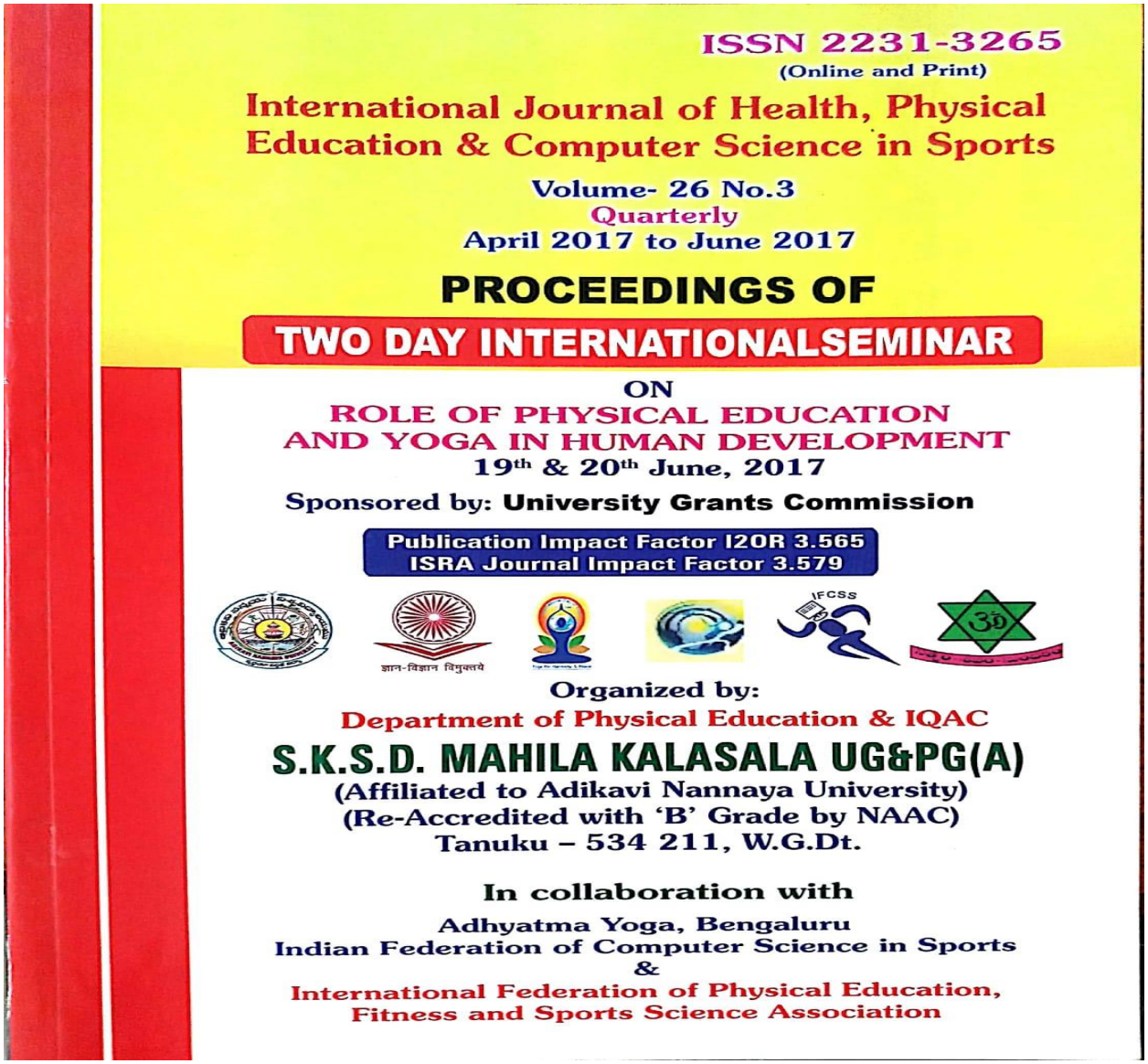
The distorted image sub graph is matched with the model graph. That is the image regions and the model regions are modeled as the image sub graph and model graph. The cost of adding a neighbor to the correspondence is the cost of the string edit distance aligning the polygonally approximated outer boundaries of the graphs consisting of the matched regions and the neighbor region candidates. This method is applicable to any region adjacency graph representation.

Conclusion:

The main aim of this paper is the Researches may get some information related to graph theory and its Applications in computer field and can get some ideas related to their field of research.

DEPARTMENT OF PHYSICAL EDUCATION

42.Published a paper titled *"EFFECT OF SELCTED ASANAS AND PRANAYAMA PRACTICE ON PHYSICAL FITNESS AND PHYSIOLOGICAL VARIABLES AMONG COLLEGE LEVEL WOMEN STUDENTS "* in the International Seminar Book ROLE OF PHYSICAL EDUCATION AND YOGA IN HUMAN DEVELOPMENT" With ISSN 2231-3265.



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ISSN 2231-3265
International Journal of Health, Physical Education and Computer Science in Sports
Volume No.26, No.3
Journal Impact Factor 3.565
A Peer Reviewed (Refereed) International Research Journal

Effect of Selected Asanas and Pranayama Practice on Selected Physical Fitness and Physiological variables Among College Women's Students

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ABSTRACT: The present study is to find out the effect of selected asanas and pranayama practice on selected physical fitness and physiological variables among college women students. 30 subjects were selected from J.M.J College for Women, Tenali. The subjects were between 17 and 21 years. They were divided into two groups of fifteen in each. One group was acted as the experimental group and another group was acted as the control group. The experimental group underwent the selected asanas and pranayama practice trainingfor 6 weeks 5 days per week. Each training session was for one hour in the evening from 4.00 PM to 5.00 PM. To achieve the result, the collected data on following criterion measures namely physical fitness variables that is flexibility andbalance; physiological variable namely resting pulse rate. The standardized tests will be taken before and after the selected asanas and pranayama practice training. Flexibility was tested using sit and reach test, balance was tested using stork balance test and resting pulse rate was tested using radial artery. The ANCOVA was applied to analyzed the collected data and in all cases the criteria for the statistical significance was set at 0.05 level of confidence.

Keywords: asanas and pranayama practice, flexibility, balance and resting pulse rate

INTRODUCTION

Yoga is one of the most ancient cultural heritages of India. It was invented by Hindu yogis over 2500 years ago. The word yoga means 'unity' or 'oneness' and is derived from the Sanskrit word 'Yug' which means 'to join'. In this sense, it is an exercise in moral and mental cultivation that generates good health (arogya), contributes to longevity (chirayu), and the total intrinsic discipline culminates into positive and perennial happiness and peace. It works on all aspects of the person: the physical, mental, emotional, psychic and spiritual. Therefore, yoga is said to be indispensable of the ultimate accomplishment in life. It is a science that affects not only the conscious self but the subconscious as well.

Patanjali's famous definition of yoga is "YogasChittaVirttiNirodhah" which means "yoga is the removal of the fluctuations of the mind". Chitta is mind, Virtti are thought impulses, and nirodhah is removal. Yoga is a positive way of maintaining physical 'up keep' mental alertness and spiritual attainment. It teaches us how to control one's senses results an integrated personality, freedom, stress, conflict and the like. It stabilizes one behavioural pattern, developed will power and ultimately helps one to lead healthy, happy and balanced life (**Swami Githananda and MeenashiBhavan, 1989).**

STATEMENT OF THE PROBLEM :The present study was to findout the effect of selected asanas and pranayama practice on selected physical fitness and physiological variables among college women students.

HYPOTHESES

1. It was hypothesized that there may be significant differences due to asanas and pranayama practice training on the selected physical fitness variables namely flexibility and balance
2. It was hypothesized that there may be significant differences due toasanas and pranayama practice training training on the selected physiological variable namely resting pules rate.

SIGNIFICANCE OF THE STUDY

1. The study will be helpful to know the effect of selected asanas and pranayama practice on selected physical fitness and physiological variables among college women students
2. The study will be helpful to prepare training schedule to improve the effect of selected asanas and pranayama practice on selected physical fitness and physiological variables among college women students
3. The study will be helpful to realize college women students and coaches for their coaching purpose.

DELIMITATIONS

The following delimitations are considered for the study

1. This study is confined to thirty subjects were selected from J.M.J College for Women, Tenali, Andhra Pradesh.
2. The subjects were selected only from the age group of 17 and 21 years.
3. Only selected physical fitness physiological variables were chosen for this study
4. The duration of the experimental period was for six weeks.
5. The study is confined only to the selected asanas and pranayama practice training.

INDEPENDENT VARIABLE

Selected asanas and pranayama practice

DEPENDENT VARIABLES

- **PHYSICAL FITNESS VARIABLES**
  1. Flexibility
  2. Balance
- **PHYSIOLOGICAL VARIABLE**
  1. Resting pulse rate

LIMITATIONS

The following limitations are considered for the study.

1. The factors like personal habits, life style, routine, diet, climatic conditions and environmental factors which might have had an effect on the results of this study could not be taken into consideration.

2. Hereditary, social and other psychological factors could not be controlled.

METHODOLOGY

SELECTION OF SUBJECTS: The purpose of the present study is to find out the effect of selected asanas and pranayama practice on selected physical fitness and physiological variables among college women students. 30 subjects were selected randomly from J.M.J College for Women, Tenali, Andhra Pradesh. The age of the subjects ranged from17 to 21 years. They were divided into two groups of 15 in each. One group acted as the experimental group. The experimental group was undergone the training for 6 weeks.

SELECTION OF VARIABLES

INDEPENDENT VARIABLE: Selected Asanas and Pranayama practice

DEPENDENT VARIABLES

- **PHYSICAL FITNESS VARIABLES**
  3. Flexibility
  4. Balance
- **PHYSIOLOGICAL VARIABLE**
  2. Resting pulse rate

Table – I: Selected Variables and Tests

S.no	Variables	Tests	Unit uppercase
1.	Flexibility	Sit and reach test	In Centimeters
2.	Balance	Stork balance test	In Seconds
3.	Resting pulse rate	Radial artery	Pulse / minute

EXPERIMENTAL DESIGN

The present study is to find out the effect of selected asanas and pranayama practice on selected physical fitness and physiological variables among college women students. 30 subjects were selected randomly from J.M.J College for Women, Tenali, Andhra Pradesh. The age ranged from 17 to 21 years. They were divided into two groups each consisting of 15 namely experimental group and control group. The experimental group underwent the selected asanas and pranayama practice training for 6 weeks. The training was given five days in a week and the training session was from 4:00 pm to 5:00 pm. The control group was not involved in any selected asanas and pranayama practice training. They were engaged in their usual activities. All the subjects were tested in the selected physical fitness variables namely flexibility, balance and physiological variables namely resting pulse rate. The pre- test was taken before the start of selected asanas and pranayama practice training and post-test was taken after 6 weeks selected asanas and pranayama practice training.

TRAINING SCHEDULE

Duration	-	6 weeks
Session	-	5 days per week
Duration of one session	-	One hour

STATISTICAL TECHNIQUES: The present study paid its attention mainly on testing the effectiveness of the selected asanas and pranayama practice training on selected

physical fitness, physiological variables among college women students. The Statistical tool used for this present study is described here. The significance of the mean difference between the pre-test and post-test values of the variables was found out by applying ANCOVA.

Day	Session	Training	Rep	Time	Density in secs
Mon	Evening 4.00-5.00	Surya namaskar	1 set	4 mins	
		Padmasana	3 rep	6 mins	30 sec
		Vajrasana	3 rep	6 mins	30 sec
		Pashchimottanasana	3 rep	6 mins	30 sec
		Uttanpatasana	3 rep	6 mins	30 sec
		Halasana	3 rep	6 mins	30 sec
		Nadishodhana pranayama	3 rep	6 mins	30 sec
		Sheetali Pranayama	3 rep	6 mins	30 sec
		Surya bhedana pranayama	3 rep	6 mins	30 sec
		Savasana& Prayer		4 mins	
Tue	Evening 4.00-5.00	Surya namaskar	1 set	4 mins	
		Sarvangasana	3 rep	6 mins	30 sec
		Matshyasana	3 rep	6 mins	30 sec
		Salabhasana	3 rep	6 mins	30 sec
		Bhujangasana	3 rep	6 mins	30 sec
		Padahasdasana	3 rep	6 mins	30 sec
		Ujjayi pranayama	3 rep	6 mins	30 sec
		Bhastrika pranayama	3 rep	6 mins	30 sec
		Anulomaviloma pranayama	3 rep	6 mins	30 sec
		Savasana& Prayer		4 mins	
Wed	Evening 4.00-5.00	Surya namaskar	1 set	4 mins	
		Dhanurasana	3 rep	6 mins	30 sec
		Garudasana	3 rep	6 mins	30 sec
		Padmasana	3 rep	6 mins	30 sec
		Pashchimottanasana	3 rep	6 mins	30 sec
		Vajrasana	3 rep	6 mins	30 sec
		Nadishodhana pranayama	3 rep	6 mins	30 sec
		Sheetali Pranayama	3 rep	6 mins	30 sec
		Surya bhedana pranayama	3 rep	6 mins	30 sec
		Savasana& Prayer		4 mins	
Thur	Evening 4.00-5.00	Surya namaskar	1 set	4 mins	
		Pashchimottanasana	3 rep	6 mins	30 sec
		Uttanpatasana	3 rep	6 mins	30 sec
		Halasana	3 rep	6 mins	30 sec
		Sarvangasana	3 rep	6 mins	30 sec
		Matshyasana	3 rep	6 mins	30 sec
		Ujjayi pranayama	3 rep	6 mins	30 sec
		Bhastrika pranayama	3 rep	6 mins	30 sec
		Anulomaviloma pranayama	3 rep	6 mins	30 sec
		Savasana& Prayer		4 mins	
Fri	Evening 4.00-5.00	Surya namaskar	1 set	4 mins	
		Salabhasana	3 rep	6 mins	30 sec
		Bhujangasana	3 rep	6 mins	30 sec
		Padahasdasana	3 rep	6 mins	30 sec
		Dhanurasana	3 rep	6 mins	30 sec
		Garudasana	3 rep	6 mins	30 sec
		Nadishodhana pranayama	3 rep	6 mins	30 sec
		Sheetali Pranayama	3 rep	6 mins	30 sec
		Surya bhedana pranayama	3 rep	6 mins	30 sec
		Savasana& Prayer		4 mins	

Table-3: Computation of Analysis of Covariance on Flexibility among Experimental Groups and Control Group

Test	Experimental	Control	Source of variance	Sum of square	df	Mean square	Obtained F
Pre-test Mean	13.73	12.17	BG	18.40	1	18.41	2.96
Pre-test S.D	2.73	2.21	WG	173.26	28	6.19	
Post-test Mean	15.07	12.26	BG	58.94	1	58.95	9.24*
Post-test S.D	2.78	2.25	WG	178.71	28	6.38	
Adjusted post-test Mean	14.30	13.04	BG	10.79	1	10.80	26.48*
			WG	11.01	27	0.41	

*Significant at 0.05 level.
Table value at 0.05 level of significance for 1 & 28 and 1 & 27 degree of freedom = 4.20 and = 4.21

The table-III shows that the pre-test mean value on flexibility of experimental group and control group are 13.73 and 12.17 respectively. And standard deviation values of experimental and control group are 2.73 and 2.21 respectively. The obtained 'F' ratio of pre test mean is 2.96 which is lesser than the required table value of 4.20for df 1 and 28 at 0.05 level of confidence on flexibility. The post-test mean value on flexibility of experimental group and control group are 15.07and 12.26 respectively. And standard deviation values of experimental group and control group are 2.78 and 2.25 respectively. The obtained 'F' ratio of post-test mean is 9.24 which are greater than the required table value of 4.20 for df 1 and 28 at 0.05 level of confidence on flexibility. The adjusted post-test mean value on flexibility of experimental group and control group are 14.30 and 13.04 respectively. The obtained 'F' ratio of adjusted post-test mean is 26.48 which is greater than the required table value of for 4.21 df 1 and 27 at 0.05 level of confidence on flexibility. The result of the study indicates that there was a significant difference among the adjusted post-test means of experimental group and control group on flexibility.

Figure-1: The Mean Values of Experimental and Control GROUPS ON FLEXIBILITY

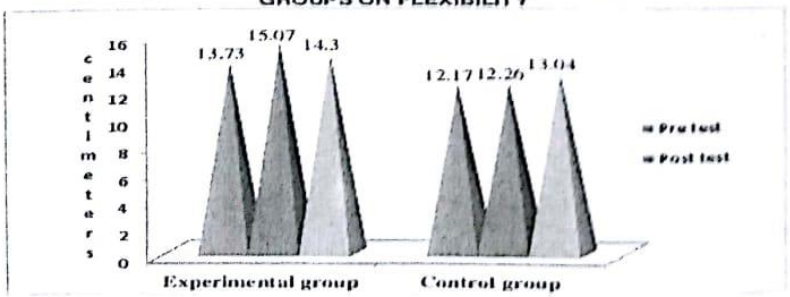


Table-4: Computation of Analysis of Covariance on Balance among Experimental Groups and Control Group

Test	Experimental	Control	Source of variance	Sum of square	df	Mean square	Obtained F
Pre-test Mean	0.37	0.36	BG	0.01	1	0.01	0.14
Pre-test S.D	0.10	0.04	WG	0.18	28	0.06	
Post-test Mean	0.64	0.39	BG	0.47	1	0.47	15.21*
Post-test S.D	0.24	0.05	WG	0.87	28	0.03	
Adjusted post-test Mean	0.63	0.40	BG	0.41	1	0.41	23.34*
			WG	0.48	27	0.09	

***Significant at 0.05 level.**

Table value at 0.05 level of significance for 1 & 28 and 1 & 27 degree of freedom = 4.20 and = 4.21

The table-IV shows that the pre-test mean value on balance of experimental group and control group are 0.37 and 0.36 respectively. And standard deviation values of experimental and control group are 0.10 and 0.04 respectively. The obtained 'F' ratio of pre test mean is 0.14 which is lesser than the required table value of 4.20for df 1 and 28 at 0.05 level of confidence onbalance.The post-test mean value on balance of experimental group and control group are 0.64and 0.39 respectively. And standard deviation values of experimental group and control group are 0.24 and 0.05 respectively. The obtained 'F' ratio of post-test mean is 15.21 which are greater than the required table value of 4.20 for df 1 and 28 at 0.05 level of confidence on balance. The adjusted post-test mean value on balance of experimental group and control group are 0.63 and 0.40 respectively. The obtained 'F' ratio of adjusted post-test mean is 23.34 which is greater than the required table value of for 4.21 df 1 and 27 at 0.05 level of confidence onbalance.

The result of the study indicates that there was a significant difference among the adjusted post-test means experimental group and control group on balance.

FIGURE-2: Mean values of experimental and control Groups on balance

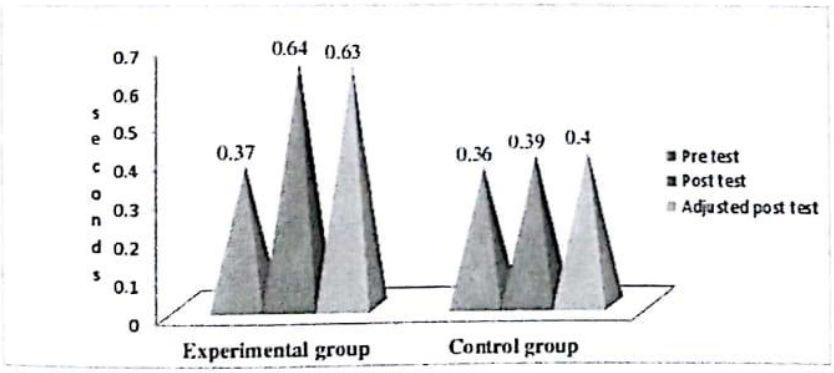


Table 5: Computation of analysis of covariance on balance among experimental groups and control group

Test	Experimental	Control	Source of variance	Sum of square	df	Mean square	Obtained F
Pre test Mean	70.73	70.60	BG	0.13	1	0.13	0.07
Pre test S.D	1.62	1.18	WG	56.53	28	2.10	
Post test Mean	68.27	69.80	BG	17.63	1	17.63	10.89*
Post test S.D	1.39	1.14	WG	45.33	28	1.62	
Adjusted post test Mean	68.22	69.85	BG	19.99	1	19.99	42.07*
			WG	12.83	27	0.48	

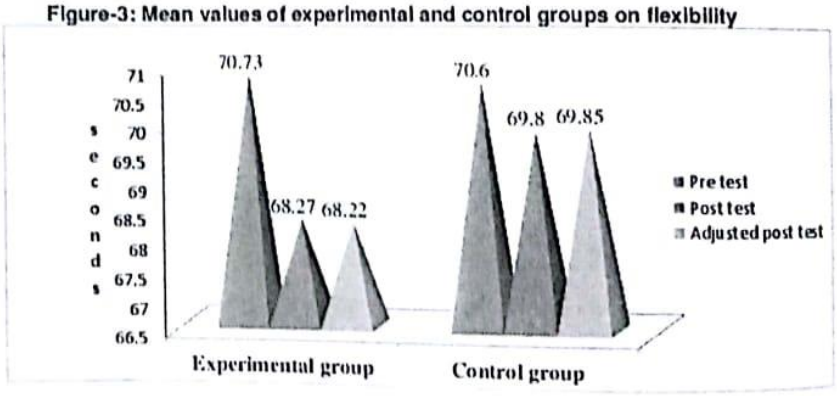
*Significant at 0.05 level

Table value at 0.05 level of significance for 1 & 28 and 1 & 27 degree of freedom = 4.20 and = 4.21

The table-IV shows that the pre-test mean value on resting pulse rate of experimental group and control group are 70.73 and 70.60 respectively. And standard deviation values of experimental and control group are 1.62 and 1.18 respectively. The obtained 'F' ratio of pre test mean is 0.07 which is lesser than the required table value of 4.20for df 1 and 28 at 0.05 level of confidence onresting pulse rate. The post-test mean value on resting pulse rate of experimental group and control group are 68.27 and 69.80 respectively. And standard deviation values of experimental group and control group are 1.39 and 1.14 respectively. The obtained 'F' ratio of post-test mean is 10.89 which are greater than the required table value of 4.20 for df 1 and 27 at 0.05 level of confidence on resting pulse rate. The adjusted post-test mean value on resting pulse rateof experimental group and control group are 68.22 and 69.85 respectively. The obtained 'F' ratio of adjusted post-test mean is 42.07 which is greater than the required table value of for 4.21 df 1 and 27 at 0.05 level of confidence onresting pulse rate.

The result of the study indicates that there was a significant difference among the adjusted post-test means of experimental group and control group on resting pulse rate.

Figure-3: Mean values of experimental and control groups on flexibility



DISCUSSION ON FINDINGS

The result of the study shows that the experimental group that had undergone selected asanas and pranayama practice training and significant improvement on selected physical fitness variables namely flexibility and balance. This may be due to the effect of selected asanas and pranayama practice training.

The result of the study shows that the experimental group that had undergone selected asanas and pranayama practice training and significant improvement on selected physiological variables namely resting pulse rate. This may be due to the effect of selected asanas and pranayama practice training

The results conformity with other studies PallavSengupta (2012), James E. Kennedy (1990), Rajakumar (2010),Bhava Ram (2009), Asha Devi Rana (2007)has also provide in their studies that an improvement did occur physical fitness and physiological variables namely flexibility, balance and resting pulse rate.

CONCLUSIONS: Based on the statistical analysis and the limitation of the study, and results the following conclusions are drawn.

- It was concluded that experimental group significantly improved on physical fitness variables namely flexibility and balance.
- It was concluded that experimental group significantly decreased on physiological variables namely resting pulse rate.

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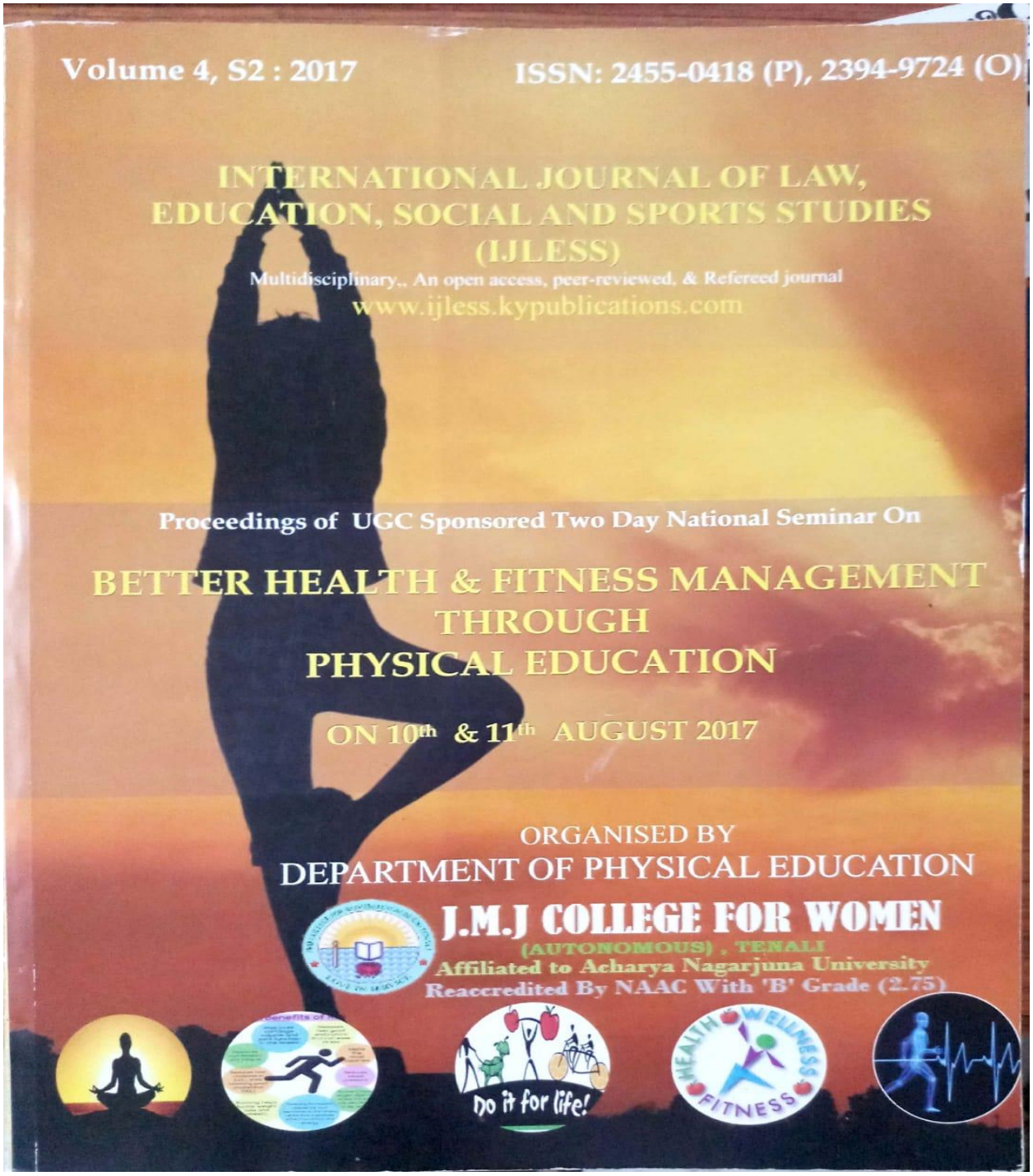
43. **P**ublished a paper titled *"COMBINED EFFECT OFRECREATIONAL GAMES WITH YOGIC PRACTICE ON SELECTED FUNDAMENTAL MOTOR SKILLS OF COLLEGE STUDENTS"* in theNational Seminar Book BETTER HEALTH AND FITNESS MANAGEMENT THROUGH PHYSICAL EDUCATION" With ISSN 2394-9724.



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Multidisciplinary, Peer-Reviewed and Refereed Journal
http://www.ijless.kypublications.com
editorijless@gmail.com
ISSN:2455-0418(P), 2394-9724(E); Vol.4.S2.2017

COMBINED EFFECTS OF RECREATIONAL GAMES WITH YOGIC PRACTICE ON SELECTED FUNDAMENTALMOTOR SKILLS OF COLLEGE STUDENTS

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ABSTRACT
The present study is to findout the combined effects of recreational games with yogic practice on selected fundamental motor skills of school students. 20 subjects were selected from J.M.J College for women Tenali, Guntur, A.P. The subjects were between 18 and 21 years. They were divided into two groups of ten in each. One group was acted as the experimental group and another group was acted as control group. The experimental group underwent the combined training for 6 weeks of 5 days per week. Each training session was for one hour in the evening from 4.00 PM to 5.00 PM. To achieve the result, the collected data on following criterion measures namely fundamental motor skill variables like leap, run, and overhead throw weretested. The standardized tests were taken before and after the combined training. The paired 't' test was applied to analyze the collected data and in all cases the criteria for the statistical significance was set at 0.05 level of confidence.Itis concluded that the recreational games with yogic practice significantly increased the leap, run and overhead of college students.

KEYWORDS:
Recreational games, yogic practice, leap, run and overhead throw.

INTRODUCTION

In the modern world, man is enjoying lots of luxuries provided by the developments in advanced technology. Simultaneously, man is also facing lots of physical, mental, emotional and social disturbances in everyday living. Undoubtedly the latest technological developments have provided all kinds of comforts in all walks of life, at home as well as the work places, in agriculture or industries and so on. They have also reduced dependence of persons on each other, has resulted in increased social, and physiological problems. It has also reduced physical work but introduced the shift system at work places. People working in day and night shift have reduced the family members to strangers. This is causing emotional upheavals. Collectively all these factors affect family life, society and nation adversely in the long run. Further, the technological advancements in every spheres of life have created lots of free, or leisure time after the working hours. Side by side easy availability of recreational gadgets like T.V, cable T.V, Video CD games, computer games have made the human child least interested in physical activity. As a result, in so many physical, mental and emotional problems have cropped up. To counteract these.i.e.to utility the free or leisure time in a constructive way and to make people physically active thereby allowing their growth and development, active recreation activities, other than the passive ones, are a must.

Yoga is one of the most ancient cultural heritages of India. It was invented by Hindu yogis over 2500 years ago. The word yoga means 'unity' or 'oneness' and is derived from the Sanskrit word 'Yug' which means 'to join'. In this sense, it is an exercise in moral and mental cultivation that generates good health (arogya), contributes to longevity (chirayu), and the total intrinsic discipline culminates into positive and perennial happiness and peace. It works on all aspects of the person: the physical, mental, emotional, psychic and

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http://www.ijless.kypublications.com
editorijless@gmail.com
ISSN:2455-0418(P), 2394-9724(E); Vol.4.S2.2017

spiritual. Therefore, yoga is said to be indispensable of the ultimate accomplishment in life. It is a science that affects not only the conscious self but the subconscious as well.

Patanjali's famous definition of yoga is "YogasChittaVirttiNirodhah" which means "yoga is the removal of the fluctuations of the mind". Chitta is mind, Virtti are thought impulses, and nirodhah is removal.

Yoga is a positive way of maintaining physical 'up keep' mental alertness and spiritual attainment. It teaches us how to control one's senses results an integrated personality, freedom, stress, conflict and the like. It stabilizes one behavioural pattern, developed will power and ultimately helps one to lead healthy, happy and balanced life **(Swami Githananda and MeenashiBhavan, 1989).**

Fundamental motor skills are common motor activities with specific observable patterns. Most skills used in sports and movement activities are advanced versions of fundamental motor skills. For example, throwing in softball and cricket, the baseball pitch, javelin throw, tennis serve and netball shoulder pass are all advanced forms of the overhand throw. The presence of all or part of the overhand throw can be detected in the patterns used in these sport specific motor skills. Similar relationships can be detected among other fundamental motor skills and specific sport skills and movements. Children normally develop motor skills in a sequential manner. Fundamental motor skills comprise one level in the continuum of motor skill acquisition. Children at the fundamental motor skill stage are building upon previously learned movements and preparing for the acquisition of more advanced skills.

STATEMENT OF THE PROBLEM

The present study is to find out the combined effects of recreational games with yogic practice on selected fundamental motor skills variables namely leap, run and overhead throwof college students.

DELIMITATIONS

6. This study confined to twenty college grails students from J.M.J College for women Tenali, Guntur, A.P.
7. The subjects were selected only from the age group of 18 to 25 years.
8. The study delimited the fundamental motor skills, namely leap, run and overhead throw.
9. The duration of the experimental period was six weeks.
10. The study is confined the recreational games with yogic practices.

METHODOLOGY

SELECTION OF SUBJECTS

The purpose of the present study is to find out the combined effects of recreational games with yogic practice on selected fundamental motor skills of school students. 20 college women's students were selected randomly from J.M.J College for women Tenali, Guntur, A.P. The age of the subjects ranged from 18 to 21 years. They were divided into two groups of 10 in each. One group acted as the experimental group. The experimental group was undergone the training for 6 weeks.

SELECTION OF VARIABLES

INDEPENDENT VARIABLE

- RECREATIONAL GAMES WITH YOGIC PRACTICE

DEPENDENT VARIABLES

- FUNDAMENTAL MOTOR SKILLS
  1. Leap
  2. Run
  3. Overhead throw

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TABLE – I: SELECTED VARIABLES AND TESTS

S.NO	VARIABLES	TESTS	UNIT UPPERCASE
1.	Leap	Fundamental motor skills Assessment leap test	Score
2.	Run	Fundamental motor skills Assessmentrun test	Score
3.	Overhead throw	Fundamental motor skills Assessment dodge test	Score

EXPERIMENTAL DESIGN

For this study, twenty school students were selected as subjects. They were selected from J.M.J College for women Tenali, Guntur, A.P.. Their age ranged from 18 to 21 years which represented a true random sample group and it was called as experimental group. These subjects were tested to find out their fundamental motor skills variables namely leap, run and overhead throw were tested.

A recreational games with yogic practice training for six weeks was given to the subjects. Their training days and hours every week ranged from Monday to Friday from 4.00pm to 5.00pm. A pre - test was conducted before the commencement of the training the final test data were collected after six weeks.

TRAINING PROGRAMME SIX WEEKS PLAN TRAINING COMPONENTS AND PERCENTAGE OF TRAINING

S.NO	TRAINING	WEEKS					
		1	2	3	4	5	6
1	Warm up	14	12	12	11	10	10
2	Recreational games	36	38	40	41	40	40
3	Yogic practice	36	38	38	39	40	40
4	Warm down	14	12	10	10	10	10
	Total percentage	100	100	100	100	100	100

STATISTICAL TECHNIQUES

't' ratio was calculated to findout the significance difference between the mean of pre and post test of the each group.

TABLE-II: TABLE SHOWING THE MEAN DIFFERENCE STANDARD DEVIATION AND 't' VALUE OF EXPERIMENTAL AND CONTROL GROUPS IN LEAP

Group	Mean	Md	Std.deviation	Std.error of the mean	't'	Table value
Experimental pre-test	13.70	6.50	1.49	0.47	29.06*	2.26
Experimental post test	20.20		1.35	0.35		
Control pre test	12.60	0.70	0.96	0.30	2.09	2.26
Control post test	13.30		1.25	0.39		

*significance at 0.05 level of confidence

To find out the significant difference between pre test and post testonleap 't' ratio was employed and the level of significance was set at 0.05. The experimental group on leappre test value was 13.70 and post test value was 20.20 respectively. The mean difference value was 6.50 and leapobtained 't' ratio 29.06 was greater than the table value 2.26. So it was to be significant. The control group on leappre test value was 12.60 and

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ISSN:2455-0418(P), 2394-9724(E); Vol.4.S2.2017

post test value was 13.30 respectively. The mean difference value was 0.70 and leapobtained't' ratio was 2.09 and is lesser than table value of 2.26. So it is found to be insignificant.

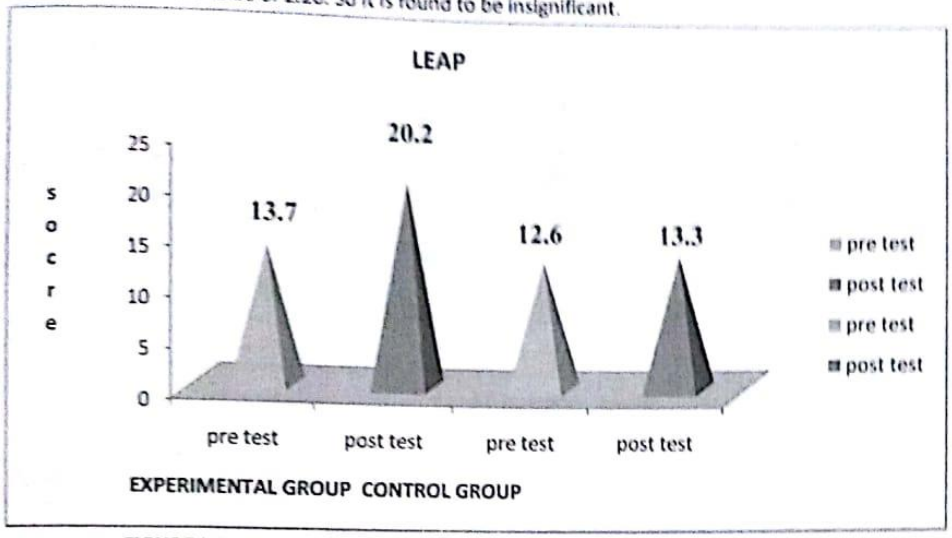

FIGURE-I: BAR DIAGRAM SHOWING THE PRE AND POST TEST MEAN VALUE OF EXPERIMENTAL GROUP ANDCONTROL GROUP OF LEAP.

TABLE-III: TABLE SHOWING THE MEAN DIFFERENCE STANDARD DEVIATION AND 't' VALUE OF EXPERIMENTAL AND CONTROL GROUPS IN RUN

Group	Mean	Md	Std.deviation	Std.error of the mean	't'	Table value
Experimental pre-test	12.60	7.20	1.64	0.52	54.00	2.26
Experimental post test	19.80		1.61	0.51		
Control pre test	12.20	0.20	0.63	0.20	0.80	2.26
Control post test	12.40		1.07	0.33		

***significance at 0.05 level of confidence**

To find out the significant difference between pre test and post testonrun 't' ratio was employed and the level of significance was set at 0.05. The experimental group on run pre test value was 12.60 and post test value was 19.80 respectively. The mean difference value was 7.20 andrunobtained 't' ratio 54.00 was greater than the table value 2.26. So it was to be significant. The control group on run pre test value was 12.20 and post test value was 12.40 respectively. The mean difference value was 0.20 and runobtained't' ratio was 0.80 and is lesser than table value of 2.26. So it is found to be insignificant.

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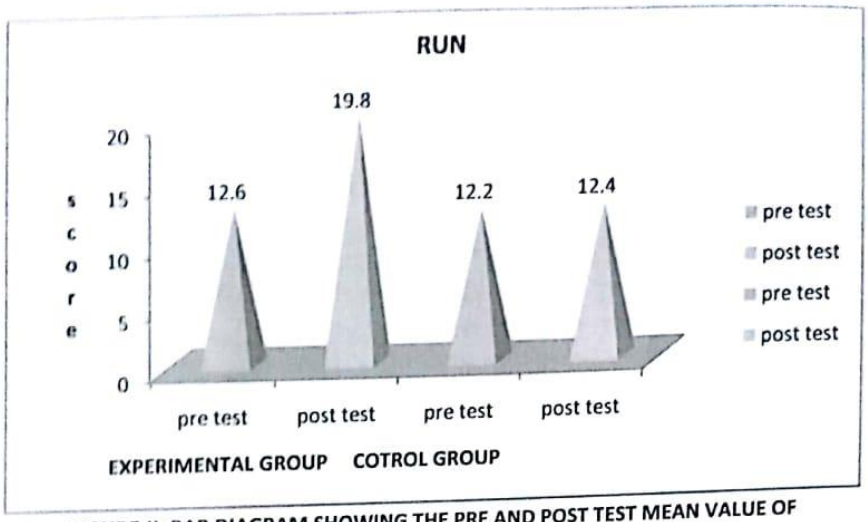

FIGURE-II: BAR DIAGRAM SHOWING THE PRE AND POST TEST MEAN VALUE OF EXPERIMENTAL GROUP ANDCONTROL GROUP OF RUN.

TABLE-III: TABLE SHOWING THE MEAN DIFFERENCE STANDARD DEVIATION AND 't' VALUE OF EXPERIMENTAL AND CONTROL GROUPS IN OVERHEAD THROW

Group	Mean	Md	Std.deviation	Std.error of the mean	't'	Table value
Experimental pre-test	11.90	7.80	0.99	0.31	58.50	2.26
Experimental post test	19.70		1.15	0.36		
Control pre test	12.00	0.20	0.81	0.25	0.80	2.26
Control post test	12.20		1.13	0.36		

***significance at 0.05 level of confidence**

To find out the significant difference between pre test and post testonoverheadthrow 't' ratio was employed and the level of significance was set at 0.05. The experimental group on overhead throwpre test value was 11.90 and post test value was 19.70 respectively. The mean difference value was 7.80 and overhead throwobtained 't' ratio 58.50 was greater than the table value 2.26. So it was to be significant. The control group on overhead throwpre test value was 12.00 and post test value was 12.20 respectively. The mean difference value was 0.20 and overhead throwobtained't' ratio was 0.80 and is lesser than table value of 2.26. So it is found to be insignificant.

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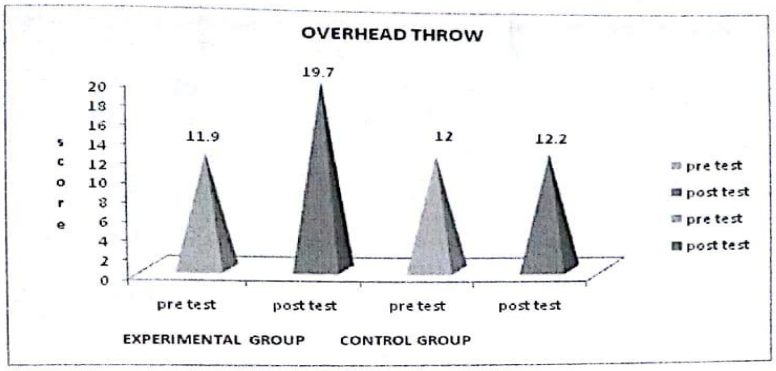

FIGURE-III: BAR DIAGRAM SHOWING THE PRE AND POST TEST MEAN VALUE OF EXPERIMENTAL GROUP ANDCONTROL GROUP OF OVERHEAD THROW

DISCUSSION ON FINDINGS

The result of the study shows that the recreational games with yogic practice group had significant improvement on selected fundamental motor skills namely leap, run and overhead throw. This may be due to the combined effect of recreational games with yogic practice

The results conformity with other studies Outle.,etal(2011), Stern HP., et al (2009), Rajakumar (2010),Pratima., et al (2008), Hardy., et al (2013), Patterson., et al (2001) has also provide in their studies that an improvement did occur fundamental motor skills namely leap, run and overhead throw.

CONCLUSIONS

Based on the statistical analysis and results of the study, the following conclusions are drawn.

- It is concluded that recreational games with yogic practice significantly improved the fundamental motor skills namely leap, run, overhead throw.

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