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International Conference on Science, Engineering & Technological Innovations

(13 – 14 August, 2022)

Bangkok, Thailand

Conference Special Issue - 37 August - 2022

Jointly Organized by:

Scientific Research Association
Unicaf University, Zambia
Institute of Educational Technology, Eurasian University
&
Research Culture Society

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International Conference on Science, Engineering & Technological Innovations

Date: 13 – 14 August, 2022

Bangkok, Thailand

Conference Special Issue - 37

Managing Editor
Dr. C. M. Patel
(IJIRMF - Research Culture Society and Publication)

Associate Editors
Dr.(hc) Rania Lampou
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Scientific Research Association
Chreso University (CU) Zambia
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Institute of Science and Technology (EU) ; Institute of Science & Technology is a self financed institute, sponsored has been started in the year 2011 with a noble aim of imparting technical education. The institution enables them to be placed as the best professionals in industries and make them enter into high level programs with competence and confidence. Institute trains specialists in Physical Science, Life Science and Computer Science,

Eurasian University is one of the largest education institutions of the central region of EU, for qualified personnel training in science, management and technological specializations. Scientific subjects performed by the university aimed to increasing the efficiency of production and control processes, power saving and environmental protection.

Chreso University (CU), a faith based University founded by Dr. Helmut Reutter and Mrs. Esther Reutter, under the umbrella vision for Chreso Ministries, was officially established in the year 2010 under the Universities Act No. 26 of 1992. And in 2016, the University was duly registered with the Zambia Higher Education Authority under the Higher Education Act No. 4 of 2013. Chreso University operates three (03) University campuses namely: City campus (RC No. HEA 022); Makeni campus (RC No. HEA 084) and Ndola campus (RC No. 077) at Zambia, Southern Africa.

'Research Culture Society' is a Government Registered International Scientific Research organization. Society is working for research community at National and International level to impart quality and non-profitable services. Society has successfully organized 100+ conferences, seminars, symposiums and other educational programmes at national and international level in association with different educational institutions.

'Scientific Research Association' (Scientific Research Organization) is an esteemed research organization working on to promote scientific research studies, activities at international level, also coordinate with other research organizations for the educational research events.

Objective of the International Conference:

- Our main objective is to promote scientific and educational activities towards the advancement of common citizens' life by improving the theory and practice of various disciplines of science and engineering.
- To meet and discuss the practical solutions, scientific results and methods in solving various problems with people who are actively involved in emerging research fields.
- To organize lectures by scientists and experts and to disseminate their ideas and concepts among the science and technology community.
- Provide the delegates to share their new ideas and the application experiences face to face.
- The aim of the conference is to provide platform to students, scholars, academicians and industry persons to converse and share the ideas.

About the Conference :

International Conference on Science, Engineering & Technological Innovations (ICSETI-2020) conducted on 13 – 14 August, 2022 at Divalux Resort and Spa in Bangkok, Thailand. It aims at bringing together students, scholars, researchers, academicians and industry persons to deliberate on contemporary issues concern to Science, Engineering and Technology research and applications.

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About the Book:

Science, Engineering and Technology cross nearly every facet of modern life and, as problem solvers, engineers are perfectly capable of managing technical activities, mastering innovative ways of science and engineering field, when they spend time and efforts understanding and acting in the field. Scientific and technological innovation, as strategic support to improve social productivity and overall national strength, must be placed at the center for development of any country.

The framework includes engineering and technology as they relate to applications of science. Engineering is used to mean engagement in a systematic design practice to achieve solutions to particular human problems. Technology is used to include all types of human-made systems and processes.

The edited book is a collection of peer-reviewed scientific papers submitted by active researchers in the International Conference on Science, Engineering & Technological Innovation. This book can be helpful to understand the various concepts of Science and Technological Innovation to the researchers and academia.

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Dear Colleagues, Ladies and Gentlemen!!!

I am glad to be one of the members of the Organization Committee of two days Conference entitled, "International Conference on Science, Engineering & Technological Innovations" jointly organized by 'Scientific Research Association', 'Research Culture Society' and 'Chreso University, Zambia' dated on 13-14 August, 2022 in Bangkok, Thailand.

The world we live in today requires constant adjustments to the many challenges that our communities as well as our planet faces in this critical times. It is only through diligent and continuous research that we will be able to find better ways to deal with all the questions that confront us in this urgent manner.

Academic communities have no choice but put their heads together in collaboration making all the required efforts in order to find intelligent alternatives to the way we are doing business today. I'm therefore greatly encouraged to see such a great community of researchers come together for this Conference.

This conference will facilitate the formulation of the novel research ideas for innovations in the field of science and technology. Currently the same collaborative conferences are really helpful to display African talents in research and innovation efforts and outputs. Special thanks to Research Cultural Society for arranging this type of jointly Scientific Research Conferences.

Best wishes for the ample success of this conference.

Thank you!!!

Rev. Dr. Helmut Reutter

Chancellor, Chreso University, Zambia, Southern Africa.

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Dear Colleagues!!!

I am delighted and excited to be part of the Organization Committee of two days Conference entitled, "International Conference on Science, Engineering & Technological Innovations" jointly organized by 'Scientific Research Association', 'Research Culture Society', 'Eurasian University' and 'Chreso University, Zambia' dated on 13 & 14 August, 2022 in Bangkok, Thailand.

This international forum will allow the participants and academicians to reveal their endeavors, extend professional networks and jointly ascertain the existing and upcoming research instructions/guidelines and innovations at international level. I believe that all the presentations in this research conference will bring interesting topics with fruitful discussions. It is really helpful to Chreso University to showcase our students/scholars research outputs and grow in research and innovation through this platform.

I honestly hope that this conference will consider and discuss all the facts, issues, challenges, advanced development and updation in the specified topic globally and come up with solutions and recommendations that will contribute significantly to a healthier world.

My hearty wishes and regards for the great success of this conference.

Thank you!!!

Professor. Christopher Simoonga
Vice Chancellor, Chreso University, Zambia, Southern Africa.

Dr.C. M. Patel

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Message

Dear Professional Colleagues,

It is gratifying to note that 'Scientific Research Association'; Chreso University (CU) Zambia; Institute of Science and Technology, Eurasian University in collaboration with 'Research Culture Society' (Government Registered Scientific Research organization) are organizing - 'International Conference on Science, Engineering & Technological Innovations' at Bangkok during 13 – 14 August, 2022.

The aim of the conference is to provide an interaction stage to researchers, practitioners from academia and industries. The main objective is to promote scientific and educational activities towards the advancement of common citizen's life by improving the theory and practice of various disciplines of science and engineering. Provide the delegates to share their new research ideas and the application experiences face to face.

I believe, this International Conference will help in redefining the strong connection between students and academicians from different institutions. An additional goal of this international conference is to combine interests and scientific research related to General Science, Physical Science, Applied Sciences, Engineering and Technology Development to interact with members within and outside their own disciplines and to bring people closer for the benefit of the scientific community worldwide.

My best wishes to the committee members, speakers and participants of this scientific conference ICSETI-2022.

Dr.C. M. Patel

Director, Research Culture Society.

Dr.Jessica C.
Founder President, Scientific Research Association.
Email : scientificresearchassociation@gmail.com

Message

Dear Colleagues !

I am grateful to co-organizing institutions, all the speakers, committee members and presenters of 'International Conference on Science, Engineering & Technological Innovations' (ICSETI-2022) The overwhelming response to the contributors were acknowledged in very positive manner and its shows that new age is very much eager to work with technical literature. The rising researcher and scholar from various institutions and in-house participants motivate us to improve ourselves.

We are currently in the era of science and engineering revolution, spearheaded by recent developments in engineering, technology and sciences, providing sustainable solutions to various issues.

Here I am delighted that the series of conference on contemporary issues in computer technology has successfully completed its three folds and entered into fourth one, it's all due to the valuable efforts of faculty members of computer science and engineering department.

I extend my best wishes for the editorial team of the special issue, at last I hope this technological literature interaction will be a source of inspiration to upcoming educationists, technocrats and stakeholders.

Jessica

ICSETI - 2022 Conference Chair
Founder, Scientific Research Association

Prof. Maria Eropenko
Head, Institute of Science and Technology
EURASIAN UNIVERSITY
Email : ist@eurasianuniversity.uk

MESSAGE

Dear Colleagues!!!

I am proud to be the part of Organizational Committee of "International Conference on Science, Engineering & Technological Innovations - 2022", jointly organized by 'Scientific Research Association'; Chreso University (CU) Zambia; and Institute of Science and Technology, Eurasian University in collaboration with 'Research Culture Society' (13-14 Aug, 2022).

We have an exciting program at this conference that will allow participants to reflect upon and celebrate their accomplishments, renew friendships and extend networks, and jointly explore current and future research directions. I hope that all participants will have a productive and fun-filled time at this online conference.

I sincerely hope that this conference will deliberate and discuss all the different facets of this exciting topic and come up with recommendations that will lead to a better world.

I wish the conference great success.

Maria Eropenko
Head, Institute of Science and Technology,
Eurasian University

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Conference Photo Gallery

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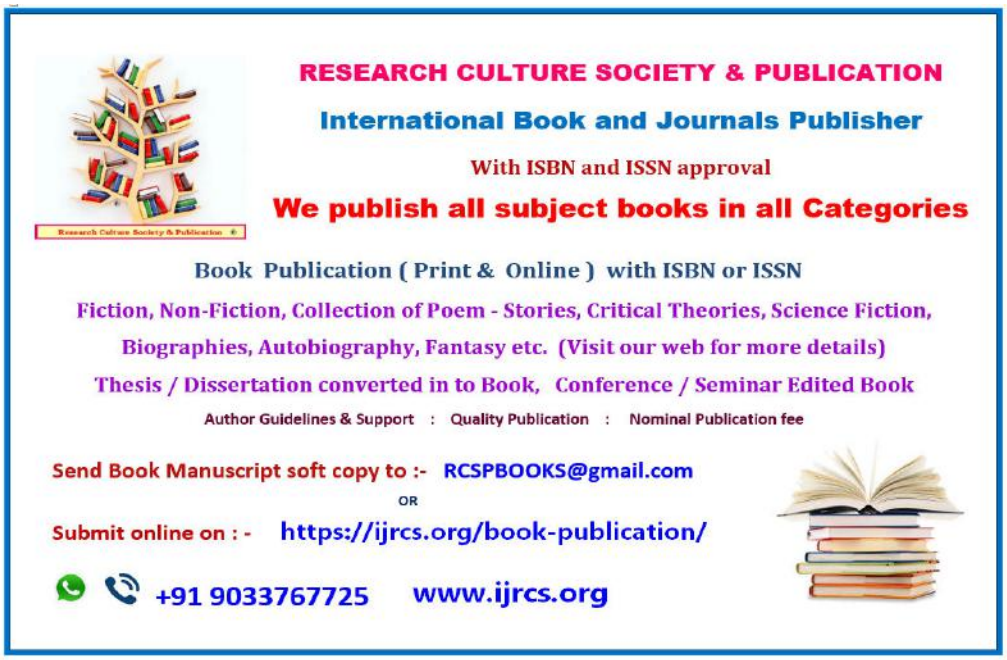

TABLE OF CONTENTS

INTERNATIONAL JOURNAL FOR INNOVATIVE RESEARCH IN MULTIDISCIPLINARY FIELD
ISSN: 2455-0620 [Impact Factor: 6.719]
Monthly, Peer-Reviewed, Refereed, Indexed Journal with IC Value : 86.87
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Challenges and sustainability in Food Engineering

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Abstract: *Food is vital for good societal health and sustenance. Over the years a vast amount of research has been undertaken pertaining to the design, operation and construction of food processing technologies. This has highlighted numerous sustainability challenges within the food system affecting the environment in addition to social and economic factors. This study aims to identify contemporary challenges pertaining to food engineering. There is an objective to recommend sustainable solutions to facilitate current and future generations through past learnings. A systematic literature review was carried out. Results have identified reliance on the following; raw materials, water and energy. Challenges pertaining to the following have been discussed: food safety and security, food wastage and food packing. Innovation gaps in technology validation are identified and the need to implement practical solutions creating a sustainable impact on future generations. The need for generating awareness and acceptance of viable solutions is important. Simultaneously, there is a requirement to create an interest amongst scalable markets to ensure future sustainability in food engineering to help global societies.*

Key Words: *Food engineering, Food Safety, Food Wastage, Sustainability.*

INTRODUCTION :

Food is vital for good societal health and sustenance. It is a crucial part of human survival within this world; thus, food production industries and their sustainability have an important role to maintain within society. Within contemporary life we are encountering many challenges relating to food production that stems from population growth, food quality and climate change (Garnett, 2013). Currently, the global population is over seven billion, however it is estimated that by 2050 the global population is expected to exceed nine billion, which will result in a requirement for 70% more food. As a result, there is an urgent need to create food safety and security to improve food chain efficiency and effectiveness (King, et al., 2017). Over the years a vast amount of research has been undertaken pertaining to the design, operation and construction of food processing technologies. This has highlighted numerous sustainability challenges within the food system affecting the environment in addition to social and economic factors.

OBJECTIVES :

This study aims to identify contemporary challenges pertaining to food engineering. There is an objective to recommend sustainable solutions to facilitate current and future generations through past learnings.

METHODOLOGY :

This study is carried out via a systematic review of literature sources, using published and grey literature sources. A well-planned method has been implemented to search, identify, extract and evaluate literature found from manual and electronic databases. The following search engines were used Google Scholar PubMed, JSTOR, Scopus, books, and magazines. The following keywords have been used within the initial search: 'food engineering' 'food sustainability' 'challenges' 'food engineering'. Numerous literature sources are identified therefore the following exclusion criteria is devised:

- Literature irrelevant to food engineering are excluded
- Literature focusing entirely on historical food engineering are not included
- Literature using languages other than English are ignore
- Literature with information duplicated in newer literature sources are not used
- Literature with insufficient technical information to their approach are excluded

A total of twenty papers are shortlisted to aid focus to this study. Upon closely examining the papers, three were duplicated therefore not used and after reading the abstracts and introductions three was eliminated. This has equated to fourteen studies. Another two literature sources were eliminated due to implementation details. Thus, twelve literature sources have reached the overall criteria and have been included within this study.

Results and Discussion :

Results have identified reliance on raw materials, water and energy. Challenges pertaining to the following have been discussed: food safety and security, food wastage and food packing.

Food safety and security

Food safety and security has great health implications for human beings and the animal kingdom. It is essential in every step of the food chain from farming strategies to production, the processes, packaging, transportation and also the final consumption of food (Lang & Barling, 2012). It is imperative to have the highest risk assessment and safety analysis measures in place. These can now be conducted through using elaborate technologies that at the forefront of technological advancements. They can include microfluidics, sensors and other bio sensing technologies which enable detection and management of food toxins, pathogens and nutrients (Dong, et al., 2015). Individuals with low income can suffer malnutrition and starvation resulting in food insecurities. This can constitute to dire public health threats on social and political sustainability.

The recent covid-19 pandemic has created further fragilities within the food systems and highlighted societal inequalities. This has resulted in food insecurity, world hunger and child malnutrition in addition to s growing concern in weight gain and obesity (WHO, 2022). The current record increase in the price of food has contributed towards a global crisis that has contributed towards heightened poverty, malnutrition and hunger. The war between Ukraine and Russia has caused a disruption in food supply chains and an economic downturn challenging food safety and security (TWB, 2022).

Food wastage

More than one third of the food produced is lost or wasted along the production chain (Lipinski, et al., 2013). This is approximately 24% of the total energy content of food that is produced. A reduction in the amount of food wastage or loss will be able to feed an additional one billion people. Food losses can occur before harvest because of processing problems which include handling, packing, transportation and retail sometimes it is as a result of infrastructure, of legal frameworks that constitute to a longer duration resulting in foods rotting. Fortunately, there are now intelligent packaging sensors

that can reduce food wastage through using time temperature indicators, and radio frequency identification, this can ensure freshness and food packaging integrity (Poyatos-Racinero, Ros-Lis, Vivancos, & Martinez, 2018).

Food packing

Intelligent food packaging technologies have been developed which implement sustainable safety and preserve quality of foods. The use of real time monitoring packaging processes has improved to extend food shelf life so that consumers and manufacturer demands can be met (Sousa-Gallagher, Tank, & Sousa, 2016). Fortunately, nanotechnology has been used using nanomaterials and robotic technologies in order to ensure food safety and quality, whilst reducing ecological footprint (Rossi, et al., 2017). The necessary protector from oxygen and moisture, spoilage and storage instructions have been considered. There is a dominant usage of titanium dioxide in food preservation as a food additive because it is believed to be nontoxic to human beings. However, further research in this area needs to be conducted in relation to human absorption, digestion, and long-term effects of titanium dioxide.

CONCLUSION :

Innovation gaps in technology validation are identified and the need to implement practical solutions creating a sustainable impact on future generations. There have been recommendations made for consumers to eat more plant based foods and reduce animal source foods as this is better for their health (Somani, 2020) and the environment (Willett, et al., 2019). Investment companies need to take risks on innovative research study ideas, by bridging the innovation gap, and seeking to implement practical solutions to create a sustainable impact, on future generations. This can only occur when users accept sustainable, innovative food processes. This can be achieved through more marketing, creating awareness of solutions, which will generate an interest from scalable markets. Governing bodies should repurpose resources used in supporting food producers and consumers. It will incentivise sustainable production, facilitate the supply of nutritious foods that will promote healthy deities making it more affordable. Necessary action must take place now to save future generations. There is a need for generating awareness and acceptance of viable solutions is important. Carefully devised policies should be implemented to facilitate shifts in consumer behaviour and provide vulnerable populations with the safety to safeguard them against consequences of new reforms. It should include the impact on the environment, health implications, energy, and transport. Simultaneously, there is a requirement to create an interest amongst scalable markets to ensure future sustainability in food engineering to help global societies.

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Establishing Mental Health Service Utilisation for Depression and Substance Use Disorder by Young People in Institutions of Higher Learning in Zambia

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Abstract : *College and university students represent an important population in which the need to study their access to and use of mental health services (MHS) remains imperative. The utilisation of services for depression and substance use disorder (SUDs) in institutions of higher learning (IHL) are guided by the accessibility of appropriate services and young people's mental health knowledge and perception of the need for the services.*

The purpose of this article was to establish MHS utilisation for depression and SUDs by young people in IHL in the Lusaka and Kabwe districts of Zambia in order to enhance their well-being and quality of life. A sequential explanatory mixed methods design was used in the four-phased study. The study involved a review of hospital records, a self-administered questionnaire, focus group discussions and one-to-one in-depth interviews. Descriptive and inferential analysis was done for quantitative data while qualitative data had thematic analysis.

Results revealed 90.5% of attendances at the selected health facilities were for SUDs, 9.5% for depression and 0.5% were co-occurring disorders. An overall 4.8% utilisation rate was found of among young people in the general population. However, low levels of utilisation of in-campus psychological counselling 40% (n=160) and health services 24.7% (n=98.8) by young people were observed. In addition, two significant associations were found at p<.05; use of psychological counselling services with knowledge of mental health problems (p=.01) and perceived need for care (p=.02). An explanation for this finding was that self-stigma, cultural beliefs, and lack of confidentiality in the services offered young people's limited utilisation of services.

Young people desired awareness of mental health issues, non-stigmatising, and non-prejudiced youth-friendly in-campus services. The study recommends awareness creation that promotes early identification of depression and SUDs and improvements in access to health services.

Keywords*: MHS, utilisation, depression, SUDs, young people, IHL*

INTRODUCTION :

Mental, Neurological and Substance use disorders (SUDs) affect the ability to think, feel and communicate (Bantjes, et al. 2020; Bradshaw, et al. 2014). Therefore, student's access and use of mental health services need to be studied due to academic stress and the setting itself causing depression and SUDs (Giamos et al. 2017). Aside from this, young people face multiple stressors that range from academic overload, constant pressure to succeed, competition with peers, adjustments to perceived independence, financial burden, and concerns about their future (Tavolacci et al. 2013). Depression is a mental disorder that is characterised by sadness, low energy, and loss of interest in previously

pleasurable activities. It also causes loss or increases appetite, and sleep, and the person experiencing this may have thoughts of suicide among other symptoms (American Psychiatric Association [APA], 2013; World Health Organisation [WHO], 2011). Further, SUDs are mental disorder resulting from use of substances such as alcohol, cannabis, heroin, cocaine, tobacco, and misuse prescribed ones (promethazine, codeine, chlorphenamine, diazepam and benzhexol). These substances disturb the thinking, behaviour, and perception of users that they suffer from substance dependence, can experience intoxication, withdrawal, and induced mental disorders (APA, 2013; WHO, 2011).

When these disorders occur in young people (students), depression and SUDs have the potential to disturb learning ability, academic performance and adjustment to higher education that gives rise to compromised self-perception (Humensky et al. 2010; Jung, von Sternberg & Davis, 2017). This negative self-perception affects their concentration to complete assigned tasks that impact on their progression. Earlier studies indicate that 75% of young people present with mental disorders at the age of 18 to 24 years (Kessler, 2005), the period of entry to institutions of higher learning (IHL). This critical stage of development predisposes young people to depression and SUDs since their emotional, psychological, and physical entities are affected by growth (Barkar, Torregrossa & Taylor, 2013; Menon, Kusanthan & Mwaba, 2016).

Consequently, social, and economic issues arise such as poor relationships and financial constraints that affect the quality of life and bring about low self-esteem limiting young peoples' educational opportunities and productivity (Fleury et al. 2014; Devkota et al. 2021). Other risk factors include bullying by peers over behaviour and mental health problems which compound the young people's poor academic performance and non-completion of their studies (Sakala et al. 2019; Siziya, Rudatsikira, & Muula, 2011). In addition, the sense of belonging to a group also worsens the situation depending on the type of members the young person associates with (Drug Watch, 2014). According to The Insight Network, 10% of students develop mental health problems in IHL while 75% are with a previous diagnosis (2020). It is well noted that about 60% of the Zambian population consist young people (CSO, 2014). Anecdotal data from a cursory survey conducted in one year at a IHL not included in the study revealed eight students had depression while five were found with SUDs. In addition, hospital records show an average of 46% of outpatient attendances are SUDs while 5% account for depression in 2016-2017 (Ministry of Health, 2019). However, the treatment gap remains at 20% in young people with mental disorders (Baingana, 2014). The lack of awareness on available services has been implicated in young people not using of health services for depression and SUDs (Devkota et al. 2021; Klepac Pogrmilovic et al. 2021; Barry et al. 2019). Utilisation in this study means use of counselling centres, health facilities or being referred for further management for depression or SUDs.

Research evidence show that mental health services (MHS) use by young people (students) aged 18 to 24 years in Zambia is scanty. Consequently, a research gap was noted on mental health services utilisation by young people aged 18-24 years in IHL in Zambia that suggested a study to be undertaken. The question therefore was to what extent do young people utilise MHS for depression and SUDs in selected IHL in Lusaka and Kabwe districts in Zambia? This study contributes new knowledge which adds to closing the knowledge gap on utilisation of MHS by young people in IHL. The study, therefore. aimed to establish mental health service utilisation for depression and substance use disorders by young people in IHL in Zambia with the eventual aim of improving their wellbeing and quality of life
The study has the following four-fold specific objectives:

1. To determine the incidence of depression and SUDs among young people in two selected health facilities of Lusaka and Kabwe districts in Zambia
2. To ascertain the factors associated with utilisation of MHS for depression and SUDs by young people in selected IHL in Lusaka and Kabwe districts of Zambia
3. To explore the young people's opinions on MHS for depression and SUDs in selected IHL in Lusaka and Kabwe districts of Zambia

4. To examine the stakeholders' views on young people's utilisation of available health services for depression and SUDs at the selected IHL in Lusaka and Kabwe districts of Zambia

LITERATURE REVIEW :

Young people are described as aged 15-26 (United Nations, 2014), and 15-35 according to the Republic of Zambia Constitution (2017), yet this study defined them as those aged 18 to 24 years old. Propositions are that most of the mental disorders observed in adulthood could be traced back to childhood and the knowledge that it takes up first 18 to 24 years for personality to be developed (Santrock, 2006; Shaffer and Kipp, 2014; Steinberg, 2014). According to the World Health Organisation (2017) and Radez et al. (2021), there are biological, psychological, and sociological interplay in emergence of mental disorders. These are discussed as biopsychosocial because of the stage in life the targeted population are in (Engel,1988). This is from the background that young people are predisposed to mental illness from the family or individual bodily characteristics genes, brain chemistry and injury to the brain through trauma or infections. In some individual's biological factors alone increase the risk for depression or SUDs. The psychological factor includes self-blame, negative thoughts, peer pressure and psychological trauma. These could be detrimental to a young person who during this period has a need for a sense of belonging to a group. In addition, lack of support, living in poverty, poor parenting and cultural beliefs have a toll on an individual.

To this end, the theories used in utilisation are discussed. The three (3) theories used in the utilisation of services such as Andersen's behavioural model of health care use (Andersen, 1995), the health belief model (Rosenstock, 1988) and the Help-seeking behaviour model (Mechanics, 1978) influenced this study. It was apparent that the complexity of utilisation required all three models to sufficiently account for the factors involved. The predisposing factor in a young person includes both intrinsic and extrinsic factors. The need factors such as perceived and evaluated, perceived need occurs when an individual is aware of the problem while evaluated need one takes a step to seek help and is made aware of the problem after an evaluation. Further, the perceived benefit motivates the individual to seek help because of what one feels could be helped to resolve the problem.

Nevertheless, life in IHL is a conduit of mental distress because of the academic stress as earlier mentioned (Giamos et al. 2017). There is evidence of 10-20% young people developing mental illness and use of substances is associated poor performance with mental distress (WHO, 2017; Clark et al. 2018; Tembo, Burns & Kalembo, 2017). Worse still, depression and SUDs affect their participation in learning and progression. According to Humphrey, Bliuc and Molenberghs (2019) and the Royal College of Psychiatrists (2011) when young people are away from home mental health problems arise because they lack family support. Motivation to use perceived need due to severity of symptoms, knowledge of the mental health problem, availability of the service, trust in health personnel, support of family or friends, and positive previous experience (Sun et al. 2018). However, there are several themes on barriers to the use of services comprise perceived stigma, poor mental health literacy, fear, labelling, inadequately trained staff, the attitude of staff, cost of service, waiting lists, family rejection and lack of services (Ali & Agyapong, 2016; MacDonald, Fainman-Adelman, et al. 2018; Sarikhani et al. 2021).

The gender variations in the presentation of disorders and seeking help at facilities for help indicate that females were prone to depression and males SUDs (Lynch, Long, & Moorhead, 2018). The help-seeking process differs in the sense that females easily seek help than males. Still, the utilisation of services are guided by the availability of appropriate service and young people's perception of their need for the services (Bantjes, 2020), and a relationship exists between mental health literacy, help-seeking intentions, and wellbeing (Ratnayake & Hyde, 2019). According to Eaton and Ryan (2017), the policies toward health and well-being for young people in IHL influence the utilisation of services on campus. In view of this, the utilisation of services by young people is affected by structural barriers, legislation, and policy frameworks (Lubaman, et al. 2016). Structure barriers incorporate awkward appointment and consultation times, non-availability of the service as close to the campus as possible,

inadequate trained healthcare workers and the lack of youth-friendly facilities and attitudinal barriers such as stigma (self and public), lack of trust and confidentiality.

METHODOLOGY :

To better understand mental health service utilisation, a sequential explanatory mixed methods design was used in a four-phased study that started with quantitative research followed by a qualitative process (Creswell, 2013; Creswell, & Creswell, 2018). Morgan (2014) described a pragmatic approach as employing both quantitative and qualitative philosophical and methodological assumptions in one study. Eleven (11) study sites were involved in the study comprising two (2) purposively selected health facilities and nine (9) randomly selected IHL from the Higher Education Authority (2019) register of which four (4) were public and five (5) were private in Lusaka and Kabwe districts of Zambia. The study population were young people aged 18-24 and other than the first years, however, key informants were also involved.

Methods and materials:

In the first phase of the study 56,457 hospital records for the years of understudy, 2014-2015 and 2020-2021 were reviewed from two selected health facilities using a checklist out of which 2731 were included in the study. Hospital records were purposively selected. The review was conducted to determine the incidence of depression and SUDs among young people aged 18 to 24 in the general population utilising services at the health facilities. This data baseline was elicited using a checklist that ensured age 18 to 24, gender both male and female, years based on the target and diagnoses of depression and SUDs met the data required for the study. Additionally, in the second phase, a 112-item self-administered questionnaire with Cronbach alpha 0.89 was administered to 400 (97%) out of 412 randomly selected participants aged 18 to 24 years from the nine participating IHL. These were selected randomly from those eligible to participate in the study at the respective sites. The questionnaire had items on knowledge of depression and SUDs; attitude towards the use of mental health services and use services and help-seeking behaviour in the past year. Further, eight (8) items were on self-assessment for depression and SUDs. Phase three involved 18 participants who were purposively selected after having first responded to a self-administered questionnaire and partook in three focus group discussions (FGDs) that used a topic guide (Creswell, 2013). The topic guide helped to explore the young people's opinions on mental health services in the IHL. Additionally, phase four included one-to-one in-depth interviews with nine purposively selected key informants from the nine participating IHLs. Another topic guide was used in this process that explored the key informants' understanding of depression and SUDs, their experience with students that presented with the disorders and the availability of services for the problems encountered. They were also given an opportunity to suggest the services to be available for the young people.

The Data were analysed using Microsoft Excel, and SPSS 27 for quantitative. Descriptive analysis was done with hospital records to determine the utilisations of services while descriptive statistics, and correlation co-efficiencies (Brink, 2018). Chi-square with confidence interval was set at p=.05 as the confidence level for the questionnaire responses. NVivo 12 was used for to perform thematic analysis for qualitative data (Bryman, 2012). Ethical approvals were sought from Chreso University Research Ethics Committee (CUREC NO.054-06-2020); and National Health Research Authority (NHRA 00015/15/10/2020), while participating health facilities, IHL permitted the study. Participants who were 18 years and above consented before participating in the study.

Analysis and Results

Phase 1: to determine the incidence of depression and SUDs among young people utilising MHS in two selected health facilities in the Lusaka and Kabwe districts

The overall data from the selected health facilities for the four-year period under study (2014 to 2015 and 2020 to 2021) revealed that the utilisation rate of services by young people in the general population was at 4.8% as shown in figure 1. However, when separated for the years 2014-2015 there was 1.6%

while 2020-2021was at 3-8%. Out of the 2,731 files included in the study, 90.5% of utilisations were for substance use disorder (SUD) while 9.5% had depression and less than one per cent (0.5%, n=15) had co-occurring disorders at the two facilities. More males were attended to for substance use disorder.

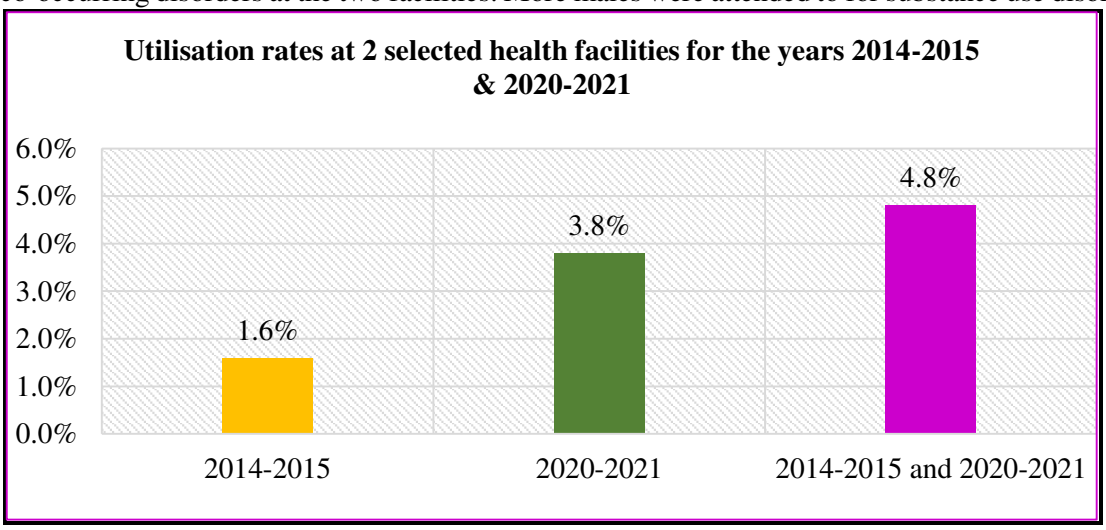

Figure 1: Utilisation rates at 2 selected health facilities for the years 2014-2015 & 2020-2021 (Fieldwork 2022)

Phase 2: to ascertain factors associated with utilisation of MHS for depression and SUDs by young people in selected IHL of Lusaka and Kabwe districts

Slightly more than half (51.5%) of the participants were female. Most of the participants (55.3%) were knowledgeable of depression and SUDs. However, low levels of utilisation of psychological counselling (40%) and health services (24.7%) were noted as shown in Figure 2. Two significant associations were found at $p<0.05$; knowledge of mental health problems was significantly associated with the use of psychological services ($x^2=31.103$, df=16, $p<.05$) and perceived need for care and use of psychological counselling ($x^2=29.807$, df=16, $p<.05$). Further, no significant associations of mental health services use with non-stigmatising service and knowledge of the availability of services. The self-assessment for depression and SUDs indicated that 37.8% scored for depression while 21.5% had SUDs.

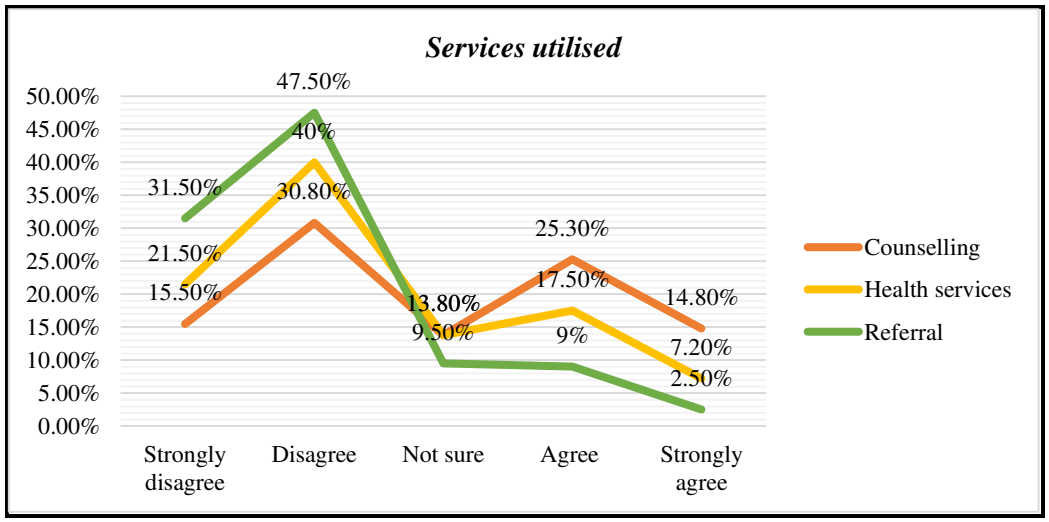

Figure 2: Services used in IHL (Field work)

Phase 3: to explore young people's opinions on NHS in selected IHL of Lusaka and Kabwe districts

As regards low levels of utilisation, the focus group discussions (FGDs) indicated self-stigma, fear of disclosure, fear of being labelled and lack of confidentiality in the services offered, and cultural beliefs

limited their use of services. Other, themes included cultural beliefs of feminism and masculinity that prohibited use, this was the belief of men being stronger than women and that it was acceptable for women to visit the clinic for problems. However, men who got depressed were deemed weak. Therefore, it was learnt that males shy away from using services because of this while females openly talked about mental health difficulties.

The participants also reported that they lacked information on mental health as they consulted social media and friends, and services were not available for them as illustrated in an extract:

> "*Professional help is not available for people who are using substance abuse. Most people who have studied guidance and counselling are unserious with their job. They really can't help because all they do is attend to minor issues …… I can't hide I had depression, and no one could help me I had to go home then my parent took me to the hospital. I have come back to continue my studies."* (FG2:F4)

Phase 4: to examine the key stakeholder's views on available health services utilised for depression and SUDs by young people at selected IHL in Lusaka and Kabwe districts

In addition, the key informants acknowledged the mental health problems among young people in IHL and suggested the need for strengthening the support offered to the young people such as structured counselling services and increasing sponsorships for those who were vulnerable, especially females. This is because the lack of essentials predisposes them to enter relationships for financial gain. Further, key informants felt that involvement of parents or guardians in the welfare of young people who present with depression or substance use problems in IHL. The key informants revealed that some institutions did not have any structured counselling facilities, let alone health facilities in-campus as shown:

> *"A few or pockets of counselling sessions are conducted by lecturers who are trained although they also get overwhelmed with the number of consultations. It is important that the school develops a counselling centre and employs enough counsellors. You know these students go through a lot of issues*." KI2

DISCUSSION :

Results from the health facilities' hospital records showed a baseline utilisation rate of 4.8% for depression and SUD among young people aged 18-24 in the general population (Ministry of Health, 2019). More males aged 23 were found to have utilised services for substance use disorders than females and utilised services for depression and SUDs in the selected health facilities. However, young people in IHL were found to be knowledgeable about mental health problems; the services available (61.5%); but reluctant to use the available services. Consistent with one study, the current study found that more than half (55.3%) of young people were knowledgeable of mental health problems and services available to them (61,5%) but were reluctant to use available services (Hunt, & Eisenberg, 2010). The study findings were like other studies on reluctance to utilise available services where the young people deemed them as non-friendly, had perceived labelling, distrust, fear of disclosure, self-reliance; cultural issues and the participants not being well informed like other studies (Banjes, 2021; Beebe, 2017; Devkota et al. 2021). However, the study also found that lack of awareness, self-stigma, and limited use of services (Al Ali, Alqurmeh, et al. 2017). The low utilization of services for depression and SUDs in IHL was less than half at 24.7% for mental health services and 40% for psychological counselling services. The study found that more males utilised services on campus especially those aged 23 and in their third year. This was a comparable finding with the incidence rate in the selected health facilities and most of the users were males aged 23. Interestingly, few females utilised the services in the general population and IHLs. The majority (60%) of the participants indicated that their use of services was influenced by friends and family or their previous use (Radez et al. 2021; WHO, 2017). Further, other participants indicated they relied on themselves to solve the problem. This begs the need to strengthen counselling services and offer youth-friendly services and health promotion and education in IHL to promote lifelong outcomes (Barry et al. 2019; Klepac Pogrmilovic et al. 2021).

Strengths and Limitations

The study has added new knowledge to the literature. It is worth noting that, the innovation of establishing the mental health service utilisation for depression and substance use disorder by young people aged 18 to 24 years in institutions of higher learning through an explanatory sequential mixed methods approach had not been done in Zambia. The study determined the incidence of depression and SUDs at the selected health facilities. Further, it brought out young people's perspectives on the issues surrounding the usage of health care facilities for depression and substance use in IHL. The nesting of key informants in the study provided their perspectives on young people's experiences with depression and SUDs within institutions and the services that were available for them. The valuable data would be of use to scholars interested in research on young people and mental health services. In spite of the identified strengths in this study, some limitations were noted such as the exclusion of first-year students missing out on their experiences or opinions on on-campus use of mental health services. Further, the non-involvement of health providers available at two IHL health centres could have brought out their views on perceived stigma. Future research could have a wider scope and include first-year students.

RECOMMENDATIONS :

The study had four recommendations. Firstly, the ministries of health and education develop policies that are complementary and promote the well-being of young people in IHL and quality of life. Further, the ministry of education to increase sponsorship for vulnerable students, especially since lack of finances causes risky behaviours resulting in depression and substance use disorders and dropping out of school. Secondly, a mandatory session for first-year students on common mental health issues and pathways to care at IHL to enhance early identification of depression and SUDs and access to health services. Thirdly, IHL should strengthen the counselling support systems for students within campuses to increase the utilisation levels. The low levels of use were because of dissatisfaction with healthcare staff, self-stigma, fears of disclosure or being known by friends. The institutions with health facilities could consider refresher courses in mental health for their healthcare workers and the dedication of specific rooms for counselling open to young people at their convenient times. Therefore, hotlines for timely help in counselling and mental health information would be ideal for developing peer-led youth-friendly health services within IHL. This holistic way of addressing young people's needs would improve their educational goals.

Fourthly, IHL to design and implement strategies to raise awareness such as periodical invitations of the mental health professionals to give regular talks on common mental health problems affecting the student population and screening for depression and SUDs. Therefore, strengthening peer education with information sheets and posters showing a clear pathway to care and support of health facilities would be helpful. In addition, introduce more recreational activities such as sports, debates, and psychoeducational campaigns to deter young people from being involved in substance use and reduce stress.

CONCLUSION :

The study concludes that the utilisation of mental health services by young people in IHL is complex. A better understanding of young people's utilisation of mental health services was through their opinionated data, and the context of the study. Utilisation, therefore, involves mental health literacy, and availability of appropriate services because young people in IHL desire awareness of mental health issues, non-stigmatising, and non-prejudiced youth-friendly in-campus services. Therefore, the synergies of different sectors dealing with young people could have better trajectories for their mental health and well-being. The current study suggests that IHL reduce stigma toward depression and SUDs to enhance the use of services. The policy frameworks that promote services in IHL are advocated for. The study recommends mental health orientation programmes for first-year students aiming at creating awareness that promotes early identification of depression and SUDs and improving access to health services.

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Investigation of Siderophore in Mycorrhizal and Non-Mycorrhizal roots on two experimental plants

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Abstract : Mycorrhizae establish symbiotic relationships with plants and play an essential role in plant growth, disease protection and overall soil quality. Siderophores are potent ferric ion chelators produced by microbes like bacteria and fungi during iron stress. The study was to investigate the siderophore content in soil and root in inoculated with *Rhizophagus fasciculatus* compared with noninoculated control plant PMK-1 and Vaibhav variety of *Solanum lycopersicum* L,.Randomized block design of 3 replicates for each treatment and of both the varieties were inoculated with a thin layer on inoculums *Rhizophagus fasciculatus* around2cm below the soil surface except in non-inoculated control pots before sowing.After 45 days the uprooted plants were subjected to qualitative and quantatative analysis.The qualitative test of Chrome Azurol sulphonate(CAS) Assay showed positive reaction, produced orange/golden yellow color indicated the presence of hydroxamate siderophore. The estimation of siderophore content in root of inoculated *Solanum lycopersicum* L., of PMK-1 variety showed 1.59µmol/m land vaibhav variety 0.93µmol/mlsimilarly in soil of both the variety recorded 0.67µmol/ml and 0.84µmol/ml respectively. The content of siderophore was recorded high in the *Rhizophagus fasciculatus* inoculated roots compared to in noninoculated control, the roots produced higher siderophore than soil. This investigation has clearly demonstrated and recorded that the Arbuscular mycorrhizal symbiosis is shown to accompanying the greater Fe uptake rates by a different host plants solubilization of Fe from insoluble iron sources must be regarded a pre requisite for improvement of plant Fe nutrition.

Key words: Mycorrhiza, Siderophores, *Rhizophagus fasciculatus,*Vaibhav, Bacteria, Environment.

1. INTRODUCTION:

Arbuscular mycorrhizal fungi (AMF) that enhance the nutrient uptake by establishing a hyphal network inside and around the plant roots (Lee and George, 2005). This fungus penetrates into the roots of a plant, growing between the root cells and into the part of the root where the products of photosynthesis, carbohydrates, are stored in the cortex. To transfer the nutrients absorbed from the soil for the carbohydrates, the fungal hyphae penetrate in the cell walls and grow into tree like structures called arbuscules. The plant cells cooperatively accommodate this intrusion. Increase of Fe, Zn and Cu uptake by mycorrhizal symbiosis plants have been reported by (Clark and Zeto, 1996; Caris*et al.,* 1998).Arbuscular mycorrhizal fungi secretes number of very low molecular weight (<10 KD) proteins called siderophores. These proteins having ferric specific ligand are produced by microbes as iron (Fe) scavenging agents in order to prevent low iron stress. Siderophores solubilize the insoluble iron in the external environment and transport it into the microbial cell. Under conditions of Fe limitation, microorganisms and plants commonly dependent on chelating agents to solubilize the iron and transport inorganic Fe. Iron produced by the grasses is the most important naturally occurring, biosynthetic chelates are the great number variety of siderophores, microbes and the relatively few phytosiderophores.

2. LITERATURE REVIEW:

It was Cox and Sanders (1974), and Kinden and Brown (1975), who have detected enzymes such as chitinase, peroxidase cytochrome oxidase and proteins in AM fungi colonized roots. Scannerini (1979), have investigated that the interfacial matrix and arbuscules were filled with polysasccharides and proteins. Gianinazzi*et al.,* (1979), have reported on enzymatic activities of acid and alkaline phosphatases in onion roots colonized with *Glomus* species. Rai*et al.,*(1982), have suggested that, the iron deficiency in nodulated legumes is very common on alkaline soils and affects such common agricultural crops as Chick pea, French bean (Hemantaranjan and Garg, 1986) and, Peanut (O'Hara *et al.,* 1988). Crowley *et al.,*(1991), have suggested that the microbial siderophores are of general importance in Fe nutrition, even in the case of graminaceae species. Cress *et al.,*(1986), have showed that mycorrhizal inoculated *Hilariajanesii* grass showed greater Fe uptake compared with that of non-mycorrhizal controls and tested positively when bioassayed for hydroxamate siderophores. Some fungal species produce more siderophore than bacteria (Milagres*et al.,*1999).Leyvaland andBerthelin, (1986), have revealed that mycorrhizal inoculation has showed increase iron solubilization from sparingly soluble sources such as iron phosphate, silicate minerals, sand and iron uptake rate by pine and ericaceous plants. Ma *et al.,*(2003), have investigated the response to iron (Fe) deficiency in two cultivars of *Festucarubra* L. used in correction of chlorosis of fruit trees cultivated on calcareous soils. It was Arefa*et al.,*(2004), who have done a comparative study on siderophore production by fungi from marine and terrestrial habitats. Haselwandter and Winkelmann, (2007), have reported that Arbuscular mycorrhizal symbiosis lead to greater Fe uptake rates by a range of different host plants.

Solubilization of Fe from rather insoluble Fe sources must be regarded a pre-requisite for improved plant Fe nutrition. Johnson, (2008), have suggested that the release of siderophores is a powerful strategy AM fungal host interactions, and for obtaining Fe from the environment. Ueno *et al.,*(2007), have identified, characterized and purified with various chromatographic root exudates collected from grasses, *Loliumperenne* Cv.Tove and *Poapratensis* Cv.Boron, the siderophores secreted from the roots of Fe deficient grasses. Grime *et al.,* (1987), have observed in a classic experiment involving several grass and herbaceous species demonstrated after inoculated with mycorrhiza had greater plant diversity than non-inoculated control. Under conditions of iron deficiency, graminaceous plants (Barley and Wheat) have developed an efficient strategy for acquiring Fe from insoluble sources (Kraemer,*et al.,* 2006). These plants secrete ferric iron-chelating compounds called phytosiderophores, which form specific strong complexes with Fe (Ma, 2005). Sorghum plants inoculated with mycorrhiza have shown uptake of iron in higher concentrations than that of non-mycorrhizal plants (Caris*et al.,* 1998). Jurkevitch (1986), have reported that Peanut plants grown on a calcareous soil with improvement of Fe, pseudobactin act as Fe source to plants and decreased the symptoms of Fe deficiency.

3. Research Objectives / Aims:

In the present investigation following are the research objectives

- Effect of the Arbuscular mycorrhizal symbiosis of *Solanum lycopersicum* L., (Var.PMK-1 and Vaibhav) inoculated with *Rhizophagus fasciculatus.*
- Extraction and analysis of siderophore from soil and roots of *Solanum lycopersicum* L., (Var.PMK-1 and Vaibhav) inoculated with *Rhizophagus fasciculatus* and the non-inoculated control plants.

4. RESEARCH METHOD:

Soil and plant material

Physico-chemical characteristic of soil used for pot experiments were determined according to Jackson (1973). 3 kg of soil: sand (3:1 v/v) mixture was filled into 18 cm diameter pots. The seeds of

PMK 1, Vaibhav, NS 524 and NS 585 varieties of *Solanum lycopersicum* L., were procured from Namdhari seed Company Bangalore, Karnataka, India. Seeds were surface sterilized by treating with 1% sodium hypochlorite for 2-3 min before sowing and after germination uniform seedlings were made one per pot.

Inoculums production

The*Rhizophagusfasciculatus* (Thax.)Walker&Schußler were mass multiplied in 18 cm diameter containing 8 kg sterilized sand : soil (1:1 v/v) mixture as the substrate and *Sorghum vulgare* L., (Jowar) as host plant. After 60 days of growth shoots of Jowar were chopped and the inoculum containing spores, root bits was air dried and 10 g of the mycorrhizal inoculum was applied to the planting area at a depth of about 4 cm to the pots (except non-inoculated control plants) before sowing seeds.

Pot experimental set up

The treatments were set as inoculated with *Rhizophagus fasciculatus* of *Solanum lycopersicum* L.,(PMK-1 and Vaibhav varieties) and non-inoculated control pots. The Pots measuring 18 cm diameter filled with 3 kg of air-dried sterilized soil:sand (3:1 v/v) mixture pots were arranged in a randomized block design with triplicates per treatment and non-inoculated control of each variety. Before sowing seeds of PMK-1 and Vaibhav varieties of *Solanum lycopersicum* L., a thin layer of inoculum *Rhizophagus fasciculatus* was placed 2cm below the soil surface except non-inoculated control pots. The pots were exposed to sunlight and received 10 ml of Hoagland nutrient solution without phosphate, once in 15 days. To maintain moister pots were watered every alternate day. The plants were uprooted after 45 days for the estimation of siderophore in the soil and roots of all the four varieties of *Solanum lycopersicum* L. The roots were washed under running water to remove the soil particles, cleaned; the oven dried roots were taken for the siderophore estimation.

Detection and estimation of siderophore production

Extraction of siderophorefrom soil

100g of soil sample was mixed with 100ml of 0.1 M phosphate buffer (pH 7.0) and kept inside the refrigerator for overnight. Supernatant was filtered, centrifuged at 5000 rpm for 30 minutes, cooled and mixed with ice acetone (1:3) to precipitate and the pellet obtained was resuspended in 0.1 M phosphate buffer (pH 7.0).

Extraction of siderophore from root

The roots were dried at 72^0 C for 48 hr, in hot air oven then 1g of grinded root was mixed with 70 % ethanol and placed in the shaker for 1 hr and filtered by using Whatman filter paper No 42. The solvent was evaporated using the rotary evaporator then remaining powered maintained used for siderophore assessment.

Chrome Azurol Sulphonate (CAS) Assay

The CAS assay is the universal chemical assay for siderophore detection described by Schwyn and Neilands, (1987), based on a siderophore's high affinity for ferric iron. When siderophore is present the following reaction occurs, which releases the free dye, which is strong in color blue to orange/ golden yellow .

Procedure

5ml of CAS (Chrome Azurol Sulphonate) solution and 1ml of soil and root sample were taken in a test tube and mixed thoroughly then allow to stand for few minutes. when siderophore present are remove the iron from dye complex resulting in the formation of blue to orange/ golden yellow color. The absorbance of the solution was measured by using UV-Spectrophotometer (Hitachi-Japan (U-3310) model) at 630 nm.

5. Discussion and Analysis:

The occurrence of siderophore content in *Solanum lycopersicum* L.,(PMK-1 and Vaibhav varieties) AM fungal inoculation influenced in rhizospheric soil and roots compared to non-inoculated plants. These findings are in accordance with Powell *et al.,*(1982, 1983). Arbuscular mycorrhizal fungi are reported to enhance Fe uptake rates of associated with host plants, which can be taken as an indication that mycorrhizal siderophores of a unknown structure may be involved(Haselwandter, 2008). Investigations of siderophore produced by mycorrhizal fungi may well lead to the discovery of novel siderophore structures as suggested previously by Haselwandter in(1995).Recently on different factors that lead to research on the siderophores have received much attention because of their potential roles and applications in various areas. The total concentration of hydroxamates, as well as ferrichrome-type siderophores earlier have been estimated by using microbial assays it has revealed that the presence of siderophores in soil. Soil microorganisms like bacteria and fungi have a particular important role to evaluate these new actions of approaches. So, that siderophore producing organisms will be making the soil fertile and they also have antifungal activity against phytopathogens observed by Girish*et al.,*(2010). High plant root Fe^{+3} concentrations were also found by other authors for plants grown in soil by Mengel and Schaumberger (1999) and on nutrient solutions (Mengel and Geurtzen, 1988; Fox *et al.,* 1996).

In many instances, the siderophores act as a plant growth promoters(Yadav*et al.,* 2011; Verma*et al.,* 2011), biocontrol agents (Schenk *et al.,* 2012) and bioremediation agents (Wang *et al.,* 2011; Ishimaru*et al.,* 2012), in addition to their valuable role in soil mineral weathering (Reichard*et al.,* 2005;Shirvani and Nourbakhsh, 2010).In fact Fe^{++}siderophore complex is formed at the mineral surface and the mechanism is that transferred into the surrounding soil solution and becomes available for uptake by the cell membrane of microorganisms or plants (Kalinowski*et al.,* 2000; Kraemer, 2004).

In addition Arbuscular Mycorrhizal fungi (AMF) can also be used as biofertilizer to improve the plant growth that depends on the production of siderophores (Van Scholl *et al.,* 2008). Kloepper*et al.,* (1980), have investigated that the role of siderophoresin the mechanism of biological control, this mechanism depends on the role of siderophores as competitors for iron in the soil that become less amount of iron availability for the phytopathogens (Scher and Baker, 1982; Thomashow*et al.,* 1990). Powell *et al.,*(1980), have presented earlier that some reservoirs of siderophores are adsorbed to soil organic matter. In addition, recently it was by Haselwandter*et al.,* (2011), have reported that the siderophores could be dissolved or adsorbed regards to their susceptibility to degradation. Some studies reported that hydroxamate siderophores are more commonly found in the dissolved phase in the soil since they consist of strong cyclic hexapeptides that make them highly resistant to the environmental degradation by some enzymes produced by plants such as hydrolases and proteases, which affect the duration of the siderophores (Hider and Kong, 2010).

6. RESULTS / FINDINGS:

The siderophore content in the soil and roots of *Solanum lycopersicum* L. varieties PMK-1, and Vaibhav inoculated with AM fungi and in the non-inoculated soil and roots shown in (Table-1). The qualitative test (CAS test) showed positive reaction, produced orange/golden yellow color indicating the presence of hydroxamate siderophore. Siderophore concentrations in AM fungi inoculated and non-inoculated soil and roots are shown in (Figure-1).

***Solanum lycopersicum* L. var. PMK-1**

In soil, inoculated with *Rhizophagus fasciculatus*produced higher siderophore(0.73µmol/ml)compared to non-inoculated control (0.05µmol/ml). Mycorrhizal roots produced considerably higher siderophore (0.96µmol/ml) than non-mycorrhizal roots (0.36µmol/ml).Siderophore content was higher in the rhizosphere soil compared to root as shown in (Table-1).

***Solanum lycopersicum* L. var. Vaibhav**

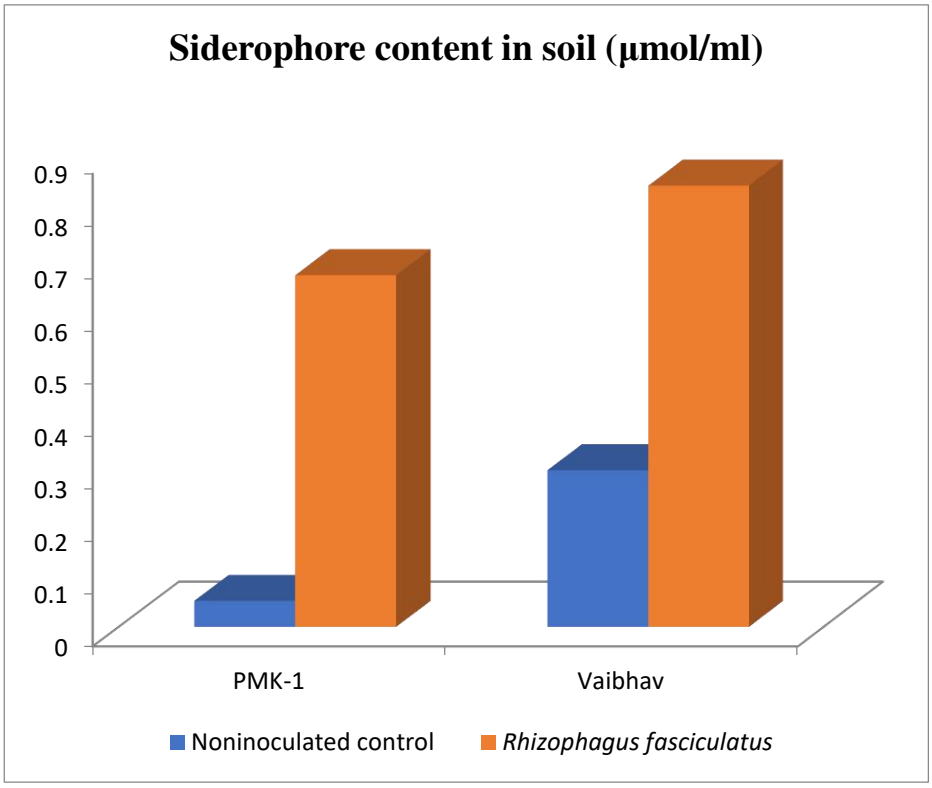
There was an increased siderophore content in the plant rhizosphere soil inoculated with *Rhizophagus fasciculatus*(0.82µmol/ml)compared to non-inoculated control (0.28 µmol/ml). Significantly increased siderophore production was observed in plant roots grown in presence of AM fungus *Rhizophagus fasciculatus*(1.64µmol/ml)than that of the non-inoculated control (0.52µmol/ml) plants. Siderophore production in the root of *Solanum lycopersicum*L., (var. PMK-1 and Vaibhav) was more with AM fungus *Rhizophagus fasciculatus* inoculation compared to non-mycorrhizal plants. Similar trend was observed in the rhizospheric soil (Table-

Table 1: Showing the siderophore content in rhizospheric Soil and Root of *Solanum lycopersicum* L., (Var, PMK-1 and Vaibhav) with and without AM fungus *Rhizophagus fasciculatus* inoculation at 45 days.

Treatments	Rhizospheric Soil	Root
PMK-1		
Noninoculated Control	0.05±0.03	0.36±0.11
Rhizophagus fasciculatus	0.73±0.03	0.96±0.03
Vaibhav		
Noninoculated Control	0.28±0.01	0.52±0.03
Rhizophagus fasciculatus	0.82±0.39	1.64±0.09

Each value is the mean of three sample ± standard error.

Figure 1: Showing the siderophore content in soil inoculated with *Rhizophagus fasciculatus* and noninoculated control of *Solanum lycopersicum* L.,(Var. PMK-1 and Vaibhav) at 45 days.



7. CONCLUSION:

The CAS (Chrome Azurol Sulphonate) assay was used for the detection of siderophore.The qualitative test CAS assay showed positive reaction, produced orange/golden yellow color indicated the presence of hydroxamate siderophore. *Solanum lycopersicum* L., var. Vaibhav had maximum siderophore production in both the root and rhizospheric soil with AM fungal inoculation compared to non-mycorrhizal plants. It was also observed that, siderophore production was more in the rhizosphere compared to roots colonized with AM fungus.

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Shorea Robusta(Shaku) leaves extract as an eco-friendly corrosion inhibitor for Mild steel in 1M Sulphuric acid solution

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Abstract : *The corrosion inhibition on mild steel in 1M sulphuric acid solution was evaluated by shakhu leaves extract. Study performed by FTIR have various concentration of SR extracts ranging from 0.05,0.1,0.2,0.3,0.4 and 0.5(v/v)were used and corrosion rate (CR)on mild steel and inhibition efficiency (IE) were investigated at 2 temperatures 298K and 308 and found that Corrosion rate increases with increase in temperature as inhibition corrosion increases corrosion rate decreases and IE decreases at elevated temperature. The substantial reduction in CR with increase in the concentration of SR extract was noted at different temperatures. However the increase in the CR at each SR extract along with the increase in the temperature failed to the increase in kinetics activities at the electrolyte and metal interface .Results shows with the increase of 0.5 g/l CP extract about 4 times lower CR of mild steel at studied temperature than in pure 1M HCL solution affirm it's robust inhibitive efficiency. Surface Examination suggest that a layer of inhibitor material absorbed on the surface of mild steel at low temperature is responsible for high IE and this phenomenon is characterized as chemisorption. Weight loss data used to test three well known absorption isotherm Langmuir, Freundlich models and found freundlich isotherm is found to be best fitted well to all the models to certain extent .However freundlich isotherm is found to be fitted with as correlation reaching to unity. The nature of adsorption of the extract on mild steel surface was in conformity with Langmuir isotherm. The result of EIS was correlating with the result of polarization measurement. Scanning electron microscopy (SEM) study confirmed that the inhibition of corrosion of mild steel is through adsorption of the extract molecules on surface of metal.*

Keywords*: Corrosion inhibition, shorea robsta, effect of temperatures, adsorption isotherms, chemisorption.*

1. INTRODUCTION :

Mild steel has been the most widely used alloy for structural and industrial applications since the beginning of industrial revolution. The use of acid media in the study of corrosion of mild steel has become important because of its industries such as acid pickling, industrial cleaning, acid descaling, oil-well acid in oil recovery and petrochemical processes [1-3]. The refining of crude oil were carried out in a variety of corrosive conditions and in such, the corrosion of equipments are generally caused by a strong acid through attacking on equipment surface. And in many of structural and industrial applications of mild steel, they are also exposed to corrosive environments and they are susceptible to different types of corrosion. Therefore, the use of corrosion inhibitors to prevent metal dissolution will be inevitable. The use of inhibitors is found to be one of the most practical methods for protection

against corrosion, especially in acidic media [4]. The majority of well-known inhibitors are organic compounds containing heteroatoms, such as O, N, S and multiple bonds [5]. Most of these organic compounds are not only expensive but also toxic to both human beings and environments [6] and therefore, their use as corrosion inhibitors are limited. Thus, efforts have been made to develop cost-effective and non-toxic corrosion inhibitors. The plant extracts are considered as an incredibly rich source of environmentally acceptable corrosion inhibitors. This area of research is of much importance because in addition to being environmentally friendly and ecologically acceptable, plant products are inexpensive, readily available and renewable source of materials [7-9]. Several authors have reported the use of the natural products as the potential corrosion inhibitors for various metals and alloys under different environments [10-19]. In the present work, an attempt was made to find a naturally occurring, cheap and environmentally safe substance that can be employed for inhibiting the corrosion of mild steel in acidic medium. In this present work, shorea robusta with the common name 'vasaka' was taken for the study, which is a shrub widespread throughout the tropical regions of Southeast Asia, including India [20]. The fresh leaves were collected from gorakhpur u.p(India) and an attempt has been made to ascertain its corrosion inhibition properties and its mechanism of inhibition. The aqueous extract of its leaves and flowers in 0.5 M sulphuric acid was tested by using weight loss, potentiodynamic polarization techniques. SEM study was also used to study the surface morphologies. The extract of leaves has also been found to use as an herbal remedy north-easthern part of India, the leaf decoction of shorea robusta traditional medicine [21].

2. MATERIALS AND METHODS

2.1 Mild steel used

Mild steel coupons of percent composition of C (0.18), Si (0.19), Mn (0.51), P (0.044), S (0.057), Cr (0.14), Ni (0.09), Mo (0.02), Cu (0.06), V (less than 0.01) and remaining Fe (Chemical analysis: % by weight by The surface were then degreased with acetone and washed with double distilled water before the experiment.

2.2 Preparation of extract of shorea robusta

Double distilled water and analytical reagents-grade H_2SO_4 (E Merk, India, AR Grade) were used for preparing solutions. shorea robusta was dried for 6 hours in an oven at 70°C and grinding to powdery form and 10 grams of the powder of shorea robusta was refluxed in 100 ml double distilled water for 1 hour. The extract of the plant was prepared by evaporating the filtrate. The required concentrations of solution were prepared by using the residues in aqueous solution of 0.5 M H_2SO_4.

2.3 Weight loss method

The rectangular specimens with dimension of (1 x 4 x 1) cm were used in weight loss experiments. Weight loss of mild steel coupons immersed in 100 ml of the electrolyte with and without the extract of plant was determined after 4 hours at 298 K. The percentage inhibition efficiency (I%) was calculated from the following equation:

$$I\% = \frac{W_o - W_i}{W_o} \times 100 \qquad (1)$$

Where Wo and Wi are weight losses of mild steel in absence and presence of the extract.

2.4 Electrochemical measurements

An electrochemical cell assembly of three electrodes was used for potentiodynamic polarization and electrochemical impedance measurements in which working electrode was mild steel, Calomel electrode was the reference electrode and Platinum wire was counter electrode. The working electrode was coated thoroughly with epoxy resin keeping surface area of 1 cm^2 for the study. The surface were then degreased with acetone and washed with distilled water before the experiment. The measurements were done by using computer controlled electrochemical workstation of CHI 760c model. Before each polarization and EIS measurement, the working electrode was introduced into the test solution and kept for 4 hours to attain the open circuit potential (OCP). Polarization measurements were made under thermostatic conditions at 298K,

308K, 318K and 328K and the measurements were carried out in the range of potential from -1.2 to 2 V with

scan rate (V/s) of 0.01. The range of potential from -0.3 to -0.7 V was chosen for Tafel plot. The percentage inhibition efficiency (I%) from the polarization measurement was calculated using the following equation [22]:

ioc_o_rr__-_i_ic_o_rr x100

I%= __

i°corr (2)

Where i^{o}_{corr} and i^{i}_{corr} are the corrosion current density values without and with the extract, respectively. Electrochemical Impedance measurement was carried out at 298K and the measurement of the response of the electrochemical system to a.c. excitation with a frequency ranging from 10,0000 to 0.1 Hz and peak to peak a.c. amplitude of 0.005 V was done. The percentage inhibition efficiency (I%) from the electrochemical impedance measurement was calculated using the following equation [23]:

R

I% = __c_t(_i)__-_R__ct_(a_) x 100

^{R}ct(i) (3)

Where $R_{ct(i)}$ and $R_{ct(a)}$ are the values of the charge transfer resistances in presence and absence of the extract, respectively.

2.5 Surface analysis

The test coupons of the size 1x1 cm^2 were exposed in 100 ml of 1M H_2SO_4 solutions in absence and presence of 1 grams and 3 grams of the plant extracts for 5 hours at 298 K and then washed with distilled water. After drying the specimens, they were examined for surface analysis by Scanning electron microscope (SEM) model Leo 435 VP with an Oxford Inca energy dispersion spectrometer system.

3. RESULTS AND DISCUSSION :

3.1. Weight loss method

The percentage of inhibition efficiency (I%) of the extract from weight loss method at different concentrations of shorea robusta at 298 K are summarized in the table 1. It is indicated that inhibition efficiency of the extract increases with increase in its concentration.

Table 1: The corrosion parameters for mild steel in 1M H_2SO_4 solution in absence and presence of different shorea robusta extract concentrations.

Temperature (K)	Solution	Conc.(g/L)	I%
298	0.5 M H_2SO_4	0.0	-
		1.0	92.5
		2.0	95.4
		3.0	98.8

3.2 Potentiodynamic Polarization measurement

Potentiodynamic polarization curves for mild steel in 1M H_2SO_4 solutions in absence and presence of various concentrations of shorea robusta extract at 298 K are shown in figure 2. The extrapolation of Tafel straight line leads to the calculation of the corrosion current density (i_{corr}), the corrosion potential (E_{corr}), cathodic and anodic Tafel slopes (β_c and β_a) and the percentage of inhibition efficiency (I%). Their values are given in the table 2.

The analysis of the data of the figure 2 reveals that, at a given temperature, the addition of the extract of shorea robusta to the acid solution increases both the anodic and cathodic overpotentials, decreases the corrosion current density (i_{corr}). The change in cathodic and anodic Tafel slopes (β_c and β_a) shown in the table 2 indicates that adsorption of shorea robusta extract modify the mechanism of the anodic dissolution as well as cathodic hydrogen evolution. From figure 2, it is clear that both cathodic and anodic reactions are inhibited and the inhibition increases as the inhibitor concentration increases in acidic media. As the anode is more polarized, the process of metal dissolution is more inhibited. From table 2, it is also clear that there is no definite trend in the shift of E_{corr} values, in presence of various concentration of the extract in 1M H_2SO_4 solutions, indicating the mixed type of inhibitor in 1M H_2SO_4 solutions.

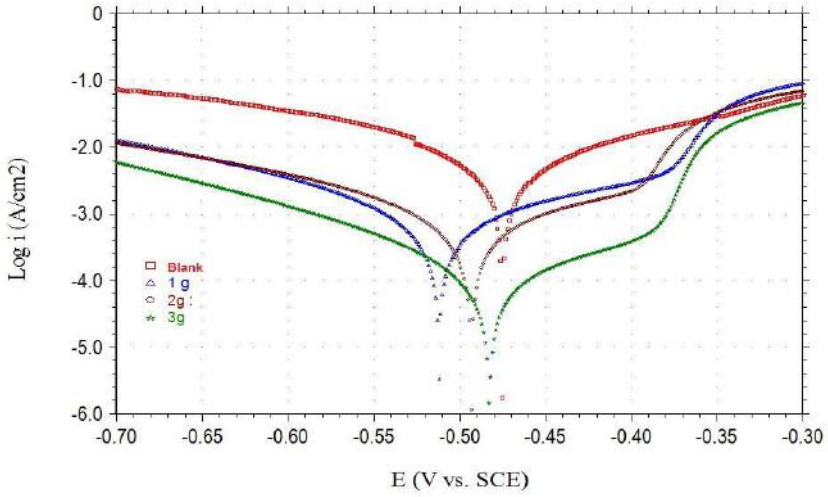


Figure2: Potentiodynamic polarization curves for mild steel in 1M H_2SO_4 solution in absence and presence of different concentrations of shorea robusta extract at 298 K**.**

3.3. Effect of temperature

The effect of temperature range from 298K to 328K on inhibition efficiency is summarized in the table 2.

It shows that an increase in temperature decreases the inhibition efficiency of the extract. This can be explained on the fact that an increase in temperature usually assists corrosion processes, particularly in media in which H_2 gas evolution accompanies corrosion, giving rise to higher dissolution rates of the metal.

Table2: The electrochemical parameters for mild steel corrosion in 1M H_2SO_4 solution in absence and presence of different shorea robusta extract concentrations.

Temp (K)	Solution	(Conc.), g/L	-Ecorr (mVvs.SCE)	βc (mV/Dec)	βa (mV/Dec)	icorr (mA/cm^2)	I%	Θ
298	1M H_2SO_4	0.0	475	54	61	8.11	-	-
		1.0	512	69	54	1.01	87.5	0.875
		2.0	493	64	149	0.53	93.5	0.935
		3.0	483	82	216	0.07	99.1	0.991
308	1M H_2SO_4	0.0	475	53	59	14.99	-	-
		1.0	518	57	45	2.94	80.4	0.804
		2.0	486	58	142	1.77	88.2	0.882
		3.0	491	72	138	0.18	98.7	0.987
318	1M H_2SO_4	0.0	481	48	51	16.39	-	-
		1.0	516	57	46	4.50	72.5	0.725
		2.0	479	70	63	2.88	82.4	0.824
		3.0	498	58	103	1.55	90.5	0.905
328	1M H_2SO_4	0.0	500	49	50	19.98	-	-
		1.0	480	54	46	10.52	47.3	0.473
		2.0	513	54	45	9.70	51.5	0.515
		3.0	468	57	54	5.50	72.5	0.725

The activation energies (E_a) for the corrosion process in absence and presence of the extract are evaluated from Arrhenius equation [24]:

$$k = A\, e^{(-Ea/RT)} \quad (4)$$

where A is the pre-exponential factor, T is absolute temperature , R the gas constant and k is the rate constant of metal dissolution reaction which is directly related to corrosion current density. Therefore, the equation can be rewritten as [25]:

$$\mathbf{i_{corr} = A\, e^{(-Ea/RT)}} \quad (5)$$

where i_{corr} is the corrosion current density. The activation energy of corrosion reaction in presence and absence of the extract can be determined by plotting log i_{corr} against 1/T which gives a straight line with a slope permitting the determination of E_a as shown in figure 3. The values of activation energies are given in table 3.

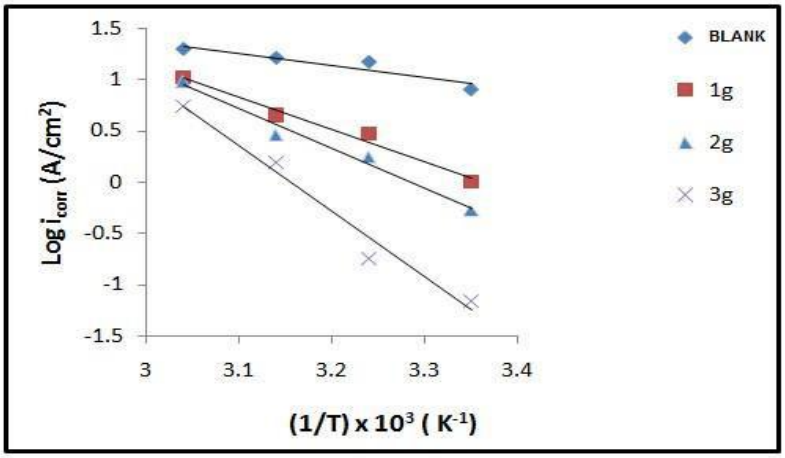


Figure 3: Arrhenius plots of log i_{corr} versus 1/T for mild steel corrosion in 1M H_2SO_4 solution in absence and presence of different concentrations of shorea robusta extract

The increasing values of activation energies (E_a) in presence of the extract at all the studied concentration in 1 M H_2SO_4 suggested that there is a reduction in corrosion rate [26].

Table 3: Calculated values of activation energies (E_a) for various concentrations of shorea robusta extract during mild steel corrosion in 1M H_2SO_4 solutions

Solution	Concentration (g/l)	E_a (k J/mol)	R^2
0.5 M H_2SO_4	0.0	22.72	0.876
	1.0	60.33	0.980
	2.0	74.33	0.978
	3.0	122.67	0. 974

3.4. Adsorption isotherms

Basic information on the interaction between the inhibitor and mild steel surface are investigated by the adsorption isotherms. For this purpose, the values of surface coverage ( ) at different concentrations of shorea robusta extract in acid media in the temperature range (298-328 K) have been used to explain the best isotherm to determine the adsorption process. The value of the surface coverage ( ) was calculated using the relationship [27]:

$$= [I\%] /100 \quad (6)$$

Attempts were made to fit these values to various isotherm including Langmuir, Temkin, Frumkin, ElAwady, Freundlich, and Flory-Huggins etc.

The best fit was obtained with Langmuir isotherm as suggested by the plot between C/ and C (as shown in figure 4) and the linear correlation coefficient of the fitted data was close to 1, indicating that the adsorption of the inhibitor molecules obey the Langmuir's adsorption isotherm as expressed as [28]:

$$[C/] = C + [1/K_{ads}] \quad (7)$$

where C is the inhibitor concentration and K_{ads} is the equilibrium constant for adsorption/desorption process of the inhibitor molecules on the metal surface. K_{ads} values were calculated from the intercept of the plot for adsorption process.

The adsorption equilibrium constant, $K_{ads,}$ is related to the standard free energy (ΔG^{o}_{ads}) by the following equation [29]:

$$K_{ads} = [1/55] \exp [-\Delta G^{o}_{ads}/RT] \quad (8)$$

where the value 55.5 in the above equation is the molar concentration of water in solution in mol/L and the negative sign of ΔG^{o}_{ads} indicated that adsorption of the extract was spontaneous process [30]. The adsorption of the extract can be presented as a substitution adsorption process between the organic molecules in aqueous solution (Org_{aq}) and the water molecules (H_2O_{ads}) on the metallic surface [30]:

$$Org_{aq} + Y.\ H_2O_{ads} \longleftrightarrow Org_{ads} + Y.\ H_2O_{aq} \quad (9)$$

where Y is the number of water molecules displaced by one molecule of the extract and Y is assumed to be independent of coverage or charge on the electrode.

Since the adsorption of the extract on the metal surface is in conformity with Langmuir isotherm, there is no interactive or repulsive force between the adsorbed molecules on metal surface [31].

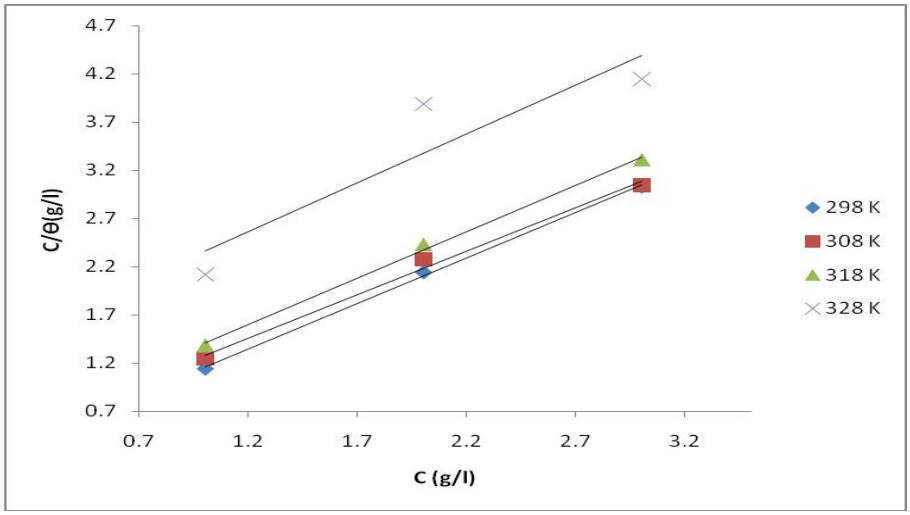


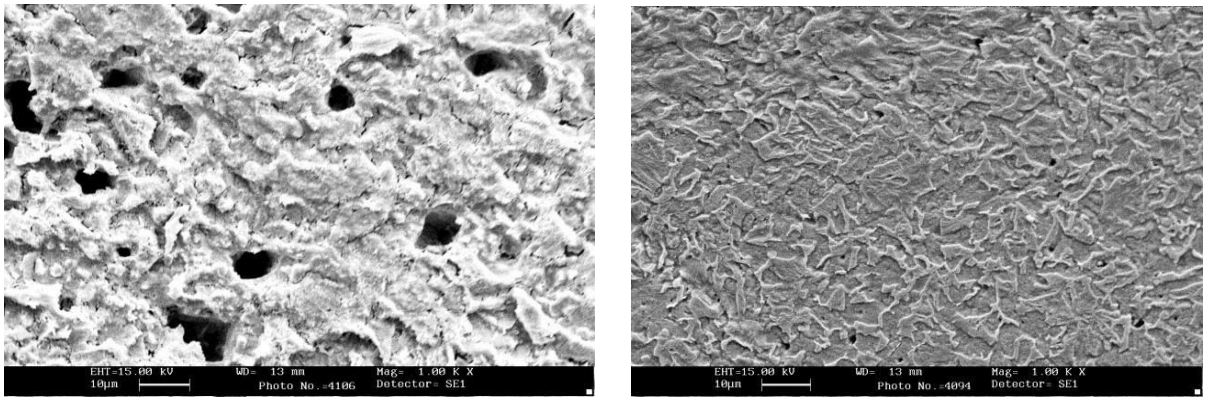
Figure 4: Langmuir adsorption isotherm for adsorption of shorea robusta extract in 1M H_2SO_4 on surface of mild steel.

Table 4: The electrochemical impedance parameters for mild steel corrosion in 1M H_2SO_4 solution in absence and presence of different shorea robusta extract concentrations.

Temperature (K)	Solution	(Conc.), g/L	C_{dl} (F cm^{-2})	R_{ct} (Ω cm^2)	I%
298	0.5 M H_2SO_4	0.0	$105x10^{-3}$	4.1	-
		1.0	9.38×10^{-3}	46.7	91.2
		2.0	2.54×10^{-3}	136.8	97.3
		3.0	1.46×10^{-3}	351.8	98.9

3.6. Scanning electron microscopy

SEM micrograms of polished surface of mild steel exposed for 5 hours in 1 M H_2SO_4 solutions in absence and presence of 3 grams of shorea robusta extract were shown in figure 6 (a)-(b). In comparison of SEM micrograms in absence and presence of the extract, there was a rough surface on mild steel in absence of the extract. There was a smooth surface with deposited extract on it in presence of the extract . This result supplements the results of electrochemical techniques and confirms that the extract of shorea robusta inhibited corrosion of mild steel through adsorption of the inhibitor molecules on metal surface.



(a) (b)

Figure 6: Scanning electron micrograph of polished mild steel (1000 x) after exposed to (a) 1 M H_2SO_4 (b) 1M H_2SO_4 containing 3 grams of shorea robusta extract.

4. CONCLUSIONS :

(i). The inhibition efficiency of adhatoda vasica extract on corrosion of mild steel in 1 M H_2SO_4 solution increases on increasing in concentration of shorea robusta extract and decreases with rise in temperature. Potentiodynamic Polarization measurement show that shorea robusta acts as mixed type inhibitor.

(ii). The increase in activation energies of corrosion process in presence of the extract indicates that shorea robusta extract retards the rate of corrosion of mild steel in 1 M H_2SO_4 solution. The nature of adsorption of the extract molecules on mild steel surface is found to obey Langmuir adsorption isotherm.

(iii). SEM study confirm that the inhibition of corrosion of mild steel is through adsorption of the extract on surface of metal and these studies also supplement the results of electrochemical techniques.

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Anti – Chair Rocking Device

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Abstract:

According to 'The Guardian', approximately 7000 students are admitted to hospitals with chair related injuries, 70 percent of which are due to students rocking their chairs. Clearly, students rocking their chairs backwards to dangerous levels is a safety hazard. It has the potential to cause serious physical injuries and may result in legal battles between parents of students who suffer injuries and school authorities. Our own school has had incidents involving students falling off chairs and there are some students who we personally know that have suffered physical harm due to this.

Keeping all of this in mind, our team decided to make an attachable device to a chair that will prevent a chair from rocking. After experimenting with multiple designs, using applied physics, our team developed a device which prevents our school chair from being rocked. Our product is a bent rod that can be attached to both the back legs of the chair making it extremely hard to rock the chair. It is made of aluminium with a piece of acrylic rubber attached to the base of the device.

This device will make chairs much safer for children in school. It is a far cheaper and practical alternative to purchasing completely new chairs that are designed to prevent rocking and this device can be attached to existing regular chairs. We estimate our device to cost 15 UAE Dirhams, which is a small amount compared to the price of a table and chair set. Furthermore, it is more practical than other attempts at solving this problem which involve purchasing entirely new chairs. We wrote an academic paper for this device.

Key Words: *Rocking, Chair, Health, Safety, Injuries, Physics, School, Student, Children*

INTRODUCTION :

For our project, we selected the research question - To design a prototype to prevent students from rocking blue coloured chairs of height 79 cm, width 49 cm and breadth 52 cm of middle and senior school students by analyzing the factors which affect the rocking of the chair by experimentation with students of various ages, heights and weights, keeping the type of chair constant.

This is quite important if looked at from the perspective of student's safety. Through the course of this project, our team studied the physics behind rocking school chairs and attempted to find multiple solutions to this problem and ultimately came up with an effective prototype that restricts a student's ability to rock their chair. Rocking a chair can undeniably be fun but it can as a matter of fact lead to

some hazardous injuries if not careful. The steadiness of a rocking chair can for the most part become unstable at any time which can result in severe damage to the spine and head to the user of the chair. Thus, preventing this is a necessary measure for the health and safety of the students.

REVIEW OF LITERATURE :

Owing to the unique and specific nature of the problem tackled by our group, previous literature on the subject was scant. Due to this reason, we were unable to find any studies which directly features an external rod solution to preventing people from falling from chairs. Most literature on the subject of preventing people from falling off chairs was relevant to senior citizens who may or may not have medical conditions, rather than students, who are our target audience. However, we did find a study from 2015 that identified chair related accidents of students as a problem and proposed an 'unrockable' chair as a solution. However, this was to be done through a different design of the chairs of the legs rather than the 'rod' solution that our team has come up with.

The 'Max Chair' was a chair designed by Mich Nash, who worked as the managing director of a design agency called Sedley Place. It was originally launched by a teacher named Tom Wates in 2007. This launch came as data from the government reveals that 7000 schoolchildren are admitted to hospitals due to chair-related accidents. It was also found that 70 percent of schoolchildren rocked their chairs dangerously.

The Max Chair is designed such that it makes it very hard to rock the chair by using a specially designed anti tilt frame. The first variant of the Max Chair went on to sell 150,000 units. However, to implement this in any school, they will have to replace all the existing chairs with Max Chairs which is not feasible.

Our rod is detachable and thus can be attached to any school chair as needed, when needed. Thus, schools would not have to purchase these chairs and replace their existing ones. Furthermore, since our product consists only of a rod, it is significantly cheaper to use than ordering brand new chairs.

Importance of Study

Our study is important as it is one of the first studies carried out regarding mechanisms to physically prevent a chair by attaching a rod, from falling over when being rocked. As mentioned previously, falling from a chair poses a great risk to student health and well-being. GEMS Modern Academy has witnessed multiple cases of students falling from rocking chairs inflicting severe harm. There do exist special types of chairs designed such that its occupant cannot fall over, however these chairs are specially designed chairs often intended for senior citizens. These are unsuitable for practical use and are often quite expensive. Our study has multiple advantages over existing designs. Most notably it allows for practical usage and furthermore, it is not too obtrusive or spacious.

Statement of Problem

The dangers posed by falls caused due to falling from the rocking of chairs is often underestimated and not paid enough attention to. Some of the injuries that can be caused by falls from chairs include but are not limited to:

Injuries to the back – Although chairs may not be that tall, the speed of impact with the floor can be sufficient enough to cause injuries to the spine and other parts of the body. When a person falling from a chair hits the floor, the vertebrae experiences pressure that can lead to painful fracture, nerve damage as well as much more among many problems.

Hand & wrist Injuries – When one falls, they bring their arms up instinctively to break their fall. Oftentimes, however, because they put their hands out to catch themselves, their hands and wrists suffer injuries. Falling from a chair can lead to wrist, arm or shoulder injuries.

Injuries to the head and brain – If your fall is facing backwards, the back of your head may hit the floor. If your head hits the ground, you may face brain injuries, broken body parts such as broken nose and eye socket etc.

Injuries to the legs – One might not expect his legs to get injured due to a chair fall since they are close to the ground. However, if your fall is forward facing, your knees can fracture as they will face most of the brunt of the impact. This can cause significant inconvenience and pain.

Students continue to rock their chairs despite being informed of the dangers of falling from their chairs. Many students rock their chairs for a variety of reasons. Some feel more comfortable in a rocking position whereas others are too used to it to stop.

Thus, there was a need to develop a product which would prevent students from experiencing such injuries as it was evident that simply informing students of the dangers of rocking their chairs was not enough to prevent injuries.

OBJECTIVES

We conducted several experiments to understand and study the factors such as the effect of variable values of masses and heights on the ability of the person to tilt the chair with the device attached to the ends of the back legs of the chair. The experiments will help us to identify the type of metal that would be efficient and effective for creating the device by analyzing factors such as the metal used in building the back legs of the chair. Furthermore, this data will be used to calculate the exact dimensions of the model such as the length and develop the device to prevent students from rocking their chairs.

Hypothesis

If the height and weight of the student increases and the angle between the legs of the chair and the floor increases, then the critical angle of the chair increases.

The independent variables of our experiment are height and weight of the students, angle between the legs of the chair and the floor, friction between the floor and the chair. The dependent variable is critical angle.

RESEARCH METHODOLOGY :

For our research, we used various methodologies such as experiments, surveys, observations and case studies. We carried out tests to find the factors affecting the critical angle, the material needed and the dimensions. To find the critical angle we had to use our prior knowledge in physics. Critical angle is the maximum angle a person can rock their chair before they fall off and cannot recover.

We conducted experiments with independent and dependent parameters and calculated the critical angle for which we had volunteers rock their chair to the maximum angle possible. One person held the chair steadily as the other noted the angle using a protractor. A person was behind the chair to make sure it did not fall. While doing these experiments, we had safety measures in place to ensure the maximum safety for the students. Yoga mats were arranged to avoid injury in case the person falls. We conducted this experiment for three different types of chairs – small blue chair, tall blue chair and red chair. The tall blue chair was the chair we were developing our prototype for. We experimented with the other

chairs to find the change in critical angle with change in dimensions of the chair. The picture below shows the three chairs.

Small Blue Chair (Left), Tall Blue Chair (Middle), Red Chair (Right)

The dimensions of all three chairs are given below:

	Length of back leg (cm)	Length of front leg (cm)	Width (cm)	Height (cm)	Breadth (cm)	Leg thickness (cm)	Backrest (cm)	Distance between the legs (cm)
Tall Blue Chair	50	47	49	79	52	3	38	46
Small Blue Chair	45	42	49	75	52	3	38	43
Red chair	40	42	50	77	52	2.5	43	46

We had students with various heights and weights and to compare them evenly we used BMI (Formula = weight in kg divided by the square of the height in meters) for ideal measurements. We analyzed the primary and secondary empirical data we had collected and created graphs and interpreted the trend lines regarding the critical angles of different students. Our group consulted the teachers, students and the people around us and reviewed our findings.

RESULT AND DISCUSSIONS :

We conducted a total of 56 experiments. Our first experiment was to find the critical angle of the tall blue chair. We conducted this experiment with students of various heights and weights and tabulated and plotted the readings on a graph. We used BMI (Body Mass Index) as the y axis for this experiment and the x axis depicts the critical angle. This helped us find out the relation of BMI with the critical angle.

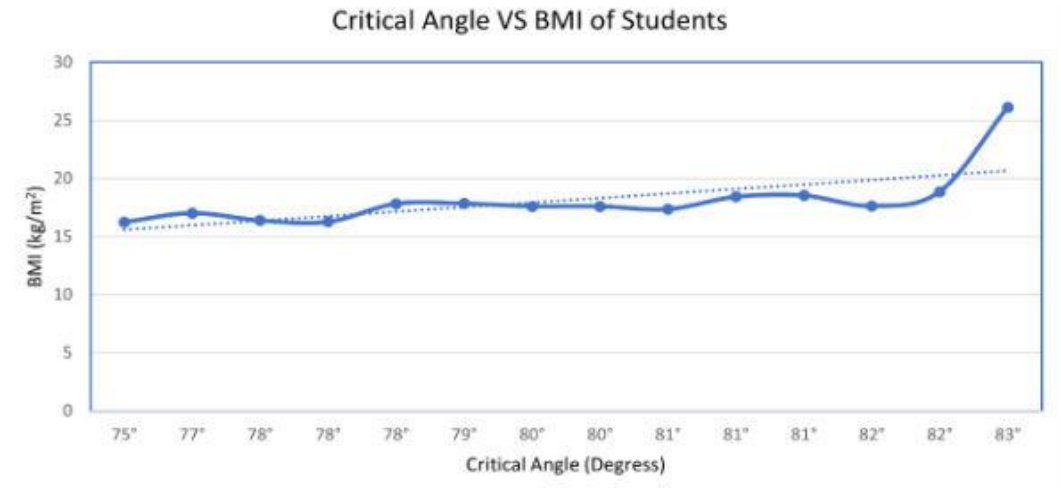
S. No.	Grade	Gender	Height (cm)	Weight (kg)	Critical Angle (degrees)	BMI
1	3	Male	119	23	81	16.24
2	3	Female	126	27	77	17.01
3	3	Male	126	26	78	16.38
4	3	Male	124	25	78	16.26
5	3	Male	121	23	82	15.71
6	3	Female	120	22	84	15.28
7	5	Male	138	35	81	18.38
8	5	Female	134	32	83	17.82
9	6	Male	144	37	82	17.84
10	6	Female	139	34	81	17.60
11	7	Male	145	37	80	17.60
12	7	Male	148	38	80	17.35
13	9	Male	168	52	81	18.42
14	9	Female	160	50	78	19.53
15	10	Male	158	44	82	17.63
16	10	Female	151	43	79	18.86
17	IB	Male	175	80	75	26.12
18	IB	Female	169	60	76	21.01
19	12	Male	168	62	79	21.97
20	12	Male	176	74	77	23.89

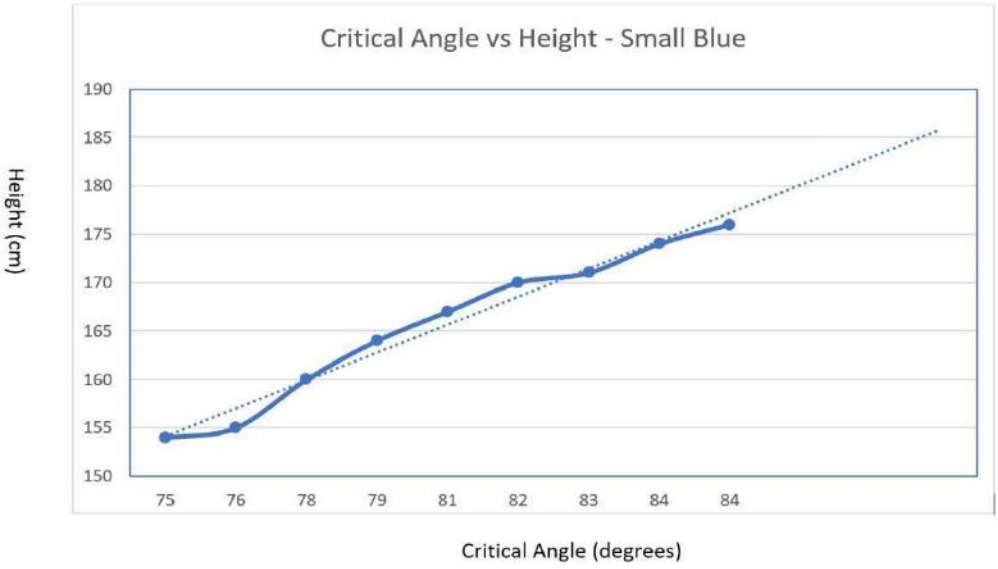
BMI Data

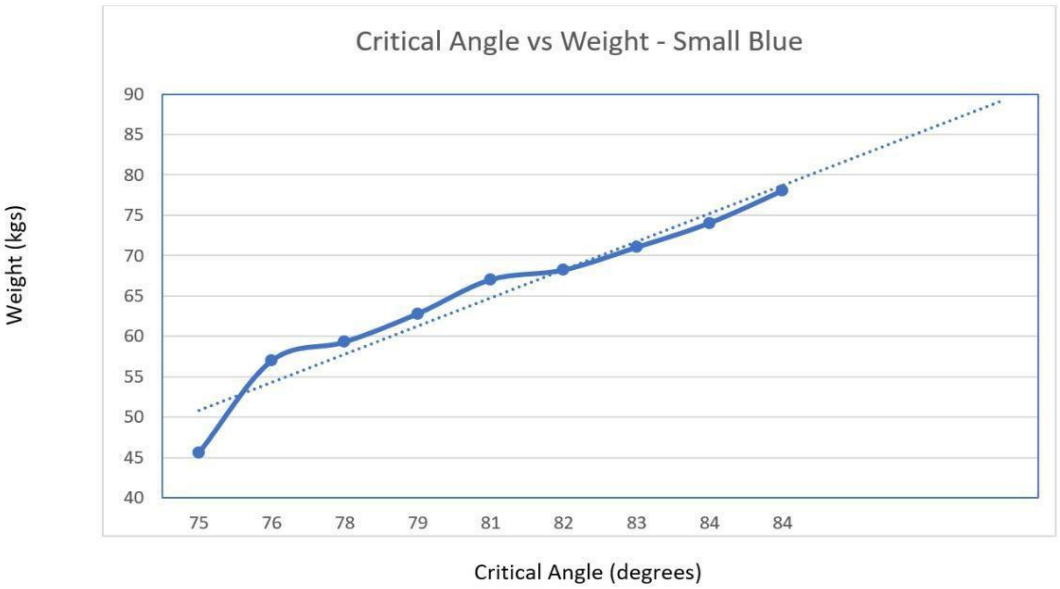
We then conducted experiments to find the critical angle of the three chairs with 12 students of varying heights and weights. The tabular column shows the values of the critical angle. Each chair has two graphs, one with the height as the y axis and one with weight as the y axis. Both the graphs have a critical angle as the x axis.

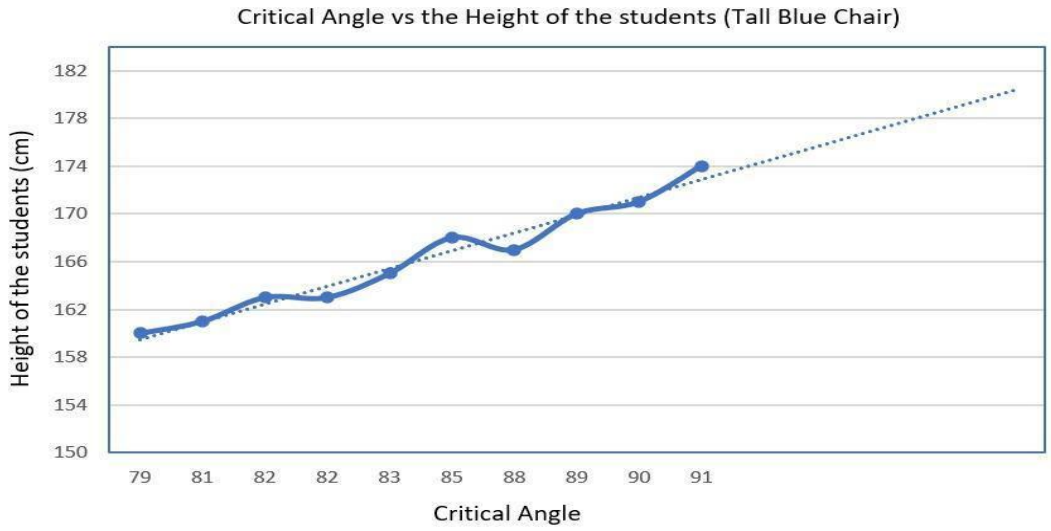
S. No.	Grade	Gender	Height (cm)	Weight (kg)	CA (Tall Blue Chair)	CA (Small Blue Chair)	CA (Red Chair)
1	10	Female	155	45.5	81	93	83
2	10	Female	154	45.5	79	92	82
3	10	Female	159	50	78	90	81
4	10	Female	157	46	86	93	83
5	10	Male	170	61	79	93	79
6	10	Male	162	52	77	89	78
7	10	Male	165	58.5	81	90	77
8	10	Male	167	50	80	77	82
9	10	Male	157	65	87	74	91
10	10	Male	160	50.1	84	77	88
11	10	Male	182	75	85	76	89
12	9	Female	153	45	86	78	89

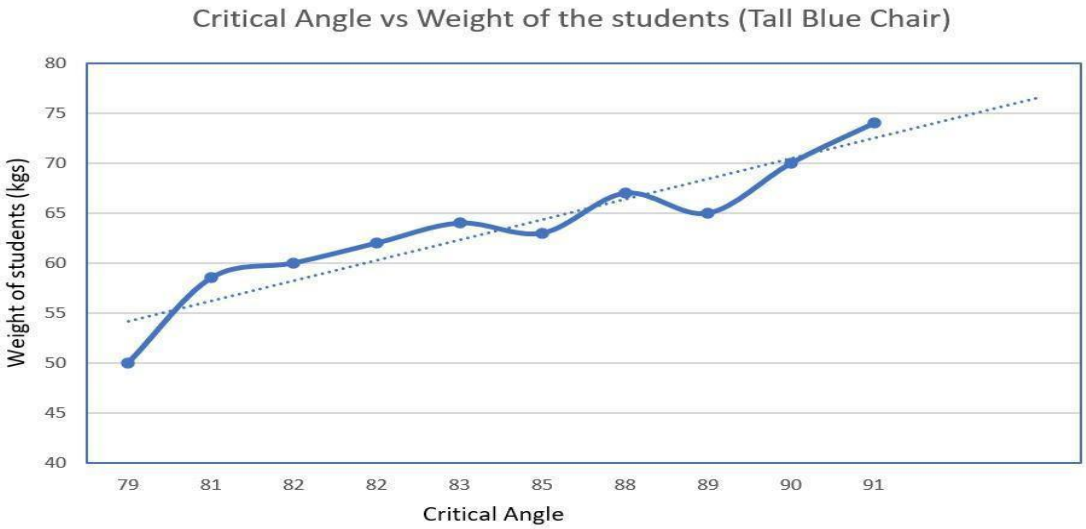
Data for All 3 Chairs

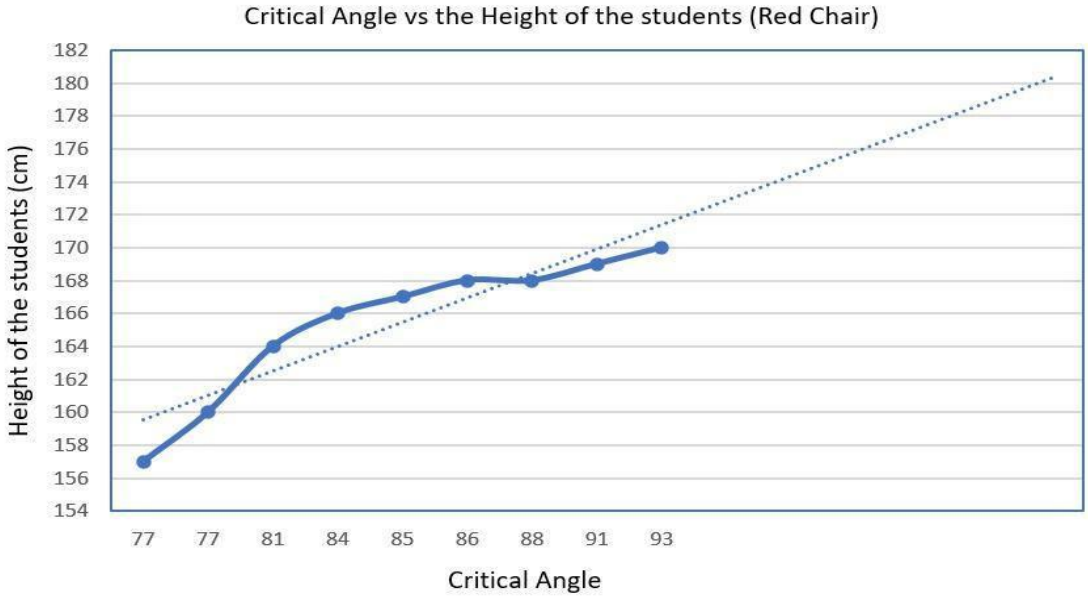

Critical Angle VS BMI of Students
BMI (kg/m²)
30
25
20
15
10
5
0
75° 77° 78° 78° 78° 79° 80° 80° 81° 81° 81° 82° 82° 83°
Critical Angle (Degress)

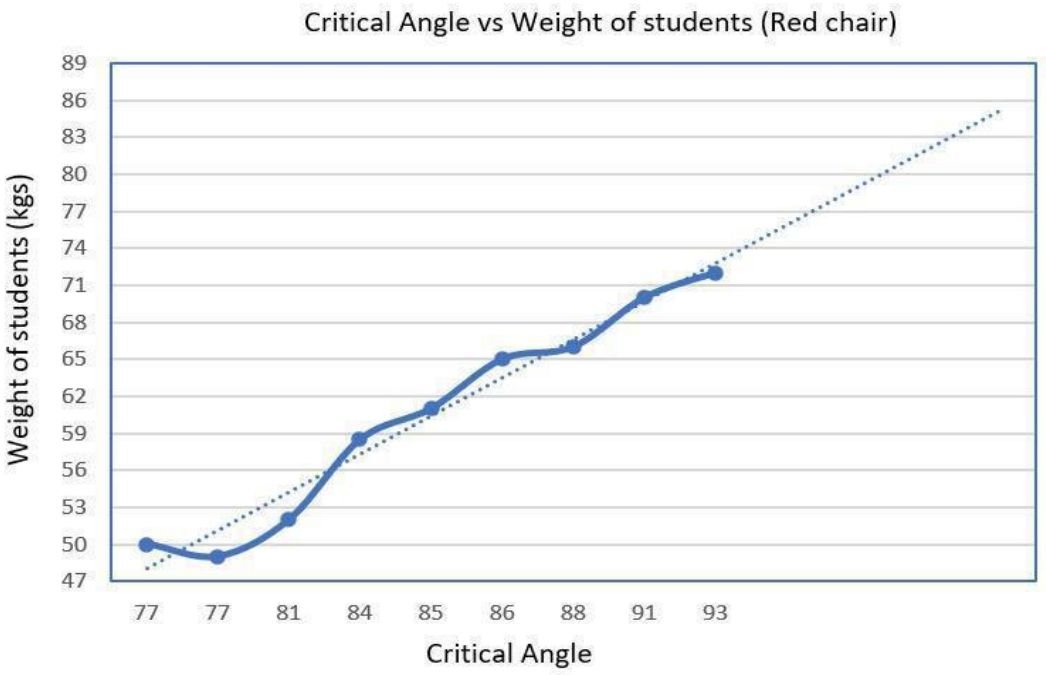

Critical Angle vs Height - Small Blue
Height (cm)
190
185
180
175
170
165
160
155
150
75 76 78 79 81 82 83 84 84
Critical Angle (degrees)


Critical Angle vs Weight - Small Blue
Weight (kgs)
90
85
80
75
70
65
60
55
50
45
40
75 76 78 79 81 82 83 84 84
Critical Angle (degrees)


Critical Angle vs the Height of the students (Tall Blue Chair)
Height of the students (cm)
182
178
174
170
166
162
158
154
150
79 81 82 82 83 85 88 89 90 91
Critical Angle


Critical Angle vs Weight of the students (Tall Blue Chair)
Weight of students (kgs)
80
75
70
65
60
55
50
45
40
79 81 82 82 83 85 88 89 90 91
Critical Angle


Critical Angle vs the Height of the students (Red Chair)
Height of the students (cm)
182
180
178
176
174
172
170
168
166
164
162
160
158
156
154
77 77 81 84 85 86 88 91 93
Critical Angle



We also calculated the slope of each graph (tabulated below) which further assisted us to find out the dimensions of the device.

	Tall Blue Chair	Small Blue Chair	Red Chair
Angle vs Weight	1.538	1.5	1.565
Angle vs Height	1.6	1.667	1.583
Angle vs BMI	0.7167		

Data for Slopes of Graph

We can infer from the graphs that for the red chair that the critical angle ranges from 77 to 93 degrees. Most values are around 90 degrees. For the small blue chair, the angle ranges from 75 to 84 degrees with most values around 80 degrees. For the tall blue chair, the angle ranges from 79 to 91 degrees with most values around 85 degrees.

Thus we can conclude that the taller the chair, the more the critical angle. The more the initial critical angle of the chair, the greater the critical angle. Using the values, we took the least possible critical angle as 75 degrees. So we needed to make a device which prevents the chair from going over 75 degrees.

We also had to account for external factors such as - air temperature, the different tiles in our school, differences in the girth of the legs of the chairs and try to eliminate the human errors which were made. The most important aspect was to find the surface area that is in contact with the floor and the thickness of that part of the prototype. We found out that the length of the leg of the chair is 50 cm, the girth of the chair is 2.64 cm, the angle of the legs is 60 degrees, and a person can rock to a maximum angle of 4 degrees when the prototype was attached.

When a chair rocks, the angle between the back leg of the chair and the floor increases which causes the chair to get inclined. When this angle becomes greater than the critical angle, the chair falls. Thus, to prevent rocking, we designed an addon to the existing chair which prevents the angle from increasing by providing an opposite reaction force. Our prototype is an extension to the back legs of the chair. We will add a specially designed prototype which provides extra surface area behind the back legs of the chair. So, when a student tries to rock their chair, the force gets cancelled out as the extra-large surface area which is in direct contact with the ground provides an equal and opposite reaction. This is based on Newton's second law of motion and Pascal's law. Therefore, the angle between the legs and the floor does not increase thereby preventing the chair from rocking.

EVALUATION :

The graphs of the data we had collected helped us to find the relation between the factors affecting the critical angle which are height and weight of the students rocking the chair and the critical angle of the chair. We analysed the graphs to understand the effect of the various models of the chair on the critical angle for the same heights or weights of two people.

Furthermore, we could use these relations derived from the gathered data to develop the precise dimensions of the device for every different chair model. In addition, the data helped us to design and decide the shape of the device to prevent the chair from rocking.

FINDINGS :

We had conducted a lot of experiments to prove our hypothesis. In our experiment, we first gathered the critical angle values of pupils of different grades and we found out that pupils of different heights and masses had different critical angles. Then we experimented with the pupils trying to rock their chair after attaching the device to the back legs of the chair and calculated the angles up to which the pupils were able to rock their chair. Ultimately, we found out that the pupils were unable to rock their chairs over the critical angle and thus the hypothesis was proven.

Error Analysis

Every measurement that is made, however carefully, will give a range of possible values known as uncertainty or error. Since all of science depends on measurements, it is important to understand uncertainties and where they come from. Error analysis is the set of techniques for dealing with them.

Some of the possible areas which may cause error are as follows:

Measurement of maximum point a student can rock their chair:

We defined critical angle as the point where if a student rocks further the chair will tip over. In other words if a chair is rocked to a point before the critical angle and released, the chair will fall forward but if it is rocked to a point beyond the critical angle and released, it will fall backwards.

In order to calculate the critical angle we asked volunteers to sit on a chair and one of our team members kneel behind the chair using their knees to support the chair. This member of our team would briefly release the chair at different points of rocking and see whether the chair would fall forwards or backwards. Thus, through multiple releases, the critical point could be ascertained.

However such a method of measurement does have certain possibility of error:

- This method of measurement is affected by the distribution of the volunteer's mass. The critical point would be different depending on whether his legs were tucked in or extended. In a real-life situation, it is a natural reflex of all persons to extend their legs straight if they were to tip

over. Since our experiment was controlled and did not involve falling backwards, it did not contain the same level of reflex action a real-life situation would.

- Due to the method used for ascertaining the critical point, it was not possible to pinpoint with exact accuracy what was the tipping point, but rather a rough area between which the chair would sometimes move forward and sometimes move backward. In order to reduce this error, multiple takes would be conducted and its average would be used as a critical point.

- Regular protractors were used for measuring the critical angle thus there could have been instrumental or human error. A protractor has a least count of one degree. Thus, in cases when critical angle was measured to be in between two degrees, we approximated where between the two degrees, the critical angle is.

Cost and Material

Our product is quite affordable, especially when compared to the total price of the chairs and tables used.

With our research we found out that the materials used to make the chair are - plastic, aluminium and acrylic rubber. Hence, we decided to use the same materials as these are sturdy and safe to use.

The rod section of our product is made of aluminium. The price of aluminium fluctuates, but in the UAE, it is currently around 10 thousand dirhams per metric ton. Each of our rods is about 150 cubic centimeters. Since we know the density of our aluminium, we can calculate the mass to be around 405 grams. Thus, the cost price of the materials for the aluminium part of the rod is 4 AED each.

To prevent scratches on the floor and to add friction, we will be adding vulcanized rubber at the bottom of the device. This cost will come to approximately 1 AED. Thus, the price for two rods, including the price of rubber and other costs would be less than 15 AED.

This may sound like a high number but it is quite small when compared to the price spent on tables and chairs by schools. GEMS Modern Academy spends around 300 AED per table and chair set. A 15 AED additional spend is comparatively small considering its benefits and how it can help avoid injuries and liability.

The reason aluminium was chosen as our material was due to the many benefits it offered over other materials. Aluminium has excellent corrosion resistance and can be easily cast. It is extremely strong but lightweight as well. We needed a material that must be able to support the weight of the student, but the rods should not be so heavy that they become difficult to carry or move. Furthermore, the lighter the material, the less the cost of transportation as thereby reducing extra costs.

Other materials we considered were polypropylene and steel. We did not use steel as it has high maintenance costs and more corrosion. Further it is not fireproof therefore extra cost is involved for fireproofing. Steel is also quite heavy, more than 2.5 times as dense as aluminium. Polypropylene was ruled out as it is flammable, susceptible to UV radiation and is difficult to paint.

RECOMMENDATIONS :

For a miniscule price of 15 AED, our device can safeguard the students' health. The manufacturers of the chair and table of a particular school can supply this device.

This device will ultimately benefit the wellbeing of the students. Schools will also benefit as they will avoid legal problems in court caused due to students getting injured.

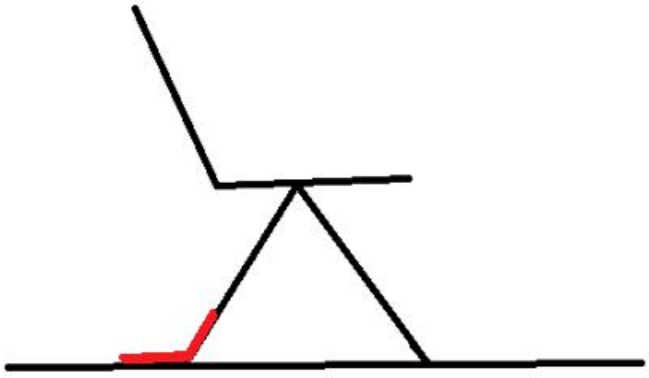
Looking at it from a business perspective, if chair manufacturers add this device to the chair, their sales will increase as the first thing parents and schools want is the safety of the students. With this device being supplied along with the standard chairs, more schools will opt for them.

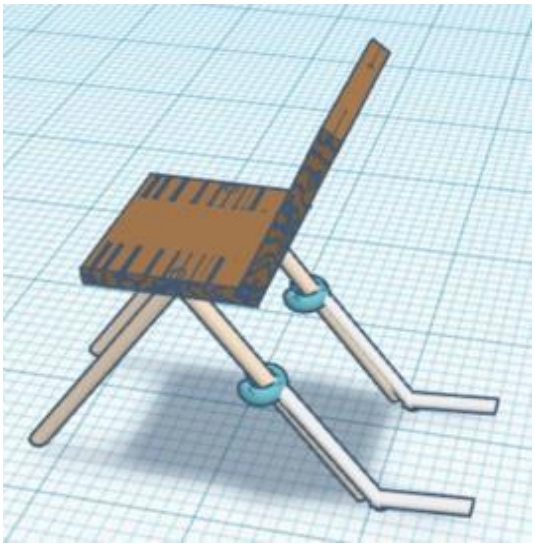
Looking at this from a wellbeing perspective, the health and safety of the students would be the first and foremost priority of each school. Students spend a major part of their life and time in the school and this time period should be safe for each student. The principals of all schools should get this device installed in their chair as soon as possible to avoid any further rocking chair accidents.

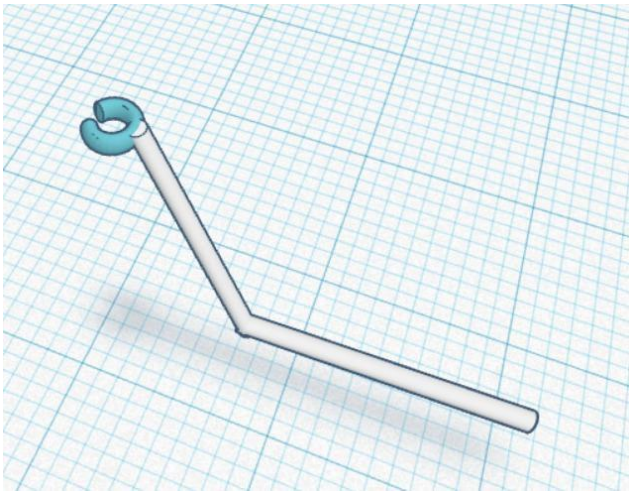
CONCLUSION :

All in all, this device is a necessity in each school. Who doesn't rock their chair? Accidents while rocking are common, and this cheap device can fix everything. The device is just a small add-on to the pre-existing chair and doesn't alter the overall dimensions of the chair. For a cost of just 15 AED, we will be able to safeguard the students.

3D model of our prototype







2D model of our prototype

The material we will use is aluminium for the rod and acrylic as rubber. What our device does, in simple terms, is that it prevents the chair from rocking completely as when a force is exerted backwards to rock the chair, the acute angle between the floor and the back leg increases. However, our device proved an opposing force because of the large surface area that is in contact with the floor. Thus, the acute angle does not increase and thus the chair doesn't rock. thereby preventing accidents due to chair rocking.

After extensive research, experimentation and consultation from teachers, we have come up with our prototype that effectively prevents a chair from rocking.

We plan on incorporating this in every school in Dubai, then move on to UAE and then around the globe as we believe that the health and safety of the students is the topmost priority.

Thus, this device should be incorporated in every school around the globe to ensure the safety of the students while rocking a chair.

LIMITATIONS :

There are a couple limitations to this device however they are highly outweighed by its benefits.

When anything new comes in the market, the logistics are looked into first - transportation, cost and manufacture. The same applies to our device. The manufacturers will have to add another manufacturing machine and increase transportation size. The schools will have to adjust to the budget accordingly. But as mentioned previously, this happens every time something new is launched, so it will not be a big deal.

The device also causes the chair to occupy more space. However, the length to which the device extends is the same as the backrest of the chair. So, the overall dimensions of the chair remain the same. There will also be no chance of students tripping as the device is thin and is in complete contact with the floor. So, no part of the device is jutting out in the air.

Overall, there are no major flaws with the device. The only limitation is that the dimensions of the device need to be adjusted based on the different types of the chairs. A particular device can only be used on chairs whose legs are of certain dimensions. This reduces the potential market for the device, on which it can be used. Multiple devices of differing dimensions will be necessary for different chairs based on their dimension, which complicates the manufacturing process and increases cost.

Scope for further research

Since our device prevents rocking of chairs of specific dimensions, our device cannot be used for chairs of different dimensions. There is further scope for research in the development of a hook that can be adjusted such that it can be used for multiple chairs whose legs are of different dimensions. This is much more efficient than the current model where there are different hooks and therefore different devices for chairs depending on the dimensions of their legs.

Competition

During the month of February in 2008, the public was introduced to a type of chair that prevented students from falling and obtaining horrific injuries while rocking their chairs. According to studies done by a teacher from London, there were over 7000 students in the UK who were admitted to hospitals due to chair-related accidents and over 70 percent of those cases were caused due to the rocking of chairs. A Math teacher, Mr. Wates, had reported many incidents where children in his class would fall off their chairs after 10 minutes into his class. Wates argued that the schools used the type of chairs created by Robin Day having molded plastic attached to four metal legs that were perfect for rocking.

Julia Neal, former national president of the Association of Teachers and Lecturers announced that it was and still is a big health and safety issue. The Math teacher along with a P.E teacher had persuaded designers to invent a chair that was untippable and prevented students from being able to rock their chairs. The "non tipping chair" was created by Sedley Place and was nicknamed Max chair. The chair had curved legs and an arched back for helping students have a good posture while sitting. It was told that no child had been able to lift the chair more than 5 cm off the ground. The public were guaranteed that accidents caused due to rocking of chairs would be reduced but would not solve the problem completely. Unfortunately, there were still many accidents due to students rocking chairs even after the school implemented the use of the Max chairs.

Robin Day Plastic Chair (Left), Max Chair (Right)

Our project is incredibly unique from previous prototypes because we are creating a separate device which will be attached to the school chairs and prevent students from being able to rock their chair instead of creating a different type of chair itself. The device will be able to be screwed to the chair so that students do not dismantle it from the chair.

No one else has tried to solve the problem because it is very strenuous and laborious to come up with a solution for this problem as we have to account for various factors.

Acknowledgement

We would like to express our sincere and heartfelt gratitude to Khushal Saini and Shriyans Sharma who helped us develop and design our product. They have been extremely cooperative, dedicated and passionate. Without their assistance, our product would not be what it has developed into.

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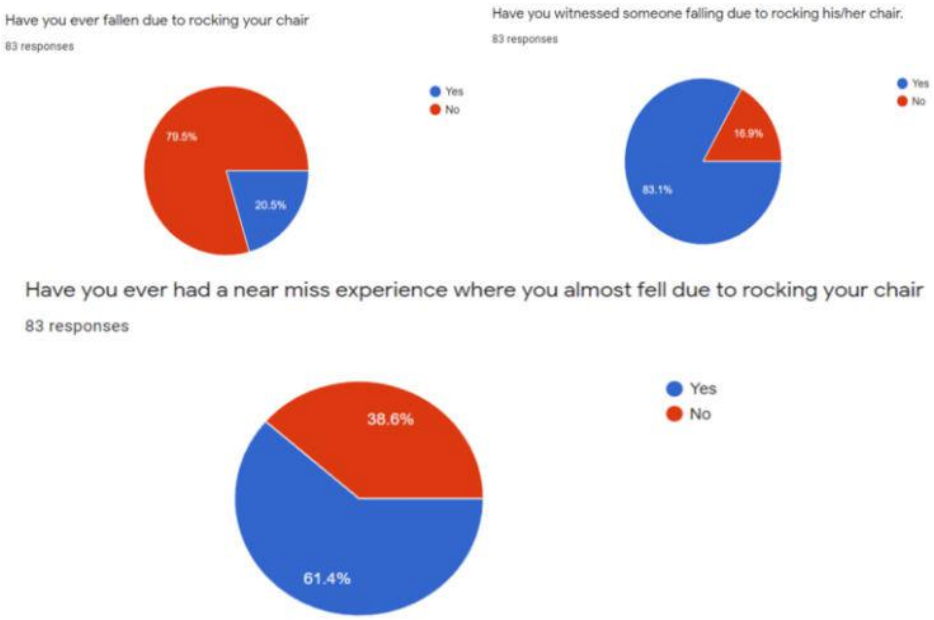
Appendix

We had conducted a survey with the students at our school who are currently in middle and senior school which include the students of Grades 7, 8, 9, 10 and 11. We had various questions but there are three main questions that helped us determine that there have been many horrific incidents related to the rocking of chairs in our school. The three main questions are – Has the student ever fallen off their chair while rocking his/her chair? Has the student ever witnessed someone else fall while rocking their chair? And finally, has the student ever had a near miss experience while rocking their chair? Most of the students have said that they have seen someone else fall while rocking their chair and confessed to having a near miss experience while rocking their chair.

This severity of this problem is now understood by us which led us to coming up with a solution for this issue. One of our inspirations for finding a solution for this was our own class teacher who told us about an incident where a girl was rocking her chair during class resulting in injuring her back. There are endless types of injuries that can occur by falling off a chair. Some frequent injuries are back and neck injuries. In severe cases, falling from a chair can cause head and brain injury.



Survey Results

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Relevance of Senior Secondary School Religious Education to the Medical Profession in Zambia.

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Abstract: *This article examines key moral values and attitudes promoted by senior secondary school Religious Education and establishes how relevant or suitable they are to the required moral values and attitudes in the medical professions in Zambia. The objectives of the study were; to identify key moral values and attitudes promoted by senior secondary school Religious Education syllabuses in Zambia. The other objective was to explain the relevance or suitability of key moral values and attitudes promoted in senior secondary school Religious Education to the required moral values and attitudes in the medical professions in Zambia.*

The study discussed in the article was qualitative in nature with a descriptive design which identified the moral values and attitudes of ***integrity, responsibility, empathy religious faith and respect for others*** *in RE syllabuses. These identified moral values and attitudes were further compared with the required moral values and attitudes in the actual work of medical doctors. Data was collected through document analysis, interviews and observations. The total number of respondents in the study was thirty-six. Document analysis was used to analyse Religious Education Syllabuses and further used to analyse medical doctors' ethical codes of conduct documents. For the purpose of triangulation, the moral values and attitudes of medical doctors were further observed in patients' wards at UTH.*

The study discussed in the article revealed that senior secondary school Religious Education syllabuses contained key moral values and attitudes including ***integrity, responsibility, empathy, religious faith and respect for others****, which were relevant to the medical profession. This led to the final conclusion that Religious Education as a school subject is relevant to the medical professions in Zambia.*

Finally, the study discussed in the article recommends that at senior secondary school level, pupils should be encouraged to learn Religious Education because it is an important school subject which can equip them with integrity, responsibility, empathy, religious faith and respect for other people's religious beliefs. In raising the status of Religious Education, the study recommends the need to make people aware that the moral values and attitudes learned in Religious Education are relevant to important fields such medicine. Finally, the study discussed in the article challenges other scholars to research further in order to establish how suitable or relevant the moral values and attitudes promoted by Religious Education are to other professions not covered in this study.

Key Words: *Integrity, Responsibility, Empathy, Religious Faith, Respect for Others, Relevance, Religious Education, Medical Profession.*

INTRODUCTION :

The formal teaching of Religious Education in Zambia was started by the Christian missionaries who introduced formal education around the 1890s. The missionaries believed that Religious Instructions equipped learners with good social attitudes, morals, skills and knowledge that were relevant or suitable to a Christian life (Snelson, 1974: 248-249).

At senior secondary school level, Religious Education in Zambia is no longer the main subject in the curriculum as Mulando (2011) and Ziwa (2007) contend that Religious Education has a low status on the school curriculum because it has become an optional subject. In his study on the status of Religious Education secondary schools in Kitwe, Mulando (2011) found that school administrators consider Religious Education as a simple subject which can be taught even by untrained teachers such as the clergy because they basically consider it as Bible Knowledge. He elaborates that some pupils find Religious Education boring because some teachers do not promote the subject as they seem to have little understanding of its purpose and are not proud to teach the subject. Comparatively, the Ministry of Education (1996) supports Mathematics, English and Science as the core or main subjects that should be compulsory and allocated more time on the school time table. These subjects can be considered as being high status subjects on the school curriculum. On the other hand, the Ministry of Education, (1996: 52-53) states that the general aim of senior secondary school education is to make pupils responsible persons capable of making a useful contribution to society and adequately qualified for the adoption of adult roles. In line with this aim, and attempting to show the importance of Religious Education in Zambia, Mujdrica (2004) Henze (2000) and Simuchimba (2001) contend that Religious Education promotes moral values and attitudes that are required in everyday life. Linking these moral values and attitudes to the moral values and attitudes required in different professions, Grawford and Graham (1992) assert that the moral values and attitudes promoted in Religious Education are required in professions such as tourism, medicine, nursing, law, education, and public service.

It is in this regard, therefore, that the study discussed in this article examined key moral values and attitudes promoted by Religious Education and attempted to establish how relevant or suitable they are to the required moral values and attitudes in the medical profession in Zambia.

LITERATURE REVIEW :

Relating religion (Religious Education) to the medical profession, Ashworth (1975) observed that freedom from interferences can only be preserved by restricting every one's freedom to exercise power over others, which is bound up with recognition of the right to life and physical security as one of the natural rights. He reveals that occasionally, cases arise in which maintenance of an individual's right to life conflicts with his or her duty to abstain from violence while protecting his or her freedom.

Malone (1998) also elaborates that medical moral principles are centered on the preservation of life and health of patients where the doctor is expected to act in the best interest of the patient to the best of his or her ability by taking care and not doing harm to patients. The doctor is supposed to practice justice by distributing scarce resources fairly to patients. Malone further explains these medical moral principles through the patients' right to life, arguing that patients have the right to sufficient information about their illness to ensure trust and avoid betrayal. Additionally, Malone reveals that medical doctors have no right to share the personal information of their patients with other people as patients have the right to privacy and strict confidentiality.

In his philosophical discussion on medical ethics, Malone (1998) defines medical ethics as the application of critical moral reflection to the field of medicine. In relation to the promotion of moral values promoted in Religious Education, Malone observes that medical ethics are also based on Christian ethics though other approaches such as virtue ethics, feminist ethics and trans-cultural ethics are also important.

Bush (1998) discusses medical doctors' fitness to practice and contends that the medical profession is a noble one which requires great responsibility. He observes that in determining if an individual is fit to practice medicine or not, one has to first consider what is involved in the medical profession, arguing that incompetence in the medical field must be reported either by the health professionals or the public to the health professional body, which has the powers to investigate, discipline and even remove medical doctors who do not follow medical ethics from the practicing register.

In his discussion on infamous conduct of autonomous individual medical doctors, Banda (1998) contended that registered medical practitioners were accountable for their moral conduct at their work place as well as outside their workplaces. He provided examples of common cases that showed infamous conduct which included sexual relations with patients or their parents, alcohol abuse and public nuisance, fighting or conviction for assault, fraud or falsifying documents and uttering disparaging remarks about colleagues. Banda concluded that every member of the medical profession should not abuse the high status of the medical profession by bringing it into disrepute, adding that any member of the medical profession who exhibits undesirable behaviour should be reprimanded and disciplined.

In his article on Euthanasia and the Sanctity of life, Banda (2009) defined Euthanasia which derives from two Greek words meaning 'happy death', the termination of the life of a terminally ill patient. He explained that Euthanasia is associated with the concept of 'mercy killing' and painless release from life adding that it is a serious moral dilemma for medical doctors because they have to make a critical moral decision. Banda sited an example of homicide or murder, which is a criminal offence in section 200 of the penal code, Cap 82 of the laws of Zambia. He revealed that Euthanasia still remained an issue of debate but provided explanations on the sanctity of life which involves religion. He explained that the prohibition of taking human life in any form was based on the most fundamental and deeply felt ethical and religious conviction that human life is sacred and is the core of everything. Banda concluded that Euthanasia was generally condemned and in many countries including Zambia, no matter what the quality of life the patient had, whether terminally ill, and hours away from death or in great pain, his or her life must be respected without interference. This implies that mercy killing or painless release from life is not allowed in Zambia and is considered immoral.

In her discussion on health care professionals in Zambia, Bbaala (2007) asserted that health professionals should be able to take time and adequately attend to each patient. She observed that due to increased workload, the health care professionals may have a huge number of patients to attend to and resort to spending less time on each patient. She cautions that spending less time treating each patient reduces and compromises health care delivery, adding that it is the responsibility of health care professionals to ensure that they spend reasonably adequate time on each patient.

Aims / Research Objectives :

The aim of this study was to examine key moral values and attitudes promoted by senior secondary school Religious Education and establish how relevant or suitable they are to the required moral values and attitudes in medical professions in Zambia. The specific objectives of the study were firstly; to identify key moral values and attitudes promoted by senior secondary school Religious Education in Zambia and secondly; to explain the relevance or suitability of key moral values and attitudes promoted in senior secondary school Religious Education to the required moral values and attitudes in the medical profession in Zambia.

RESEARCH METHODOLOGY :

The study discussed in this article used a qualitative research paradigm in which the researcher aimed at collecting respondents' views and experiences in the medical profession. A descriptive design was used in this study due to the qualitative and interpretive nature of the data collected. According to Kombo and Tromp (2004: 71), a descriptive survey is a method of collecting information on people's attitudes, opinions, habits or any other social issues through interviews or questionnaires and then

coming up with a description of the state of affairs as it exists. This involves the measuring, classification, analysis, comparison and interpretation of data. Creswell (2009: 173) points out that the qualitative paradigm had a great influence on research procedures as they tend to be similar to the qualitative strategy of inquiry. The study used document analysis to obtain secondary data from Zambia's senior secondary school Religious Education syllabuses 2044 and 2046 and the ethical codes of conduct documents for the two professions under study. Primary data was collected through face to face interviews and observations.

The sample used in this study comprised of the Health Professions Council of Zambia (HPCZ) Registrar, fourteen qualified and practicing medical doctors from the University Teaching Hospital (UTH), the Assistant Deans for the UNZA Schools Medicine, ten UNZA seventh year medical students and ten Religious Education teachers. The total number of participants in this study was thirty-six. This number was adequate because a qualitative study requires only a small number of respondents as it depends on the quality of data collected rather than quantity (Kombo and Tromp, 2004).

Due to the qualitative nature of this study, the researcher used document analysis, one to one semi-structured interviews and observations as methods of data collection. According to Creswell (2009: 175), qualitative research requires that a researcher spends considerable time in the natural setting. Therefore, the whole process of data collection took thirty days.

Validity and reliability strengthen qualitative research findings and hence it is important to ensure that it is carried out throughout the research (Creswell, 2009: 190). Therefore, the researcher ensured validity of the research findings in this study through triangulation of data collection methods and instruments.

Data analysis started during data collection or while carrying out document analysis, interviews and observations. The themes used as analysis units were derived from the research questions and objectives in order to have meaningful data interpretation and discussion. These themes were the moral values of integrity, responsibility, empathy, religious faith and respect for others. Data from field notes recorded in document analysis check-lists, observations schedules, interview guides and researcher's note book were extracted and put in a manuscript under the same five themes used during data collection mentioned above. A coding system was developed based on the samples of collected data on document analysis check-lists, observations schedules, interview guides and researcher's note book.

Due to the sensitive nature of some aspects of the study, some names of participants remained anonymous in order to maintain their right to privacy. In order to ensure the integrity of the study, the researcher exercised honesty and trust with the participants as he was open and free to them. Collection, presentation, interpretation, analysis and discussion of data were done in an honest and objective manner in order to avoid the researcher's opinions, presumptions and assumptions affecting the findings of the study.

Discussion and Analysis of the Research Findings :

Moral Values and Attitudes promoted by Senior Secondary School Religious Education that are relevant to the Medical Profession in Zambia

This article reveals the identified moral values and attitudes in Religious Education that are also found in the medical profession. This include: integrity, responsibility, empathy, religious faith and respect for others as will be highlighted in the discussion of the findings under this heading.

Integrity

The findings of the study in this article show integrity which is promoted in the Religious Education syllabuses and UNZA School of Medicine curricula and is required in the work of medical doctors. For example, Religious Education lessons on honesty and loyalty to elders, authority and the Supreme Being are related to the honesty, confidentiality, professionalism, objectivity, and accuracy expected to be practiced by medical doctors in their work. Medical doctors are expected to show integrity by being

honesty, avoiding corruption and taking advantage of their clients and patients. Malone (1998) explains integrity in the medical profession through patients' right to life which also elaborated in Article 12 and 17 of the Bill of Rights in Zambia's constitution. He points out that patients have the right to sufficient information about their illness in order to ensure trust and avoid betrayal adding that medical doctors have no right to share patient's personal information with other people because they have the right to privacy and strict confidentiality. This moral value of confidentiality and trust required in medical doctors clearly shows promotion of integrity similar to that promoted in Religious Education.

In justifying the importance of integrity in professional work and life, Riggs (1990: 62) explains that all human societies depend on honesty in dealings and respect for the truth. This is also in line with Simuchimba (2005) who points out that senior secondary school Religious Education should contribute to the growth of pupils' maturity as morally upright adults and citizens. Integrity is important in medical doctors' work as the findings revealed that they were expected to have a noble character without any blemish or criminal offence. Therefore, as a subject that promotes integrity and honesty, Religious Education and its promotion of moral values and attitudes can be said to be relevant or suitable to the practice in medical professions.

Responsibility

The second moral value taught in Religious Education that is relevant or suitable to the required moral values and attitudes in medical profession in Zambia is responsibility. Senior secondary school Religious Education lessons on corruption, personal qualities, service in society, attitudes towards work in different religions and God's direction of human lives help pupils to develop a sense of responsibility. Religious Education pupils are taught to relate well with others, use their leisure time responsibly and work hard for the benefit of society. Now, all these lessons are relevant or suitable to the medical doctors' work. In this regard, Bush (1998) contends that the medical profession is a noble profession which requires great responsibility arguing that incompetence in the medical field must be reported either by the health professionals or the public to the health professional body.

Similarly, Thabo (2009) discusses health care services in Zambia and postulates that a good health care system is important for the development of any society and most important it is a human right adding that every human being has the right to access proper health facilities and services. Therefore, she explains that medical doctors, helped by their government should show responsibility and ensure that every person has access to free medical care. This responsibility is clearly similar to that promoted in Religious Education.

Medical doctors are supposed to be role models with the responsibility of exhibiting good public conduct including dressing decently, not involving themselves in careless public dancing, not using harsh language to clients and patients or misusing alcohol and exhibiting violent bahaviour. Medical doctors are also required to relate well with colleagues, be dedicated to their work and consider the consent of clients and patients as first priority, by acting promptly, consciously, diligently and reasonably. On Religious Education promoting moral responsibility, Cox (1966: 56) states that Religious Education provides practical guidance on behaviour and induces moral conduct. He further points out that in Britain, parents insist that their children be taught the difference between right and wrong through subjects like Religious Education. The findings here are also in line with Boudillons' (1990: 18) contribution that religion and its learning has a great positive social impact as it unifies society and supports moral values and attitudes that keep society together as responsibility is promoted in its members.

Empathy

Empathy was another moral attitude taught in Religious Education that was relevant or suitable to the required moral values and attitudes in the medical professions in Zambia. For example, Medical doctors are required to show compassion, kindness and care in their handling of patients, especially sensitive cases such as HIV and AIDS patients, abused children, blood transfusion, postmortem, genetic manipulation and organ transplant cases. This is in line with Riggs (1990: 62) who argues that Religious

Education provides values such as love, sensitivity, compassion and care for others, including the weak. Malone (1998) also elaborates that medical moral principles are centered on the right to life through preservation of life and health of patients where the doctor is expected to act in the best interest of the patient to the best of his or her ability by taking care and not doing harm to patients and practicing justice by distributing scarce resources fairly to patients.

Similarly, Banda (2009) reveals that although Euthanasia (killing a terminally ill patient) still remains an issue of debate, the sanctity of life which involves religion should be considered. He explains that the prohibition of taking human life in any form is based on the most fundamental and deeply felt ethical and religious conviction which states that human life is sacred and is the core of everything and hence it should be respected protected and reserved at all costs. He further states that in the Judeo-Christian tradition, the sanctity of life is a gift from God and no one has the right to take it away under any circumstances. This sanctity of life traced from religion together with the right to life enshrined in Article 12 of the Bill of Rights in Zambia's constitution clearly shows the promotion of empathy in both Religious Education and the medical profession. This relevance has also been supported by Grawford and Graham (1992) who recommend Religious Education as a relevant subject to everyday life and point out that studying religion at school was of great value for jobs in tourism, medicine, nursing, law, education, police work and public service.

Religious Faith :

As alluded to earlier in this article, religious faith as an attitude is naturally promoted in Religious Education but only implicitly promoted in the Medical curricula. This means that although is not the core value or attitude required for one to become a medical doctor, its suitability or relevance to the moral values and attitudes promoted in medical professions is fairly clear.

In the medical profession, the relevance of religious faith can be seen through medical doctors' use of religious faith and prayer in dealing with difficult conditions such as lumbar puncture, cancer, gasping for breath as well as the counseling of patients and encouraging them to have the healing strength from God. Additionally, the upholding of the right to life by following medical ethics of protecting human life and taking the patients' consent as first priority by not doing any harm to life are similar to the prohibition of killing in different religions including Christianity in the Ten Commandments (Article 12 of Part III the Zambian Constitution). This is also in line with Simuchimba's (2001) position that the spiritual and moral aspects of Religious Education make it different from other school subjects in terms of contribution to the preparation for life in society, as well as Henze's (2007) and Masterton's (1987) elaboration that the spiritual nature of Religious Education is necessary in life. This necessity of religious faith in work and life pointed out by Simuchimba, Henze and Masterton justify the finding that moral values and attitudes promoted in senior secondary school Religious Education syllabuses are suitable to the required moral values and attitudes in the legal and medical professions in Zambia.

Respect for Others :

Finally, the relevance or suitability of moral values and attitudes promoted in senior secondary school Religious Education to the required moral values and attitudes in the medical profession can be seen through respect for others. As earlier explained, this is one of the key attitudes taught in senior secondary school Religious Education and promoted in the medical profession.

The moral attitude of respect for others learnt in Religious Education is related to the medical doctors' moral attitude of treating patients from different religious traditions with respect, dignity and privacy. Thus the provision of a column for religious denomination on patients' record cards enables medical doctors to know their patients' religions or religious beliefs so that they can handle them respectfully, especially if they have knowledge of the different religious traditions from Religious Education. It is therefore, clear from the findings that the knowledge of different religious beliefs, values and skills of overcoming racial, cultural and language barriers acquired from Religious Education helps learners including those who become lawyers and medical doctors to be neutral and tolerant to people who

follow different religious beliefs and values in life. The forgoing findings are in line with Cox (1966: 53), who asserts that the aims of Religious Education must be adequate to the teacher, worthwhile to the children and useful to the community. In this regard, the moral attitude of respect for others, learnt in Religious Education is worthwhile to the pupils and useful to the community through the services of medical doctors who may show this moral attitude in their work. The foregoing findings and argument is also in line with Henze's (2007) contention that the learning about different religions in Religious Education should not be seen as a danger but as an enrichment of learners' moral values and attitudes useful in the society in which they will live and work.

CONCLUSION :

This article has discussed the relevance of Religious Education to the medical profession in Zambia. In the first specific objective it was established that senior secondary school Religious Education syllabuses 2044 and 2046 in Zambia taught some key moral values and attitudes that include; integrity, responsibility, empathy, religious faith and respect for others.

In the second objective, the findings showed that the identified moral values and attitudes including integrity, responsibility, empathy religious faith, and respect for others taught in Religious Education are directly and indirectly relevant or suitable to the required moral values and attitude promoted in the medical professions in Zambia. This is because in the medical work, the practice of humility, obedience, loyalty, confidentiality, honesty, love, care, compassion, kindness and fairness in dealing with patients is promoted. The medical profession also calls for dedication to duty, good public conduct, sobriety, transparency, respect for others and fairness in dealing with both clients and the public at large. This, therefore, means that a learner who has done school Religious Education is more likely to put into practice the above stated qualities, values and attitudes. However, it should be acknowledged that medical doctors who did not learn Religious Education may have acquired the moral values and attitudes discussed above, from other sources that were not part of the study discussed in this article. Nevertheless, the study clearly showed that moral values and attitudes learnt in Religious Education are relevant 'suitable' and contribute greatly to the required moral values and attitudes in the medical professions in Zambia.

RECOMMENDATIONS :

The article highlights recommendations of the study as the findings of the study raised some important issues that may require change of mindset, immediate action or further research. Therefore, the following are the recommendations of the study: Firstly; the study recommended that, at senior secondary school level, pupils should be encouraged to take Religious Education because it is an important school subject which can equip them with important moral values and attitudes including integrity, responsibility, empathy, religious faith and respect for other people's religious beliefs established in this study.

Secondly; the study recommended that, in order to show the importance of Religious Education, there is need to make school administrators, teachers and pupils aware that the moral values and attitudes learned in Religious Education are relevant 'suitable' to the required moral values and attitudes in many professions as shown in the legal and medical professions explored in this study. Lastly; the study the study discussed in this article provoked other scholars to research further and establish how relevant or suitable the moral values and attitudes promoted by Religious Education are, to other professions rather than the medical professions explored in this study.

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Allelopathic Potential of *Tamarindus indica* L.on morphological parameters of Black gram (*Vigna mungo* (L.) HEPPER)

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Abstract : The Present investigation has been carried out to assess the Allelopathic Potential of *Tamarindus indica* L. on morphological parameters of Black gram (*Vigna mungo* (L.) HEPPER). Various concentrations of leaf latches and leaf extracts were prepared respectively from fully senesced fallen leaves and fully matured leaves of Tamarindus tree for the experiment. In the germination study, healthy and uniform seeds of *vigna mungo* selected and experiments were conducted by the application various concentrations of leaf leachates and leaf extracts to the seeds length and germination study and were dramatically decreased with increasing the concentrations of leaf extract The leaf extract had more inhibitory effect than the leaf leachates on germination and morphological parameters of black gram. Form this investigation it clearly showed *Tamarinbus indica* had strong allelopathic effects on germination and growth of black gram *vigna mungo*.

Keywords: Allelopathic Potential, Germination study, leaf leachates, leaf extracts, morphological parameters, black gram, Tamarindus tree.

INTRODUCTION :

Hans Molish(1937), Emeritus professor of plant physiology at the university of Vienna, coined the word 'Allelopathy' from Greek words ‘allelon', meaning 'mutual' and pathos, meaning harm to describe the effects that one plant could have on another due to released chemicals. Allelopathy has received increased attention Over the last 40 years with studies on effect of weed interference on crop yields, allelopathic effects of crop plants on other crop plants, crop plants on weeds and allelopathic effects of woody seed plants on crop plant in forestry and Horticultural fields. The present study was carried out to 'nvestigate the allelopathic effect of Tamarindus indica L. leaf leachates and leaf extracts on seed germination and seedling growth of black gram (Vigna mungo Hepper,).

OBJECTIVES OF THE STUDY :

- Vegetation pattern in Plant Communities
- To understand the mechanism of action of Allelochemicals inhibiting the uptake of nutrients
- To study the morphological and biochemical parameters with effect of leaf leatchates and leaf extracts.
- Seed germination and Seedling Growth of *Vigna mungo.*

MATERIALS AND METHODS :

Seeds of *Vigna mungo L.* were procured from Regional Pulse Research Station vamban, Pudukottai District , Tamil Nadu. The fully matured senesced fallen leaves of *Tamarindus indica L.* were collected from Annamalai University campus, Annammalai nagar.

Preparation of leaf leatchates,

The Preparation of leaf leatchates and dried fresh leaf extracts and germination studies were followed as per the methods of Padhy et al., (2000)

20 grms of fallen leaves were collected from *Tamarindus indica L.,* tree. They were washed in tap water thoroughly followed by tap water and were later soaked in 100 ml of distilled water for 48 hours, later the leaves were filtered and the filtered water is known as leaf leatchates and were considered as 20% concentration.

Preparation of Dried leaf extracts

The collected Tamrinduss indica were air dried, ground to a fine powdered and extracted in water, where in 25 grms of Tamrinduss indica leaf powder was soaked in 1 litre of distilled water kept for 48 hours at Room temperature with occasional shaking.

Germination Study,

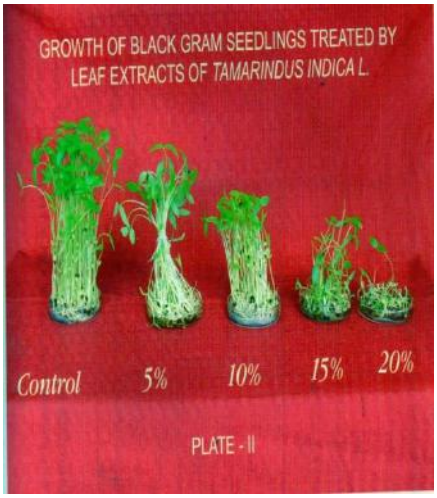
The selected seeds of *vigna mungo* were surface sterilized with 0.03% formalin solution for 20 minutes and then washed thoroughly with distilled water.

In the germination study, 25 seeds were placed sterilized pertiplate lined with two layered filter paper, 10 ml of leaf leachates and leaf extracts was added per treatment to the seeds on the petri plates. Distilled water served as a control. The process was continued for 15 days. Later the seeds were allowed to germinate in a growth chamber and kept in light intensity of 2+- 0.4 K Lux and at 30+-2°C till 15 days.Each treatment were repeated in triplets. The number of seeds germinated were counted regularly each day and germinating percentage was calculated.. The morphological parameters were studied on the root and shoot length from 8th and 15th day after sowing. The infusion was decanted and filtered through 3 layers of Whatmen No 1 filter paper.

The concentrations of leaf leatchates and leaf extracts were prepared with dilutions such as 5%, 10% ,15% and 20% was the standard solution, with distilled water were prepared respectively from fully senesced fallen leaves of Tamarindus tree for the experiment.

The Germination Percentage refers to the appearance of the radical by visual observation.It was calculated using the formula, The formula was given by Carley and Watson (1968)

$$\text{Germination Percentage} = \frac{\text{Number of seedsgerminated}}{\text{Total number of seeds sown}} \times 100$$



Observations and Results

The study showed a dramatically decreased with increasing the concentrations of leaf extract

The leaf extract had more inhibitory effect than the leaf leachates on germination and morphological parameters of black gram.

Form this investigation it clearly showed *Tamarinbus indica* had strong allelopathic effects on germination and growth of black gram *vigna mungo*.

Allelopathy depends on chemical compounds mainly added to the environment from living plants or dead and decaying plant parts (Tukey, 1969)Allelochemicals also refers to the secondary metabolites produced by plants and are the byproducts of primary metabolitic process and they have no physical function essential for the maintance of life (Levin,1976).

Table :1 Allelopathic effect of Leaf Leachates and Leaf Extracts of *Tamrindus indica* L. on germination percentage of Vigna mungo (L.) Hepper.

Concentrations	Leaf Leachates	Leaf Extracts
Control	97	97
5%	91	86
10%	84	78
15%	76	63
20%	67	56

Table :2 Allelopathic effect of Leaf Leachates and Leaf Extracts of *Tamrindus indica* L. on the shoot length and root length (cm/plant) of Vigna mungo (L.) Hepper.

Concentrations	8th day old seedlings		15th day old seedlings	
	Shoot length	Root length	Shoot length	Root length
Control	9.2	6.1	15.12	8.4
5%	8.7	5.6	14.1	7.2
10%	7.2	5.2	12.5	6.1
15%	0.6	4.8	10.3	5.4
20%	5.9	4.2	9.2	4.1

The acquired knowledge of allelopathy helps in

i) Explaining vegetation patterns in plant communities
ii) Understanding reduction in crop yields to adaptation of minimum tillage and use Of stubble mulch of crop residues.
iii) Breeding crop plants that will inhibit at the weeds through allelopathic action, thus reducing the need for chemical weed killers.
iv) Afforestration.
v) Understanding several ecological phenomena such as succession patterning of vegetation etc,

Allelopathy is a area where research studies have shown that allelopathy could be utilized, for the following,
a) To increase the production of food grains, vegetables, fruits and forestry.

b) To decrease harmful effects of modern agricultural practices on soil health and productivity and

c) To maintain the soil productivity and pollution free environment for our future generations. Allelopathy is ecologically important because it influences dominance. productivity. succession. Species diversity, composition of plant communities and vegetation dynamics,

CONCLUSION :

The study clearly showed the Allelopathic potential of leaf leachates on the germination and growth parameters black gram (Vigna mungo.(L.) Hepper. From the investigation the Leaf Extracts of *Tamrindus indica* L. had more adverse effect on the germination ,growth of Black gram seedlings than the Leaf Leachates

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Synthesis, Characterization and Biological Activity of Aromatic Ring Selenosemicarbazone

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Abstract : Selenium is a p-block element with atomic number 34, valence electronic configuration ([Ar] $3d^{10}$ $4s^2$ $4p^4$) and also a member of chalcogen family. Selenium is an essential trace element in having its own codon in mRNA that specifies its insertion into selenoproteins as selenocysteine and this insertion for selenoprotein production has some implications for the requirement of selenium for cancer prevention and this element also involved in different physiological functions of the human body, having its chemoprevention properties. Its deficiency explained by low 60-70% of normal selenoenzyme activity levels in brain and occurs only when a low selenium level is linked with an additional stress. One analogues of selenium is selenosemicarbazone. Reaction of KSeCN with hydrazine hydrate and cyclohexanone in acidic medium resulted into formation of cyclohexanone selenosemicarbazone. Anti-tubercular activity of the compound is also investigated.

Keywords : Selenium, cyclohexanone selenosemicarbazone, isatin selenosemiarbazone, anti-tubercular activity

Materials

Cyclohexanone, hydrazine hydrate, HCl, methanol are purchased from LobaChem, whereas KSeCN, isatin, indole chemicals are procured from Sigma-Aldrich.

Instrumentation:

Melting Point: The melting point of synthesized ligands and their complexes were determinedwith a lab fit electrically heated apparatus.

Infrared spectroscopy: Infra-red (IR) spectra was recorded using KBr pellets by SHIMADZUFTIR 8400S, Fourier Transform, Infrared spectrophotometer (Department of chemistry, Lovely Professional University).

NMR spectroscopy:

^1H and ^{13}C NMR spectra were recorded on a BRUCKER ADVANCE III NMR Spectrophotometer at 500 MHz in DMSO and $CDCl_3$ with TMS as the internal reference.

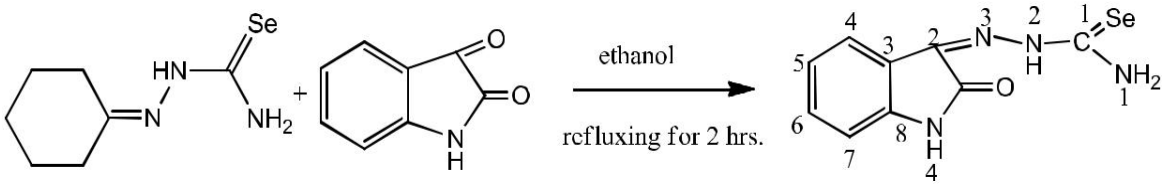
Anti-Tuberculosis Activity: The anti-mycobacterial activity of the synthesized selenosemicarbazones was assessed against M. tuberculosis using a MicroplateAlamar Blue assay (MABA) [35]. This methodology is non-toxic, uses a thermally stable reagent and shows good correlation with the proportional and BACTEC radiometric method. Briefly, 200µl of sterile deionized water was added to all outer perimeter wells of a sterile 96 well plate to minimized evaporation of the medium in the test wells during incubation. The 96 well plates received 100µl of the Middlebrooks 7H9 broth and a serial dilution of the compounds was made directly on the plate. The final drug concentrations tested were

between 100 and 0.2µg/ml. Each test was carried in triplicate. Plates were covered and sealed with parafilm and incubated at 37°C for five days in sealed plastic bags with 5% CO_2 atmosphere. After this time, 25µl of freshly prepared 1:1 mixture of Almar Blue reagent and 10% between 80 was added to the plates and incubated for 24 hrs. A blue color in the well was interpreted as no bacterial growth, and pink color was scored as growth. Pyrazinamide, Isoniazid and Ethambutol were included as standard drugs. The acceptable ranges, (MIC) of the standard drugs were 1.6µg/ml, 3.2µg/ml, 3.125µg/ml and 0.8µg/ml, respectively.

Experimental

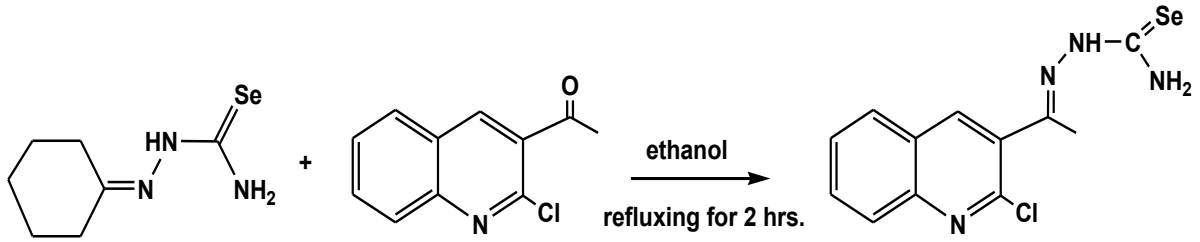
Synthesis of isatin selenosemicarbazone (HIstsesc, H^1L):

Cyclohexanone selenosemicarbazone, (0.5g, 2.29mmol) was dissolved in 20 ml of ethanol with heating. To it was added isatin (0.33g, 2.29mmol) and the mixture was refluxed for 2 hours. 1ml of glacial acetic acid was added during refluxing. **Dark reddish** solution thus formed was filtered and kept for crystallization at room temperature. Yield, 60%, m. p. **160-170 C**. Main IR peaks (KBr, cm^{-1}): (NH_2) 3380m, 3244m; (–NH–) 3142w; (C=N) + (C=C) + (NH_2) 1600s, 1543m, 1461s; (C=Se) 897s (selenoamidemoiety). ^1H NMR ($CDCl_3$, δppm): 13.0 s (1H, N^2H), 10.74 s (1H, N^4H), 7.63-6.95 m (3H, $C^{5,6,7}H$), 7.89 s (1H, N^1H_2), 5.46 s (1H, N^1H_2).



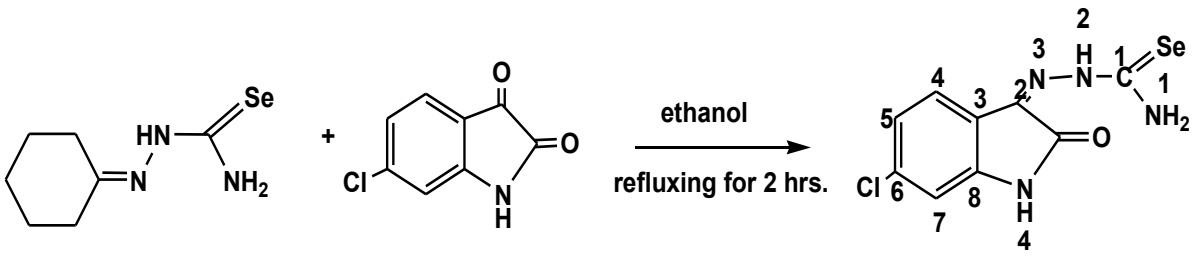
Synthesis of 2-chloro-3-quinoline selenosemicarbazone (2-HClQusesc, H^2L):

Cyclohexanone selenosemicarbazone, (0.5g, 2.29mmol) was dissolved in 20 ml of ethanol with heating. To it was added 2-chloro-3-quinoline (0.43g, 2.29mmol) and the mixture was refluxed for 2 hours. 1ml of glacial acetic acid was added during refluxing. **Light reddish** solution thus formed was filtered and kept for crystallization at room temperature. Yield, 60%, m. p. **175-178°C**. Main IR peaks (KBr, cm^{-1}): υ(NH_2) 3398m 3252m; υ(–NH–) 3140w; υ(C=N) + υ(C=C) + δ(NH_2) 1645s, 1593m, 1477s; υ(C=Se) 877s (selenoamidemoiety). ^1H NMR (δ, ppm; d^6-dmso and $CDCl_3$): 12.29 s (1H, N^2H), 9.10 s (1H, C^2H), 8.33 s (1H, C^6H), 7.29-6.92 m (1H, $C^{4,7,8,9}H$) ,6.39 s (1H, N^1H_2), 4.00 s (1H, N^1H_2).



Synthesis of 6-chloro-1H-indole selenosemicarbazone (6-ClHinsesc, H^3L):

Cyclohexanone selenosemicarbazone, (0.5g, 2.29mmol) was dissolved in 20 ml of ethanol with heating. To it was added 6-chloro-1H-indole 2,3 dione (0.41g, 2.29mmol) and the mixture was refluxed for 2 hours. 1ml of glacial acetic acid was added during refluxing. **Dark orange** solution thus formed was filtered and kept for crystallization at room temperature. Yield, 60%, m. p. **90-100°C**. Main IR peaks (KBr, cm^{-1}): υ(NH_2) 3406m, 3232m; υ(–NH–) 3136w; υ(C=N) + υ(C=C) + δ(NH_2) 1685s, 1600m, 1479s; υ(C=Se) 819s (selenoamidemoiety). ^1H NMR (δ, ppm; d^6-dmso and $CDCl_3$): 10.29 s (1H, N^4H), 9.16 s (1H, N^2H), 8.80-7.03 m (1H, $C^{4,5,7}H$), 8.75 s (1H, N^1H_2), 7.77 s (1H, N^1H_2).



RESULTS AND DISCUSSION:

Discussion on IR Spectroscopy:

The ν(N-H) peaks in selenosemicarbazones ligands appear in the range 3232-3406 cm^{-1}**.** The (-NH-) peaks in the ligands appears in the range 3136-3142cm^{-1}. The characteristic C=Se) peaks showed the range between 819-897 cm^{-1} and suggested that there is the formation of selenosemicarbazones ligands.

Table 1. IR studies of synthesized ligands:

Synthesised Ligands and Metal Complexes	**ν(NH_2)**	**υ(-NH-)**	**υ(C=N) + υ(C=C) + δ (NH_2)**	**υ(C=Se)**
Isatin Selenosemicarbazone	3380m, 3244m	3142w	1600s, 1543s, 1461s	897s
2-chloro-3-quinoline selenosemicarbazone	3398m, 3252m	3140w	1645s, 1593m, 1477s	877s
6-chloro-1H-indole selenosemicarbazone	3406m 3232	3136w	1685s, 1600m, 1479s	819s

Discussion on ^{1}H NMR spectroscopy:

In ^{1}H NMR spectra, N^2H proton signal appeared at the range δ 9.16 - δ 13.0 ppm The C^2H proton appeared in the range δ 9.10 ppm in case of 2-chloro-3-quinoline selenosemicarbazone . The proton ring appeared in the range δ 6.92- δ 8.80 ppm respectively.

Table 2. ^{1}H NMR studies of synthesized ligands:

Synthesised Ligands	(1H, N^2H)	(1H, C^2H)	(1H, N^1H_2)	(Ring protons)
Isatin Selenosemicarbazone	13.0 s	-	7.89 s-5.46 s	7.63-6.95 m (3H, $C^{5,6,7}H$)
2-chloro-3-quinoline selenosemicarbazone selenosemicarbazone	12.2 s	9.10 s	6.39 s-4.00 s	8.33 s (1H, C^6H), 7.29-6.92 m (1H, $C^{4,7,8,9}H$)
6-chloro-1H-indole selenosemicarbazone	9.16 s	-	8.75 s-7.77 s	8.80-7.03 m (1H, $C^{4,5,7}H$)

Result and Discussion on biological activity:

The anti-tubercular activity of synthesized ligands are not so similar as compared with standard drugs.

Table 3. Anti-tuberculosis activity:

Mycobacterium tuberculosis H37RV strain								
Synthesized Selenosemicarbazones Ligands	**MIC (µg /mL)**							
S. No.	***100***	***50***	***25***	***12.5***	***6.25***	***3.12***	***1.6***	***0.8***
Isatin selenosemicarbazone	**S**	**S**	**S**	**R**	**R**	**R**	**R**	**R**
2-chloro-3-quinoline selenosemicarbazone	**S**	**S**	**S**	**S**	**R**	**R**	**R**	**R**
6-chloro-1H-indole selenosemicarbazone	**S**	**S**	**S**	**S**	**R**	**R**	**R**	**R**

Ethambutol -1.6 µg/ml
Pyrazinamide- 3.125µg/ml
Rifampicin - 0.8 µg/ml
Streptomycin- 0.8µg/ml

Standard Drug Photograph:

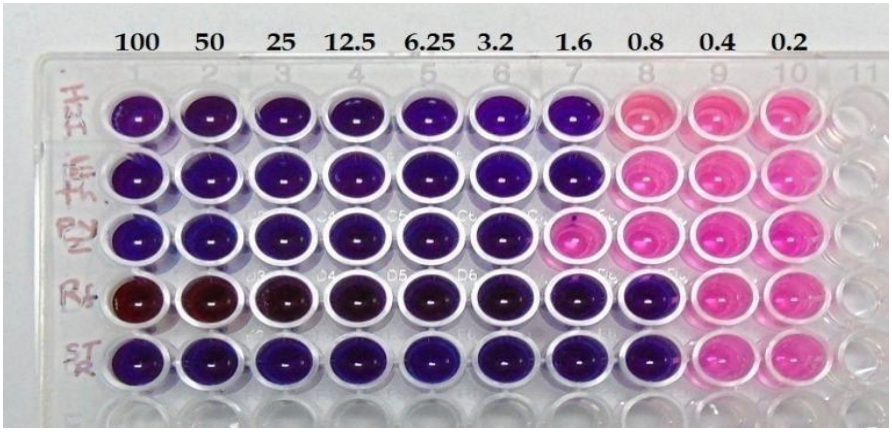


Figure- Anti-tubercular activity of standard drugs

Figure Anti-tubercular activity of synthesized ligands

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Plagiarism dilemmas during scientific writing and how to prevent it ?

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Abstract : *Research work and its publication need continuous training, implementation of new discoveries and follow-up of academic honesty and journalistic ethics. Lately cases of excessive plagiarism have been identified in research publication. Plagiarism is a subject to sanctions such as penalties, suspension, expulsion from work, considerable fines and even imprisonment (Kock N. 1999 and Kock N. 2003). The topic of plagiarism is a large and varied subject with wide-ranging implications for education. This section includes problem-shaping research, it seeks to understand why these problems occur and how it can be solved with the best deal. The good practice to limit the plagiarism is to educate students on how to properly conduct research, cite, quote, and create own unique and original work. This section contains a number of policy and recommendations for scientific writing. The only way we can make sure we are successfully teaching students how to write with integrity is by checking and assessing their work. Institutions willing to prevent or handle plagiarism benefit from high levels of academic honesty. It is compulsory to all the authors, reviewers and editors of the entire research journal to know about the plagiarism and how to avoid it by the ethical guidelines and use of plagiarism detection software before submitting the research paper (Kumar at al, 2014). Therefore it is imperative for authors to increase their knowledge about common type of plagiarism and how to avoid it? Author also suggests that plagiarism should be the part of syllabus in school and college education.*

Key words*: Plagiarism Dilemmas, Scientific writing, Research writing.*

INTRODUCTION :

Plagiarism is the unethical use and publication of text, thoughts, ideas, language, representation or expressions of another researchers, authors and own previous work without proper acknowledgment and pretending that they are one's own original work. It can involve violating copyright laws. Writers who plagiarize commit serious legal and ethical violation. Plagiarism is a serious academic and intellectual felony. It can result in highly negative consequences such as paper retraction and loss of author reliability and social status. Several authors are accused of plagiarism because they simply do not understand it and therefore, don't know how to avoid it. The rules of plagiarism are not the same in all countries. In India plagiarism considered to be a crime, and there have been cases of people being imprisoned for plagiarism (www.plagiarism.org/blog/2017/10/27/is-plagiarism-illegal). In recent digital time authors have opportunity to easy access the data, representation and language on the internet which makes easy to copy and paste information in research paper. Writing a book or research paper poses challenges in collection of literature and providing evidence for making the paper stronger. Uses of previously published information and ideas in research paper are necessary steps, but should be adding with caution and without falling into the trap of plagiarism. Therefore, it is imperative for authors to increase their knowledge about plagiarism.

TYPES OF PLAGIARISM :

Limitation of plagiarism in research sometimes unclear. Finding of various types of plagiarism is a necessary step towards the prevention. Following are the common types of plagiarism. Masic I (2012) categorized the following types of plagiarism.

a) **Direct form of plagiarism-** when an author copies the text, audio or video recording without acknowledgement of original source
b) **Mosaic form of plagiarism**- Using of idea and opinions from the primary source, a few words and phrases without acknowledgement of original source
c) **Self-plagiarism-** Reuse own work without mentioning the primary own source.

Besides the above Masic I, (2004) listed ten most common types of plagiarism as follows.

1. **Clone**- Publishing the work of other authors, which is just transcribed, as his/hers own;
2. **Ctrl-C**- When a author use most of the text from a single primary source without alterations
3. **Find-replace**-Changing key words and phrases but retaining a considerable part of the content of the original sources;
4. **Remix-**Paraphrasing numerous sources which are so arranged that complement each other;
5. **Recycle**-The use of their own work without citing, which is already published in past.
6. **Hybrid**- Combine fully cited sources with sources copied without citation
7. **Mash up**-Blending the copied material which is taken from multiple sources;
8. **Error 404**:- Include quoting non-existent or inaccurate source;
9. **Aggregator**- When proper citation of sources is included but its own work is almost zero
10. **Re-tweet** - Includes appropriate citations, but much more text has been used from the original

COMMON CAUSES OF PLAGIARISM

1. Lack of knowledge about plagiarism
2. Personal ambitions of poorly educated authors
3. Financial pressure
4. Lack of time to spend in research work
5. Academic promotions

STEPS TO AVOIDING PLAGIARISM

Plagiarism can be confusing and overwhelming topic. Converging on standardized guidelines would be beneficial with regard to text recycling and improving education and the promotion of active communication between journal and authors during the submission process if confusion arise (Burdine et *al.* 2018). Be vigilant against plagiarism, however accidental it may be. To learn more about plagiarism and how to avoid it, here are some guidelines to avoid plagiarism.

1. **Understand plagiarism:** Plagiarism occurs when we use another person's words, or ideas, and attempt to pass them off as our own. However, plagiarism can be of many different types. Therefore, it is a good way to have more and accurate information about plagiarism to find a solution.
2. **Understand the background:-** Do not copy paste the text exactly from the original source. First understand the problem and then explain it in own view.
3. **Properly quote and paraphrase**: Using evidence of previous research is important in academic writing, but those sources must be acknowledged properly. Authors can include information from outside sources through proper paraphrasing and quoting.
4. **Properly cite sources:** As noted in Step 2, researchers can summarize and quote pieces of evidence to include information from outside sources. But, all of that information must be cited within the paper using in-text citations and a separate references list.
5. **Check the work for possible plagiarism:** Before submission an assignment a software checking for plagiarism is always good for ensuring that we have properly used outside sources in our work.
6. **Referencing** – It is necessary ways to avoid plagiarism is including a reference page cited at the end of research paper. This page is very specific and includes the author(s), date of publication, title, and source.

SUMMARY AND CONCLUSION :

Lately a number of cases of plagiarism have been identified in research publication. Plagiarism is a subject to sanctions such as penalties, suspension, expulsion from work, considerable fines and even imprisonment (Kock N. 1999 and Kock N. 2003). For the publishing a genuine research work, one has to make an honest effort to read the original sources thoroughly and then rewrite it in own words, ideas and pattern with the proper acknowledgement of primary sources. Therefore, it is imperative for authors to increase their knowledge about common type of plagiarism, types of plagiarism and how to avoid it? Author also suggests that plagiarism should be the part of syllabus in school and college education.

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Morphological study of the Gomati, Yamuna, and Varuna river basins in India using remote sensing data: A review

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Abstract: *The basin dynamics and drainage network system of tributaries of the Ganga river were comparatively studied via morphometric analysis. Morphometric parameters such as stream order, bifurcation ratio, drainage density, elongation ratio, circulatory ratio, form factor, length of overland flow are considered in the current research.Thorough inspection of the data specified that Gomti, Varuna and the Yamuna river basins are in the 7^{th}, 5^{th} and 4^{th} order respectively and they have consistent lithology and dendritic drainage pattern. River basins are tectonically undisturbed as they low bifurcation value. Low drainage density values suggest that the basins are densely vegetated and consists of permeable subsurface. Shape parameters viz. elongation ratio, circulatory ratio signified that basins are elongate in shape and it suggests that river basins are still in their infancy. Also length of overland flow indicates that basins are in early mature stage. According to form factor value it is confirmed that river basin consist of shorter flow peaks of long lasting duration. The current study is exceedingly beneficial in sustainable basin management, infrastructure projects, flood management and other societal development.*

Keywords: *Morphometry; infrastructure; geomorphology; elongation ratio.*

INTRODUCTION :

The Ganga foreland basin formed by the collisional activity of the Indian and Eurasian plates during the tertiary period and is the most important part of Himalayas. The Ganga foreland basin is an active foreland basin on the outskirts of India (Dickinson 1974). Earlier multiple alluvial fans filled this foreland basin and its landscape was engraved by varied climatic conditions and fluvial processes (Parker 2000). The Ganga Plain, a key physiographic subdivision of India is one of the world's most densely populated areas due to presence of rivers, alluvial soil, and its key location in the Indo-Gangetic foreland basin. The Ganga Plain is 1000 kilometers long and 200 to 450 kilometers wide. The Gangetic plain is drained by snow-fed rivers like the Ganga and Yamuna, as well as groundwater-fed rivers like the Gomti, Chhoti Gandak, and Kalyani. There are also rain-fed rivers like the Jharahi and Daha (Singh and Singh 2005; Singh et al. 2010a; Singh et al. 2015).

The morphometric approach is used to examine the Earth's surface, landscape, and other aspects (Clarke 1996; Agarwal 1998; Reddy et al. 2002). Linear, relief and areal aspects are three morphometric diagnostic criteria that helps studying the earth's properties (Nautiyal 1994; Nag and Chakraborty 2003; Magesh et al. 2012b). Morphometric parameters are important in characterizing river basins, stream numbers and orders, geomorphology, subsurface water and groundwater hydrology, and basin evolution morphology (Kanhaiya et al. 2018; Kaushik and Ghosh 2018a, 2018b; Prakash et

al.2017c; Prakash et al. 2016a; Rai et al.2018; Rai et al. 2017; Senadeera et al. 2001; Singh and Kanhaiya 2015; Sreedevi 2004, 2005; Kanhaiya et al 2018). For investigating and interpreting river dynamics and neotectonic processes, morphometric analysis has become a profitable tool (Thomas et al. 2010; Pareta and Pareta 2011; Singh and Kanhaiya 2015; Kaushik and Ghosh 2015a, 2015b; Prakash et al. 2016a; Prakash et al. 2016b; Prakash et al. 2017a; Prakash et al. 2017b; Prakash et al. 2017c; Rai et al.2018; Kanhaiya et al.2018; Singh et al 2018b; Singh et al.2018b).

Drainage network system can be easily scrutinized and controlled via analyzing Morphometric parameters (Nautiyal 1994; Srivastava et al 1995; Srivastava 1997; Nag 1998; Agarwal 1998; Shreedevi et al 2001, 2005, 2009; Vittala et al 2004; Manjare et al 2014). The drainage network of a certain region can be used to infer evolutionary processes acting on that region (Kale and Gupta, 2009; Della Seta et al 2014; Rai et al 2017). The drainage basin analysis is quite beneficial in terms of groundwater management, environmental evaluation, and so on (Manjare et al 2014; Kumar and Chaudhary 2016). Studies of drainage basins also aid in inferring drainage characteristics, climate change, flood threats, and hydrologic processes (Mesa 2006; Angilleri 2008; Perucca and Angilleri 2010; Singh and Awasthi 2011a, 2011b; Javed et al 2009, 2011; Kumar et al 2015; Rai et al 2017; Eze and Efiong 2010). In semi-arid settings, drainage basin studies can be particularly useful for investigating and conserving watersheds (Khanday and Javed 2016, 2017).

Remote sensing and GIS applications prove to be a very useful and proficient tool for contrasting watersheds, river basins, and morphometric analysis. It can be utilized effortlessly to perform drainage morphometry (Agarwal 1998; Nag 1998; Das and Mukherjie 2005). Drainage morphometry can be used to investigate landforms, topography, and groundwater potential zones (Rai et al 2014).

The current research targets the Ganga River tributaries, with the primary goal being learning about their tectonics, watershed management, and flood management.

Area of Research :

The Ganga plain is one of the world's most tectonically significant and active alluvial plains. Varuna river basin, Gomati river basin, and Yamuna river basin are researched as tributaries of the Ganga rivers. Morphometric datas and are comparatively assembled for Gomati, Varuna and the Yamuna river. Near Mau Aima in Pratapgarh, the Varuna river runs from 25° 27' N latitude to 82° 18' E longitude. Varuna river controls the drainage system of Varanasi (Khan et al.1998). Varuna river basin has a total catchment area of 3445.14 km2 and is part of the Indo-Gangetic plain, which is underlain by Holocene-Pleistocene alluvial deposits (Raju et al. 2009). The Gomti river basin stretches from 80° 0' 10" E to 80° 11' 4" E longitude to 25° 31' 16" N to 28° 53' 17" N latitude, sandwiched between the Ganga and Ghaghara river basins. The Gomti River drains an area of around 30437 km2. The Gomti River begins at Fulhaar Jheel near Madho Tanda Pilibhit, Uttar Pradesh, and flows for about 30437 kilometers (Dutta et al. 2015). The Gomti river drains the Pleistocene–Holocene alluvial plain and distributes materials sourced from the Himalayas (Kumar and Singh, 1978). The Yamuna river basin stretches from latitude 27° 00' N to latitude 27° 10' N and longitude 78° 15' E to 78° 26' E. The Indo Gangetic plain covers the majority of the area. This river flows through Fatehpur and Agra, draining parts of both. The Yamuna river basin is divided into four geological periods: Proterozoic, Paleozoic, Mesozoic, Cenozoic, and Deccan volcanic (Sinha et al. 2005). Yamuna River flows through crystalline gorges in the Himalayas (Gansser 1964).

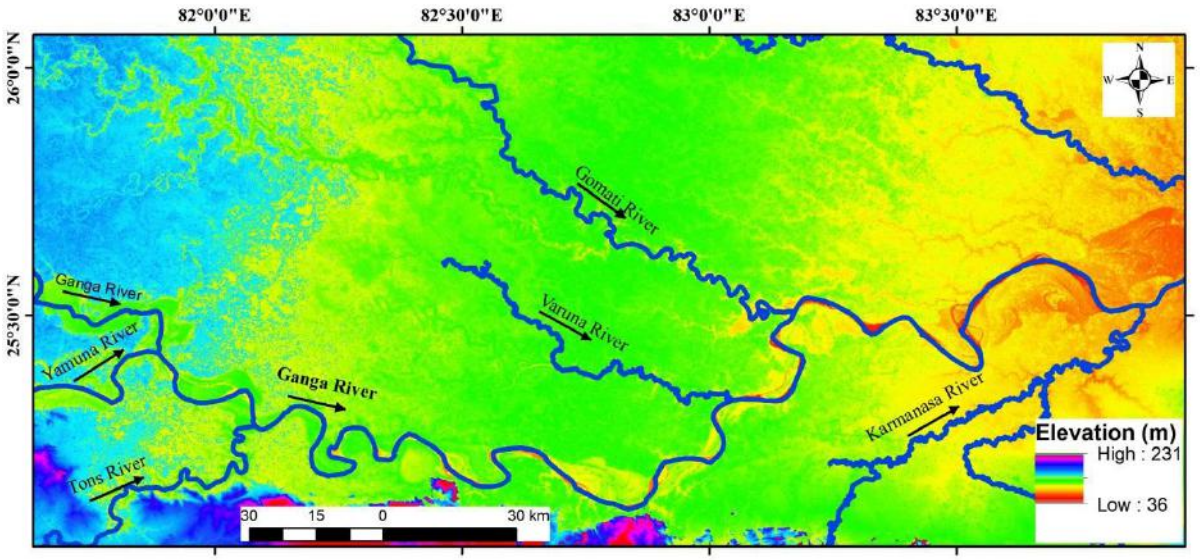

Fig 1. Detailed location map of the study area.

RESULT AND DISCUSSION :

Table 1: Compiled data of morphometric parameters for different rivers (Ansari et al. 2012; Prakash et al. 2017; and Prakash et al. 2016).

Sr. no	Parameters	Gomati	Varuna	Yamuna
1	Stream order	7	5	4
2	Bifurcation ratio	5.29	3.84	4.2
3	Drainage density	0.4	0.26	1.75(Avg.)
4	Elongation ratio	0.49	0.5	0.69(Avg.)
5	Circulatory ratio	0.19	0.19	0.67(Avg.)
6	Form factor	0.19	0.19	0.36(Avg.)
7	Length of overland flow	1.25	1.92	0.27

Table 2: Compiled morphometry data for sub watershed of different river (Ansari et al. 2012; Prakash et al. 2017; and Prakash et al. 2016).

Sr.No	Morphometric Parameters	Gomti River	Varuna River	Yamuna River
Sub watershed 1	Bifurcation ratio	4	4.03	5.11
	Drainage density	0.4	0.29	1.82
	Elongation ratio	0.42	0.56	0.74
	Circulatory ratio	0.23	0.15	0`83
	Form factor	0.14	0.25	0.43
	Length of overland flow	1.25	1.72	0.27
Sub watershed 2	Bifurcation ratio	3.95	3.2	5.6
	Drainage density	0.39	0.19	1.82
	Elongation ratio	0.49	0.56	0.63

	Circulatory ratio	0.28	0.15	0.49
	Form factor	0.19	0.25	0.31
	Length of overland flow	1.28	2.63	0.23
Sub watershed 3	Bifurcation ratio	4.97	2.81	4.2
	Drainage density	0.4	0.28	1.6
	Elongation ratio	0.4	0.65	0.7
	Circulatory ratio	0.18	0.23	0.69
	Form factor	0.13	0.33	0.34
	Length of overland flow	1.25	1.78	0.31
Sub watershed 4	Bifurcation ratio	3.73	5.33	~
	Drainage density	0.4	0.31	~
	Elongation ratio	0.45	0.61	~
	Circulatory ratio	0.33	0.29	~
	Form factor	0.16	0.28	~
	Length of overland flow	1.25	1.61	~

We have developed exclusive morphometric parameters for tributaries of the Ganga river, namely Gomati, Yamuna, and Varuna, based on formerly considered morphometric analysis. Stream order, bifurcation ratio, drainage density, elongation ratio, circulatory ratio, form factor, and length of overland flow are considered in the current study.

The familiarity with the stream order is essential for drainage basin analysis, which is accomplished using Strahler's approach (Strahler 1964). The Gomati River Basin is in the seventh order stream, whereas the Yamuna River Basin is in the fifth, and the Varuna River Basin is in the fourth order stream.

The rate of the number of streams of one order to the number of streams to the next higher-order is known to be bifurcation ratio (Horton 1945). The bifurcation ratio is another name used for indicating relief and dissection (Schumm 1956). Less distortion and minimal structural problems are indicative of low bifurcation ratio values (Strahler 1964). Bifurcation ratios with higher and lower values exemplify the young and mature stages of basin development respectively (Manu and Anirudhan 2008). A lower value suggests an elongate basin (Mekel 1970), whereas a higher value indicates a dominant structural control (Morisawa 1985). Flooding is more likely in areas with a high bifurcation ratio (Howard 1990; Rai et al 2017). The range of values from 3 to 5 strongly suggests homogeneous lithology and a natural drainage network (Kale and Gupta 2009). The Varuna river basin possesses a bifurcation ratio (Rb) from 2.0 to 5.0, with a mean value of 3.84 indicating minimal geological instability and stable lithology. The value for the Yamuna River ranges from 4.2 to 5.6 with a mean of 4.2 suggesting less tectonic effect and homogeneous lithology. The lithology of the Gomti River is consistent, although structural control is limited as its bifurcation value ranges from 3.73 to 5.26, with a mean of 5.29.

Drainage density ascribes to the overall length of a stream per unit area, which reflects the rigidity of space between channels (Horton 1932) and the linear scale of landform elements in stream degraded topography. Drainage density values can be utilized to estimate travel time of river water (Langbein 1947). Drainage density, according to (Smith 1950), is a significant indicator of landform development as well as a numerical measurement of landscape segmentation and runoff potential. Low and high drainage density infer coarse and fine drainage texture respectively (Strahler 1964). A river basin with low drainage density has dense vegetation and a highly permeable subsurface with low relief whereas a river basin with high drainage density has impermeable strata, less plant cover, and high relief (Chow 1964). Changes in drainage density value result in changes in the hydrology of the watershed (Yildiz 2004). The drainage density of the Gomti River ranges from 0.39 to 0.4, with a mean of 0.4 is indicative of dense vegetation and a relatively permeable subsoil as well as low terrain. The

drainage density values for the Yamuna River range from 1.60 to 1.82, with a mean of 1.75 indicates a highly permeable subsurface with dense vegetation and low relief. The drainage density of the Varuna river is low, ranging from 0.19 to 0.31 with an average of 0.26 suggesting dense vegetation, low relief, and a relatively permeable subsoil.

The elongation ratio is the ratio of the diameter of a circular drainage basin to the basin's maximum length (Schumm 1956). Circular basins are more successful in runoff discharge than elongated-shaped basins (Singh and Singh 1997). Elongation ratio values of 1 and in between 0.6 and 0.8 are indicative of very low relief with strong and steep ground slope respectively (Strahler 1964). The high value of this attribute indicates heavy infiltration and little runoff whereas the lower value is indicative of high runoff and erosion (Reddy et al 2004b). Various drainage basin shapes are classified as circular (0.9 – 1.0) with high tectonic activity, oval (0.8 – 0.9) with active tectonic activity, less elongated (0.7 – 0.8) with less tectonic activity, elongated (0.5 – 0.6) with no tectonic activity, and less elongated (0.5) with no tectonic activity (Sarma et al 2015). Varuna possesses a value of 0.5 for elongation ratio indicating that it has an elongated form. Other sub-watersheds have elongation ratios ranging from 0.56 to 0.65, indicating erosional activity. The Re values for the Yamuna river basin range from 0.63 to 0.73, with an average of 0.69 suggesting that the basin has seen some structural disturbances and has a moderate to the slightly steep ground slope as well as a less elongated shape. The Gomti River Basin has an elongate shape with a value ranging from (0.4–0.49) and a mean of 0.49.

The circulatory ratio is a dimensionless quantity that expresses the basin's circularity and is defined as the ratio of the basin's area to the area of a circle with the same diameter (Miller 1953). The circulatory ratio value indicates the stages of life cycle of watersheds, with low values indicating a youthful stage, medium values indicating a mature stage, and high values indicating a mature stage of a river basin (John Wilson et al 2012; Rai et al 2018). Shape-related parameters helps in understanding the effect of size and shape of flood dangers and can be easily evaluated, which aids in understanding hydrological behavior (Ward and Robinson 2000). For Gomti river and Varuna river it ranges from 0.18 – 0.33 and 0.15 – 0.29 respectively with a mean value of 19. The average assessment of 0.19 Rc values for the Gomti and Varuna river basin strongly suggests that the river basin are still in their infancy. Rc values in the Yamuna River Basin range from 0.49 to 0.83, indicating that the river basin is in its early stages. When Rc values are close to 1, the basin has a circular shape.

According to (Horton 1945; Gregory and Walling 1973), the form factor is an essential aspect in determining the shape of a drainage basin and the relationship between flow intensity and discharge. The hydrology of a watershed is influenced by its morphology (Tucker and Bras 1998). When form factor values are low, such as less than 0.4 in the Varuna river basin, flow peaks are shorter and long-lasting. Its value ranges from 0.19 to 0.33, with an average of 0.19. This indicates that the rainfall is irregular. The form factor values for the Yamuna river basin range from 0.31 to 0.43, with an average value of 0.36, indicating a slightly elongated basin, whilst a value approaching 1 indicates a fully circular basin. Values in the Gomti River Basin range from 0.13 to 0.19, with an average of 0.19, indicating shorter flows of longer duration. In comparison to circular basins, the water flow in elongated basins is spread out over a longer period (Mustafa and Yusuf 1999).

According to Horton (1932), the length of overland flow refers to the flow of water across a long distance over the ground surface before it is focused into a specific stream channel altering the hydrology and physiography of the basin. With longer lengths of overland flow, geomorphic maturity is achieved, and vice versa. The length of an overland flow is proportional to the average channel slope and a significant extent and it is identical to the length of a sheet flow (Singh and Kanhaiya 2015). Varuna river has a value ranging from 0.61 to 2-63, with a mean of 1.19, indicating that the river basin is in its late youth or early maturity. The Gomti River is in its late youth or early youth stage of basin development, with values ranging from 1.25 to 1.28 with a mean of 1.25. The Yamuna River has modest values ranging from 0.27 to 0.31, with an average value of 0.27, indicating that the basin is still in its early stages of development. Lower values result in less rainfall responsible for surface runoff and stream flow, according to (Muthukrishnan et al. 2013).

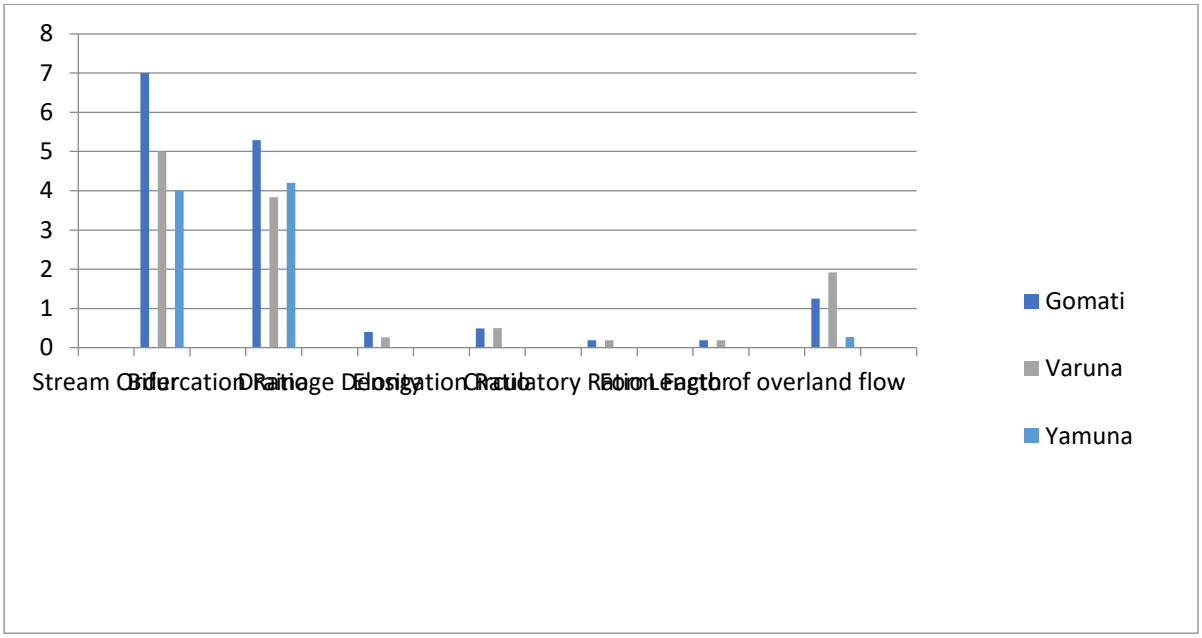

Fig 2. Graph of compiled data of morphometric parameters.

CONCLUSION AND DISCUSSION :

Remote sensing and GIS applications are beneficial in the morphometry of the river basins A thorough morphometric investigation of the Gomti, Varuna, and Yamuna rivers reveals that the Gomti is in the 7th order, the Varuna is in the 5th, and the Yamuna is in the 4th order. Because these rivers have low bifurcation values, it may be understood that they are less geologically disturbed and have consistent lithology, implying that the river basin has a dendritic drainage pattern. The Gomti, Varuna, and Yamuna river basins have low drainage density values, indicating lush vegetation and a relatively permeable subsoil. The Gomti and Varuna river basins are in elongate shape and have low elongation ratios, but the Yamuna river basin has a little greater value with significant structural disturbances. Low circulation ratio values for Gomti, Varuna and the Yamuna confirm that they are in their youth stage. It is much easier to manage flood dangers in an elongated-shaped basin, and all three rivers have a low form factor value. The Gomti, Varuna, and Yamuna river basins have a modest length of overland flow, indicating an early stage of basin development.

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Security Assessment of Cloud Technology in Online Learning Environment

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Abstract: *The world saw a drastic situation in the year 2020 when the Pandemic was declared. All most all the sectors had been affected due to COVID-19 along with Educational Institutions. To overcome and maintain the education to be provided regularly, nearly most educational institutions implemented virtual schooling. These implementations were made by cloud technology. In the paper, we talked about the current scenario of the virtual schools/colleges and the challenges which are faced by the institutions and we provided the prevention techniques which includes DDOS, ARP Spoofing, and other attacks. Further, we also researched the security aspects of these virtual schools/colleges. We did a small survey about the awareness of cloud computing and security attacks amongst teachers and students. We elaborated our findings and prevention techniques. For reference, we also checked the current online learning platforms and how they function to secure their environment.*

Key Words: *Cloud Computing, Security, Vulnerability, School, Zoom, GCP, AWS, Virtual Machine.*

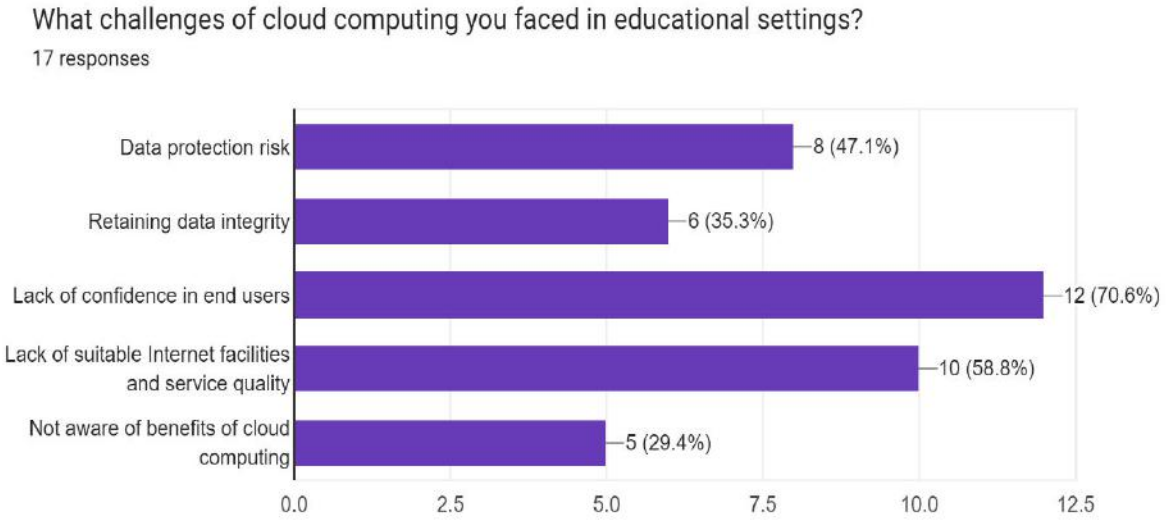
INTRODUCTION :

A change should be constant and the rapid changes in the world due to the Covid it has impacted a lot of people in every aspect of life. Education Sector is one such example where Teachings are now preferred online and the emerging demand for getting things online has made the IAAS provider make more profit. But We also have to think about the other aspects of it. As students and teachers are on the cloud, their data is also online, and it is a concern of privacy and security. In crucial times, the company "Zoom Technologies" have been an emerging Player. Along with providing users with the ease of getting into a video conferencing with everyone it also had a flaw of the connection not being secure. When we talk about the cloud we don't specifically do not mean only about getting on a call with the students. There are also other areas of cloud technology that the teachers, as well as the students, are using it. In this paper, we will discuss cloud technology and also the use-cases of it, and what is the importance of security concerning the users who are using this technology. In further discussion, we will also have a brief analysis of the current research and threats which are relevant to the educational sector. Nothing on the internet is 100% secure and that's what is taken into consideration.

The Zoom Era and the insecure connection

The nature of cloud computing makes its adoption a dilemma. The prevalent concern of cloud computing is security. Even though cloud service providers have provided assurances, the issue of security remains a major concern among adopters and potential adopters. Studies (e.g., Svantesson,2012; Yu, Niu, Yang, Mu, & Susilo, 2014; Zissis & Lekkas, 2012). Zoom is one of the video conferencing service providers which is a direct competitor of Microsoft and Google Meet. Zoom at its peak was the top used video conferencing application and due to this, there were a lot of security attacks that were happening on them. That led to the discovery that the communication between two clients was not encrypted which led to allegations on they to steal the data. The company said the Data which were online for sale was taken due to the security flaws with the Facebook SDK(Software

Development KIT) and they removed the Codes of the SDK after that to resolve this issue. (Mehta, 2021). The term "Zoom Bombing" is a term that is used by the people where some unknown users use the public invitation link and take control over the video conference and disturb the attendees with disturbing and irrelevant content. More recently, security firm Cisco Talos found two more Zoom vulnerabilities, both involving malware delivery. Hackers could send viruses to users through loopholes within the service's GIF and .zip file-sharing systems. Malware is one of the most common cybersecurity threats and can have severe consequences. (partida, n.d.). As with this lot of schools, and institutes migrated to google meet. We asked in the survey about the challenges they faced in the educational settings and the results are like 47.1% of the users are worried about the Data protection risk. Data retention problems are faced by 35.3% of the users. From this survey, we can also see that there are also 29.4% of users are not aware of the benefits of cloud computing.

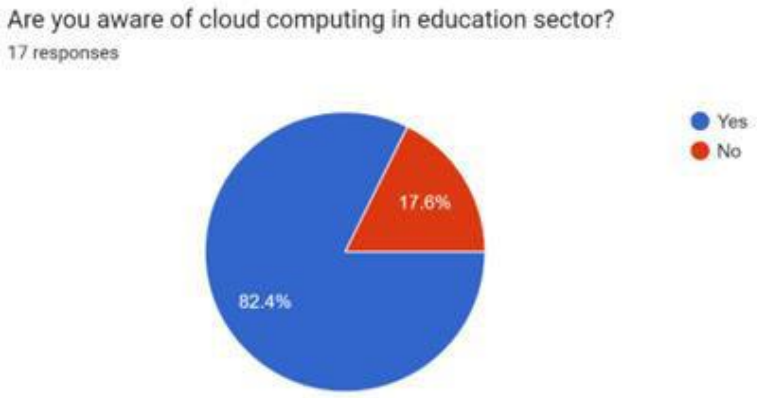


Analysis of cloud technologies in online learning

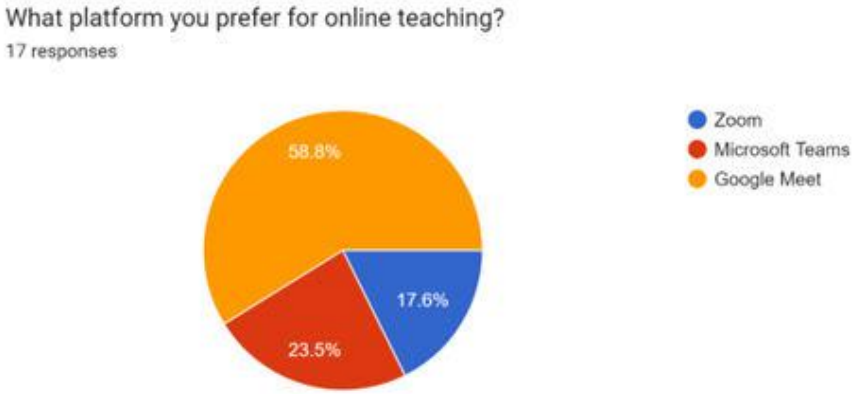
Cloud computing refers to the pc resources and systems available on-demand via the Internet that can provide several integrated computing services without being restricted to local resources to facilitate the user. These resources include data space for storing, backup, and self-synchronization, programmatic processing capabilities, task scheduling, mail payment, and remote printing. When connected to the network, the user can control these resources through an easy programming interface that simplifies and ignores the small print and internal processes. (Al-Malah, Aljazaery, Alrikabi and Mutar, 2021). Several cloud technologies are currently available where the top contenders are Amazon AWS, Google GCP, and Microsoft Azure and from these the widely used one is GCP amongst the school. Google offers the services like Google Meet for free. The other services are the ability to access emails and online drives for students and teachers. The traditional ways of storing the files offline have a lot of issues which had impacted the teachers and the staff. Now with all the data stored on the cloud one need not carry the exam paper with them and keep it safe, it is already safe on the internet. The students can easily use the study materials anytime, so there are no limitations for them to learn at a specific time. The sharing of the materials is very easy, and the teachers can share the assignments and other important documents with the students and amongst themselves without a hassle. Although Cloud Computing is very easy to set up easy to use. Some schools are not able to afford it and due to this google provides free accounts for teachers and students under the initiative of Indian Government funds. Let's take what advancements have been done in the online learning platform. All India Council for Technical Education (AICTE) has partnered with Microsoft Corporation India Pvt. Ltd. to implement a Cloud email offering for all its institutes. As an element of Cloud Adoption, all institutes get access to Microsoft Office 365 for Education. (BV, kommareddy and N, 2013).

We have also taken a small survey of what the students and teachers think about cloud technologies and security. Some of the questions are below with the graphs.

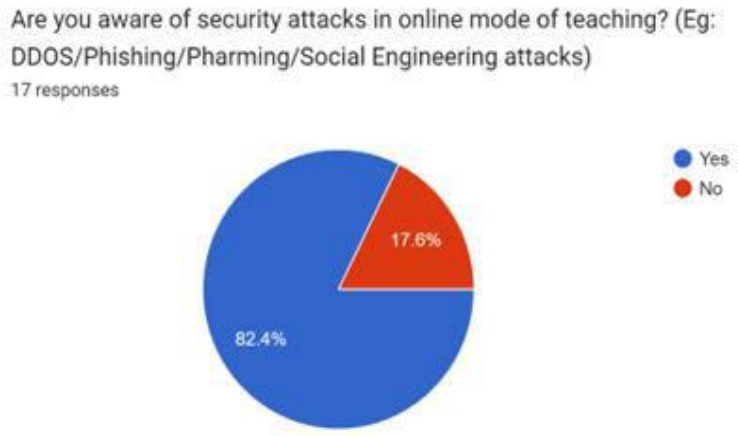
The first question was if the students and the teachers are aware of cloud computing in the education sector and the results are that 824% of them are aware and the rest 17.6% are not aware



The second question we asked was what the preference of online teaching is the students, and the teachers prefer to be on and the result is 58.8% of them prefer to use google meet, 23.5% prefer to use Microsoft teams and 17.6% of them use Zoom.



As there are attacks that are happening nowadays, the next question was if the users are aware of the most popular attacks, and the results are 82.4% of the people do know about the attacks and 17.6% of them do not know about the attacks which is also a matter of concern.



Advancement of Online learning

The advancements of the Cloud are pacing and so does the urge of taking everything online and the Learning platform is also in the race. The AWS, Google Classroom, and Microsoft are helping to be on the current page with the world. Mostly at a higher level, cloud computing helps the potential students to utilize the high computing capability to use it for their research in a very cost-effective and efficient way, thus making a room for extra utilization of cloud computing at a glare for other functionalities such as using it for storage and also using the cloud infrastructure to connect with everyone without any physical interventions. The below image is of cloud computing architecture which is used as a model in the school environment. (Prakash Mishra, Rani Panda, Pati, and Kumar Mishra, 2019).

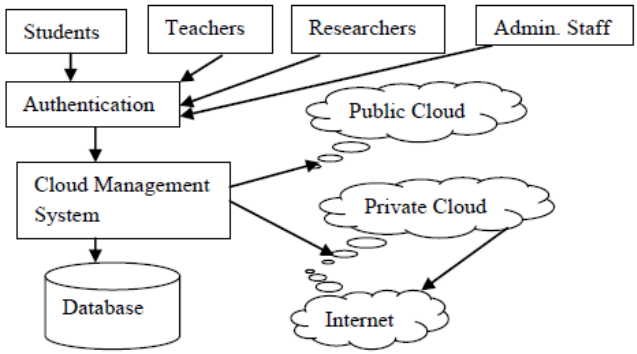


Fig1: Cloud computing Architecture

Online Teaching is no longer an option, but it is now a necessity for every student, and everyone needs to adapt it. And some of the advancements help the students and the teachers to adapt to it very easily. Many online tools are available, which is important for an effective and efficient learning environment. Educators can use a combo of audio, videos, and text to succeed in out to their students in this time of crisis to maintain a human touch in their lectures. this will help in creating a collaborative and interactive learning environment. (Dhawan, 2020)

Vulnerabilities and recent attacks on online learning

There have been a lot of attacks which have happened recently and one of them which was quite common which we wrote above was about Zoom bombing. The three layers of cloud service models IaaS, SaaS, and PaaS provide different services but on the other hand, it also leaks information which is a risk for cloud computing. This leads to brute forcing which consumes a lot of power which is ideal for a cloud because SaaS provides virtual machines, Easy for the hackers to also perform a DDoS attack.

In the software development lifecycle of cloud models of PaaS, the data used can be compromised and leads to data leak which the hackers can easily perform Session Hijacking. (Chou, 2013). In the cloud, the digital machine has to alternate the hardware infrastructure and cloud-based data are geographically distributed, so it turns out to be tough to implement standard security controls such as Hardware Security Model (HSM). Currently, security matrices are no longer tailored to cloud infrastructure so cloud consumers cannot use any matrices to check the security of their cloud resources. (Shinde, Bhabad and Sankhe, 2015). Now the world is moving into Zero trust architecture, and this means that no one can be trusted on the internet for this the first method to be implemented is Multifactor authentication. If the users in the cloud infrastructure are not using Multifactor authentication, then this is a big flaw. Data deletion is something that has to be executed very carefully. Threats associated with statistics deletion commonly exist due to the fact you don't have full visibility into the place your data is bodily saved in the cloud. This reduces your capability to verify whether or not or no longer your facts have been securely deleted.

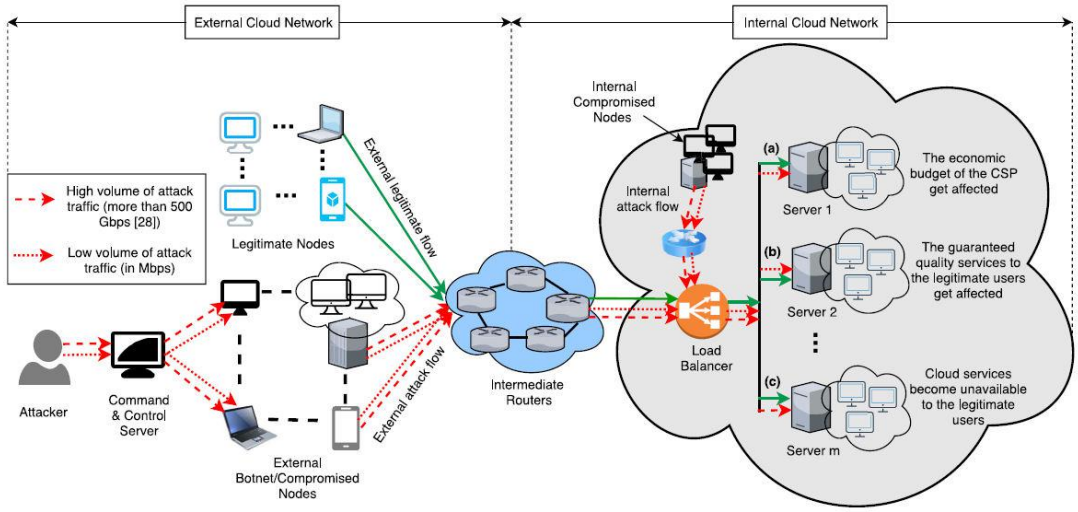
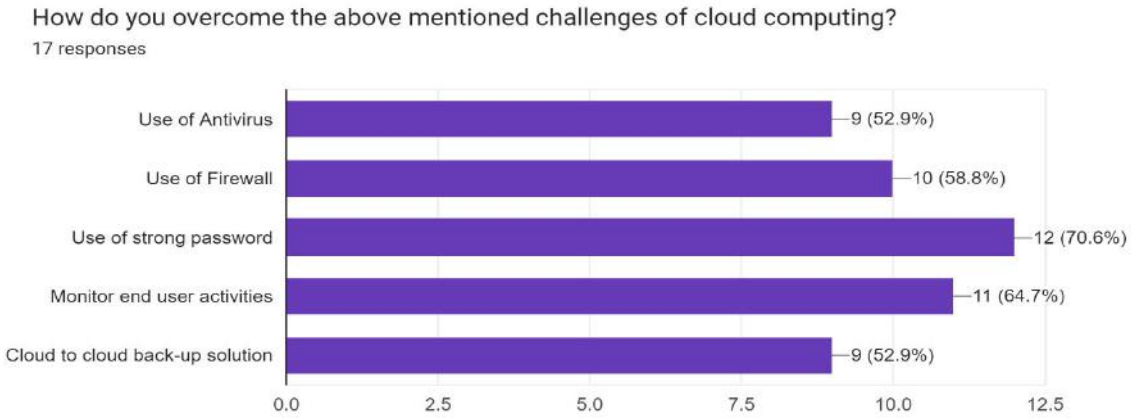


Fig2: Dos attack scenario in cloud computing(Agrawal and Tapaswi, 2019)

Remediation for online learning Platform

The vulnerabilities which are discussed and the risks of it can be minimized with remediation techniques. The first remediation which we recommend is to fix the access management, One should not give administrative privileges to unauthorized staff, and limited access should be provided to students. The second remediation should be of implementing Multifactor authentication for students. The third remediation will be to properly maintain the data deletion process. This will not lead to data leakage. One of the disadvantages of the cloud is that the data which is uploaded is not encrypted. There should be automation where the data stored on the cloud should be encrypted automatically. Proper cloud infrastructure should be defined like in the case of Colleges and schools it should be a Private cloud where only the students and the teachers can get access to the infrastructure and the data within them. Students and faculty members use many virtual machines, but these machines also have restrictions. In a physical environment, segmentation can be utilized to stop this kind of criminal activity, but in a virtualized environment, segmentation is not an option. However, a cloud without segmentation can enable web system hackers to access databases or financial systems. Use of the Virtual Security Gateway, which allows users to apply some important rules, login, and access rights, much like it is done with systems installed in universities, is the solution to this kind of issue in virtual settings. (Bulusu and Sudia, 2013). As we surveyed the remediation from the user's perspective and here are the results. We can see that 52.9% of the users use antivirus and 58.8% users firewall. 70.6% of the student and teacher users have a strong password.



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CONCLUSION :

In this paper, we have researched how the COVID-19 pandemic has changed education forever using cloud computing technology with security. The adoption of e-learning is continued to persist post-pandemic and it has shown a high impact on the education sector. Many people were unaware of the Cloud platform before COVID-19. The cloud services provided by the providers are unable to ensure total security in the cloud. Data protection is important as it prevents information from fraudulent activities, hacking, phishing, and identity theft. Different technologies must be secured against preferred approaches and support e-learning platforms can offer e-learners. We focused on the advancement of the cloud platform by considering barriers and highlighting actions we can take to develop useful approaches to overcome them. Remediation of cloud computing develops the latest e-learning methodology that can motivate e-learners to learn and prepare for future work. We looked at the challenges, advancements, and remediations of cloud computing while setting up the secured e-learning platform.

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IN VITRO BIOLOGICAL ACTIVITIES OF PLANT-ASSOCIATED *Eurotium* FUNGAL STRAINS IN VIETNAM

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Abstract : *Eurotium spp. are wide-distributed fungi and have been considered a prolific source of bioactive natural products. In order to assess biological properties of plant-associated fungal strains belonging to Eurotium in Vietnam, we evaluated in vitro activities of six fungal isolates (symbolized as C1, C2, C3, C6, C7 and C8) and determined their taxonomic characteristics. Amongst all fungal strains, C1 and C8 were recorded to have significant radical scavenging capacity, with SC50 values of 96.07 and 121.12 µg/mL, respectively. Furthermore, C1 also demonstrated a slight anti-inflammatory property. Subsequently, these two strains were classified as Eurotium cristatum fungi based on molecular and morphology identification, in combination with biochemical properties, includings pH and salinity tolerance range as well as enzymatic activities. Remarkably, the fungal strains were safe to test animal. These results highlight the application prospects of studied fungi in fermentation of different tea substrates for domestical value-added products.*

1. INTRODUCTION :

Eurotium is classified as teleomorph of genus *Aspergillus*, (Tricomaceae, Eurotiales), consisting of about 17 species, with some of the more common ones being *E. amstelodami, E. chevalieri, E. herbariorum* and *E. repens* [16]. *Eurotium* spp. are characterized by colonies of spherical or ellipsoid spores with moderately rapid growth rate and the ability to reproduce both sexually and asexually [10]. In addition, some species of *Eurotium* are also reported to possess interesting traits such as osmotolerant, xelotolerant or thermotolerant [10]. Because of these aforementioned attributes, *Eurotium* spp. have a wide range of distribution. They can be found in soil and different kinds of aquatic environments, even in extreme conditions like Dead Sea [7]. In terms of indoors, common strains like *E. herbariorum* or *E. rubrum* and *E. amstelodami* can be located in ceiling tiles, insulation, on the surface of leather products or textiles, grain products, poultry feed, bakery products, dried fruits and spices which have been subjected to periodic condensation [11]-[5][15][23]. Amongst all of these, the genus *Eurotium* is probably best known for their inclusion in the fermentation of Fu brick tea which have been well-known for excellent health benefits, including anti-oxidant, anti-inflammatory and anti-obesity properties [12][18]. There is a widespread speculation about the correlation between the number of "golden flowers" (which are the spores of *Eurotium* spp.) on the tea brick and the quality and health benefits of the tea. However, at the present, the amount of research regarding to the characteristics or bioactivities of *Eurotium* spp. is still rather limited. Thus, it is necessary to determine whether *Eurotium* spp. make a direct contribution in the claimed bioactivities of Fu-brick tea.

The main objective of the study is to elucidate biological activities and characteristics of *Eurotium* fungal strains isolated from plant samples of Vietnam and stored at Institute of Natural Products Chemistry since the year of 2010. As far as we are aware, the study is one of the first to focus on the potential biotechnology application of the fungal group in Vietnam and is expected to discover promising microbial candidates for future research.

2. MATERIALS AND METHOD :

2.1. Fungal strains

Six fungal strains (C1, C2, C3, C6, C7, C8) were purified and cultured on potato dextrose agar (PDA) plates (200 g potato, 20g dextrose, 15g agar, pH=7.0) at 25°C for up to 10 days. Macro-morphological characteristics of the strain were determined and illustrated in Figure 1. Accordingly, fungal colonies had a modest growth rate with diameter approximately 1.7 cm/ 5 days at 28°C. The surface of the colonies seemed spongy with light yellow thin edges and greyish brown center. The fungal strains were recorded to release dark brown pigments into the medium.

The fungal biomass was stored in 20% glycerol solution at -80°C for long-term preservation.

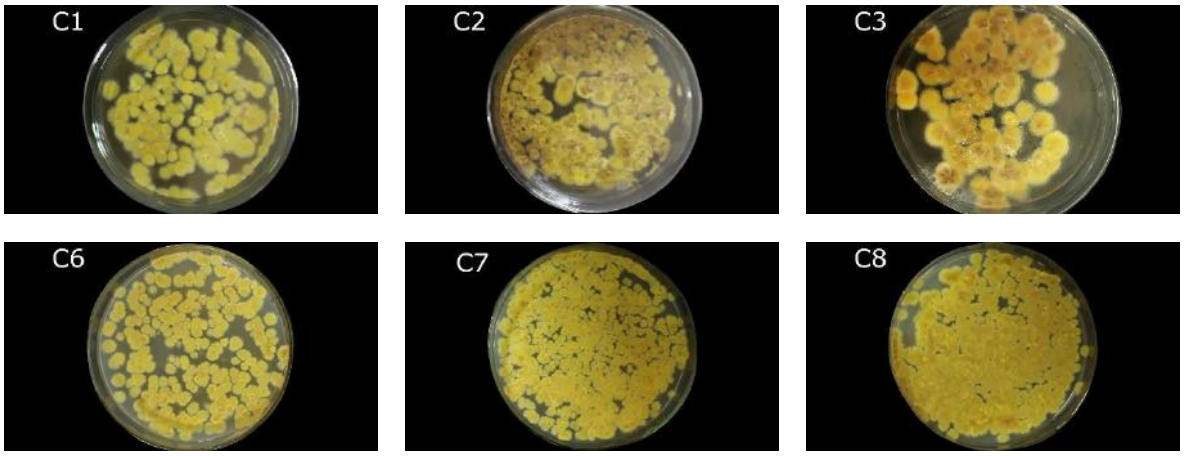

Figure 1: Colonies of six *Eurotium* strains (C1, C2, C3, C6, C7, C8) on PDA at 28°C/ 5 days

2.2. Fermentation and extraction of the fungi

Eurotium spp. strains were cultivated at 25°C for 14 days in 150 mL of potato dextrose broth (PDB) in an incubator shaker (IKA, Germany). The fermentation broth (containing fungal biomass) was extracted with ethyl acetate (EtOAc, China) (v:v=1:1) as previously described [22]. The crude extracts were obtained via using rotary vacuum evaporator (EYELA, Japan) to remove the solvents and subsequently dissolved in dimethyl sulphoxide (DMSO, Signma Aldrich, Germany) for biological assessments.

2.3. Antioxidant assay

The antioxidant activity was determined by DPPH (1,1-diphenyl-2-picrylhydrazyl) assay[2]. Reaction vials containing 10 µL of extract solution at serial diluted concentrations and 190 µL of DPPH solution were incubated at 37°C for 30 min in the dark. The absorbance of mixtures was measured at 515 nm against a blank prepared the same way using 1% DMSO instead of fungal extract. Ascorbic acid was used as positive control. The results were presented as the averages of at least 3 replicates ± σ ($p \leq 0,05$). SC50 values of test samples were calculated by interpolation from linear regression analysis (Table curve, USA).

2.4. Anti-inflammatory assay

The in vitro anti-inflammatory activity of tested fungi was determined using nitrite assay in murine macrophages following published method [8][21] with minor modifications.

Cell culture: Murine macrophage RAW 264.7 cells (ATCC TIB 71) were maintained and cultured at 37°C under humidified air, with 5% CO_2 atmosphere in Dulbecco's Modified Eagle Medium (DMEM) supplemented with 10% fetal bovine serum (FBS), 100 units/mL penicillin and 100 mg/mL streptomycin.

Cytotoxic assay: Prior to nitrite assay, cell viability of RAW 264.7 macrophages in exposure to test fungal extracts was evaluated by (3-(4,5-Dimethylthiazol-2-yl)-2,5- diphenyltetrazolium bromide (MTT) colorimetric method [1] .In brief, seeded cells ($5*10^4$ cells per well in 96-well plates) at the exponential growth phase were treated with serial diluted concentrations of the extracts (200-100-50 µg/mL) and 1 µg/mL lipopolysaccharide (LPS, Sigma-Aldrich, Germany). After 36 hours, MTT (Sigma-Aldrich, Germany) solution (0.5 mg/mL) was added to each well and incubated (4h, 37°C, 5% CO_2). Formed formazan blue crystals in cells were dissolved in DMSO for detection at 570 nm (Tecan F150 microplate reader, Switzerland).

Nitrite assay: RAW 264.7 macrophages were seeded in 96-well microtiter plates at a density of $1*10^5$ cells per well for exponentially growing. After a cell starvation period in 1% FBS medium for 6 hours, macrophages were then treated or not with fungal crude extracts (37°C, 5% CO_2, 24 h) and stimulated with 1 µg/mL LPS in 24h. Cell-free supernatants were collected to determine the production of nitric oxide (NO) content by reaction with Griess agent (1% sulfanilamide and 0.1% N-1-naphtylethylenediamine dihydrochloride in 2.5% H_3PO_4) (Sigma-Aldrich, Germany) (30°C, 20 min) and detected by absorbance at 550 nm (Tecan F150 microplate reader, Switzerland). The inhibition of NO production of test samples was calculated by interpolation basing on calibration of a standard curve with known sodium nitrite concentrations.

2.5. Morphological and molecular identification

The isolated strains were categorised based on morphological characteristics like colony shape, color of the aerial hyphae, growth rate in PDA medium, and microscopic features of reproductive structures.

The extraction of fungal DNA was carried out according to the method of Mishra [14]. The fungal hyphae were added to extract solvent (0.1M Tris-HCl pH 8.0, 10 mM EDTA pH 8.0, 2.5M NaCl, 3,5% CTAB, 150 uL 20mg/mL protease K) in 1.5 mL tubes containing glass beads (0.5-1mm). The supernatant after centrifugation (10000 rpm, 10 mins) was collected and added an equal volume of phenol-chloroform-isoamyalcohol (25:24:1) mixture before being added to chloroform solvent. Isopropanol was supplemented to the mixture for precipitation of DNA. After centrifugation and washing with ethanol 70% and TE buffer (10mM Tris-HCl, 1mM EDTA, pH 8.0), the total DNA of a fungal strain was collected.

The total DNA was assessed for purification via DNA electrophoresis on 0.8% agarose gel and used as template for the amplication of fungal ITS sequences (MasterCycler EP Gradient S cycler, Germany) using universal primers ITS1 (5'-TCCGTAGGTGAACCTGCGG-3') and ITS4 (5'-TCCTCCGCTTATTGATATGC-3') [26]. The PCR was started with an initial denaturation at 95°C for 3 min, followed by 30 cycles of denaturation at 94°C for 30 s, annealing at 50°C for 30 s, and elongation at 72°C for 30s, and final elongation took 10 min at 72°C. The PCR products was evaluated via electrophoresis on 0.8% agarose gel, purfied and sequenced. ITS sequences were then compared with those available in GenBank via BLASTn searches. MEGA 7 software was utilized to analyse the sequence and build the phylogenetic tree of the fungal strains.

2.6. Biophysical and biochemical characterization

Effect of cultural conditions

Physicochemical characteristics are important for profiling and tapping applicability of a microbial strain. For determination of cultural factors affecting growth of studied strains, the harvest

fungal biomasses after inoculating in basic medium under standard conditions (shaking incubator 200 rpm, 5 days) with varying pH ranges from 4.5 to 8.5, supplemented with different sodium chloride concentrations ranging from 0 to 5% and at different temperatures (20, 25, 30, 35°C) were evaluated and compared.

Biochemical characteristics

The enzymatic activities (Beta-glucosidase, Cellulase, Xylanolytic enzymes, Carbohydrase, Casein hydrolytic, Pectinolytic, and Lipolytic acitivities) of studied fungal strains were determined by observing formation of halo areas surrounding fungal colonies on agar plates containing appropriated substrates, i.e., esculin, carboxymethylcellulose, xylan, soluble carbohydrate, skim milk powder, pectin and olive oil respectively [6].

2.7. Safety test in animals

Safety test of a fungal strain in BALB/c mice was carried out as the procedure mentioned earlier by Carter [24]. Accordingly, BALB/c mice (6 weeks old, 18–20 g, n = 10) were given either a 0.5 mL intraperitoneal (IP) or 0.2 mL intravenous (IM) injection of brain heart infusion (BHI) broth (Merck, Germany) containing fungal spores. Animals were observed daily for health evaluation up to 10 days' post infection.

3. RESULTS AND DISCUSSION :

3.1. Antioxidant assay of extracts

DPPH is a nitrogen centered radical which can create stable radicals in saturated EtOH solvents. Once tested samples are added in this mixture, the light absorbance of DPPH free radicals will be reduced if the sample has the ability to neutralize and scavenge radicals. The antioxidant activities of the sample are determined by the absorbance value of the samples in comparison with the control value obtained at the wavelength of 515 nm.

SC% (Scavenging Capacity, %) which is calculated based on the formula shown in the method section indicates the radical scavenging capacity. The SC% values of 6 fungal crude extracts at 200 µg/mL were shown in Table 1.

Table 1. DPPH scavenging capacity of fungal extracts.

Sample	Scavenging Capacity (SC,%)	SC50 (µg/mL)	Note
Positive control (+) (ascorbic acid)	87.48±0.38	9.75	Positive
Negative control (-) (DMSO+DPPH)	0.0±0.0	-	
C1	85.36±0.03	96.07	Positive
C2	58.62±0.03	167.11	Positive
C3	39.38±0.07	263.88	Negative
C6	35.34±0.07	284.65	Negative
C7	18.13±0.01	>500	Negative
C8	80.54±0.08	121.12	Positive

Antioxidant activities of the fungal extracts against free radicals were indicated through SC% and SC50 values. The results showed 3 out of 6 samples possessing a value of SC> 50% at 200 µg/mL. A moderate antioxidant activity of C2 crude extract was illustrated, with a percentage of free radical scavenging at 58.62% and a SC50 value of 167.11 µg/mL. C1 and C8 displayed a relatively higher free radical scavenging at 80-85% and SC50 of 96,07µg/mL and 121,12µg/mL respectively.

This is consistent with the results mentioned in previous research. Miyake and colleague (2009) had evaluated the antioxidant activity of *Eurotium herbariorum* NE-1 and NE-4 extracts isolated from dried bonito. Both strains possessed significant free radical scavenging capacity against DPPH with SC% being 82.3±4.7% for *E.herbariorum* NE-1 and 85.8±3.5% for *E.herbariorum* NE-4 [19]. Another research of Miyake (2014) continued to assess free radical scavenging capacity on DPPH of other members of Eurotium genus isolated from karebushi. The SC% value of *E. herbariorum* NU-2 and *E. repens* KBN2062 was 60.3% and 63.5% respectively [20].

3.2. Anti-inflammatory assay of extracts

3.2.1. Cytotoxicity

The effects of fungal extracts at concentrations ranging from 25 to 100 µg/mL on the growth of macrophages RAW 264.7 were determined basing on viable cell percentages in existence of LPS. Results showed that the cell viability ranged from 89.35±2.24 to 98.92±1.03% (data not shown), indicating no significant cytotoxicity was elicited by incubating with fungal extracts. Therefore, these extracts were chosen to be tested in further anti-inflammatory assay at highest concentration of 100 µg/mL.

3.2.2. NO production

The anti-inflammatory activity of six fungal strains was evaluated in terms of induced NO production by RAW 264.7 cells. The amount of released NO was measured as the accumulation of nitrite in the culture supernatants. Results showed that five out of six tested fungal extracts did not show any effect, while wells treated with 100 µg/mL extract from fungal strain C1 resulted in an NO inhibitory percentage of 61.34±1.03% (Figure 2). While the inhibition of NO production to the culture medium in wells treated with LPS was taken as 0%, the percentage by incubation with positive control (cardamonin 3.0 µM) was 87.42±1.33%.

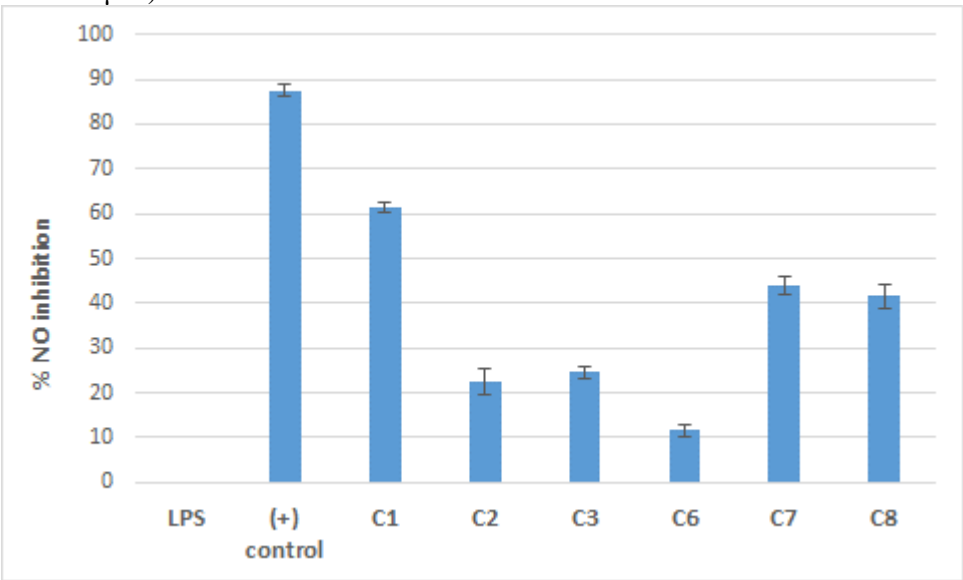

Figure 2: Nitric oxide inhibitory activity of fungal extracts at 100 µg/mL on RAW 264.7 macrophages. Data represent the mean ± standard deviation of three independent wells.

There have been some previous research focusing on the anti-inflammatory property of other fungal extracts. The study of Nihad (2013) focused on assessing the bioactivities of four fungal strains

isolated from honeycomb sponge, ascidian and seaweed. The extracts of these four fungi possessed a modest ability to inhibit NO, with the most significant being *Engyodontium album* (49.31%) and *C. globosum* (46.4%) at a concentration of 6 mg/ml each [4]. In another study of Shin (2021), extract of *Phellinus linteus* mycelium was shown to significantly reduce NO production at concentration of 100 (19.3%), 200 (36.5%), and 500 (47.9%) µg/Ml [3]. Thus, compared to the previous results, it can be claimed that extract from fungal strain C1 had a moderate NO scavenging capacity which worth further investigation.

3.3. Identification of *Eurotium* strains

3.3.1. Molecular identification

Since C1 and C8 possessed most remarkable antioxidant properties, these two fungal strains were selected for further identification. According to the results, the ITS sequences of strains C1 and C8 bore strong resemblance to several species of genus *Aspergillus* such as *A. ruber* K8 (MH237639.1), *A. amstelodam*i BAB-6506 (MF319924.1), *A. cristatus* FBKL3.0186 (KY28916.1), *A. chevalieri* TUHT82 (LN482478.1), *Eurotium cristatum* EN220 (JQ743649.1) (Figure 3). In order to identify the species, morphological characteristics including colony shape, spores and conidia were taken into account.

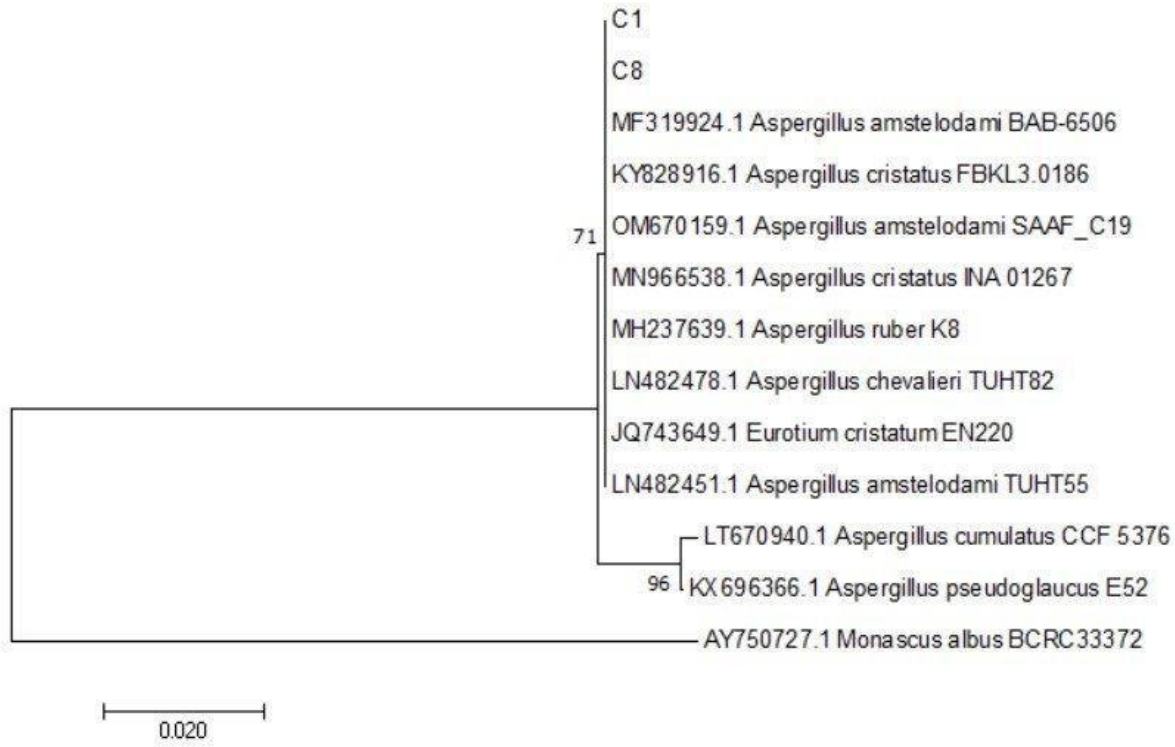

Figure 3: Phylogenetic tree of 2 fungal strains based on ITS, using Neibour Joining tree method with bootstrap value of 1000 and MEGA7 software

3.3.2. Morphological identification

On PDA agar plates, colonies of both strains C1 and C8 appeared with slightly spongy surface, pale yellow thin edges which darkened to yellow green or grayish brown in the central area. The reverse side was initially colorless, but gradually turned dark brown over the observed period. The conidiophores (150-550 µm x 6.0-16.5 µm) which were stemmed directly form basal filaments were straight, smooth, light brown to brown in the vesicule area which were spherical or pear-shaped. Single phialides covered from a half to three fourth of the vesicule surface, with a size of 5.0-10µm x 3.0-4.0µm. The conidiospores were elliptic at first, but developed to rough and spined spheres with age. The ascocarp was yellow, spherical to globose, 55-150 µm wide, while the ascus (8.0-11 µm) shaped

like an ellipsoid and consisted of 8 ascospores. All of which were globose, rough, with 2 thin equatorial edges and had a size of 3.7-5.5 µm x 3.0-4.5 µm. Thus, the combination of molecular and morphology results indicated that both C1 and C8 belonged to *Eurotium cristatum*.

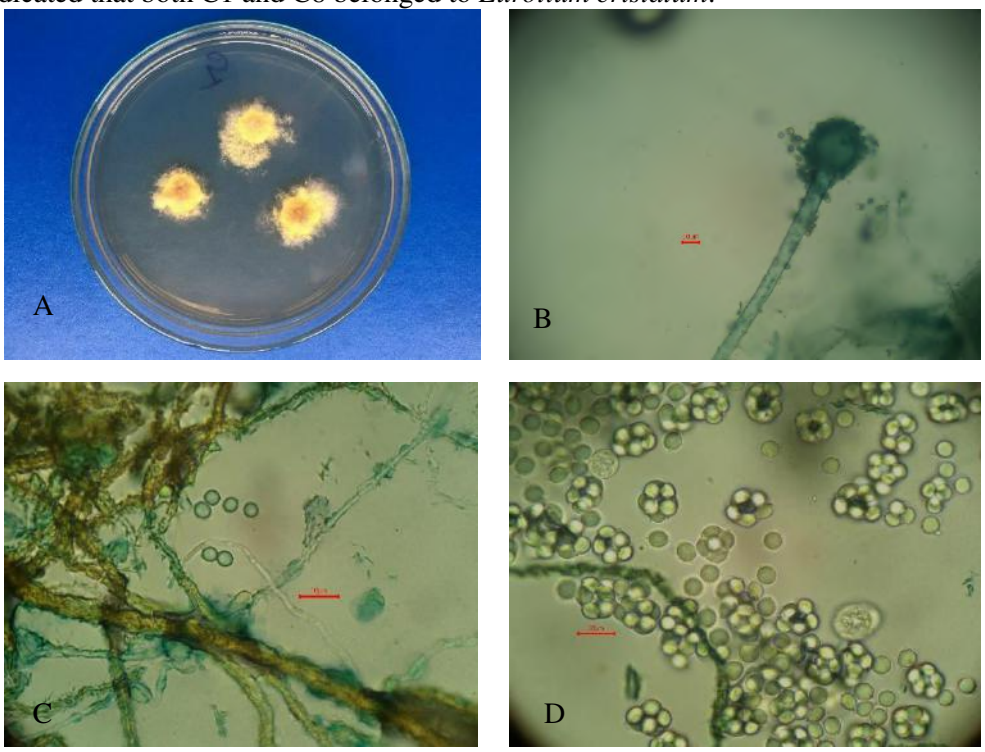

Figure 3: Strain C1: (A) Colonies on DG18 medium at 25°C/7 days; (B) Conidiophore X 400; (C) Conidiospores X 1000 ; (D) Asci and ascospore X 1000.

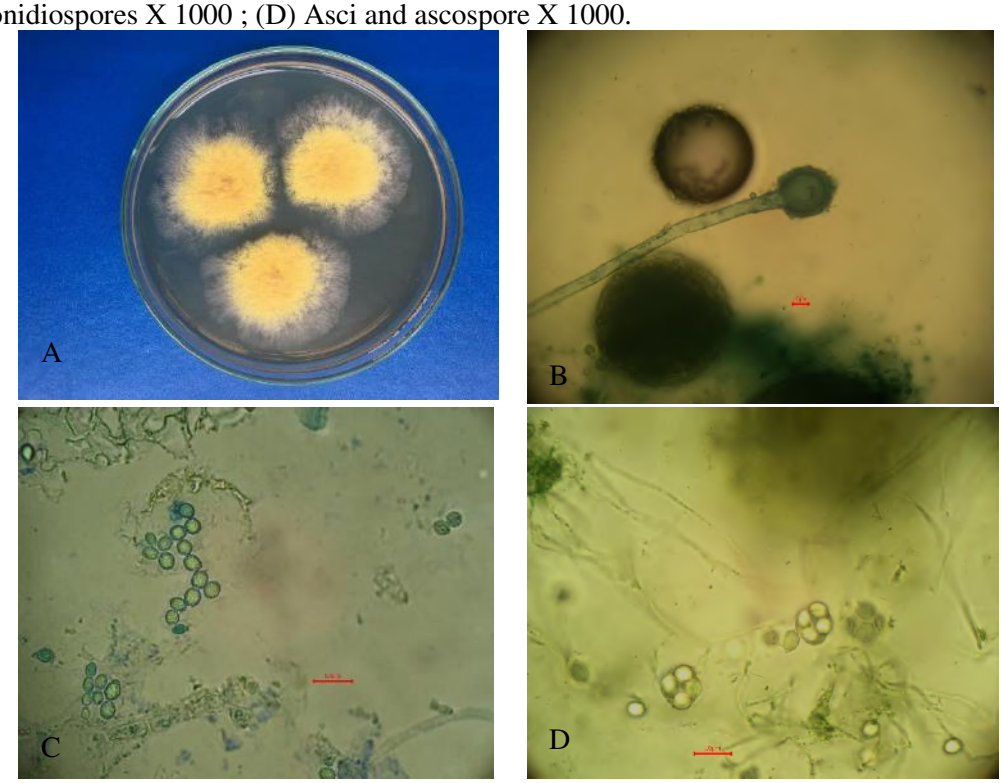

Figure 4: Strain C8: (A) Colonies on DG18 medium at 25°C/7 days; (B) Conidiophore X 400; (C) Conidiospores X 1000 ; (D) Asci and ascospore X 1000.

4.4.3 Biophysical characterization of *Eurotium* strains

Table 4. The biophysical properties of fungal strains

Strains	Biophysical properties		
	Temperature (Optimal, °C)	pH (Optimal)	NaCl (%)(Optimal)
C1	15-40 (25)	4,5-8,5 (7)	0-3 (1)
C8	15-40 (25)	4,5-8,5 (7)	0-3 (1)

The results of the experiment showed the temperature tolerance range for C1 and C8 were from 15 to 40 °C, with the optimal being 25 °C (Table 4). Previous research did mention about the minimum and maximum values of temperature for the growth of *Eurotium amstelodami* and *Eurotium chevalieri* isolated from animal feeds were 15 °C and 37 °C, with the highest growth rate recorded at 25 °C [15]. Another species of *Eurotium* genus, *E. repens* was recorded to grow in the range of temperatures from 4–5 to 38–40 °C, with the optimum temperature in the range of 25–27 °C [25]. In terms of pH, both strains were able to grow in the conditions of pH from 4.5 to 8.5, while the highest development rate was witnessed with pH of 7. This optimal pH was higher in comparison with the previous data, such as pH 4.5 -5.5 of *E. rubrum* and *E. repens* [13]. The two fungal strains C1 and C8 also recorded quite wide tolerance range of NaCl concentration from 0 to 3% with the optimal concentration being 1%. Since *Eurotium* spp. were regarded as osmotolerant, many species in this genus possess a broad salinity range. For instance, *E. amstelodami* was detected in environments with salinities ranging from 3% to 32% NaCl [7].

3.4. Biochemical characterization of *Eurotium* strains

In terms of biochemical properties, the presence of extracellular enzymatic activities of two fungal strains C1 and C8 was determined. Both strains revealed considerable enzymatic activities in all tested aspects, including: cellulase, xylanase, pectinase, amylase, β-glucosidase, lipase and casein hydrolase (Table 5).

Table 5. The biophysical properties of fungal strains C1 and C8

Strain	Biochemical properties						
	Cellulase	Xylanase	Pectinase	Amylase	β-glucosidase	Lipase	Casein hydroxylase
C1	+	+	+	+	+	+	+
C8	+	+	+	+	+	+	+

Previous study of Kaminishi (1999) has extracted, purified and characterized the enzyme lipases from *Eurotium repens* and *Eurotium herbariorum* NU-2 [17]. In another research, Peng Cheng and his team detected the enzymatic activities of α-amylase, pepsin, trypsin and lipase in *Eurotium amstelodami* isolated from Black Brick tea [9].

3.5. Safety results of the fungi

In vivo safety tests revealed no fatal case in BALB/c mice when injected with aliquots containing fungal biomasses of strains C1 and C8, both intraperitoneally and intravenously. The mortality rates as well as animal's conditions after 10 days of injection were determined and presented in Table 6.

Table 6. Safety results of test fungal strains in BALB/c mice.

Sample	**Number of test animals**	**Injection route**	**Mortality rate (%)**	**Animal's condition**
Control (BHI broth)	5	IM	0	Healthy
	5	IP	0	Healthy

BHI broth containing C1 biomass	5	IM	0	Healthy
	5	IP	0	Healthy
BHI broth containing C8 biomass	5	IM	0	Healthy
	5	IP	0	Healthy

From these achieved results, fungal strains C1 and C8 with noteworthy bioactivities and low toxicity showed considerable promise for future application in food industry or therapeutic treatment.

4. CONCLUSION

In general, six *Eurotium* fungal strains were isolated and their bioactivities evaluated. Two of the fungal ethyl acetate extracts possessed remarkable antioxidant and anti-inflammatory activities. These two strains were subsequent identified as *Eurotium cristatum* and exhibited considerable enzymatic activities. The knowledge of these fungal species, along with their morphological, biophysical and biochemical characteristics may serve as foundation for continuous research of their metabolites and eventual industrial or pharmaceutical application.

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Scum forming Cyanophycean algae from Bori Dam, Jalgaon (M.S.)

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Abstract: *Stagnancy in water reservoir promotes algal growths on surface of water. They produce scum on water surface. Algal members belonging to Cyanophyceae are observed dominant. Due to fast multiplication rate, and mucilage production, they readily form scum. This relates to biological pollution of water. Analysis of Bori Dam water is screened for to record scum forming algae. In present report 25 taxa is taxonomically enumerated belonging to Cyanophyceae.*

Key words : *Scum, Cyanophyceae, Algae, Bori Dam, Jalgaon.*

INTRODUCTION:

Algae forms green scums on water surface and responsible for water pollution. Bori dam water is studied with relation to scum forming Cyanophyceae.The main source of water for Bori dam is Bori river which is tributary of Tapti river. The total length of dam is 3,365m. The height of dam 20m. It is situated between 20° 46′19″N longitude and 75°1′37″E latitude. Algae of various water bodies of North Maharashtra were studied by many workers. Barhate and Tarar (1981) studied algal flora of river Tapi as well as Cyanophyceae of Khandesh. Bhoge and Ragothaman (1986) studied Cyanophyceae from Jalgaon region. Nandan and Aher (1999) worked on algal flora of fish pond in Dhule. Mahajan and Nandan (2004) worked on BGA of Hartala lake of Jalgaon. More *et al* (2005) studied the algal diversity of Panzara river of Maharashtra. Nandan and Aher (2005) has studied algal diversity of Haranbaree dam and Mausam river of Maharashtra. Chaudhari *et al* (2007) studied on algae from paddy fields of North Maharashtra.

MATERIAL AND METHOD :

Bori Dam is located near the village Tamaswadi, Taluka, Parola. District, Jalgaon. Different sites of dam were selected for scum collection to catch diversity of scum forming algal taxa throughout the year 2018-2019. The samples along with algae were collected in clean plastic bottles. Different algal scums were preserved in 4% formalin. Bottles were labelled and kept carefully for further study. Identification of algal taxa were done with the help of monograph Desikachary (1959) and relevant literature.

SYSTEMATIC ACCOUNT

1.*Chroococcus turgidus* (Kutz.) Nag.

Planktonic, cells more or less spherical, ellipsoidal, single blue green to olive green, with sheath 21.6µ and 14.4 µ in diameter, sheath colorless, single cell 7.2 µ broad and 16.2 µ long.

2.*Chroococcus minutes* (Kutz.) Nag.

Cells oblong in groups of 2-4, light blue-green, with sheath 20µ 25µ diameter, without sheath 3.6 µ - 5.4 µ in diameter, sheath colorless.

3. *Gloeocapsa rupestris* Kutz.

Cells 5.4-6µ in diameter, with sheath 14.4 µ -16 µ in diameter, sheath colorless or slightly yellow found in floating masses in stagnant water.

4. *Gloeocapsa gelatinosa* Kutz.

Cells without sheath, 2.4 µ in diameter, with sheath, 4.8 µ -8.4µ in diameter, blue-green, sheath colorless, thin.

5. *Merismopedia minima* Beck

Cells in small colonies of 4, pale blue-green, free swimming about 0.7-0.9 µ broad.

6. *Merismopedia glauca* (Ehrenb.) Nag.

Colonies small with 16-32 cells, pale blue-green, cells closely arranged 2.5µ-3.5µ broad, cells oval.

7. *Myxosarcina spectabilis* Geitler

Cells in three dimensional colonies 5.4 µ -9 µ broad, sheath hyaline, thin, cell content blue-green.

8. *Arthospira platensis* (Nordst.) Gomont.

Trichome 9 µ broad spirals more or less regularly coiled, cells as long as broad 2 µ -3 µ, distance between spirals variable. Cells content uniform blue-green.

9. *Spirulina meneghiniana* Zanard ex Gomont

Trichome 1.8 µ broad, flexible, irregularly coiled, blue-green, spirals 3.4 µ -4.8 µ broad.

10. *Oscillatoria martini* Frem.

Trichome loosely spirally coiled, unconstricted at cross walls 5.4µ broad, end attenuated, cells 18 µ long, non-granulated.

11. *Oscillatoria laete-virens* Gomont

Trichome straight, fragile, apices attenuated, slightly curved, apical cells conical and slightly acute, cells 3.6 µ long as well as broad content uniform blue-green.

12. *Oscillatoria rubescens* Dc ex Gomont

Trichome straight, at the end slightly attenuated, cell 3.6µ broad and 5.4 µ long, cells not constricted at cross wall, cell content uniform or slightly granulated.

13. *Oscillatoria animalis* Ag.ex Gomont

Trichome not constricted at cross walls briefly attenuated at end, slightly bent, 36µ-62 µ broad cells blue-green 1.8 µ long not granulated at cross wall,end cell pointed, no calyptra,not capitate.

14. *Oscillatoria terebriformis* Ag. ex Gomont

Thallus dull blue-green, trichome end bent and slightly attenuated, unconstricted at cross wall, cells 3.6 µ -5.4 µ broad and 2-5 long end cell not capitate, no calyptra.

15. *Oscillatoria subbrevis* Schmidle

Trichome single, 3.6µ-5.4µ broad nearly straight not attenuated at apices, cells 1.6 µ -2.5µ long, not granulated at cross wall, end cell rounded, calyptra absent.

16. *Oscillatoria raoi* De Toni J

Trichome straight, pale green, planktonic, uniform in thickness, without constriction ,5.4 µ broad, septa, indistinct with distinct granules an either side, end cell rounded without calyptra.

17. *Oscillatoria princeps* Vaucher ex Gomont

Trichome blue-green straight, not constricted at cross walls 20.4 µ -25.5µ broad, cells 2.4 µ long, end cell rounded.

18. *Oscillatoria tenuis* Ag.ex Gomont

Trichome slimy, straight, sligthly constricted at cross walls 3.6 µ -4.8 µ long, septa granulated, end cell hemispherical.

19. *Phormidium fragile* (Meneghini) Gomont

Trichome constricted at cross wall, septa not granulated, attenuated at end 1.8µ-2.4 µ broad, pale blue-green, cells nearly quadrate as long as broad.

20.*Phormidium ambiguum* Gomont

Filament bright blue-green, end not attenuated not capitate, cells 5.4µ-6.3µ broad, 1.8 µ -3.6 µ long, sheath thin, end cell rounded, calyptra absent.

21. *Phormidium rubroterricola* Gardner

Trichome 2.2 µ -2.4 µ broad not constricted at cross walls, end cells obtuse-conical, cells quadrate or shorter than longer.

22. *Lyngbya martensiana* Menegh.ex Gomont

Filament with sheath 10.8µ broad cells 1.8µ long not constricted at cross wall, end cell rounded, sheath colorless 1.8µ thick

23. *Lyngbya majuscula* Harvey ex Gomont

Filaments very long, sheath colorless, 3.6 µ -5µ in thickness. Trichome blue-green, not constricted at cross wall not attenuated at ends,18 µ -25.5 µ broad, cells as long as broad, cross walls not granulated, end cell rotund, calyptra absent.

24. *Nostoc spongiaeforme* Agardh ex Born et Flah. Var.*tenue* Rao C.B.

Trichome 3.6 µ -3.8 µ broad cells spherical to sub spherical, heterocyst spherical 5.4 µ - 6.3µ in diameter. Thallus gelatinous, sheath hyaline.

25. *Calothrix marchica* Lemmermann Var. *intermedia* Rao C.B

Filament singly 3.6 µ broad with slight attenuation without hair, cells constricted at cross wall spherical 3.6 µ -5.9 µ broad.

SUMMARY AND CONCLUSION :

Algal scums of Bori dam water were studied to know scum forming taxa. Dam water is mostly stagnant which favours growth of algae. Cyanophyceae members are mucilaginous they form

blue green scums on water surface. Mucilage helps to adhere the scums. Analysis of scum revealed their dominance. Total 25 taxa belonging to 11 genera of Cyanophyceae were explained taxonomically from Bori dam. The taxa like *Chroococcus*, *Merismopedia*, *Gloeocapsa*, *Phormidium* and *Oscillatoria* were found common from scum analysis. Algal scums appear prominently in summer season.

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REVIEW FOR A SaaS BASED CLOUD ATTACK

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Abstract: *In today's world web applications are integral part of our day today life. Currently there are infinite numbers of web users around the world. These web applications allows users to use the services provided by them upon just a simple clicks from anywhere in the world. Due to rapid growth as well as competition in the business the service providers are making use of the web applications to attract the user. Some of the common examples of the web applications are banking applications, social networking applications, ecommerce applications etc. There exists a variety of attacks that imposes threat on these web applications. One of such attack is known as SQL Injection attack. Research has shown that about 64% of the overall web applications running worldwide are prone to SQLIA. SQL injection is a SQL code injection technique, which forces the database to execute malicious SQL commands that can perform unwanted actions on the underlying database such as getting access to private information or even deleting the entire tables or the database itself. So the prevention against such an attack is must for the web applications.*

Various research work in this area have been carried out so as to provide better and more accurate defence mechanism against SQLIA, but still the incident of SQLIA are reported time and again even with big cloud service providers. This paper reviews some latest work from some of the best journals in this area.

Key Words: *SQL injection attack(SQLIA), Cloud Security, Machine Learning, SQL injection vulnerability, Web application, Structured Query Language*

1. INTRODUCTION : The web application provides the services as requested by the user (client) by taking the request in form of user inputs. Then this submitted request is posted back to the web server and accordingly the appropriate service is invoked and the result is returned to the client. In this overall life cycle of processing any type of request the destination is database. During the request submission the attacker can impose the SQL Injection Attack. Some of the major SQLIA goals for the attacker are Database finger printing, Extracting data, Modifying data, Modifying database schema, Remote control, Bypassing authentication.

2. Attack Implementation Mechanism :

Malicious SQL commands can be introduced by the attackers into a web application which relies on taking the inputs by many different input mechanisms. Some of the common input mechanisms are discussed in this section. [19, 20]

- **Injection through user input** - Web application can read input of the user that the users provide in several controls such as text-boxes, text areas, password fields etc. and this input is submitted via HTTP GET or POST requests. In this case, the attackers inject malicious SQL commands in these user input controls.

- **Injection through cookies** - Cookies are small amount of information that are stored on clients machine. The stored information contains client's state information generated by Web applications,

attacker may misuse this cookie's contents which can initiate sql injection(if this web application uses the cookie's contents to build SQL queries.

- **Injection through server variables** - Web applications use these server variables in many ways, such as counting the number of users visited the web application, for logging of usage information, identifying browsing trends etc. Modification to these variables causes sql injection attack on the web application.

- **Second-order injection** - In this type the attackers enters malicious inputs to the database directly and when this input is used at a later time, SQL Injection Attack gets initiated. For example:- If an attacker tries to impersonate the admin (whose user name = "admin123") and changes the password of the admin in the application with a new password. The sql query for the updation of password is as follows:-

Query_Str="UPDATE users_details SET user_password='" + new_password +"' WHERE user_Name='" + user_name + "' AND password='" +old_password + "'"

The injected malicious sql query will be as following (here it is assumed that the old password is old_Admin and the new password is new_Admin).

UPDATE users_details SET user_password =" new_Admin" WHERE userName="admin123"--" AND password= "old_Admin".

As "--" is treated as comment operator in SQL and everything following – will be ignored by the database. Therefore, the attacker is successfully able to update the admin password in the database.

3. SQLI NJECTION ATTACKS TYPES :

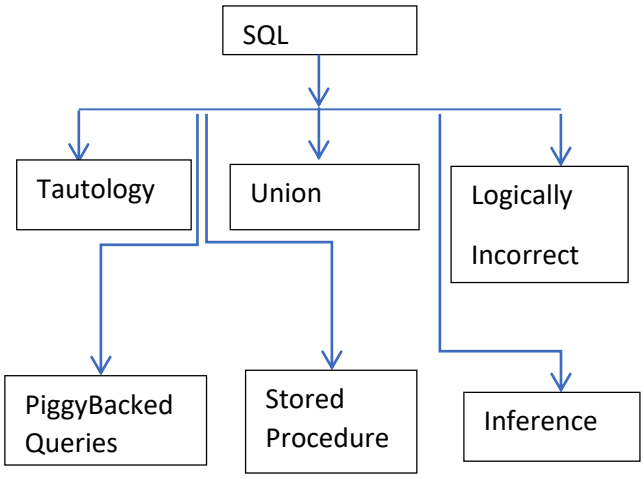

Fig. 2 SQL INJECTION ATTACK TYPES

Tautologies-In Tautology type of sql injection attack all the condition result including the negative ones becomes true all the time. Thus bypassing the actual logic and leading to unauthorized access to the database as well as exploiting the sensitive data. Since the condition is to be set as true every time in this type of SQLIA, the fields in the WHERE condition is targeted by the attacker. [16] For example if an attacker inputs user id as ADMIN and password as anything' or 'Y'='Y, the query thus formed will be as follows

SELECT * from user WHERE user_id = 'ADMIN' and password = 'anything' or 'Y'='Y'

The above mentioned query becomes a tautology condition and evaluates to true giving unauthorized access the attacker.

Logically Incorrect Queries- Logically Incorrect Queries- The attacker in this type of attack intentionally gives commands that causes logical, syntax or conversion errors. Information such as database name, tables names or column names used in the database are exposed by making use of such type of syntax errors in the sql commands.

For example the error message given by an application which is using MICROSOFT SQL SERVER as the backend database as "Microsoft OLE DB Provider for SQL Server" is due to failed conversion of a given data type to another data type caused by an incorrect query given by the attacker. If the attacker gives the input as "convert (float , (select employee_name from sysobjects where xtype='u'))".

The resultant query thus formed will be as

SELECT acc_details from bank_details WHERE password = convert (float , (select employee_name from sysobjects where xtype='u')).

In this case the attacker tries to fetch the table name from the metadata table and then perform type casting of table name into float data type which is an invalid type conversion. Thus application displays the Microsoft OLE DB Provider for SQL Server" error message exposing the backend database name "Microsoft SQL SERVER" as well as the table's column name "account_info" due to incorrect type conversion.

Union Query- Union query allows, an attacker fetch information or the sensitive data from a table other than the original table that is meant to provide that particular information by injecting an sql query including UNION SELECT clause. [20]

For example by injecting UNION clause such as: "UNION SELECT payment_details from Payment where acctNumber=563214 - -" in the login control field of the application, which results in the following sql query:

SELECT User_Info FROM users_details WHERE login= "UNION SELECT payment_details from Payment where acctNo=563214 - -".

There is no user details available in the user_details table with login equal to "" in the application, so the first query returns null value in this case while the second query returns data from the table "Payments", such as the payment details of the user for account number = 563214.

PiggyBacked Queries- This type of SQLIA allows the attacker to piggyback some additional queries to the original sql command.

Example : If an attacker wants to delete the table schema from the database, he can inject the following value in the login field of the application "'; drop table ACCOUNT_DETAILS –". That results into the following sql query at the backend:

SELECT user_info FROM user_details WHERE login_id ='SAM' AND login_password= "'; drop table ACCOUNT_DETAILS –".

As the delimiter marks the end of the first query and treat everything after it as complete second query and thus goes on to delete the ACCOUNT_DETAILS table from the database due to additional piggyback query.

Stored Procedures- Stored procedures are the major backbone for the backend database. These stored procedures are required to run sql queries and fetch the data from the database in the application. [21] The use of stored procedure minimizes the risk of many attacks including SQLIA as well as protects from direct exposure of sensitive data at the same time. The stored procedures are provided with the capability of interacting with the operating system in order to accomplish several task. But this feature of the stored procedure can be misused by the attacker and cause SQLIA.

For example in order to shutdown the operating system, the attacker may inject the input as "'; SHUTDOWN;" in user id field of the application and thus forming the sql command as

SELECT * from user_info FROM users_details WHERE login_id ='sam' AND login_password=" "'; SHUTDOWN;".

Although the below mentioned stored procedure is used to execute the command in the application, but the command "'; SHUTDOWN; forces the operating system to shut down as soon as it is executed.

```
CREATE PROCEDURE CHECK_USER_AUTHENTICATION
@userName varchar2, @userPassword varchar2
AS
EXEC("SELECT user_info FROM users_details WHERE login_id='" +@userName+ "' and password='" +@ userPassword );
GO
```

4. PREVENTION TECHNIQUES-

1. Prepared Statement -One of the simple ways to avoid SQLIA is to make use of prepared statement which uses parameters for the values to be inserted in the database instead of directly inserting the user input which may contain malicious scripts capable for causing SQLIA. [27]

string Command1 = "Select Count(ID) from tblEmployees where UserName = @UserName and Password=@Password";

In the above query @UserName and @Password are parameters to the query. string Command2 = "select * from tbl_customers where city_name = @city";

In the above query @city is parameters to the query.

2. Stored Procedures – Stored procedures are stored in the database containing all the commands that are to be executed when invoked from the web application. In this way all the user inputs are not allowed to form a sql query directly and execute in the database but rather they are given to stored procedures to which in turn forms legitimate query to get executed. [28]

```
CREATE PROCEDURE stpUpdateMemberByID
@MemberID int,
@MemberName varchar(50),
@MemberCity varchar(25),
@MemberPhone varchar(15)
AS
BEGIN
UPDATE tblMembers
Set MemberName = @MemberName,
MemberCity = @MemberCity,
MemberPhone = @MemberPhone
Where MemberID = @MemberID
END
GO
```

3. Validating User Input – User input is captured by the web application in various web application controls. Web applications must make use of validations of several types on each of the such controls used for receiving inputs from the user which

basically checks the syntax of the user input. Examples for such validation controls are in ASP.NET are RequiredFieldValidation Control, CompareValidator Control, RangeValidator Control, RegularExpressionValidator Control, CustomValidator Control, ValidationSummary. [21, 25]

4. Encrypting Data – All the data stored in the database must be in encrypted form, so that in any case if the malicious query gets an entry in the database must not able to read the data and thus bypass SQLIA. Below is an example of how to create a encrypted stored procedure in sql server. [29, 30]

```
CREATE PROCEDURE dbo.usp_GetCatsByName @catname varchar(70)
        WITH ENCRYPTION
AS
        SELECT    CatId, CatName, Phone
        FROM dbo.Cats WHERE CatName = @catname;
GO
```

5. **Limiting Privileges** – User access is restricted in case of limiting privileges. According to the specific authorization, users must be allowed to have access to the database so as to prevent unauthorized user passing malicious sql query which may lead to SQLIA. [18]

5. LITERATURE REVIEW :

Some of the tools and techniques for detecting and preventing SQL injection are given below:

Gu et al. [1] proposed a framework for the detection of SQLIA named as DIAVA which is capable of recognizing the malicious SQL queries exchanged in the application and notify the admin about the attack. The damage caused by the SQLIA is rapidly analyzed by this framework and thus proves out to be very effective in detecting as well as preventing of SQLIA on the web applications. DIAVA performs SQLIA detection via a model which is based on regular expression and the evaluation of disclosed data is performed by making use of dictionary based engine.

Tripathy et al. [2] gave a solution to detect the SQLIA in web application by the use of machine learning. The result showed that the machine learning algorithm detected the malicious SQL queries with more than 98% accuracy from the normal SQL queries and thus proves out to be a better solution for prevention against SQLIA. The pre-processing of data such as data cleaning is performed as the data is collected from various sources which is followed by feature selection to determine the best set of optimized features that are actually responsible for the attack. The approach make used for the following classifier for model selection namely AdaBoost Classifier, Random Forest, SGD, Tensorflow Linear classifier, Decision Tree, Deep AN and Tensorflow boosted tree. The experimental results showed that the among these algorithms RandomForest with 10 selected features showed better results for Precision, Accuracy, F1 score , Recall, specificity and sensitivity.

Aliero et al. [3] proposed to automate the SQLIV (SQL Injection Vulnerability) in SQLIA by making use of black box testing. In this context the author proposed an improved scanner based on object-oriented methodology that reduces the false negative as well as false positive results for SQL injection vulnerability in SQLIA. The scanner works with four major components which are crawling, attacking, analysis as well as reporting. The accuracy of the proposed scanner is tested against three vulnerable applications and the result showed that the proposed scanner is much efficient than the existing ones.

Another machine learning approach for the detection as well as prevention of SQLIA is proposed by Hasan et al. [4]. This model lies between the application and the application database so as to allow only non-malicious sql query to get executed in the database. Among the twenty three different machine learning classifiers which were used to check the accuracy, it was discovered that the Ensemble Boosted Tree achieved an accuracy of 93.8%.

Wang et al. [5] proposed long short-term memory (LSTM) deep learning methodology for detection of SQLIA for resolving the security concerns in the transport systems. This methodology depicts the high accuracy and false positive rate in comparison with other traditional SQLIA approaches which has high false negative rate and false positive rate. The risk of over fitting the dataset is drastically reduced by the proposed LSTM based deep learning model.

Latchoumi et al. [6] proposed another machine learning approach as a defence mechanism against SQLIA. For classification of normal SQL queries against the malicious SQL queries, all the SQL queries are tested against well trained SVM algorithm which is capable enough to detect the malicious queries and thus guard against SQLIA.

Hlaing et al. [7] also suggested a SQLIA detection as well as prevention mechanism in their research work. The proposed approach works in two steps. The input sql query is divided into set of tokens which are double dashes (--), space ( ), sharp symbol (#) as well as strings that are preceded by symbol. After the collection of tokens from the given input sql query, this token set is checked against the predefined reserved lexions (which are predefined legitimate sql commands, operators, symbols etc.) so as to prevent SQLIA. If match is found between token set and predefined reserved lexions, then it is concluded that the SQLIA was attempted and the given sql query is not allowed to get executed in the database. The outcome of the research showed better result for prevention against SQLIA.

TABLE 1. SUMMARY OF THE APPROACHES PROPOSED TO DEFENSE AGAINST SQLIA

Refrrences	**Proposed Framework/Tool**	**Technique used**	**Advantage**
Gu et al. [1]	DIAVA	Regular Expression based model	Detection as well as prevention against SQLIA.
Tripathy et al. [2]	ML Model	Random Forest ML Classifier	High accuracy in detection for SQLIA.
Aliero et al. [3]	Scanner	Black box testing	Accuracy testing done against three vulnerable web applications.
Hasan et al. [4]	ML Model	Ensemble Boosted Tree.	93.8% accurate results obtained.
Wang et al. [5]	ML Model	Long Short-Term Memory (LSTM) based on deep learning	Overfitting of the dataset is reduced to a great extent thus giving better results.
Latchoumi et al. [6]	ML Model	SVM Algorithm	More accurate detection of malicious sql query is attained
Hlaing et al. [7]	Scanner	Predefined lexions based checking of sql queries	Capable of sanitizing the sql query by matching against predefined list of tokens

6. CONCLUSION AND FUTURE WORK :

Security of database is one of the prime issue which is to be taken care of. There are several types of attacks in the web applications where SQL Injection also has an important place. The attackers can inject the malicious sql code at various points of the application and can gain access to the database. There are several types of tools and frameworks available working on different technique for detection/prevention for SQL Injection attack, some of which is discussed in this paper. In our future work we propose a development of a security mechanism for ensuring the security for SQL injection attack for the web applications and testing its effectiveness, efficiency, and performance.

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Mobile Cloud Computing : Taxonomy and Challenges

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Abstract: *Mobile cloud computing is a combination of three types of technology. In which the first is mobile computing, the second is cloud computing and the third is wireless technology. Mobile cloud computing has become a very important and advanced computing technology in today's time, But mobile devices are still affected by many kinds of challenges or Issues. There is a problem of storage in this, the problem of security, the problem of privacy remains the problem of connectivity. Mobile cloud computing is being used to overcome these problems, so it is necessary that our mobile cloud computing is very secure because at present work is being done in many areas, such as in the field of education, in the field of business, in the field of health, etc., With the help of mobile devices. Due to which there are many security issues, till through this paper, we have study what is in it. This type of challenges can be seen and can be taken for research in the future.*

Key Words: *Mobile cloud computing, Cloud computing, challenges, security, privacy.*

1. INTRODUCTION :

Mobile Cloud computing has become a very important communication and storage area in the present time. Cloud computing and the internet are commonly used in mobile cloud computing. It is composed of three types of computational technologies in which mobile computing, cloud computing, and wireless network which improves computing capacity and storage capacity so that the user gets a good experience through

mobile devices[1]. The same cloud computing is used to perform resource based operations with the help of internet which provides us a good range of mobile device for computing, This is a new area of information technology in which we will get to see many benefits in future [2]. Cloud computing integrates a variety of technologies to provide services, platforms and infrastructure to various users and business organizations and Mobile cloud computing further combines cloud computing with mobile device and wireless technologies distributed across the environment to enable seamless connectivity With the rapid development of technology, more and more users upload different types of data to the cloud including sensitive data or Data security and privacy are top concerns when sharing data [3]. The advantage of mobile cloud computing is achieved only when we apply it to cloud computing, it utilizes our mobiles space and its benefits are passed on to mobile users through mobile devices [4].

In the last few years, there has been a lot of progress in this field, which also works as network of computers and applications. Application Model such as cloud computing have happened in the software services community, due to this, there is a lot of research potential in the cloud computing

field. Mobile cloud computing refers to the use of cloud computing due to the reduced storage capacity of mobile devices and stores the data on the cloud through the applications of mobile devices. Access that data through mobile devices, there are many application of mobile cloud computing, there are many facilities to use it, but if the data is being stored somewhere, then there is also a risk of it being stolen, all these things and we do this, will discuss in the paper.

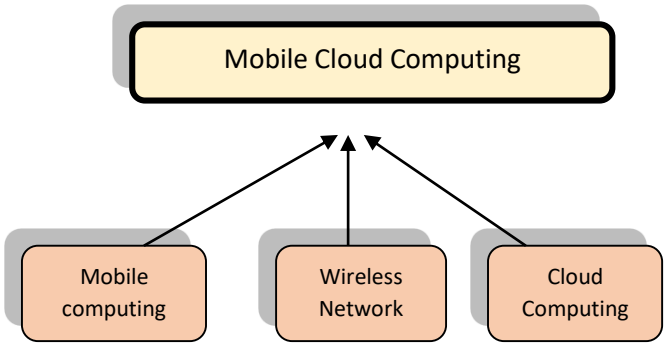

Fig 1. Mobile Cloud Computing

2. LITERATURE REVIEW :

Mobile Cloud Computing has become a very important technology in today's time. According to the research conducted by researchers.

According to D. Harith et al. [5] We have also come to know that mobile users do not have access to a lot of data stored or data processing facilities in mobile devices, due to currently storing their data and information for cloud resources, this type of users numbers are increasing day by day.

According to Hussain Multaq Alnajrani et al. [6] every issue regarding security and privacy still remains in mobile cloud computing because we store the data of mobile devices on cloud storage with the help of cloud services. The Security and privacy in the mobile cloud computing is receiving greater attention these days, yet several existing security and privacy laws and regulations are still needed.

According to Eweaya Ibukum et al. [7] The important of security in technology cannot be overstated, it is one of the most pressing challenges, and it has received insufficient study attention and Users today save information in the cloud on the basis of confidence, but when a technology or technical problem comes as a result of a service provider's server failure or entire business failure, mobile cloud computing users are put at danger, and mobile devices are subjected to battery exhaustion attacks

According to SMP Qubeb et al. [8] Specifically addresses the many optimization methods for mobile cloud computing, as well as the various drawbacks that various mobile devices experience, as well as the communication quality. It also offers a way to deal with security-related challenges. And divided this research into two parts first, analyzing the patterns of security attacks that mobile devices adopt. He recommends proper authentication and encryption to keep the data secure. And second is that we should basically focus on the model of our infrastructure which is respecting the security issues.

According to Abdul Hanan Abdullah et al. [9] Mobile Cloud Computing is a very important technology, it is also being used rapidly in different types of fields, but in mobile cloud computing, there are different types of Issues and challenges among users regarding energy efficiency regarding security. It needs to increase its performance. It needs to increase the effciency of its battery, its cloud space and maintaing the confidentiality of the stored data.

According to Pragya Gupta et al. [10] At present, Mobile Cloud Computing is expanding its scope very fast, where earlier mobile devices were used only for voice call and message send or receive, whereas now with the help of smartphones, we can store our data on cloud storage. But in this, Issues is coming about the security and privacy of user's data which needs to be removed.

3. OVERVIEW OF TECHNIQUES

A. Mobile Computing

It has become a very important field today with its development and with the help of wireless technology and internet, mobile devices have become easy to use with the help of cloud computing concept, It is easy and expanded, its utility has increased in any organization, office, home or society. [11] Mobile computing is type of technology that provides us the facility that users can send their transfer data from one device to another devices without any physical link. Transmission in mobile computing occurs without any wireless devices like laptop, Mobile, PCs etc. Devices are connected to a network without any physical link, so we can easily send our messages, videos, text, voice recordings etc. from one devices to another with the help of mobile computing. [12]

B. Cloud Computing

todays technology field has become very flexible with the cloud computing and internet, it provides important source of data in many area like business organization with the help of a third party so that the data can be installed but in this also we have to there is a risk of security and privacy of the data, it is fixed independent online platform on which we remove the data, in this we also increase our data storage [13]. In General, cloud Computing is a web-based processing in which resort software and information is provided cloud computing through computers and smartphones. It is a new style in which virtualized Service provider are used [14]. Cloud computing provides many types of facilities such as connectivity between users of one or more platforms, the work of commercial data storage, work of data managing etc. We can say that this platform in which users can access data online as per their convenience and desire or may interconnect on different platforms resources through the Internet [15].

C. Mobile Cloud Computing

Mobile cloud computing is made with the help of these types of technology, in which the first is mobile computing, the second is wireless communication or the Internet and the third is cloud computing. Security and privacy is a big issue in cloud computing because cloud storage is used in mobile cloud computing, some mobile devices do not have the facility of internet clouded username and password and some mobile devices these facilities are available. The devices in which these facilities are not available are difficult to find when they are missing, with the help of cloud technology, we can block our mobile device, almost all the social networking sites we used are cloud based and these technology works all these applications we operate through mobile devices and store several hosted through internet this all applications are generally accessed through mobile devices [16].

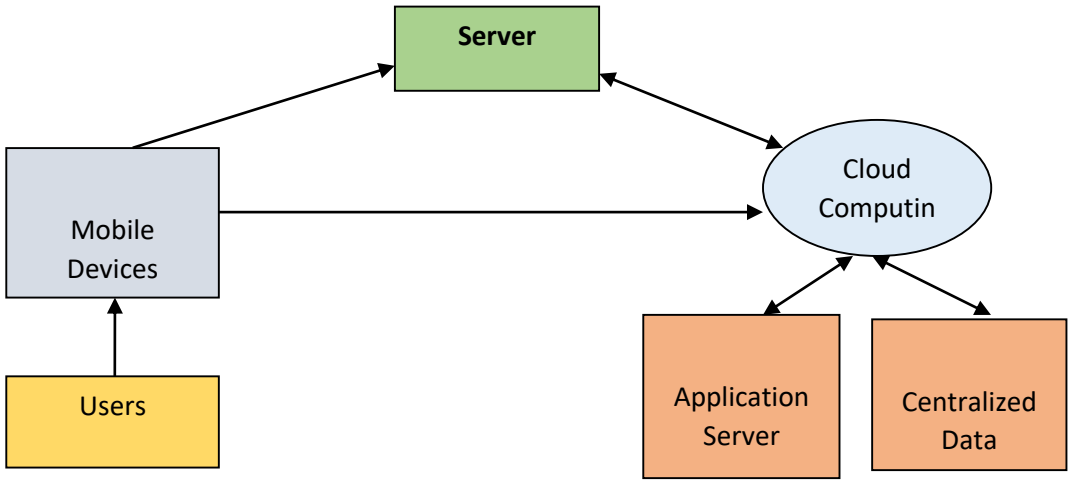

Fig 2. Architecture of Mobile Cloud Computing

4. APPLICATION OF MOBILE CLOUD COMPUTING

At present mobile cloud is being used very widely we are using it in various organizations or individually used in Mobile Commerce, Mobile Learning , Mobile Health Care , Mobile Gaming and many more with the help of mobile devices.

1. Mobile Commerce

In mobile commerce Mobile devices are allow to business to business, business to customer, customer to customer and many other types of data are stored on the cloud which can be easily retrieved.

2. Social Media Networking

Social media networking is cloud-based technology in which users and any organization stores data on cloud storage through social media platforms and establishes a connection between social media platforms and users through networking.

3. Sharing Data

In this, we share or receive information or data on a cloud based platform through mobile devices. Users store huge amount of data or information on multiple platform cloud storage via mobile devices. this is also a good application of mobile cloud computing.

4. Mobile Gaming

The concept of mobile gaming is also our cloud based because whatever we play on it, the data and transaction of the player are stored on the cloud platform.

5. Mobile Learning

In mobile learning use mobile cloud online content, online class, what will see online material all this data is stored on cloud storage.

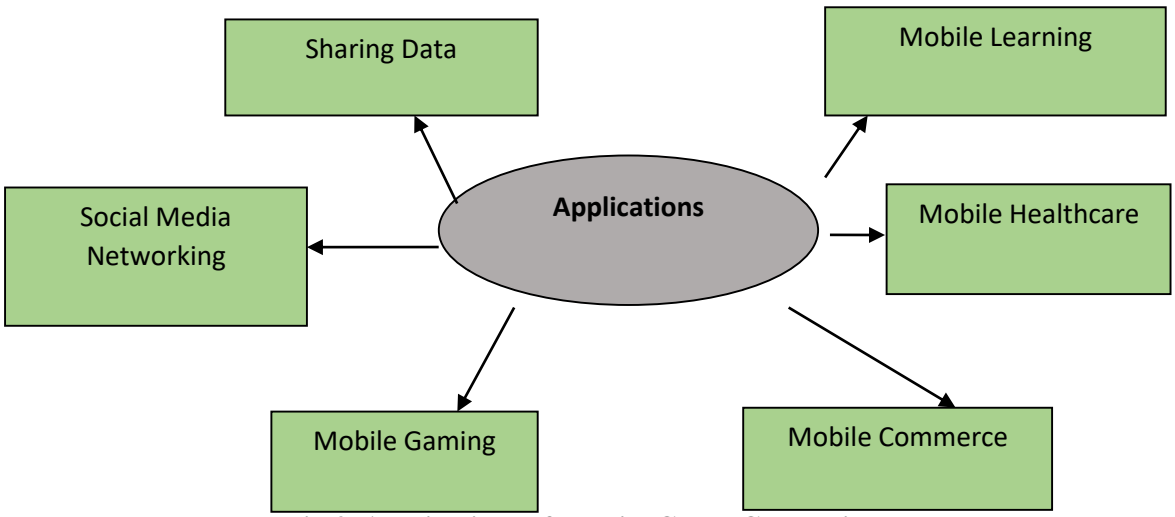

Fig 3. Applications of Mobile Cloud Computing

5. BENEEFITS OF MOBILE CLOUD COMPUTING

The benefits of mobile cloud computing empower a unique specialty. Compared to the current mobile computing. It has many possibilities that can be used in research work, covering many areas such as natural language processing, image processing, querying, multimedia, sensor data applications and sharing of internet access [17]. Mobile cloud computing helps reduce the data storage limits of mobile devices and when mobile devices also works to increase battery life and also provides may

technical facilities through mobile cloud like location awareness services etc. [18]. With the help of mobile cloud computing, we improve the storage capacity of our mobile devices like any users or organization can list their large amount of data in cloud storage. Like Facebook, amazon, flip-cart etc. to cloud their very large amount of data are sored using the cloud storage [19].

TABLE I
Benefits of Mobile cloud computing

Sr. No.	Drawback of Mobile Devices	Benefits of Mobile Cloud Computing
01	Storage Capacity is limited	Storage Capacity in Unlimited
02	Battery Life Issue	Battery Life is Increased
03	Sharing Data With another Devices is low	Accessing data on Demand and self service

6. CHALLENGES OF MOBILE CLOUD COMPUTING

The main goal of mobile cloud computing is to make cloud data accessible and accessed by users in a faster way. Such as data security challenges, mobile cloud application security challenges mobile, mobile device security challenges, offloading security challenges, privacy challenges etc. [20].

security and privacy challenges we come to know that the data of users is stored on cloud server through mobile devices where we are at risk of data loss and data recovery and mobile devices being many types of unauthorized applications. Due to which third party accesses our data, in cloud storage, we are at risk of many received malicious attacks.

Data Integrity refers to how pure, how complete and how accurate our data is, this means that the users can access the stored data on his cloud from any corner of the world and any type of data or information stored on cloud storage. Confidential data or any private data can store and retrieve information through mobile devices this type of data integration is lacking in mobile cloud computing.

In Mobile Cloud Computing the data of mobile devices is stored on the cloud through cloud based applications. These cloud based application consume a lot of energy and battery which has an impact on battery life and Connectivity Problem refers to the very low connectivity, low transfer speed users get through mobile devices when they store data to cloud or receive data from cloud [21].

Problems with security and privacy are natural as we are using a new technology and data is stored from different locations on cloud computing or applications available on our mobile devices or later installed also. It is a challenges for us that how we can save our data and privacy [22].

Table II
Mobile Cloud Computing Challenges/Issues

Sr. No.	Challenges	Issues
01	Challenges in Mobile Devices Transmission	Issues in Low Bandwidth
		Issue in Mobile Devices to acquiring cloud infrastructure
02	Challenges in Mobile Devices Network	Issues in Wireless Network
		Issues in Connection to one network to another

03	Challenges in Mobile Devices Running Applications	Issues in Compatibility
		Issues in Mobile Cloud computing confluence
04	Challenges in Security	Issues in Stored Information Security
		Issues in Device Privacy
		Issues in Unauthorized Attack
		Issues in Security Attack
		Issues in Cloud Application
		Issues in Virtualized Data Security
		Issues in Authentication

7. CONCLUSION AND FUTURE SCOPE :

In this paper, we studies what is mobile cloud computing technology and its security challenges. Mobile cloud computing is very beneficial for the users as it works in cloud computing with the help of mobile devices. Users are using various types of application in mobile devices through mobile, it is increasing day by day. Sharing the personal file, data or information of users on cloud storage through mobile cloud computing is a very challenging task because in this we are prone to fraud with many security issues or privacy issues. In the field of mobile cloud computing, we have learned that what can be the research interest that is going on in the trend at the present time and many types of areas have been seen in it, mainly data security and user privacy etc.

According to the research done in the past years, what are its drawbacks, which technology is being used in it, what are tis applications, what are it advantages. There are many security issue in mobile cloud computing And found that there are still found that there are still problems arising in this regarding data security, data confidentiality, mobile cloud application security, offloading security and privacy and these challenges can be worked on for future research areas. Through this paper, we look at the security issues in the future research area and need to work on it and we purposed work on its data security and privacy.

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Design and Development of Multilinguistic talking bot for learning & educating Children for Child Abuse

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Abstract: *Today, child molestation and physical abuse are at their peak, and stories about a child being molested or inappropriately touched are heard every other day. The innocent child does not even know they were molested, and it is a crime if someone is doing that. Children who fall prey to this are usually below six years of age. It is time to teach them about these early life stages. It is a terrible subject to talk about in our society, and parents also feel discomfort educating their children about these issues. Considering the child's age and teaching them by learning, playing, and growing, a first-of-its-kind toy was developed in the current study, using the Design Thinking methodology to make children aware of these sensitive activities. Since the best friends of any kid were their toys, they were empathetic to them. In this study, an intelligent bot with features similar to humans was designed to teach children about good touch and bad touch and also has many features like voice reversal, and can speak poems, the alphabet, body parts, and other cultural songs with multilinguistic features. This toy can help children and their teachers teach and make them aware in interactive ways. There was no such type of multilingual, intelligent bot with many features in the commercial market. Currently, the testing is going on in the nearby schools, and later it can be planned for commercialization; the IPR was filed. It will also lay the foundation for teaching sex education in the later stages of life. Currently, Hindi and English are used later; many languages can be incorporated into the toy because of the modular and storage-based electronics used in making it.*

Key Words: *Child Abuse, Design Thinking, Multilinguistic Toy, good touch & bad touch.*

1. INTRODUCTION:

Abuse of a child occurs when a caregiver or some stranger harms the child's emotions or body. It may occur to both males and girls in any household. Child abuse was divided majorly into four main categories based on the emotion and the impact caused by the abuse on the child[1],[2],[3]. These abuses have many detrimental impacts on the mind. They may lead to the feeling of distrust over others, inability to express emotions, feeling of inferiority & worthlessness, and may even lead to mental illness. Various types and their occurrence percentage were shown in Figure (1).

• Physical Abuse: Children are abused physically, which can cause pain & injury to the child. It includes Slapping, hitting, bullying, burning, and other physical misbehavior.
• Sexual abuse: Children are abused sexually, which can cause pain, bleeding, and even damage to private parts. It includes Bad touch, rape, intercourse, sexual exploitation, pornography, and others.

• Emotional abuse: Children are abused mentally and emotionally, and this can cause mental distress, discomfort, trust issues, and low self-esteem. It includes Shouting, threatening, blackmail, isolation, and others.
• Neglect: This abuse is caused when the basic needs of the child are not fulfilled, which can cause malnutrition, health & mental issues. Not giving enough food, clothing, cleanliness & hygiene, health care, and others.

The below chart shows the basic distribution of the various types of abuse on the child. As per the distribution, child neglect is maximum followed by Physical abuse and emotional abuse than sexual abuse.

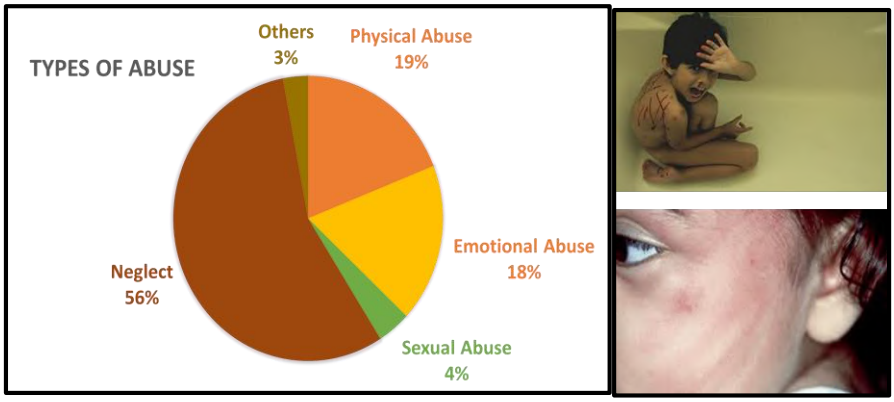

Figure 3: Various (a) type of abuse and its Percentage (b) victim child (source: [1])

In the study of Child Abuse Pediatrics Research Network (CAPNET) among 3667 patients in US, the children below 10 Years of age by Joanne N. et al. [4] find that there were 22.3% of cases can be categorized as mild abuse and 14.2 % cases were definite abuse. In the research[5] of child sexual abuse in England and Wales, 32 males and 11 female banned people, and 19 males and 51 females sexually attacked youngsters were identified as being involved in the instances. It was found that a lack of Institutions and professionals breached their duty of care by either taking no action or acting too slowly to prevent child abuse [6]. Due to unemployment and economic pressure, social isolation, and parental depression, the economic stress and social isolation caused by society's reactions to the COVID-19 pandemic have the potential to worsen child abuse and neglect [8], [9].

Schools may need to think about population-based mental services, in which interventions are made for severe socioemotional and behavioral issues, assistance is given to caregivers and school settings, and promotes the psychological well-being of all kids as a whole [7].
This is a global issue and needs to be solved for the well-being of the children. To teach young children about child abuse and educate them about the various good and the bad touch is of prime importance today. To cater to the problem and to understand the adolescent behaviors of children from age group 2 to 8 years design thinking approach [10],[11],[12] was used. The approach for teaching them much be such that it must be relatable to them via playing, learning, and growing. Teachers, doctors, parents, and children were interviewed, and their information from them was analyzed to know the root cause of the problem. Details steps were given in the subsequent sections.

2. METHODOLOGY:

The design thinking process, as shown in Figure (2), has five steps that can help in approaching the problem in an empathetic way and gives a user-centric solution. In the current study, the user is children below the age of 8 years who fall easy prey to child abuse. The later section discusses a detailed approach of Design thinking towards development in solving the problem.

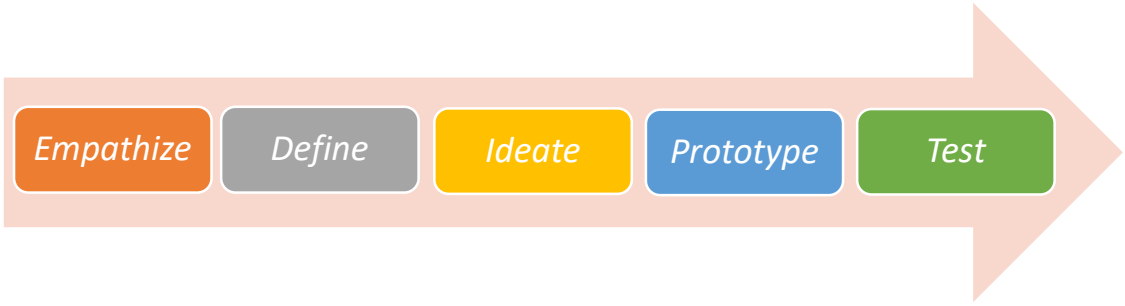

Figure 4: Design Thinking Approach

2.1 **Empathy Stage**: It is the first step in the design thinking methodology, which helps the designer develop a deep understanding of the problem involving a user. For this, a thorough literature survey and interviews with parents, counselors, doctors, teachers, and the children. A questionnaire set of methodology was adopted, and a specific set of questions were asked from a different set of peoples. The results are shown below.

a) Parents: On taking a survey of over 20 parents in urban areas of tier 2 cities of India, it was found that 7 out of 10 parents are either not comfortable or have been able to teach their children about child abuse. 3 out of 10 parents are unaware of this type of abuse over a child. This data even exceeds in rural areas. Every parent wants to teach their children about abuse, but they are either unaware of what to do or how to teach and are dependent on schools to teach this. Every parent is concerned and requires this to teach either in schools or some other medium such that the children can understand this and inform their parents if some misbehavior activity happens to them.

b) Doctors/pediatrics/NGO: After discussion with them, it was found that most children who have gone through such type of abuse are either unaware of abuse or were allured by some means in a condition not to tell anyone. This type of abuse mostly happens by a known person, as per the statics shown in the Figure (3). Most of these cases remain unaccounted by the parents, or sometimes parents are only responsible for the abuse. As per the statics, one out of three children was abused. The cases were very high in orphanages or special schools for disabled children. The government is taking action against these types of crimes. In India, the juvenile justice act 2000, which was amended in 2015 but the lack of awareness among children and parents is probably the biggest reason for an increasing number of cases of abuse [13], [14].

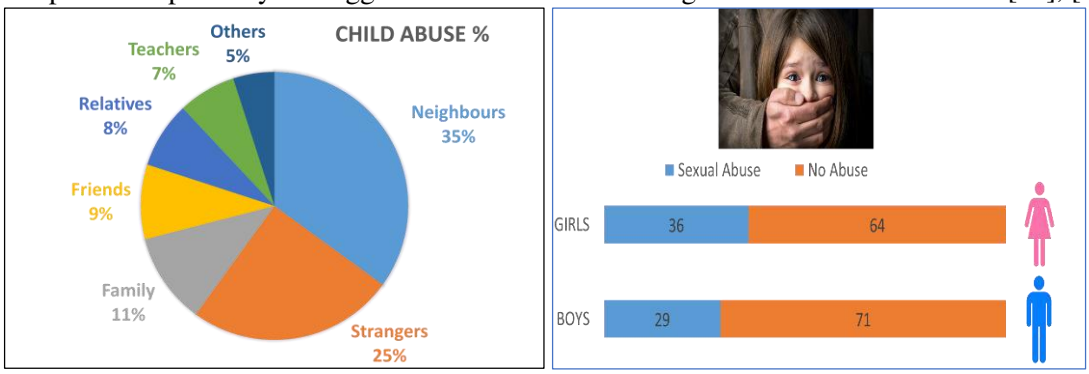

Figure 5: (a) Percentage of Person involved in child abuse (b) percentage of gender distribution in child abuse

c) Teachers / Principles/counselors: On talking with the teachers and other people associated with this domain, it was found out that in our country, talking about issues like child abuse, sex education, and others is considered to be as taboo. Teachers try to teach by books, poems, and other activities but the young brain of children feels hard to learn this and they may even forget after some days since there were no standard guidelines for this. Teachers and counselors try to

teach this as much as possible and take feedback from children on a daily basis to know about the child or any abuse the child has gone through. If such things were found, counseling of parents was done, or if abuse crossed the limit, any legal action was taken against the culprit.

d) Children: In talking with children, the primary step is to engage with them, make friends, and answer your questions. On taking with them, it was found that they didn't know much about these things and were not even aware of the crimes. Some children from 6 to 8 years know something about this but not entirely. Even some have gone through such type of abuse but they are unaware of this. A small bait makes them your friend and they become easy prey for such types of unlawful activities.

After doing the empathy study and closely relating the issue, it was concluded that to make the children aware, and they must be taught in a more relatable manner which can also help them to recall for a long. The current study targets the reduction of Physical & Sexual abuse by teaching children about various types of touches, i.e., good & bad touch, which can help spread awareness among the children about this crime and also help reduce such crimes. All the teachers, parents, and others want to safeguard their children but require a more defined path for teaching them profoundly via learning and playing.

2.2 **Defining stage** After doing a detailed empathy study on various users, it was found that children can relate better to toys rather than teaching, books, or seeing videos. The toy is a friend to them, and this is the best way to teach them knowledge of touch. The toy can also be the solution to the discomfort parent face while talking to the children about these types of issues. This can also help teachers in teaching and making children understand the touches. Making a toy more fragile such that special children like deaf, dumb, blind or have any physical disability can understand.

Figure 6: (a) Children are more empathetic towards toys (b) Various types of touches on the body (Source :https://pehchanfaridabad.in/31208/how-to-teach-children-the-difference-between-good-touch-and-bad-touch-in-hindi/)

To sum up the above outcomes a problem statement was defined as "To develop a toy preferable of human appearance that can teach good and bad touches to children via visual and audio gestures along with helping them in learning things in a playful manner. "

2.3 **Ideation stage**: It is the step where the defined statement is further developed by shortlisting the various ideas to implement and to give the pathway towards the solution. Since the toy is the best

friend of any child and if learning can be provided via a toy, they found it more relatable. Various types of touches were identified, as shown in the Figure(4). This can be classified into three types:

- Good Touch: This is an acceptable touch, i.e., touch on hands or shaking hands
- Bad Touch: This is a touch that is not acceptable, i.e., touch on private parts like the chest, buttocks, urinal, or mouth. This touch is considered a crime.
- May not like Touch: This is a touch which depends on the child whether they like the touch or not i.e. touch on thighs, stomach, legs, shoulders, and others.

On doing further study, the touch also depends from person to person and may be categorized into two types:

- Family Touch: The touch by the family members, i.e., parents, grandparents, and someone trustworthy.
- Stranger Touch: The touch by a person not belonging to a family or someone we cannot trust on.

These types of considerations also need to be taken care of before approaching the solution.

Various modes were added to increase the toy's functionality and give a more relatable understating via learning & playing. The toy must be a multilinguistic type such that learning should not be restricted by the barrier of language. After brainstorming the various ideas for developing the toy, six working modes were selected, which can be easily incorporated into the toy and make the toy friendlier to children. The six modes of working were:

1. Family touch mode: When someone from the family touches the body.
2. Stranger Touch mode: When some stranger person touches the body.
3. Human Body parts: To learn about various body parts
4. Learning Education: Alphabets, numbers, poems, and tables were there
5. Culture and songs: Cultural songs and bhajans, shlokas
6. Voice Reversal: To repeat the voice of the person

By implementing these modes on the toy, better relatability and learning to children would be there.

2.4 **Prototyping Stage:** For Prototyping, significant areas of good touch and bad touch along with audio, visual, and gestures and with six different modes needed to be incorporated with two different languages, for that Arduino mega [15],[16] was selected as a basic controlling unit of the toy.

a. For touch, different sensitive body parts were identified, and capacitive-based aluminum-based sensors were employed, which provided a good interface with the doll.
b. For audio signals and to make the toy multilinguistic, a card module is employed, which can store as many audio languages in the system along with the speaker module.
c. A display unit was used to directly get the required input from the Arduino and display the various modes along with the audio signals.
d. For regulating and selecting from 6 modes available and rotatory based regulator controlling unit was made, as shown in the Figure, which the user can navigate by rotation, and the required mode can easily be played with a "Play" button placed nearby.
e. For physical gestures, a servo motor was attached to each hand which had a smiley attached to it. For a "good touch," a happy smiley will be shown by the gesture along with audio and text display, and similarly, for a "bad touch," a sad smiley will be shown by the gesture along with audio and in text display and for not so good touch or "Ok touch" both the hand moves up showing the happy and sad smiley along with audio and text display.
f. For voice reversal, a mike is placed, which can record and revert back the sound

The whole coding was done in dedicated software of Arduino IDE, and all the actuators and the sensors were incorporated into the doll, as shown in the Figure (5). It is a toy that will be used in the school education, so the affordability of the system was also a major factor for designing the system.

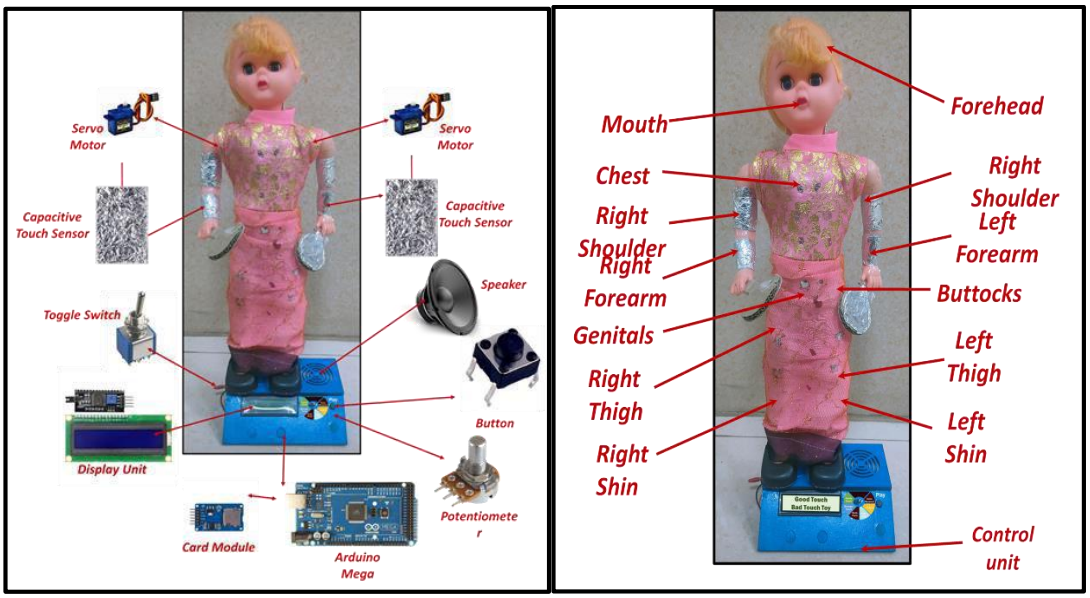

Figure 7: (a) Electronic modules used in the toy for Prototyping (b)Major Parts of the Good touch-Bad touch toy

The basic working of the toy involves a rotating regulator which can select a particular mode, and various sensors and actuators are guided after that by the controlling unit. The working of different modes is given below.

- Family touch mode: For a family, there were majorly two touches, i.e., good and bad touch; this mode teaches children that for a family person touching the body parts was allowed. So when someone touches the body parts an audio message along with text and physical gestures is shown by the doll.
- Stranger Touch mode: When this mode got selected, it has majorly three touches good touch, bad touch, and Ok touch. Audio, along with text and physical gestures, were linked to it, and the doll works similarly to mode 1.
- Human Body parts: In this mode, when the major body parts were touched, the audio was played along with the text to name that body part. For example, when the right hand is touched, the audio comes as "This is my Right hand," and similarly, other body parts were narrated, shown via gesture and display.
- Learning Education: In the mode, various poems, alphabets, tables, and others were playing, and the touch sensors of the right and left hand worked as next and previous buttons, respectively. So when this mode got selected, and the user touched the right hand, the audio got played, and for the following audio, they could again touch the right hand, and for previous audio, the user could touch the left hand.
- Culture and songs: In this mode, the cultural songs, and shlokas were going to be getting played for the child to learn and this works similarly to the above mode. This way, cultural learning can be done for the children.
- Voice Reversal: In this mode, mike records the 5-second sound and replays that. This will help the child to get instant feedback on his voice, and they can learn new words.
- For changing the language, the play button needs to be pressed two times. Currently, two languages were included in the basic design, i.e., English & Hindi, and in the later version, these can be increased.

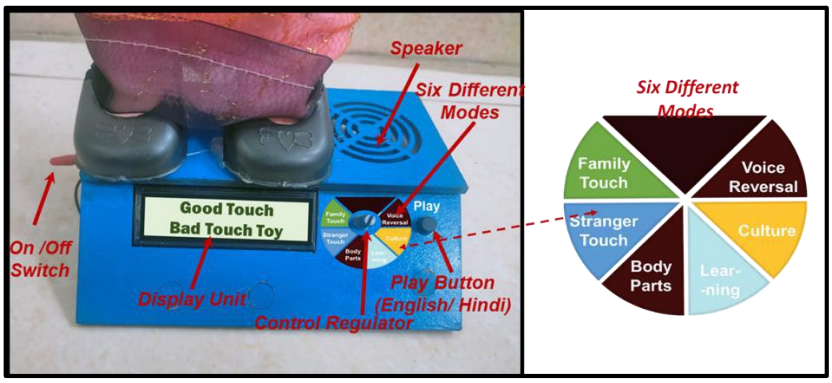

Figure 8: Control unit and Different working Modes

2.5 **Testing Stage:** Since it is an electronic toy that can be used for teaching and learning for children, proper consideration was made to make the human-like outer body. Upon starting, it will greet with a Namaste and can be modified as per tradition, and then there will be various modes that will help them to learn and grow. Initially, for testing, schools were targeted since it is a product for teaching purposes, and it was presented in nearby schools in front of teachers and students. The reviews from the teachers and the students were satisfying. Children feel empathetic to the toy, and as per reviews, this can be translated to commercialization. Later IPR was filed for the toy, which can help translate it to the market. As shown in the Figure (7), the three ways to depict the good touch, bad touch & the OK touch.

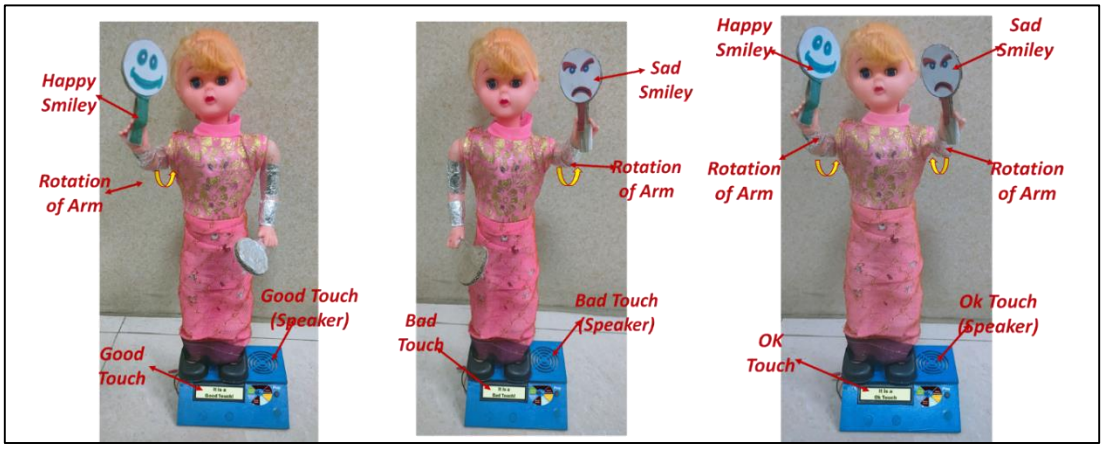

Figure 9: Shows Good touch; Bad touch; Ok Touch

3. BENEFITS:

Teaching child abuse to children is very difficult or even their young minds cannot understand its complexity. Lack of guidelines in the current education sector and during and after COVID increased a very high rate of child abuse. There was a need and requirement for such a toy that would teach about these types of unlawful activities and teach how to tackle them.

All the working modes in the toy were designed to increase the child's mental ability and help in gaining more knowledge. Since the toy designed is multilingual and so a country where literacy level is not high, this toy can easily have incorporated into the local language. Physical gesture, audio sound & text display will help in easy learning and will be in the memory for a long time.

This doll can also lay the foundation of sex education in developing countries since, it is time to include primary sex education in the curriculum of the school to teach students about that.

S.No	Form	Diary No.	Request No	Title
1	Form-XIV	9484/2022-CO/L	51435	Smart, Multilinguistic Talking Bot for Learning & Educating Children for Child Abuse

Figure 10: Testing of the prototype and IPR filed for the toy

4. RESULTS & CONCLUSION:

Child molestation is increasing at an alarming rate, and it is a global issue now. After COVID-19, the cases of home abuse increased even though there were strict laws and regulations for this. One in three children is the victim of such types of abuse. The abuse was majorly four types physical, sexual, emotional abuse & neglect. This can hamper the mental growth of the child and can cause serious health issues, and later it becomes challenging for the child to get normal.

In the current study, using a design thinking approach, the detailed method was explained to solve the problem in an empathetic way. Various interviews and surveys were done among the major stakeholders, i.e., children, teachers, parents, councilors, doctors, and others; the results were evaluated to know the root cause of the problem. It was found out that, in the current system, there is no specified roadmap for teaching these types of issues to the children, and lack of awareness among the children is the major cause of the increasing number of cases. Since children do not know that the abuse is a crime and even a small bait makes any stranger their friend, these cases were high in specially-abled children.

An intensive study was done to solve the problem, and it was found out the best way to spread awareness among children is via toys. Toys were the best friend of the children, and they are relatable to them. In this way, teaching the child via learning & playing becomes easy for teachers and parents. The problem statement was defined that "To develop a toy preferable of human appearance that can teach good and bad touches to children via visual and audio gestures along with helping them in learning things in a playful manner."

The toy was developed with electronics & sensors and equipped with audio, visual text display & physical gestures via movement to convey the message. The toy can function in 6 modes:

- Family touch mode
- Stranger touch mode
- Body parts
- Learning Poems, alphabets, number
- Culture & Songs
- Voice Reversal

The mode can be easily selected via rotary dial, and the toy helps in learning in a joyful manner. Later the testing was done in various schools, and the results were very promising. The copyright was filed, and it is planned to commercialize the toy and include it in the primary education system.

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A Study on Nano Pre Generalized Pre Regular Continuous and Nano Pre Generalized Pre Regular Irresolute Functions in Nano Topological Spaces

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Abstract: *We have defined a new class of sets in Nano topology called Nano Pre Generalized Pre Regular Closed (briefly Nano pgpr closed) sets in Nano topological spaces. Also, Nano Pre Generalized Pre Regular Open (briefly Nano pgpr open) sets, Nano Pre Generalized Pre Regular neighborhood(briefly Nano pgpr nbd) and its operators in Nano topology were studied by M.Manisha and Dr.M.Anitha. This paper is committed to induct and constructs Nano Pre Generalized Pre Regular Continuous (briefly N-pgpr Continuous) functions and Nano Pre Generalized Pre Regular Irresolute (briefly N-pgpr Irresolute) functions in Nano topological space. Also, we discussed its properties with appropriate example for N-pgpr Continuous and N-pgpr Irresolute functions in Nano topological spaces to understand the concept clearly. Further we have investigated some of its characteristics.*

Keywords*: Nano pgpr open set, Nano pgpr closed set, Nano rg*closed set, Nano rg* open set, Nano pgpr continuous, Nano pgpr irresolute .*

1.INTRODUCTION:

In 1970, generalized closed defined by Levine [5] in topology. After, N.Palaniappan [6] introduced regular generalized closed. The concept of Pre generalized pre regular closed set was proposed by M.Anitha and P.Thangavelu [1]. Lellis Thivagar [4] defined and studied Nanotopological spaces. K. Bhuvaneswari and K. Mythili Gnanpriya[2,3] introduced N-g-closed sets, N-gp closed and N-pg closed set. Further the concept of N-gpr closed sets has been developed by C.R.Parvathy and S.Praveena [7]. M.Anitha and M.Manisha[11] introduced the concept of Nano Pre Generalized Pre
Regular Closed sets in Nano topological space. Herein, we have construct Nano Pre Generalized Pre Regular Continuous and Nano Pre Generalized Pre Regular Irresolute functions in Nano topological space.

2.Nano Pre Generalized Pre Regular Continuous and Nano Pre Generalized Pre Regular Irresolute Function:

Definition 2.1: A function f : (U, $\tau_R(X)$)→ (V, $\sigma_{R'}(Y)$) is said to be Nano Pre Generalized Pre Regular Continuous function (briefly Nano pgpr continuous), if for each Nano closed subset A of V, the set f^{-1} (A) is Nano pgpr closed subset of U.

Example 2.2: Let U={a,b,c} with U/R={{a,b},{c}}. Let X={a,b} then $\tau_R(X)$={U,∅, {a,b},{c}} NPGPRC(X)={∅, {a},{b},{c},{a,c},{b,c},U}. Let V={x,y,z} with V/R' ={{x},{y,z}}. Let Y={x,z} then $\sigma_{R'}(Y)$ ={∅, {x},{y,z},U}. Define f : (U, $\tau_R(X)$)→ (V, $\sigma_{R'}(Y)$) as $f(a) = x, f(b) = y, f(c) = z$ then f^{-1}({x})={a}, f^{-1}({y,z})={b,c}. Thus {a} and {b,c} are Nano pgpr closed set in U. That is, the

inverse image of Nano closed set in V is Nano pgpr closed set in U. Therefore, f is Nano pgpr continuous.

Theorem2.3: A function f : (U, $\tau_R(X)$)→ (V, $\sigma_{R'}(Y)$) is said to be Nano Pre Generalized Pre Regular Continuous function (briefly Nano pgpr continuous), if and only if the inverse image of every Nano open set in V is Nano pgpr open in U.

Proof: Let f be Nano pgpr continuous and G is Nano open in V. That is, V-G is Nano closed in V. Since f is Nano pgpr continuous, f^{-1} (V-G) is Nano pgpr closed in U. That is U-f^{-1}(G) is Nano pgpr closed in U. Therefore, f^{-1}(G) is Nano pgpr open in U. Thus, the inverse image of every Nano open set in V is Nano pgpr open in U, if f is Nano continuous on U. Conversely, Let the inverse image of every Nano open set be Nano pgpr open. Let S is Nano closed in V. Then, V-S is Nano open in V. Then, f^{-1}(V-S) is Nano pgpr open in U. That is, U-f^{-1}(S) is Nano pgpr open in U. Therefore, f^{-1}(S) is Nano pgpr closed in U. Thus, the inverse image of every Nano closed set in V is Nano pgpr closed in U. That is, f is Nano pgpr continuous on U.

Theorem2.4: A function f : (U, $\tau_R(X)$)→ (V, $\sigma_{R'}(Y)$) is said to be Nano Pre Generalized Pre Regular Continuous function (briefly Nano pgpr continuous) if and only if $f(NpgprCl(A))\subseteq NCl(f(A))$ for every subset A of U.

Proof: Let f be Nano pgpr continuous and A be a subset of U. Then, f(A) is a subset of V. Since, f be Nano pgpr continuous and *NClf(A)* is Nano closed in V, $f^{-1}(NCl(f(A))$ is Nano pgpr closed in U. Since, $f(A) \subseteq NCl(f(A)), f^{-1}(f(A)) \subseteq f^{-1}(NCl(f(A)))$, then $A \subseteq f^{-1}(NCl(f(A)).NpgprCl(A) \subseteq NpgprCl[f^{-1}(NCl(f(A))] = f^{-1}(NCl(f(A)))$. Thus, $NpgprCl(A) \subseteq f^{-1}(NCl(f(A)))$. Therefore, $f(NpgprCl(A) \subseteq NCl(f(A))$ for every subset A of U. Conversely, Let $f(NpgprCl(A) \subseteq NCl(f(A))$ for every subset A of U. If F is Nano Closed in V and since f^{-1}(F) $\subseteq U$, $f\left(NpgprCl\left(f^{-1}(F)\right)\right) \subseteq NCl\left(f\left(f^{-1}(F)\right)\right) = NCl(F) = F$. That is, $f\left(NpgprCl\left(f^{-1}(F)\right)\right) \subseteq F$. Thus, $NpgprCl(f^{-1}(F)) \subseteq f^{-1}(F)$. But $f^{-1}(F) \subseteq NpgprCl\left(f^{-1}(F)\right)$. Hence, $NpgprCl\left(f^{-1}(F)\right) = f^{-1}(F)$. Therefore, $f^{-1}(F)$ is Nano pgpr closed in U for every Nano closed set F in V. Thus, f is Nano pgpr continuous.

Remark2.5: If f : (U, $\tau_R(X)$)→ (V, $\sigma_{R'}(Y)$) is Nano Pre Generalized Pre Regular Continuous function (briefly Nano pgpr continuous) then $f(NpgprCl(A))$ is not necessarily equal to *Ncl(f(A))* where $A\subseteq U$.

Example2.6 : Let U={a,b,c,d}with U/R={{a,c},{b},{d}}. Let X={a,d} then NPGPRC(X)={∅, {a},{c},{d},{a,c},{a,d},{c,d},{a,b,c},{a,c,d},{b,c,d},U}. Let V={p,q,r,s} with V/R' ={{p},{r},{q,s}}. Let Y={p,q} then $\sigma_{R'}(Y)$={∅, {p},{q,s},{p,q,s},U}. Define f : (U, $\tau_R(X)$)→ (V, $\sigma_{R'}(Y)$) as f(a)=p,f(b)=q, f(c)=r, f(d)=s, then f^{-1}({r})={c}, f^{-1}({p,r})={a,c}, f^{-1}({q,r,s})={b,c,d} then f is Nano pgpr continuous. Let A={a,d} is subset of U. then $f(NpgprCl(A))$ ={p,s} and $NCl(f(A))$=U. Hence , the above remark is proved.

Theorem 2.7: A function f : (U, $\tau_R(X)$)→ (V, $\sigma_{R'}(Y)$) is Nano Pre Generalized Pre Regular Continuous function (briefly Nano pgpr continuous) if and only if $NpgprCl(f^{-1}(B)) \subseteq f^{-1}(NCl(B))$ for every subset B of V.

Proof: If f is Nano pgpr continuous and B⊆V. $NCl(B)$ is Nano closed in V and hence, $f^{-1}\left(NCl(B)\right)$ is Nano pgpr closed in U. Therefore, $NpgprCl(f^{-1}(NCl(B)))= f^{-1}\left(NCl(B)\right)$. Since, B⊆ $NCl(B)$, $f^{-1}(B) \subseteq f^{-1}\left(NCl(B)\right)$. Therefore,$NpgprCl(f^{-1}(B))\subseteq NpgprCl(f^{-1}(NCl(B)) = f^{-1}(NCl(B))$. That is, $NpgprCl(f^{-1}(B))\subseteq f^{-1}\left(NCl(B)\right)$. Conversely, Let $NpgprCl(f^{-1}(B)) \subseteq f^{-1}(NCl(B))$ for every subset B of V. If B is Nano closed in V, then $NCl(B) = B$. By assumption, $NpgprCl(f^{-1}(B)) \subseteq f^{-1}(NCl(B)) = f^{-1}(B)$. Thus, $NpgprCl(f^{-1}(B)) \subseteq f^{-1}(B)$. But $f^{-1}(B) \subseteq NpgprClf^{-1}(B))$. Therefore, $f^{-1}(B) = NpgprClf^{-1}(B))$. Hence, $f^{-1}(B)$ is Nano pgpr closed in U for every Nano closed set B in V. Therefore, f is Nano pgpr continuous on U.

Remark 2.8: If f: (U, $\tau_R(X)$)→ (V, $\sigma_{R'}(Y)$) is said to be Nano Pre Generalized Pre Regular Continuous function (briefly Nano pgpr continuous) then *Npgpr(f^{-1} (B))* is not necessarily equal to f^{-1}*(NCl(B))* where $B \subseteq V$.

Example 2.9: By example 2.6, Let B={p,q}is a subset of V, then *NpgprCl*($f^{-1}(B)$)={a,b,c} and f^{-1} *(NCl(B))* =U. hence the equality does not hold for the theorem 2.7.

Theorem 2.10: A function f: (U, $\tau_R(X)$)→ (V, $\sigma_{R'}(Y)$) is said to be Nano Pre Generalized Pre Regular Continuous function (briefly Nano pgpr continuous), if and only if $f^{-1}(NInt(B)) \subseteq NpgprInt(f^{-1}(B))$ for every subset B of V.

Proof: If f is Nano pgpr continuous and B⊆V. *NInt(B)* is Nano open in V and hence, $f^{-1}(NInt(B))$ is Nano pgpr open in U. Therefore, $NpgprInt(f^{-1}(NInt(B)))= f^{-1}(NInt(B))$. Also, $NInt(B) \subseteq B$, implies that, $f^{-1}(NInt(B)) \subseteq f^{-1}(B)$. Therefore, $NpgprInt(f^{-1}(\text{NInt(B)})) \subseteq NpgprInt(f^{-1}(B))$. That is, $(f^{-1}(NInt(\text{B})) \subseteq NpgprInt(f^{-1}(B))$. Conversely, Let $(f^{-1}NInt(B)) \subseteq NpgprInt\ f^{-1}(B)$ for every subset B of V. If B is Nano open in V, then $NInt(B) = B$. By assumption, $f^{-1}(NIntB)) \subseteq NpgprInt\ (f^{-1}(B)) = f^{-1}(B)$. Thus, $f^{-1}(B) \subseteq NpgprInt(f^{-1}(B))$. But $NpgprInt(f^{-1}(B)) \subseteq f^{-1}(B)$. Therefore, $NpgprInt(f^{-1}(B)) = f^{-1}(B)$. Hence, $f^{-1}(B)$ is Nano pgpr open in U for every Nano open set B in V. Therefore, f is Nano pgpr continuous on U.

Remark 2.11: If f : (U, $\tau_R(X)$)→ (V, $\sigma_{R'}(Y)$) is said to be Nano Pre Generalized Pre Regular Continuous function (briefly Nano pgpr continuous) then *NpgprInt($f^{-1}(B)$)* is not necessarily equal to f^{-1} *(NInt(B))* where $B \subseteq V$.

Example 2.12: By Example 2.6, Let B={p,q} is a subset of V then $NpgprInt(f^{-1}(B))$ ={a} and $f^{-1}(NInt(B))$=∅, Thus the equality does not hold for the above theorem 2.10.

Note: Let A be a subset of a Nano topological space (U, $\tau_R(X)$) and NPGPRO(U,X) is closed under arbitrary union then A is a Nano pgpr open set iff A is Nano pgpr neighborhood of each of its points.

Theorem 2.13: In a Nano topological space (U, $\tau_R(X)$) , if the collection of NPGPRO(U, X) is closed under arbitrary union and let f : (U, $\tau_R(X)$)→ (V, $\sigma_{R'}(Y)$) be a function. Then the following are equivalent.

1. The function f is Nano pgpr continuous.
2. For each x∈ U and each Nano open set H in V with f(x)∈H there exists a Nano pgpr open set G in U such that x∈ G and f(G)⊆ H.

Proof: (1) →(2)

Suppose (1) holds. Let x∈U and H be a Nano open set in V with f(x)∈H, then x∈ f^{-1}(H). Since f is Nano pgpr continuous , $f^{-1}(H)$ is a Nano pgpr open set in U. Put G=$f^{-1}(H)$, then x∈G and f(G)= $f(f^{-1}(H)) \subset$ H. Therefore (2) holds.

(2)→(1)

Suppose (2) holds. Let x∈U and H be a Nano open set in V containing f(x). By hypothesis, there exist a Nano pgpr open set G_x in U such that x∈G_x and f(G_x) ⊂H. This implies x∈$G_x \subset f^{-1}(H)$, which implies $f^{-1}(H)$ is Nano pgpr neighborhood of each of its points. By above Note $f^{-1}(H)$ is a Nano pgpr open set in U. Therefore, f is Nano pgpr continuous.

Theorem 2.14: In a Nano topological space (U, $\tau_R(X)$) , if the collection of NPGPRO(U, X) is closed under arbitrary union and let f : (U, $\tau_R(X)$)→ (V, $\sigma_{R'}(Y)$) be a function. Then the following are equivalent.

1. The function f is Nano pgpr continuous.
2. For each x∈ U, the inverse of every Nano neighborhood of f(x) is Nano pgpr neighborhood of x.

Proof: (1) →(2)

Suppose (1) holds. Let x∈U and H be a Nano neighborhood of f(x), therefore there exists a Nano open set K in V such that f(x)∈K⊂H and hence x∈ f^{-1}(K)⊂ f^{-1}(H). Since f is Nano pgpr continuous and $f^{-1}(K)$ is a Nano pgpr open set in U. Therefore, $f^{-1}(H)$ is Nano pgpr neighborhood of x. Thus, for each x∈U, the inverse of every Nano neighborhood of f(x) is Nano pgpr neighborhood of x.

(2)→(1)

Suppose (2) holds. Let x∈U and H be a Nano open set in V containing f(x). This implies H is Nano neighborhood of f(x). By (2),$f^{-1}(H)$ is Nano pgpr neighborhood of x. Since x is arbitrary, $f^{-1}(H)$ is Nano pgpr neighborhood of each of its points. By above Note $f^{-1}(H)$ is a Nano pgpr open set in U. Therefore, f is Nano pgpr continuous.

Definition 2.15: Let (U, $\tau_R(X)$) and (V, $\sigma_{R'}(Y)$) be Nano topological spaces. Then a mapping f : (U, $\tau_R(X)$)→ (V, $\sigma_{R'}(Y)$) is Nano Pre Generalized Pre Regular Irresolute(briefly Nano pgpr irresolute) function on U, if the inverse image of every Nano pgpr open set in V is Nano pgpr open in U.
Example 2.16: Let U={x,y,z} with U/R ={{x,y}{z}}. Let X={x,y} then NPGPRO(X)={∅, {x},{y},{x,y},{x,z},{y,z},U}. Let V={a,b,c} with V/R' ={{a},{b,c}}. Let Y={a}then NPGPRO(Y) = { ∅, {a}, {a,b}, {a,c},U}. Define f : (U, $\tau_R(x)$)→ (V, $\sigma_{R'}(Y)$) as $f(x) = a, f(y) = b, f(z) = c$ then f^{-1}({a})={x}, f^{-1}({a,b})={x,y},f^{-1}({a,c})={x,z}. That is, the inverse image of every Nano pgpr open set in V is Nano pgpr open in U. Therefore, f is Nano pgpr irresolute.

Theorem2.17: A function f : (U, $\tau_R(X)$)→ (V, $\sigma_{R'}(Y)$) is said to be Nano Pre Generalized Pre Regular Irresolute function (briefly Nano pgpr irresolute), if and only if the inverse image of every Nano pgpr open set in V is Nano pgpr open in U.

Proof: Let f be Nano pgpr irresolute and F be Nano pgpr closed in V. That is, V-F is Nano pgpr open in V. Since, f is Nano pgpr irresolute, $f^{-1}(V - F)$ is Nano pgpr open in U. That is, U-$f^{-1}(F)$ is Nano pgpr open in U. Therefore, $f^{-1}(F)$ is Nano pgpr closed in U. Thus, the inverse image of every Nano pgpr closed set in V is Nano pgpr closed in U, if f is Nano pgpr irresolute on U. Conversely, Let inverse image of every Nano pgpr closed set be Nano pgpr closed. Let G be Nano pgpr open in V. Then, V-G is Nano pgpr closed in V. Then $f^{-1}(V - G)$ is Nano pgpr closed in U. That is, U-$f^{-1}(G)$ is Nano pgpr closed in U. Therefore, $f^{-1}(G)$ is Nano pgpr open in U. Thus, the inverse image of every Nano pgpr open set in V is Nano pgpr open in U. That is, f is Nano pgpr irresolute on U.

Theorem2.18: A function f : (U, $\tau_R(X)$)→ (V, $\sigma_{R'}(Y)$) is said to be Nano Pre Generalized Pre Regular Irresolute function (briefly Nano pgpr irresolute) if and only if *f(NpgprCl(A))⊆ NpgprCl(f(A))* for every subset A of U.

Proof: Let f be Nano pgpr irresolute and A be a subset of U. Then, f(A)⊆V. Since f is Nano pgpr irresolute and *NpgprCl(f(A))* is Nano pgpr closed in V. $f^{-1}\left(NpgprCl(f(A))\right)$ is Nano pgpr closed in U. Since, $f(A) \subseteq NpgprCl(f(A)), A \subseteq f^{-1}(NpgprCl(f(A)))$. Thus, $f^{-1}(NpgprCl(f(A)))$ is a Nano pgpr closed set containing A. But, *NpgprCl(A)* is the smallest Nano pgpr closed set containing A. Therefore, *NpgprCl(A)*⊆ $f^{-1}(NpgprCl(f(A)))$. That is, *f(NpgprCl(A))*⊆ $NpgprCl(f(A))$. Conversely, Let *f(NpgprCl(A))*⊆ $NpgprCl(f(A))$ for every subset A of U. If A is Nano pgpr closed in V, since $f^{-1}(F) \subseteq U$, *f(NpgprCl*$(f^{-1}(F))$⊆ $NpgprCl\left(f\left(f^{-1}(F)\right)\right) = NpgprCl(F)$. That is, *NpgprCl*$(f^{-1}(F)) \subseteq f^{-1}(NpgprCl(F)) = f^{-1}(F)$. Therefore, $NpgprCl(f^{-1}(F)) = f^{-1}(F)$. Therefore, $f^{-1}(F)$ is Nano pgpr closed in U for every Nano pgpr closed set F in V. That is, f is Nano pgpr irresolute.

Remark 2.19: If f : (U, $\tau_R(X)$)→ (V, $\sigma_{R'}(Y)$) is Nano Pre Generalized Pre Regular Irresolute function (briefly Nano pgpr irresolute) then *f (NpgprCl(A))* is not necessarily equal to *NpgprCl(f(A))* where *A*⊆ *U*.
Example 2.20: By example 2.16, Let A={y,z} is subset of V. then *f (NpgprCl(A))* ={b,c} and *NpgprCl(f(A))*=U. Hence,the above remark is proved.

Theorem2.21: A function f: (U, $\tau_R(X)$)→ (V, $\sigma_{R'}(Y)$) is Nano Pre Generalized Pre Regular Irresolute function (briefly Nano pgpr irresloute) if and only if *NpgprCl*($f^{-1}(B)$) ⊆ f^{-1} *(NpgprCl(B))* for every subset B of V.

Proof: If f is Nano pgpr irresolute and B is a subset of V, then *NpgprCl(B)* is Nano pgpr closed in V and hence $f^{-1}(NpgprCl(B))$ is Nano pgpr closed in U. Therefore, $NpgprCl(f^{-1}(NpgprCl(B))) \subseteq f^{-1}(NpgprCl(B))$. Since, $B \subseteq NpgprCl(B)$, $f^{-1}(B) \subseteq f^{-1}(NpgprCl(B))$. Therefore, $NpgprClf^{-1}(B)) \subseteq NpgprCl(f^{-1}(NpgprCl(B))) = \subseteq f^{-1}(NpgprCl(B))$. Conversely, Let $NpgprClf^{-1}(B)) \subseteq f^{-1}(NpgprCl(B))$ for every $B \subseteq V$. If B is Nano pgpr closed in V, then $NpgprCl(B) = B$. By assumption, $NpgprCl(f^{-1}(B)) \subseteq f^{-1}(NpgprCl(B)) = f^{-1}(B)$. Thus, $NpgprCl(f^{-1}(B)) \subseteq f^{-1}(B)$. But $f^{-1}(B) \subseteq NpgprCl(f^{-1}(B))$. Therefore, $NpgprCl(f^{-1}(B)) = f^{-1}(B)$. That is, $f^{-1}(B)$ is Nano pgpr closed in U for every Nano pgpr closed set B in V. Therefore, f is Nano pgpr irresolute on U.

Theorem 2.22: A function f: (U, $\tau_R(X)$)→ (V, $\sigma_{R'}(Y)$) is said to be Nano Pre Generalized Pre Regular Irresolute function (briefly Nano pgpr Irresolute), if and only if $f^{-1}(NpgprInt(B)) \subseteq NpgprInt(f^{-1}(B))$ for every subset *B* of *V*.

Proof: Let f be Nano pgpr irresolute and B is a subset of V. Then, $NpgprInt(B)$ is Nano pgpr open in V. Therefore, $f^{-1}(NpgprInt(B))$ is Nano pgpr open in U. That is, $f^{-1}(NpgprInt(B))$=$NpgprInt[f^{-1}(NpgprInt(B))]$. Also, $NpgprInt(B) \subseteq B$ implies that $f^{-1}(NpgprInt(B)) \subseteq f^{-1}(B)$. Therefore, $NpgprInt[f^{-1}(NpgprInt(B))] \subseteq NpgprInt(f^{-1}(B))$ .That is, $f^{-1}(NpgprInt(B)) \subseteq NpgprInt(f^{-1}(B))$. Conversely, Let $f^{-1}(NpgprInt(B)) \subseteq NpgprInt(f^{-1}$(B)) for every subset B of V. If B is Nano pgpr open in V, $NpgprInt(B) = B$. Also, $f^{-1}(NpgprInt(B)) \subseteq NpgprInt(f^{-1}(B))$. That is, $f^{-1}(B) \subseteq NpgprInt(f^{-1}$(B)). That is, $f^{-1}(B) \subseteq NpgprInt(f^{-1}(B))$. But $NpgprInt(f^{-1}(B) \subseteq f^{-1}(B)$. Therefore, $f^{-1}(B) = NpgprInt(f^{-1}(B))$. Thus, $f^{-1}(B)$ is Nano pgpr open in U for every Nano pgpr open set B in V. Therefore, f is Nano pgpr irresolute.

Remark 2.23: Equality not hold for the above theorem 2.21 and theorem 2.22. It can be proved from the following example.Let U={a,b,c} with U/R ={{a,b}{c}}. Let X={a,b} then NPGPRO(X)={∅, {a},{b},{a,b},{a,c},{b,c},U}. Let V={x,y,z} with V/R' ={{x},{y,z}}. Let Y={x}then NPGPRO(Y) = { ∅, {x}, {x,y}, {x,z},U}. Define f: (U, $\tau_R(X)$)→ (V, $\sigma_{R'}(Y)$) as $f(a) = x, f(b) = y, f(c) = z$ .Since, the inverse image of every Nano pgpr open set in V is Nano pgpr open in U. Therefore, f is Nano pgpr irresolute. Let B={y} is a subset of V then f^{-1} *(NpgprCl(B))* = {a,b,c} and *NpgprCl*(f^{-1} *B))* ={b} thus the equality not hold for theorem 2.21. Let B={y,z} is a subset of V. Then, $f^{-1}(NpgprInt(B))$=∅ and $NpgprInt(f^{-1}(B))$ ={b,c}. Thus, the equality does not hold in theorem 2.22.

CONCLUSION:

Herein, we have defined Nano Pre Generalized Pre Regular Continuous and Nano Pre Generalized Pre Regular Irresolute functions. In future, this concept will be developed with some applications.

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RESOURCE ALLOCATION MANAGEMENT AND NODE-LEVEL FAULT TOLERANCE USING ADAPTIVE PARTICLE SWARM OPTIMIZATION AND FIRST FIT HEURISTIC ALGORITHM OVER GRID COMPUTING

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Abstract : *Grid Computing Systems, with their focus on Creative applications, high-performance orientation and large-scale resource sharing, have emerged as a significant new field. One of the important goals in any computational grid environment is to achieve effectual allocation with fault tolerance to complete the task on time. Optimal resource allocation and the fault tolerance system's failure rate remain a problem in the current system. To address the abovementioned issues, The Fit First(FF) heuristic algorithm and the Adaptive particle Swarm Optimization (APSO) algorithm are proposed in this research to improve grid system efficiency and resource allocation. The proposed system involves resource allocation using the APSO algorithm, path and node-level fault tolerance and multiple resource formation using the FF heuristic algorithm for better efficiency. Consider the number of tasks, number of resources and number of grid users at first when considering grid computing. The APSO algorithm is used to select more optimal resource efficiently in this work, and it is used to control resource allocation. The optimal tools for the user requirements are chosen by generating objective functions using the best fitness value.*

Key words: *Grid computing, Adaptive Particle Swarm Optimization (APSO) algorithm, Fit First (FF) heuristic algorithm, fault tolerance, resource allocation.*

1. INTRODUCTION:

Grid computing provides access to resources from various administrative domains and offers a heterogeneous and dynamic resource. The Grid's resources are combined to form a virtual organization to solve significant business and scientific issues. The technology's primary goal is to share unused and dispersed resources, including storage capacity and computational power. Data and computational grids are described as a combination of software and hardware infrastructure that provides low-cost, pervasive and reliable access to high-performance computing resource. A data grid is a collection of large datasets that are primarily used to provide information to applications.

Problem-solving becomes more complicated as human civilization progresses. Grid computing is a useful tool for resolving difficult issues. The grid scheduler schedules tasks and finds the best resource for each task in computational grids. The scheduler must consider various factors, including communication time, reduced makes pan, user demand and failure handling mechanism. There is a need for an appropriate scheduling algorithm to make optimal resource use and satisfy all users' needs. The grid scheduler is primarily concerned with how to assign resources to jobs reasonably and effectively. When selecting resources for a job, the scheduler should consider job characteristics such as user deadline, length of the job and resource characteristics such as job cost, capability and communication time.

Many factors, such as heterogeneity, dynamic nature of resources and grid structure distributions, have been obtained in grid resource allocation and management. Grid's key role is to complete user's application request and offer the best service. The distributed resource and the communication network are two significant infrastructures in the grid system. Grid resource management becomes complicated due to the geographically dispersed, essentially heterogeneous, dynamically entering and leaving resources in the Grid. It was addressed that managing grid resources and ensuring that consumers transparently use grid resource is a challenging task for grid systems to solve.

The resource allocation problem for constrained grid application is formalized in. The research considers a very general case in which programmes are decomposed into tasks with precedence relationships. The challenge is to determine the best resource allocation that minimizes overall cost while maintaining service level agreements for execution time. This paper offers a structure for developing a heuristic solution to this NP-hard problem and an example of such a heuristic and gives a numerical model. The example of grid computing for the marketplace is shown in Fig 1.

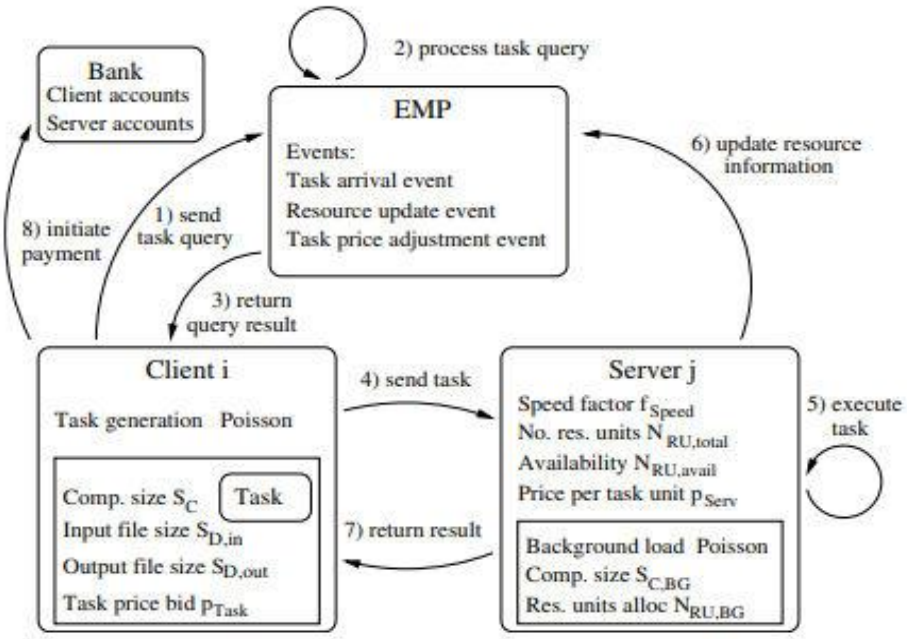

Fig 1 example of grid computing for marketplace

Grid allocation highly depends on resource allocation. Different approaches that use the market mechanism to assign resources have been built over the last few years. However, the effectiveness of such measures has not been thoroughly examined. This research looks at how market-based resource allocation through continuous double auctions and the proportional share protocol outperforms a traditional round-robin approach. It creates a model for the market, server and clients, and then gives simulation results. The number of resources, contact delays, the amount of load in the system, various degree of resource heterogeneity are all factors that are examined.

There is a growing need for more complex and advanced hard-real-time computing system in industrial computing. Fault tolerance, in particular, is one of the criteria that are playing an essential role in the design of new hard-real-time distributed systems. Several schemes have been introduced to promote fault-tolerant computing in distributed systems, divided into two categories. A passive backup copy of a primary task is allocated to one or more back up the processor in the first class, which uses passive replication techniques; when a primary task fails, the passive copies of the task are restarted on the backup processor, implying that a passive copy is only performed when the primary task fails. The same set of task is often performed on two or three sets of processors in the second class, which utilizes active replication methods; every primary task has an active backup copy:if one of the primary tasks fails, the mirror image will continue to execute.

2. PROPOSED METHODOLOGY:

Resource Allocation management using APSO and FF algorithm is proposed to improve Grid computing efficiency significantly. The proposed work includes developing many resources, a fault tolerance system, and resource allocation optimization. Fig 2 depicts the overall block diagram of the proposed approach

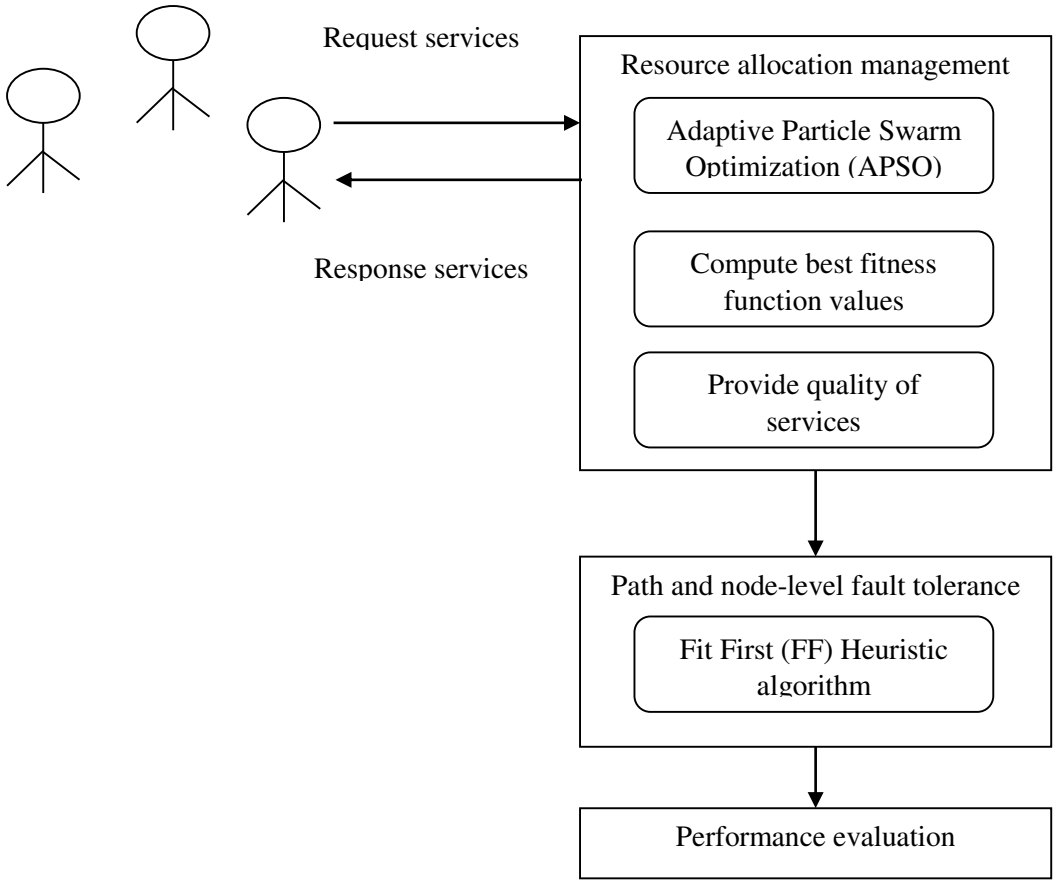

Fig 2 Overall block diagram of the proposed system

Form multiple numbers of resources on the grid system

Consider the number of tasks, number of grid users, and resources when considering grid computing. A grid system is intended to finish a series of programs/applications to complete a specific task. The execution of such programs requires the use of Grid resource. The task of grid users, the strategy of resource allocation and grid resource are the fundamental factors that determine a resource allocation issue in the grid system. Grid system allocation allocates required resources to grid task based on the idea that user expectations are met, resulting in the task running time being as short as possible. User share grid resource by uploading tasks to the grid system. The grid resource allocation mechanism re-allocates these tasks to the required resources according to a certain plan, allowing the powerful allocation algorithm to take advantage of the grid system's computing power to increase the grid system's overall throughput. The conceptual model of the Grid framework is shown in Fig 3.

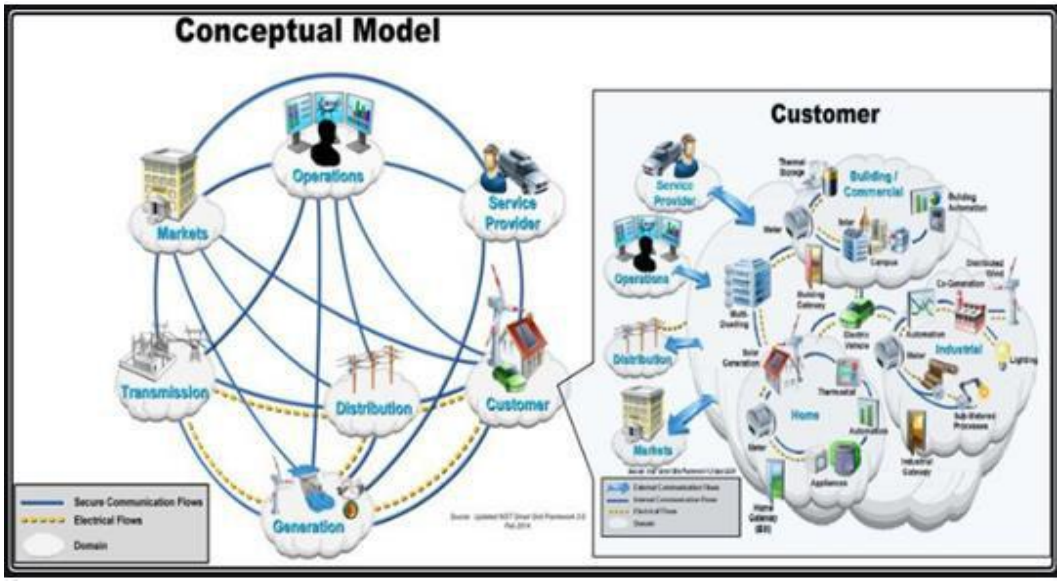

Fig 3 conceptual model of grid framework

Grid operators are in charge of operating grid resources, which involves monitoring and responding to various power system incidents. Grid operators usually exchange information at the distribution system level using a common communication infrastructure with a certain QoS level supported by communication network operators through service level agreements. The periodic task T_i is completely identified by a pair (C_i, T_i), where C_i denotes the execution time of $t_i's$ and T_i denotes the request period of t_i's. Between every two consecutive requests,$T_i$is periodic witha constant interval. At time 0, t_i's first request occurs. The execution time for all the (infinite) requests of t_i is equal and constant to C_i at the worst case. The scheduling problem consists of finding an order in which all of the task's periodic requests are to be executed on the processors in order to satisfy the following scheduling conditions: Given n independent periodic task$t_{1,}t_{2,\ldots}t_n$ and a set of identical processor, the scheduling program consists of finding an order in which all of the task's periodic requests are to be executed on the processors to satisfy the following scheduling conditions: Tasks and processor are sequenced, preserving the integrity of the system: At most one processor is assigned to each task at a time, and no processor is assigned to more than one task at a time. Deadlines are met, i.e., each task's request must be completed before the next task's request, i.e., by the end of the task's period, the number of processors, m is kept to a minimum.

Resource allocation management by using Adaptive Particle Swarm Optimization (APSO) algorithm

The APSO algorithm is used to choose more optimal resources efficiently in this work, and it is used to control resource allocation. To adjust the resource allocation management techniques and local grid structure characteristics, it is important to respect the hierarchical features of task resource allocation management when allocating and managing resources[14]. According to research on the conventional distributed grid resource allocation management system, the grid layout features are typically suitable for a few resource allocation tasks with matching elements in resource allocation management, making it easy to trigger path congestion and low resource allocation performance. The distance between the shared resource and its components is primarily controlled in the five-layer hourglass model system. The resource management process and usage of each element in the structure are distributed in five layers in turn. The connection between the bottom layer and the shred resource is relatively wide since it is nearest to the shared physical resource; the closer you get to the top, the smaller the information definition of the shared physical resource. Therefore, the smaller the detail of the shared resource. The shared physical resource is at the bottom, while the abstract shared resource is at the top.

There are approximately three levels of scheduling and allocation according to five hierarchies in resource management and allocation. The exploration of resources is the first step. When a user discovers an appropriate grid resource for the application and selects the least expensive resource from its computing is known as resource discovery. The selection of a system is the second level. Based on their source discovery time, choosing the resource that meets the application's minimum cost. Initially, static and dynamic grid computing resource information is acquired.

Secondly, the Source Discovery Period is requested for the optimization strategy for the available grid resource. Application execution is the third phase. Since the shared resources in the Grid are not exclusive to the user, when the application executes, they are reserved for user action. Generally, to achieve the task submission, the script approach and the command line are adopted. Fault-tolerant mechanism development, resource allocation management, connection preparation and other tasks must be completed before the application is executed. Simultaneously, the application's execution process should be tracked, accomplished by a particular grid resource prediction and grid resource monitoring mechanism. The occupied grid resources should be released after the application is completed.

PSO method is described using a standard circumstance in which a set of birds flying for getting food. This method shows that their self-experience guides an individual to fly towards the specific direction for food andothers who are all closer to the location of food while searching for food. Here the bird is referred to as a particle, and the group of birds are mentioned as particle swarm. The particle is encrypted in such a manner that it should be mentioned as a task scheduler. This method aims to determine the proper scheduler from all the particles by performing analysis about all the particles several times. The evaluation of particle is performed using the formula given below.

$$v_i^{(t+1)} = wv_i^{(t)} + c_1 r\left(pb_i^{(t)} - x_i^{(t)}\right) + c_2 R\left(gb_i^{(t)} - x_i^{(t)}\right) \quad (1)$$

$$x_i^{(t+1)} = x_i^{(t)} + v_i^{(t+1)} \quad (2)$$

In which $x_i^{(t)}$ and $v_i^{(t)}$denotes the position and speed of the particle i in the ith iteration respectively, $w, c_1$and c_2 refers to weight parameters, R and r denotes the random values from [0,1], and $gb_i^{(t)}$ and $pb_i^{(t)}$ are referred to global best and personal best of the particle i, respectively.

Every solution is estimated to be a particle in space, in the PSO method, and each particle comprises its speed, position and fitness value determined using an optimal function 5,6. Also, the particle can recognize their present location and the appropriate location in the whole swarm. The present location of the particle can be changed by the information given as follow: (a) The present speed; (b) the present location; (c) The proper prior location; (d) the proper location of the whole swarm.

The initialization process of the individual is carried out initially. Afterwards, the individual is segmented into a set of sub-individuals. The problem area is divided into multiple virtual sub-areas in which the sub-area is represented in the form of a hypercube. Also, every single dimension from all the available dimensions are split into equal-sized pieces, and so sub-areas are created. The particles are then transmitted to the sub-areas at low speed. A selected set of motion coefficients are used in each sub-individual, and these motion coefficients are dynamically varied at the optimization process. At last, the solution which is found at the time of optimization is meant to the optimal solution to the problem, which is determined by the newly designed method named as Adaptive Particle Swarm Optimization (APSO) algorithm. The average and accurate costs for the individuals and the time for running this APSO algorithm are calculated efficiently.

In this research, the new APSO is designed based on the motion patterns known as the motion pattern adaptation.

1. A small $|\rho_1|$ and a large V_c are found to allow the particle to choose a large range (V_c) and small $|\rho_1|$ is not allowed to move along any specific direction. F=1, f is assigned a value 1 which is balanced between p and g, at the initial stage.
2. The proper directions determined by the particles are retained because of the large number of iterations $|\rho_1|$. The higher $V_c$is considered to be more helpful.

3. Eventually, the searches should be focused on the properly determined solutions (larger F) among the proper solutions (smaller V_c and smaller $|\rho_1|$).

By replacing the coefficients $(w, c\ and\ \alpha)$ simultaneously, the APSO can be maintained efficiently. The values of F, ρ_1 and V_c are varied based on the below format.

$$V_c^{(t)} = \begin{cases} V_{max} & t < t_1 \\ \frac{(t-t_1)(V_{min}-V_{max})}{t_2-t_1} + V_{max} t_1 < t < t_2 \\ V_{min} & t > t_2 \end{cases} \quad (3)$$

This feature confirms that the value of V_c is maximum at the initial phases and is minimum at later phases of the search process, throughout the time of linearly reducing from iterations $t_1\ to\ t_2$.

$$F^{(t)} = \begin{cases} F_{min} & t < t_1 \\ 1 & t_1 < t < t_2 \\ F_{max} & t > t_1 \end{cases} \quad (4)$$

The above formula maintains greater concentration on the personal best and then a balanced search through personal and global best. The searching process is lastly intent over the global best. At the time of optimization, the values of the coefficients are varied.

The essential parameters such as QoS are time, cost and reliability. Cost and time are inversely proportional to each other; if a task can be allocated more users, advanced resources and tools may be used, resulting in lesser time for its completion and vice-versa. This research aims to balance the cost and time factor by using optimal resource allocation, henceforth, resulting in improved reliability and reduced failure rates. By distribution of resources as per user needs significantly raise the QoS co-efficient values

Path and node-level fault tolerance method for better improvement using Fit First (FF) Heuristic algorithm

In this paper, the path and node-level fault tolerance are carried out by the FF heuristic algorithm, which effectively minimizes the failure time and improves response time speed. The efficiency of the fault-tolerant approach depends on the data transmitting time and error rate . By dispersing the unmapped tasks uniformly among the available particles and minimising the particles' idle time, the system's performance can be enhanced effectively.

Also, it is considered that the processors are integrated using some communication subsystem and are part of a distributed system. The error features of the hardware are as follows:

(1) The processors fail to stop the processor which is either functioning (non-fault) or stops functioning;

(2) Every non-fault processors are communicable with each other;

(3) Hardware administers the fault processor separation in a way that the separation of fault processor cannot affect the functioning of a non-fault processor; mainly, the processors are independent with respect to failures;

(4) The processor failure P_f is identified by the outstanding non-fault processors after the failure happens, but within the instant coinciding with the completion time of the scheduled task onP_f.

This method fixates on a dynamic fault-tolerant process in which the failure of the grid is recognized prior to the task scheduling process and is executed by considering that the failure of the task will not happen. The failure rate is evaluated using the formula given below:

$$FR(R_j) = \frac{T_f}{T_{sub}} \quad (5)$$

Here T_f denotes the number of failed tasks that are executed earlier in particle j, and T_{sub} denotes the number of tasks provided to execute earlier in particle j.

The failure rate is varied from 0 to 1. The proper particle having a large capacity and the low failure rate is not able to determine, and so the difference between the fitness value and the failure rate is computed for determining the absolute fitness value. The difference calculation is performed using the formula given below:

$$F_{diff} = \frac{(diff(T_i) - diff_{imin})}{2} \quad (6)$$

The failure fitness rate (FFR) is evaluated using the formula mentioned below,

$$FFR = \frac{(FR(R_j) - FR_{\min})}{2} \quad (7)$$

In which $diff_{imin}$ refers to the minimum difference of task i in particle $j \in n$, and $FR_{\min}$ denotes the minimum failure rate among all the particles.

The tasks are assigned to the particles based on the overall fitness value. The fault-tolerant system can seamlessly carry out its specific operation even if software and/or hardware failure occurs. The fault-tolerant is proposed with such frameworks for ensuring accurate operation in case of any faults. As several fault-tolerant systems are utilized in real-time applications, the timing constraints of the real-time applications are not affected.

The fault tolerance is assigned with permanent and/or physical redundancy. The tolerance for both the permanent and temporary device failures is assigned by physical redundancy through software and hardware components. The system's failure may occur if the fault in the real-time distributed system is not identified and resolved in a reasonable time. These systems can operate with high efficiency even if software and/or hardware failure occurs. The fault-tolerance technique is utilized for maintaining the accuracy of these systems. The software and hardware redundancy are utilized for effective approaches. The hardware faulttolerance is attained using communication links, resources (memory and I/O device), and processors. At the same time, the software fault tolerance tasks are embedded into the system to handle the faults.

The tasks are allocated to the processors in order continuously in the FF approach. The processor that is feasible is allocated with the task. The tasks are scheduled to the processors by maintaining some priority order, and then the whole tasks are scheduled to the single processor using the partitioning algorithm. Assume the tasks as $T_1 \leq T_2 \leq \cdots . T_n$, the method is operated as follows,

For i=1;2;….;n, the task is allocated to the first processor P_j in such a manner that i and all the remaining tasks are allocated earlier to P_j can be allocated onP_f. The task is scheduled to a new processor if no such processor is present. Fig depicts the example of fault-tolerant in smart grid.

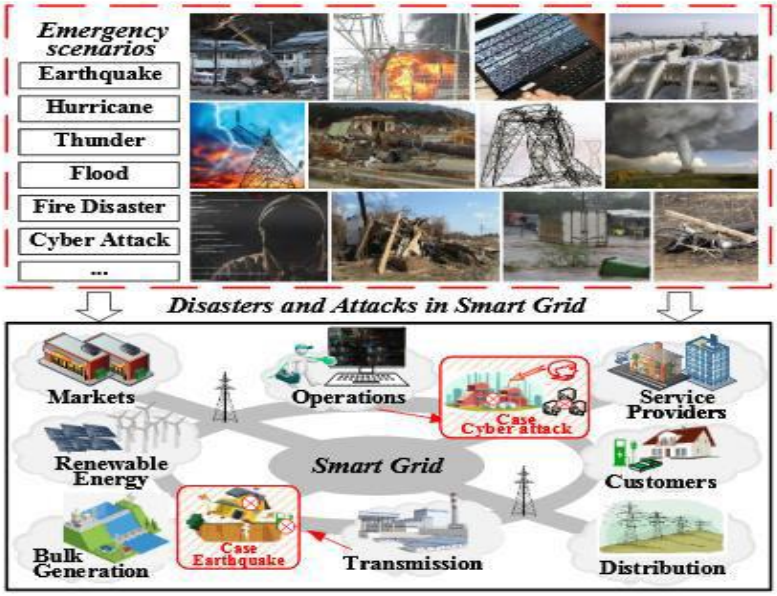

Fig 4 Example of fault-tolerant smart grid

The main and reference copies of various tasks are allocated to the same processor in the FF algorithm. In general, the main and reference copies should not be allocated to the same processor so as to endure the processor fault. But in the newly designed FF algorithm, the main and reference copies are considered by enlarging the periods, such as the priority of the copy is equal to the inverse of its

period. The connection between the main copy t_i and backup copy B_i is separated by providing the highest priority to t_i. Therefore, the tasks are arranged by minimizing the RM priorities and are allocated to the processors in the given order:

$$t_1B_1, t_2B_2, \ldots . t_nB_n \quad (8)$$

4. SIMULATION RESULT :

A comparison process is performed for evaluating the efficiency of the grid resource allocation management method on the basis of optimized target decision. Initially, the resource allocation decision planning structure is designed for similar resource requirement. By comparing the accuracy and efficiency of the resource allocation process of the traditional and new methods, the entire system's performance is determined. The experiment parameters are acquired before carrying out the experiment [19]. The particular parameter information is given in Table 1 below:

Table 1 Experimental Test Parameters

Resource capacitymb	allocation capabilities %	memory GB	Maximum detection time (s)
1300	35	110	18
1200	50	140	26
1600	78	220	38
1400	64	210	20
1500	75	156	60
1300	48	230	57
1200	65	170	40

In this paper, the performance of the new APSO+FF algorithm is compared with the traditional Multi-task Target Decision (MTTD), and PSO-GELS approaches with respect to time complexity, accuracy, error rate and cost complexity. Table 2 depicts the comparison values of the traditional and new methods.

Table 2 Comparison metrics of existing and proposed system

Methods/Metrics	**PSO–GELS**	**MTTD**	**APSO+FF**
Accuracy (%)	87.04	91.03	93.08
Error rate (%)	23.76	20.47	16.13
Time complexity (sec)	45	38	29
Cost complexity (GB)	0.13	0.1	0.08

1.Accuracy

Accuracy is considered the most important performance measure and is calculated as a ratio of accurately predicted observations to the total observations.

$$\text{Accuracy} = \frac{(\text{TruePositive} + \text{TrueNegative})}{(\text{TrueP ositive+ FalseNegative} + \text{FalsePositive} + \text{TrueNegative})} \quad (9)$$

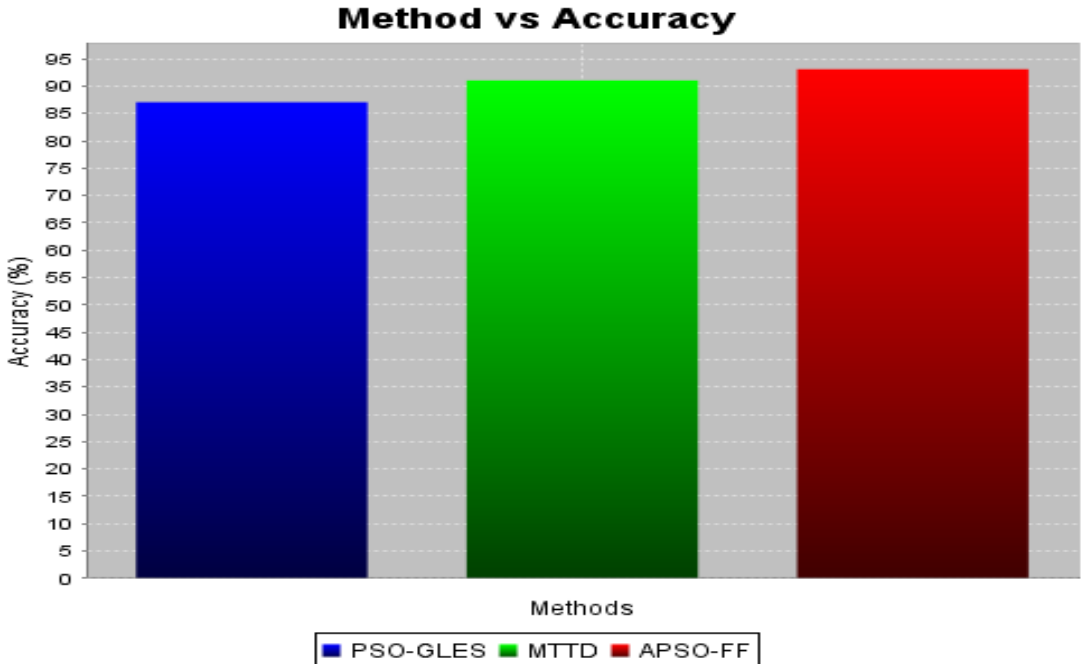

Fig 5 Accuracy comparison

In Fig.5, the comparison of the accuracy of the existing and the newly designed methods is shown. The name of the methods is mentioned along the X-axis, and the accuracy value is mentioned along the Y-axis in the above graph. This graph shows that the accuracy of the APSO+FF method is higher than the traditional MTTD and PSO-GELS methods. This paper shows that the optimal resources are chosen by the APDO+FF algorithm using the fitness function values. As the fault tolerance system improves efficiency, the performance of the whole grid system is enhanced efficiently. The experimental results show that the accuracy of the particle allocation over grid computing is improved in this new APSO+FF method.

1. Error rate

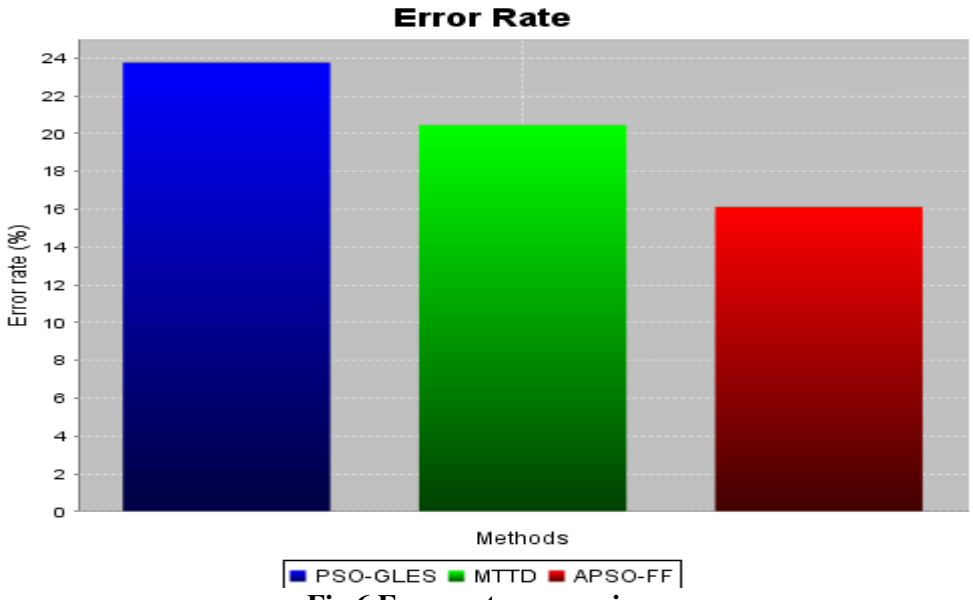

Fig 6 Error rate comparison

In Fig.6, the comparison of the error rates of the existing and the newly designed methods is shown. The name of the methods are mentioned along X-axis, and the error rate is mentioned along Y-axis in

the above graph. This graph shows that the error rate of the APSO+FF method is lower than the traditional MTTD and PSO-GELS methods. This paper shows that the optimal resources are chosen by the APDO+FF algorithm using the fitness function values. As the fault tolerance system minimizes the failure rates, the performance of the whole grid system is enhanced efficiently. The experimental results show that the accuracy of the particle allocation over grid computing is improved in this new APSO+FF method.

2. Time complexity

If the new method is operated in less time, the performance of the system is enhanced.

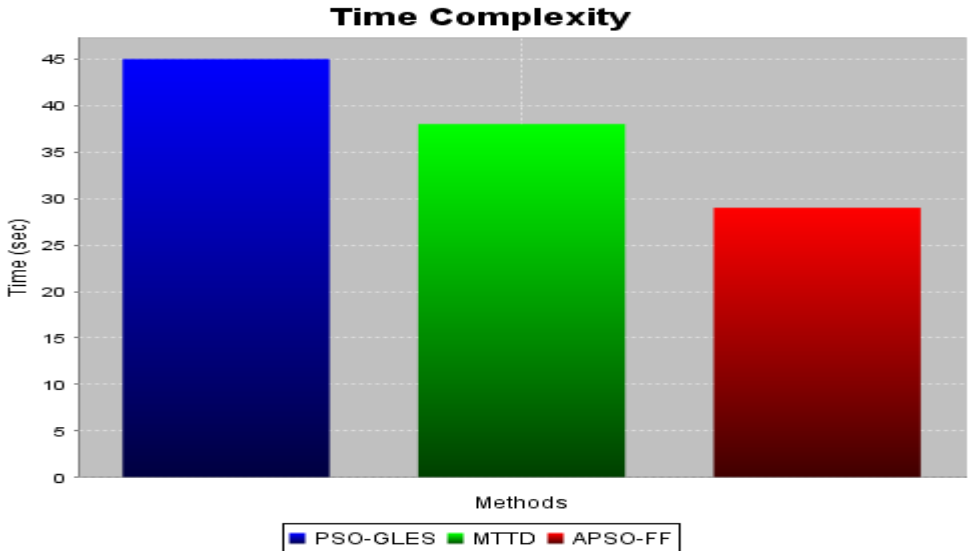

Fig 7 Time complexity

In Fig.7, the comparison value of the existing and the newly designed methods is computed for finding the time complexity. In the graph, the name of the methods are mentioned along X-axis, and the time complexity is mentioned along Y-axis. This graph shows that the time complexity of the APSO+FF method is lower than in the traditional MTTD and PSO-GELS methods. This paper shows that the optimal resources are chosen by the APDO+FF algorithm using the fitness function values. The performance of the whole grid system is enhanced efficiently, as the fault tolerance system improves the response speed and minimizes the failure rates. Thus, the experimental results show that the accuracy of the particle allocation over grid computing is improved in this new APSO+FF method.

3. Cost complexity

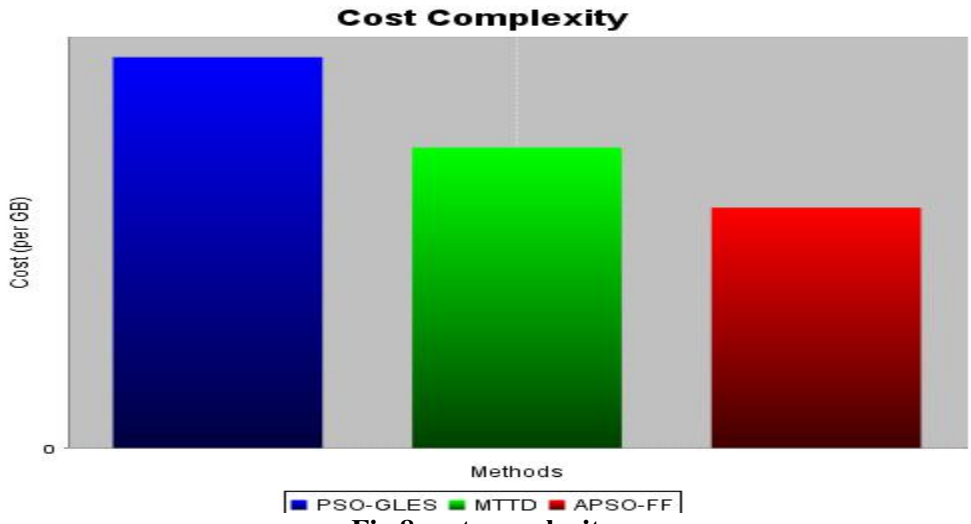

Fig 8 cost complexity

In Fig.8, the comparison value of the existing and the newly designed methods is computed for finding the cost complexity. In the graph, the name of the methods are mentioned along X-axis, and the cost complexity is mentioned along Y-axis. This graph depicts that the cost complexity of the newly designed APSO+FF approach is low than in the MTTD and PSO-GELS methods. In this paper, the optimal resources are chosen by the APDO+FF algorithm using the fitness function values. The performance of the whole grid system is enhanced efficiently, as the fault tolerance system minimizes the cost and failure rates. Thus, the accuracy of the particle allocation over grid computing is improved in this new APSO+FF method.

5. CONCLUSION:

As modern information technology is growing rapidly, grid technology becomes a major core segment in the next generation of the Internet. The speed of the network is faster if a huge number of computers are available on the grid. APSO algorithm and FF heuristic algorithm are designed for enhancing the performance of the entire grid system. The arrangement of several numbers of particles is built over the grid computing environment. Using the APSO algorithm, the particle assigning is performed so that more optimal particles are created for the required used on the grid. The failure rate and error rates are considerably reduced by using the FF heuristic algorithm. This APSO+FF algorithm has high accuracy and performance, low error rate, low cost and reduced time consumption compared to traditional MTTD and PSO-GELS approaches. The hybrid optimized methods will be designed in the future to ensure efficient load balancing in grid computing.

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Comparative Study of Traditional and Vedic Multiplication Method at upper primary level

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INTRODUCTION:

The Vedas are an infinite storehouse of knowledge and are beyond the limits of time and space. People keep ridiculing the Vedas for not being able to understand the many secrets of Vedic knowledge. But there are some troubled men who do things that last for centuries. One of them is Jagadguru Shankaracharya Shri Bharati Krishnatirtha Ji Maharaj of Govardhan Math, Puri. After eight years of intense solitary practice, ontemplation and contemplation, he discovered the key to the long-lost knowledge by which Vedic mysteries could be unraveled. Based on this, he composed a work called Vedic Mathematics.

The four Vedas are well known to all, but they also have four Upavedas and 6 Vedangas. All these together make up the primeval collection of that divine knowledge. The four Upavedas are as follows-

	Veda	**Upveda**
1.	Rigveda	Ayurveda
2.	Samaveda	Gandharvaveda
3.	Yajurveda	Dhanurveda
4.	atharvaveda	architecture

Architectural Upaveda means that all the architectural and structural related human enterprise and visual arts come under engineering. Swamiji naturally considered mathematics or computation science in this department. Swamiji says that the 'Sixteen Sutras' on which his work is based are an appendix to the Atharvaveda. These formulas are applicable to all sections in all chapters of all branches of mathematics (arithmetic, algebra, geometry, plane and spherical, trigonometry, plane and positive geometric, differential and integral etc.). These sutras are easily understood. Their application is also simple and is easily remembered. The whole process is oral, if needed, practice. Usually it is seen that students find it difficult to do multiplication of numbers. Time is also spent and yet the result is flawed. The practical method of multiplication which has been in vogue for centuries and with which the student is fully familiar yet fails to instill confidence or confidence in the correctness of the product.

In Vedic mathematics, some formulas have been given for multiplication, which are as follows-

(1) Nikhilam Navatscharam Dasatah – Out of all nine but the last ten. (All from nine and last from ten.)

(2) Urdhvatiryak - both straight (erect) and obliquely. (Vertically and Crosswise.)

I found this Vedic method very simple and interesting, so I thought why not teach the process of multiplication to the students through this method so that the curiosity about the new

method will also remain in the students and at the same time there will be a comparative discussion of the prevailing practical method.

OBJECTIVE:

Comparative study of Vedic and practical methods of multiplication.

Sample:

Out of the Air Force School of Jaipur, 100 students were selected as follows-

Age Group – 11-14 Years

Class - VI to VIII

PROCESS:

(1) First of all the students have been selected on the basis of the marks of Mathematics in their previous class in the following way-

L-level group - Scores less than 50 = Group of students from below general level.
N-level group - Scores from 50 to 70 = Group of general level students.
H-level group - Scores above 70 = Group of students from general to higher level.

(2) After selecting the students, two groups were formed. The first was called T Group and the second was called V Group and took 50-50 students each.

(3) The structure of each group is as follows:
L-level10 students
N-level30 students
H-level10 students

Abbreviation:

(1) T-Group - group of students who do the multiplication process in a practical way
(2) V-Group - Group of students who do the multiplication process by Vedic method
(3) H-Level — Group of students from general to higher level
(4) N-Level – Group of General Level Students
(5) L-level - Group of students with below normal level.

RESEARCH PROCESS (experimental steps) :

(1) Both student groups were given 5 questions of each type to perform multiplication. The V-Group was asked to perform the multiplication operation by the Vedic method and the T-Group by the traditional method.

(2) In each group, the level-wise time taken by the students to complete each type of question was determined. Time is determined in seconds (Sec.).

(3) The time taken by the entire T-Group and the V-Group to solve a question is found in seconds.

(4) The total errors committed by the entire T-Gropu and V-Group in solving a question were also found.

(5) The obtained data are listed in Table I, II, III, IV and V.

(6) The entire experiment was carried out in the following four steps.

The method of solving questions from both the methods was explained-

(2×1) Type Questions

practical method	Vedic method
73×9	73×9
73 ×9 657	73+3 base = 10 09-1 (73-1) 9-72 729-72 657

(2×1) Type Questions

practical method	Vedic method	the explanation
97×88	97×88	
97 ×88 776 776× 8536	97-03 88-12 (88-3) / (-3) (-12) 85/36 8536	base 100 deviation negative right side of north = (-3) (-12)=36 left side of north one number + deviation of another number 97-12 = 85 88-3 = 85

(2×3) Type Questions

practical method	Vedic method	the explanation
98×123	98×123	
98 ×123 294 196× 98×× 12054	98-02 123+23 (98+23)/(-46) 121/46 12100-46 12054	base 100 deviation negative right side of north -2×23= - 46 = 6 left side of north 98+23 = 121 12100-46 12054

(3×3) Type Questions

practical method	Vedic method	the explanation
512×497	512×497	
512 ×497 3584 4608× 2048×× 254464	512+012 497-003 5(512-003)/(012)×(-003) 5 (509)/(36) = 2545/36 = 254500-36 = 254464	base = 100 Substratum = 500 Substratum = 500 base = 100 = 5 512 - 003 = 509

(3×5) Type Questions

practical method	Vedic method	
342×999999	342×999999	
342 ×99999	00342×99999 00342-1/99999-00341	

3078 3078× 3078×× 3078××× 3078×××× 34199658	00341/99658 = 34199658	

(a) Other types of multiplication on the same basis (4×2), (4×3), (4×4), Solving questions of (2×5), (5×4), (5×5) explained.

(b) 2×2 questions were solved.

The questions of (c) (3×2) and (3×3) were solved.

(d) The questions (4×2), (4×3) and (4×4) were solved.

(z) The questions (5×2), (5×3), (5×4) and (5×5) were solved.

ANALYSIS OF DATA:

Table I to Table V.

RESULT AND CONCLUSION:

(i) Result

On the basis of the data obtained under the experiment, the following results were obtained-

(1) Students of H Level (5×2) i.e. questions carrying 6-7 marks and those with higher level can easily solve them by Vedic method.

(2) Students with N-Level, L-Level, even the entire student group (4×3) and above level, can solve the questions quickly by the Vedic method.

(3) Based on the errors made by the students, it also seems appropriate that the Vedic method is more effective and less time consuming than the prevailing practical method.

(ii) Conclusion

(1) Solve multiplication problems with (2×2), (3×2), (4×2), (5×2) fast practical methods.

(2) Solve multiplication problems (4×3), (5×3), (4×4), (5×4), (5×5) using the Vedic method quickly.

(3) While solving the questions by the students, it was found that the students of N-Group had more enthusiasm, the main reason for the mistakes made by N-Group was found to be 'lack of practice' in solving the Vedic method.

(4) Not only the students of general to high level but also the students of general and below normal level are also benefited by the Vedic method.

(5) If the Vedic method is given more encouragement by the teacher, then the multiplications from (2×2) to (2×5) can also be solved in less time by the Vedic method than the practical method.

(6) Hail is used more frequently in multiplication by practical method whereas it is used less frequently in Vedic method. This is the reason that in practical method the possibilities of errors remain constant.

(7) If the multiplication activities are done by the Vedic method which is beneficial, effective and interesting than the practical method in every situation, then the students will be completely sure about the correctness of the product.

(8) If practice is done, then the student will develop the confidence of giving error free product in multiplication of large numbers and at the same time interest in the work will remain intact.

Finally a suggestion for the students who want to do something in their life-

"Suffering and adversity is the best quality to teach a man; those who bear them with courage are victorious in their lives.

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A case study and survey of cancer from Lunglei District of Mizoram, northeastern India.

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Abstract : *The present study was carried out on cancer patients at Lunglei District of Mizoram, northeast India from 2015-2020. The study highlighted the occurrence of 28 different types of cancer with a total of 1033 cancer cases within a period of 6 years. Stomach cancer account for the highest number with a total 166 cases followed by oesophagus cancer at 140 cases. Lung cancer turns out at 3rd position with 123 cases. The present study also reported the most frequent cases of cancer among 50-59 age groups which was at 26.43 % , followed by 60-69 age groups which accounts for 24.78 %. 40-49 age groups come at third position which accounts for 17.04 %. The study also highlighted the frequency of cancer cases among the male and female patients which stood at a total of 515 cases in males as against 518 cases in females.*

Key words: *Obesity, Lifestyle, Cancer, Carcinogen, Lunglei.*

INTRODUCTION :

Cancer has been one of the deadliest diseases in the modern world and suffers by majority of the adult individuals especially in the developing countries. A social determinant which includes certain factors such as income, employment, food, transportation etc. may go a long way in ensuring and impacting the health outcome of cancer patients. Little research work has been carried out on the field of cancer in recent time from Mizoram which is the worst cancer suffering state of all over India thus highlighting the need for more and urgent research in the field of cancer science. Cancer is due to uncontrolled growth of cell leading to the formation of abnormal cell (Garima et al. 2015). 30 % of cancers in western countries is considered to be due to dietary factors (Doll and Peto, 1981) and the risk of cancer due to dietary factors is considered to be lower in developing countries (Timothy et al.2004). Cancer has become an important health issue and is the second most common cause of death next to cardiovascular problems especially for people over the age of 60 (Turhal et al.2013). Several factors are responsible for the cause of cancer which includes diet, obesity as well as pollutants (Anand et al.2008). Lifestyle problems such as obesity is a contributing factor for multiple cancer (Marmot et al. 2007;Calle et al.2003; Kushi et al.2012; Fowke et al.2012) Few cancer researches has been carried out so far from Mizoram on certain cancer which includes smoking related cancer (Lalpawimawha & Lalruatfela B, 2016) and stomach related cancer (Phukan et al.2006, Ghatak et al.2016). The incidence rate of cancer is very high despite the low population size of Mizoram (Lalramliana et al.2021).

STUDY AREA:

Lunglei district is the second most populous district in the state of Mizoram and it is named after its headquarters, Lunglei. Lunglei district covers an area of 4538 Sq km and is bounded on the east

by Myanmar, on the southeast by Saiha district, on the northeast by Serchhip district, on the south by Lawngtlai district, on the west by Bangladesh and on the north by Mamit and Aizawl district. The district has two international boundaries with Myanmar and Bangladesh and it has two sub-divisions i.e Lunglei and Tlabung.

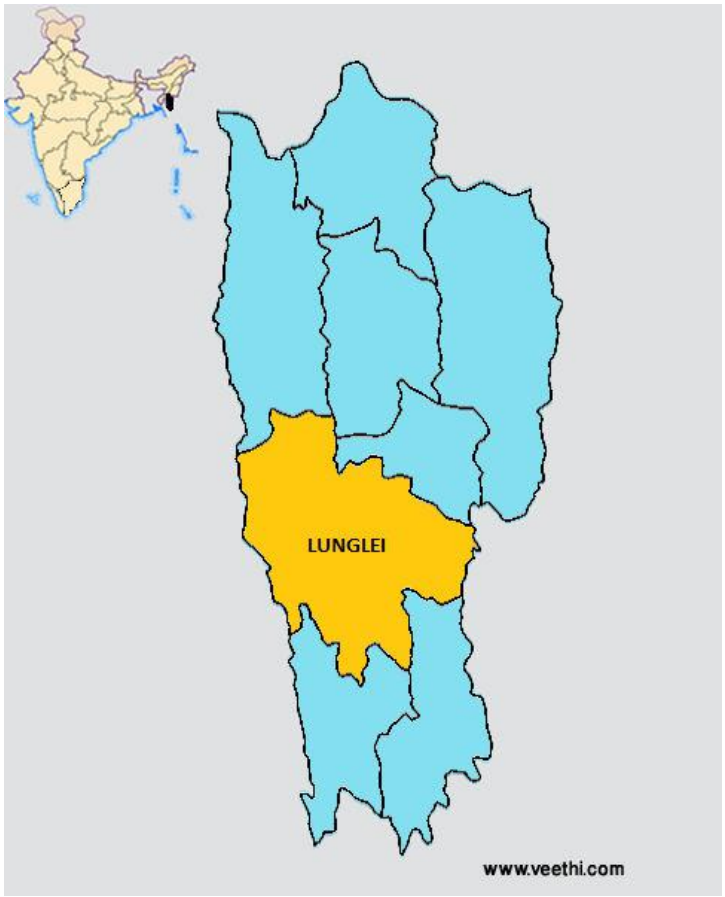

Fig.I. Map of Lunglei district of Mizoram, India.

METHODOLOGY:

The study was carried out from hospital based information as well as diagnostics collected by Population Based Cancer Registry (PBCR), Civil Hospital, Aizawl Mizoram. The research was conducted from Lunglei, the second largest district of Mizoram for a period of six years from 2015 to 2020 from 1033 cancer patients. Microsoft excel was used for the various data analysis as well as comparisons of different parameters.

RESULTS & DISCUSSION

The present study highlighted 28 different types of cancer from Lunglei District of Mizoram with total cases of 1033 over a period of six years from 2015-2020. Among the 28 types of cancer encountered from the study area stomach cancer was highest with 166 cases which are followed by oesophageal cancer at 140 cases. Lung cancer comes at third position with total cases of 140 during the study period. The number of male cancer patients is 513 cases as against the female patients which come at 518 during the study period. The age group of 50-59 has the worst cancer case which is followed by 60-69 age groups.

Tab.I. Cancer types and cancer patients from Lunglei District of Mizoram from 2015-2020.

Sl.No	Cancer type	2015	2016	2017	2018	2019	2020	Total
1.	Blood	0	0	1	0	0	4	5
2.	Bone	1	7	7	1	3	2	21
3.	Brain	3	0	2	1	0	1	7
4.	Breast	13	12	26	12	18	10	91
5.	Cervix	15	12	9	14	13	19	82
6.	Colon	4	4	2	3	6	7	26
7.	Eye	0	0	1	0	3	0	4
8.	Gall bladder	3	7	3	6	1	2	22
9.	kidney	2	0	2	1	0	5	10
10.	Larynx	3	2	1	3	0	2	11
11.	Liver	8	9	14	10	8	12	61
12.	Mouth	7	9	10	11	15	14	66
13.	Lung	21	24	26	14	16	22	123
14.	Nasopharynx	8	10	11	5	10	1	45
15.	Oesophagus	17	9	32	25	30	27	140
16.	Rectum	4	4	8	5	1	1	23
17.	Stomach	26	25	32	32	22	29	166
18.	Tongue	1	0	2	0	0	0	3
19.	Thyroid	4	2	6	3	6	2	23
20.	Tonsil	1	1	0	1	0	2	5
21.	Throat	0	2	2	0	0	3	7
22.	Ovary	5	7	4	6	4	6	32
23.	Skin	3	2	1	2	2	1	11
24.	Uterus	5	4	4	2	1	3	19
25.	Neck	2	3	1	1	2	2	11
26.	Prostate	0	1	1	1	1	3	7
27.	Penis	1	0	2	1	0	0	4
28.	Urinary bladder	0	2	2	0	2	2	8

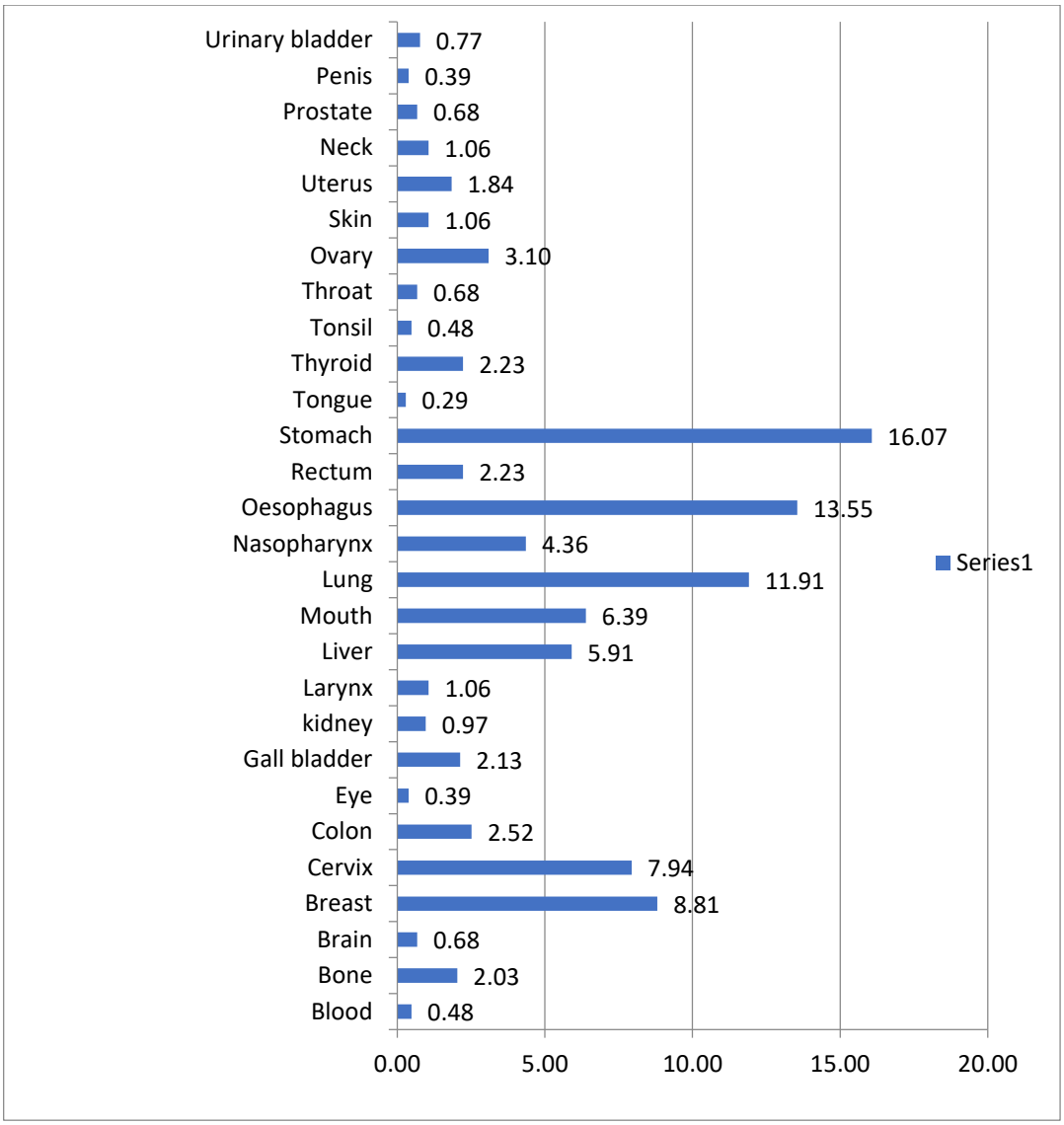

Fig.II. Occurrence of cancer types in percentage from Lunglei district of Mizoram

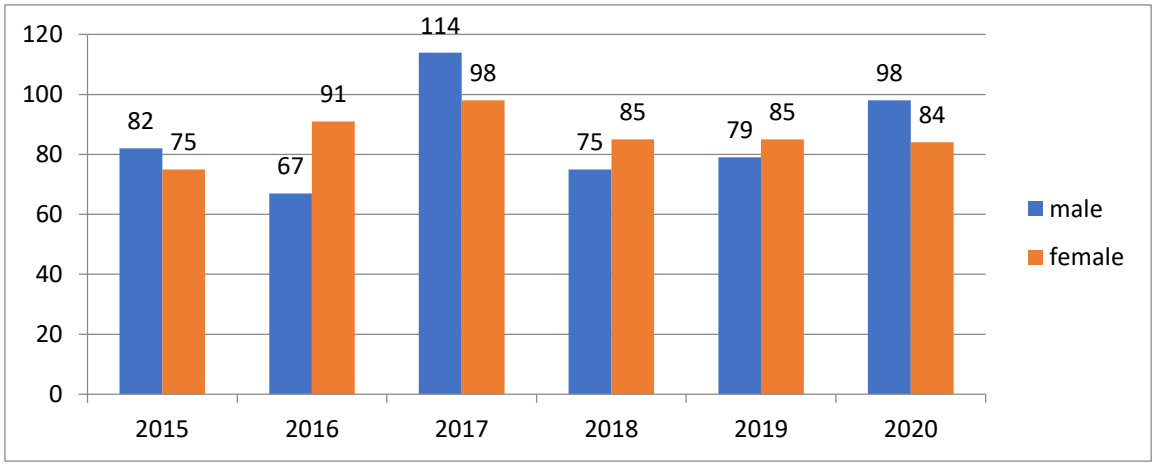

Fig.III. Male vs female comparison of cancer patients in Lunglei District of Mizoram from 2015-2020

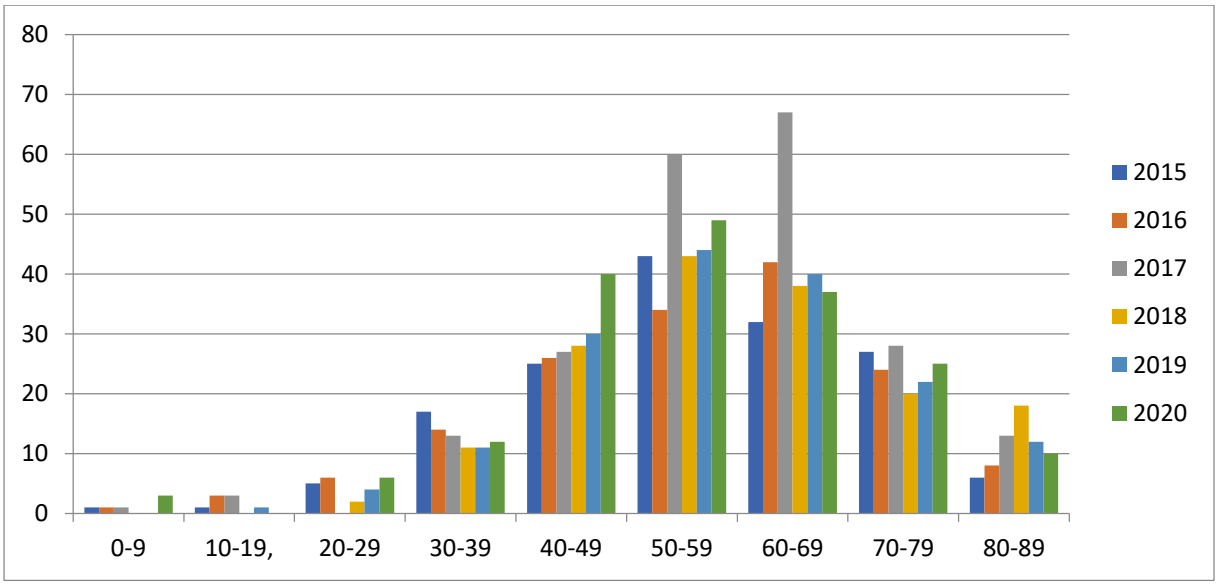

Fig .IV. Age-wise comparison of cancer patients in Lunglei District of Mizoram from 2015-2020

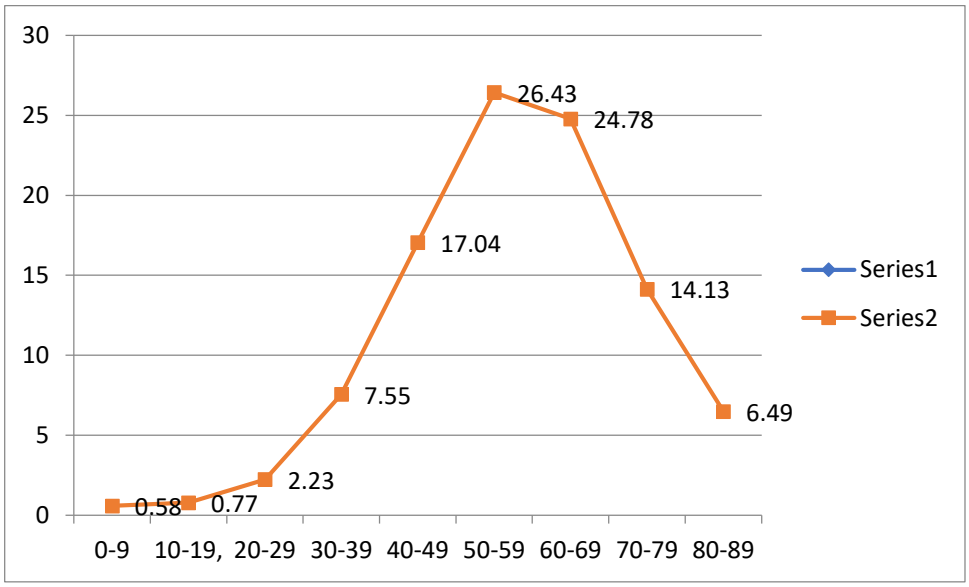

Fig . V. Age-wise comparison of cancer patients in percentage from Lunglei District of Mizoram from 2015-2020.

The different types of cancer cases from Lunglei District of Mizoram can be briefly highlighted as follows:

Blood cancer: Blood cancer case is rare which accounts for only 0.48 % from the cancer cases encountered from the study area.

Bone cancer: Bone cancer accounts for 2.03 % from the overall cancer cases studied during the study period.

Brain cancer: Brain cancer is also present only in few numbers and accounts for only 0.68%

Breast cancer: Breast cancer is a common form of cancer case from the study area among the female population accounts for 8.81% of the overall cancer cases from the study area.

Cervix cancer: Cervix cancer is also another common form of cancer among the females and contributed to 7.94% of the cancer cases encountered.

Colon cancer : Ccolon cancer is common between male and female population and accounts for 2.52%.

Eye cancer : An eye cancer case is not common from the study area and contributed to only 0.39 % of the cancer cases encountered.

Gall bladder cancer: Gall bladder cancer cases accounts for 2.13% during the study period and few cases were encountered.

Kidney cancer: Though kidney cancer case is not common, it contributed to 0.97% cases.

Mouth cancer: Mouth cancer is another common form of cancer from the study area and it contributed to 6.39% from the overall cancer cases during the study period.

Lung cancer: Lung cancer is one of the most common forms of cancer form the study area and it contributed to 11.91% during the study period.

Nasopharynx cancer: Nasopharynx cancer cases are also common from the study area and it accounts for 4.36%.

Oesophagus cancer: It is also one of the most common forms of cancer from the study area and it contributed to 13.55% and it attained the number 2 position in terms of frequency.

Rectum cancer: Rectum cancer accounts for 2.23% of the cancer cases from the study area and though not very common, few cases were encountered.

Stomach cancer: Stomach cancer is the most common form of cancer and attained the number 1 spot from the study area and it accounts for16.07%.

Tongue cancer: Tongue cancer is the least common form of cancer from the study area and contributed to only 0.29%.

Thyroid cancer: Thyroid cancer accounts for 2.23% of the overall cancer cases from the study area.

Tonsil cancer: Though not a common form of cancer, it still accounts for 0.48% of the cancer cases from the study area.

Throat cancer: Throat cancer cases are not common but contributed to 0.68% from the overall cancer cases from the study area.

Ovary cancer: Ovarian cancer is another common form of cancer among the females and accounts for 3.10%.

Skin cancer: Skin cancer cases accounts for 1.06% and though not very common, few cases were encountered from the study area.

Uterus cancer: Uterus cancer is another less common form of cancer encountered among the females and accounts for 1.84%.

Neck cancer: Neck cancer accounts for 1.06% and few cases were encountered from the study area.

Prostate cancer: Prostate cancer accounts for 0.68% and though not so common, few cases occurred from the study area.

Penis cancer: Few cases were encountered from the study area and it accounts for only 0.39%.

Urinary bladder Cancer: It is the less common form of cancer and contributed to 0.77% of the overall cancer cases from the study area during the study period.

The results clearly defined the role of lifestyle as well as dietary factor in the major cases of cancer in Lunglei district of Mizoram. Most of the common cancer encountered in the study area such as lung cancer may be associated with smoking as most of the local people are smokers. Other cancer which includes stomach cancer may go along way with dietary factors and lifestyle of the local people. Though the causes of cancer cannot be directly correlated with the lifestyle and dietary factors of the local people, it is certain from the present survey that many carcinogens are associated with the life of the local people from the study area.

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