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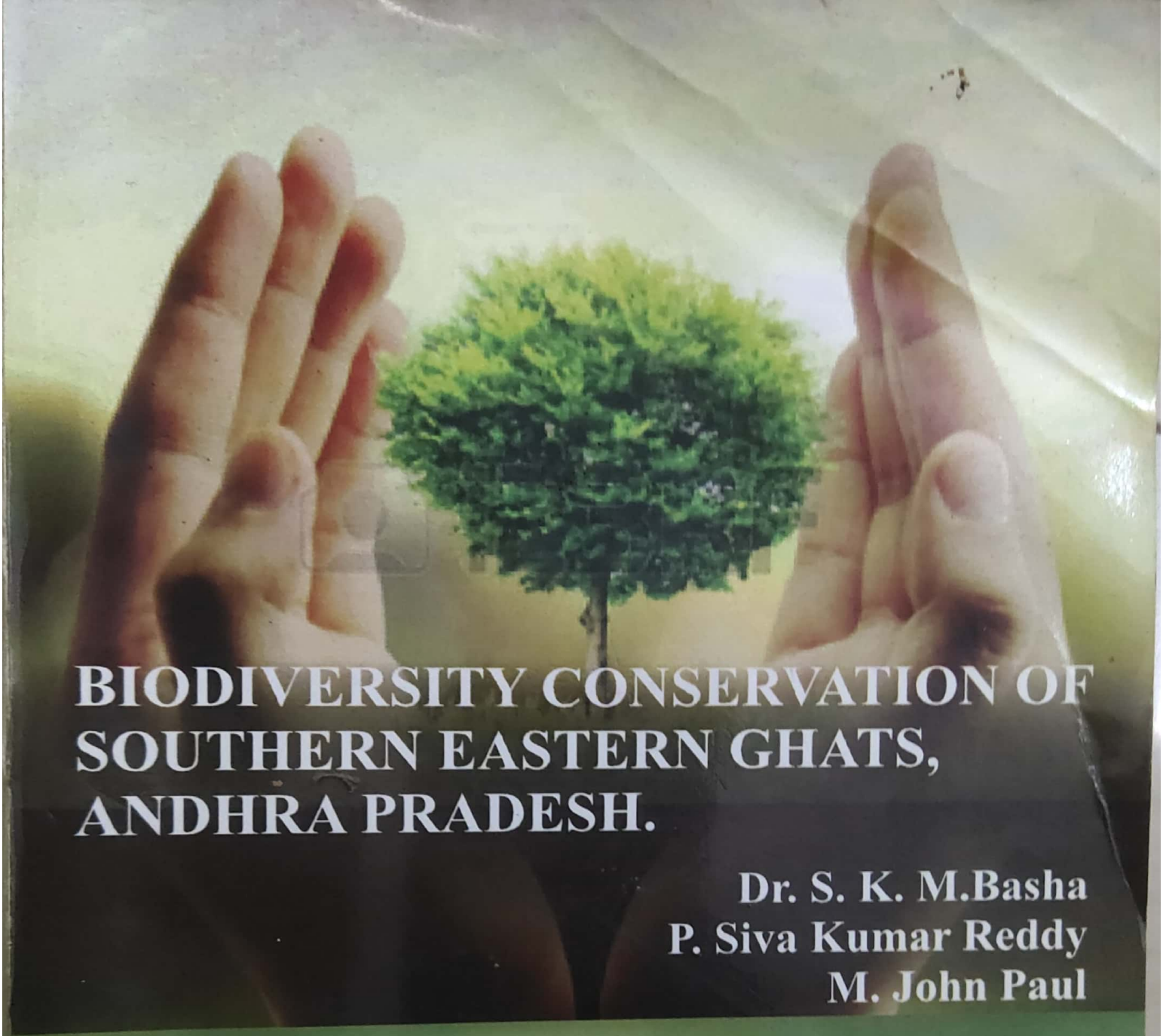

BIODIVERSITY CONSERVATION OF SOUTHERN EASTERN GHATS, ANDHRA PRADESH.

Dr. S. K. M.Basha
P. Siva Kumar Reddy
M. John Paul

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BIODIVERSITY CONSERVATION OF PULICATLAKE

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MEDICINAL PLANTS RESEARCH

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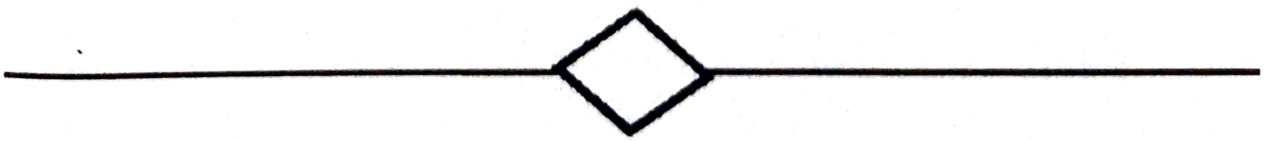

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Usage of e –Shodh Sindhu in Promition of Research and Academic Knowledge by Scholars and PG Students in Shri Padmavati Mahila Vishvavidyalayam: A Study

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Librarian, Narayana Engineering College, Nellore.

Abstract

The aim of this paper is to know about usage of E-shodhsindhu by research scholars and PG Students their awareness, area of specialization, availability, level of satisfaction, and future requirements for their study. It also explains their experience in usage of E-shodhsindhu and productivity.

Keywords: *E-ShodhSindhu, E-Books, E-Journals, E-Databases, INFLIBNET, Resource Sharing, Sri Padmavati Mahila Vishvavidyalayam.*

Introduction

Libraries play an important role in vast changing e environment. E resources changed the role of libraries, its scope and users. It also changed its nature of Job what it has done earlier. Modern information and communication technologies had profound influence on its access to various types of online e resources like e journals, databases, e books method of resource sharing and upgrade its resources to attract its users.

UGC INFONET- Digital Library consortium

The University Grants Commission (UGC) has initiated a programme to provide e resource over Internet to scholarly literature in all areas of learning to university sector in India. The programme is wholly funded by the UGC. All universities which comes under UGC be the members of this programme and it also be extended to degree colleges also.

E-ShodhSindhu

Based on the recommendations of an expert committee, the MHRD has formed e-shodhsindhu merging three consortia Initiatives, namely UGC INFONET Digital Library Consortium, NLIST and INDEST-AICTE Consortium. The e-ShodhSindhu will continue to provide current as well as archival access to more than 15,000 core and peer-reviewed journals and a number of bibliographic, citation and factual databases in different disciplines from a large number of publishers and aggregators to its member institutions including centrally-funded technical institutions, universities and colleges that are covered under 12 (B) and 2(f) Sections of the UGC Act.

Objectives of Study

- The major objectives of the study follow
- To find out the awareness and utility of e shodhsindhu among research scholars and PG Students
- To identify area of interest on databases on e shodhsindhu
- To find out the purpose and utilization on e shodhsindhu
- To estimate level of satisfaction regarding usage of e shodhsindhu
- To find out the suggestions and improvement on usage of e shodhsindhu

Methodology

This present study used survey method to conduct research. A well structured questionnaire covering entire components was distributed to collect data from respondents.

Scope and Limitations

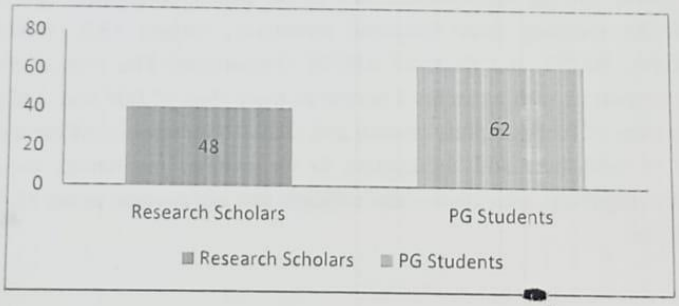
The present study confined was carried out by distributing 50 Questionnaire to Research Scholars and 75 Questionnaire to PG Students of Shri Padmavathi Mahila Vishvavidyalayamu in the year 2019. Only 40 Scholars and 62 PG Students responded.

Literature Review

At this stage it is important to view research gap need and importance of present study. It is revealed that majority of users are aware of e shodhsindhu online resources available In library. YCH Venkateswarlu (2015)" Problems In accessing UGC INFONET E-Journals consortium among Research scholars : A Survey of Sri Venkateswara University Library , Tirupathi, AP" have indicated Increase acceptance of electronic resources by research scholars in present environment in which the UGC INFONET has played a meaningful role to assist academic and research community.

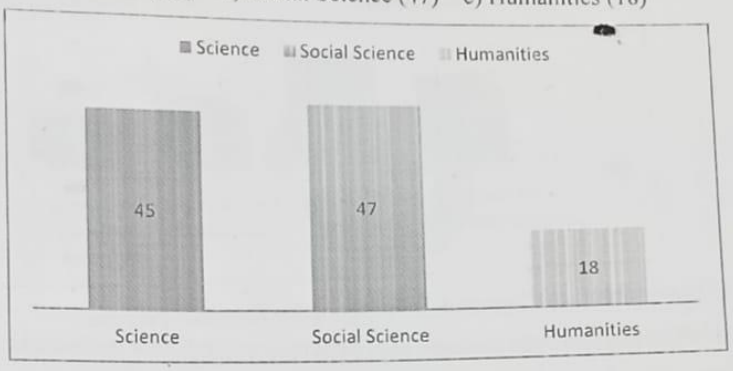
Data Analysis and Interpretations

1) Designation Research Scholars (48), PG Students (62)



The above graph explains usage E-ShodhSindhu by PG students more than Research scholars.

2) Departments (a) Science (45) b) Social Science (47) c) Humanities (18)

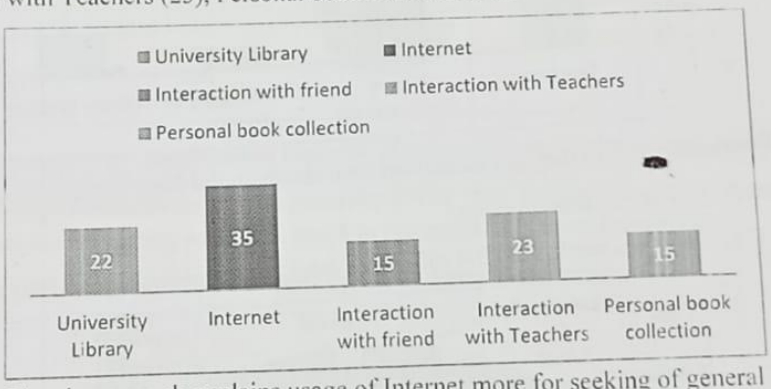


The above graph explains usage of e-shodhsindhu by social science department more when compare to sciences and humanities

3) When you are seeking information, which source of information do you generally consult? Tick all the relevant Colum?

University Library (32), Internet (35), Interaction with friend and colleague (15)

Interaction with Teachers (23), Personal book collection (15)

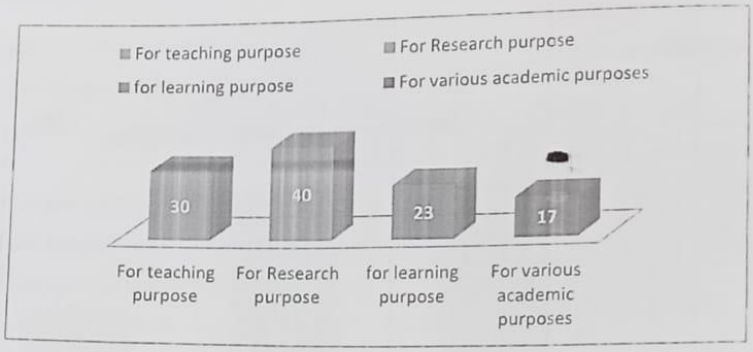


The above graph explains usage of Internet more for seeking of general information.

4) For what purpose do you seek information (Tick all the relevant columns)?

(30) For teaching purpose, (40) For Research purpose, (23) for learning purpose,

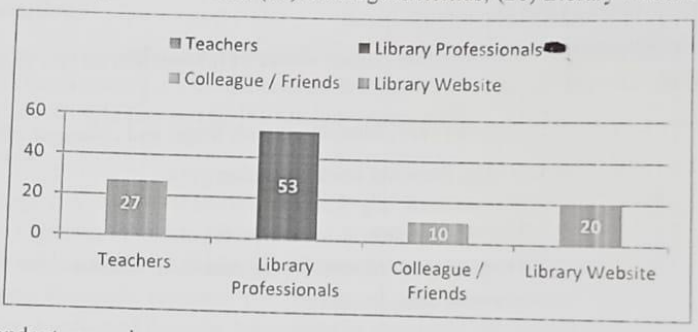
(17) For various academic purposes.



Majority of respondents says they seek information for Research purpose.

5) From which source you came to know about E-ShodhSindhu?

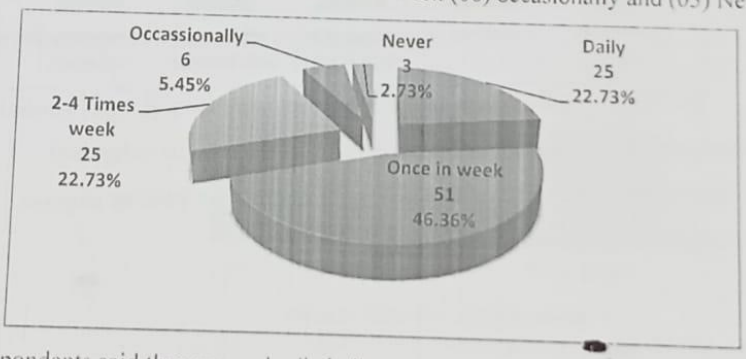
(27) Teachers, (53) Library Professionals, (10) Colleagues/friends, (20) Library website



Majority of respondents says they get awareness on e shodhsindhu from Library Professionals.

6) How often do you use E-ShodhSindhu?

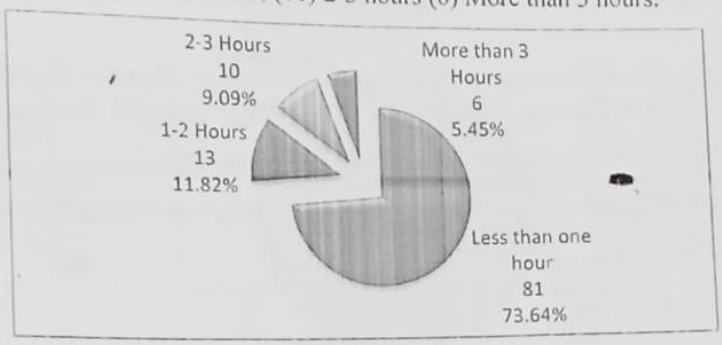
(25) Daily, (51) Once in a week, (25) 2-4 times in a week (06) occasionally and (03) Never



Majority of respondents said they use e-shodhsindhu once in a week.

7) How much time do you spend in E-ShodhSindhu in a visit?

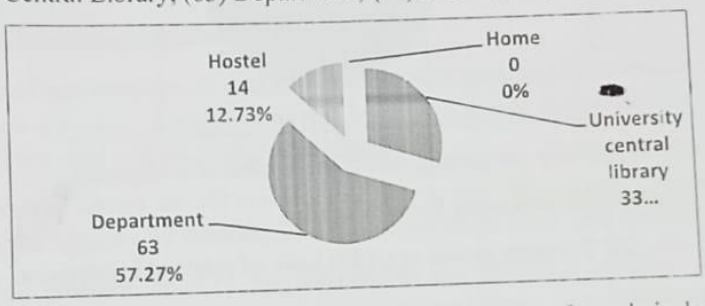
(81) Less than one hour, (13) 1-2 hours, (10) 2-3 hours (6) More than 3 hours.



Majority of respondents says that they spend on e shodhsindhu by less than one hour

8) Where do you access E-ShodhSindhu?

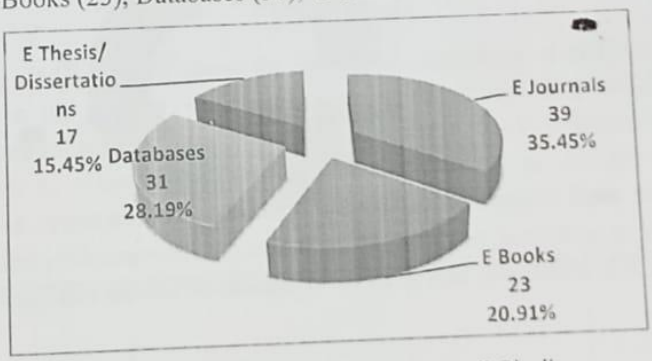
(33) University Central Library, (63) Department, (14) Hostel, (Nil) Home



Regarding access to e – shodhsindhu majority of respondent access from their departments.

9) Which types of e-resources do you generally prefer from E-ShodhSindhu? (Please indicate your preferences by putting as 1, 2, 3, and 4 in the boxes/ 4 is more important)

E- Journals (39), E-Books (23), Databases (31), e-theses/dissertations (17).



Majority of respondents prefer to use E- Journals from E-ShodhSindhu.

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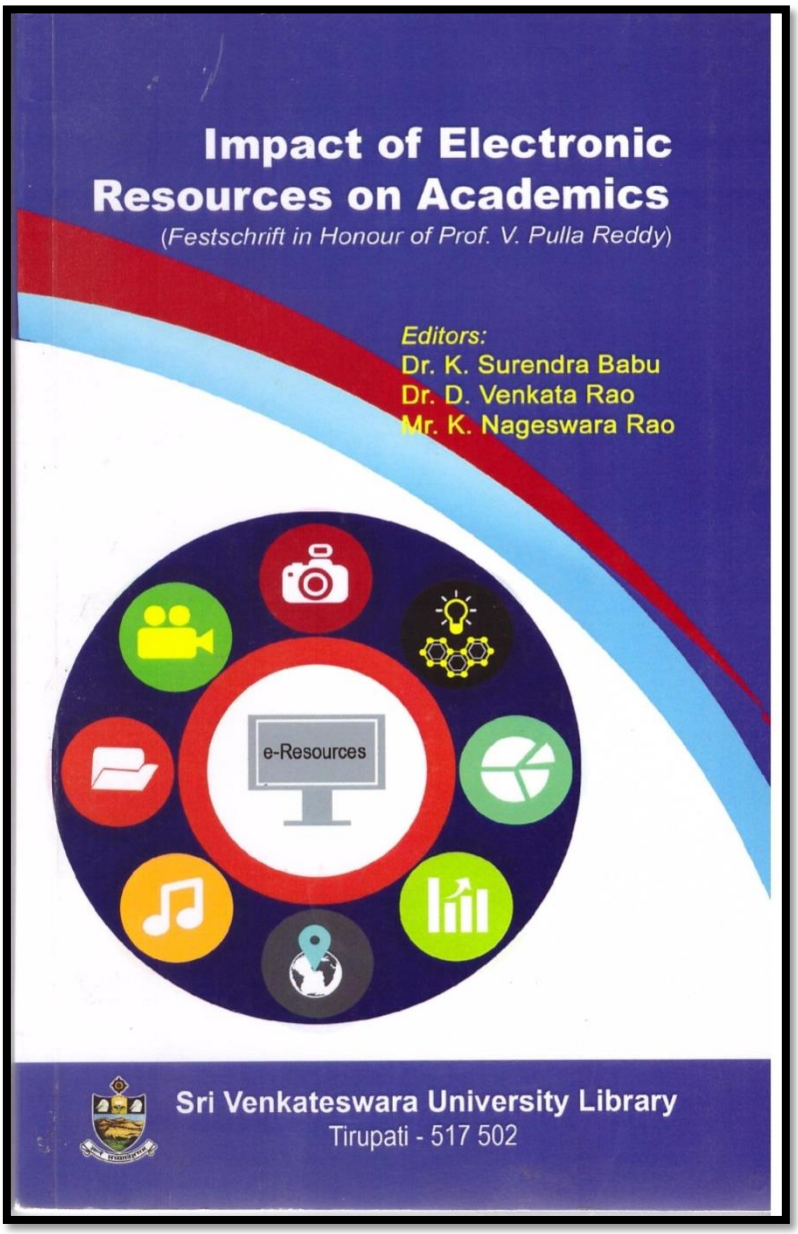
Impact of Electronic Resources on Academics
(Festschrift in Honour of Prof. V. Pulla Reddy)
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Use and effectiveness of E-ShodhSindhu in pro of higher education among the research schola faculty members of Dravidian University: A S

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Abstract *- The present study aims to analyse the use and effecti shodhsindhu consortium e-journals in promotion of higher educa the faculty members and research scholars of Dravidian Universit also intends to determine the frequency of use of E-ShodhSindhu, t in E-ShodhSindhu, access place for E-ShodhSindhu, types of e-port ShodhSindhu, effectiveness of E-ShodhSindhu on academic activiti faced and overall satisfaction with E- ShodhSindhu. Questionnaire adopted to elicit data from faculty and research scholars of Dravidia A total 110 respondents participated in the survey from which 6 members and 48 are research scholars. The study reveals that faculty scholars are using E-ShodhSindhu online databases subscribed b University. Majority of faculty and research scholars are using e research purpose and the department is the most preferred location e-journals.*

Keywords: E-ShodhSindhu, INFLIBNET, E-journals, e-resou databases, Dravidian University

Introduction

The recent developments in Information Technology change scenario. Libraries and Information Centres have embrac information technology more profoundly than many othe most of them are currently using electronic products and offers tremendous opportunities to provide solutions to some challenges now libraries are facing. Electronic Publishing or

Conclusion

The study reveals that the faculty members and research scholars of Dravidian University mostly rely on E-ShodhSindhu e-journals for research purpose and publishing articles. They are using the available e-journals satisfactorily. The library professionals tried their best for promotion, assistance and guidance in accessing e-journals. The increase in e-journals subscription indicates that the library has made drastic changes in E-ShodhSindhu e-journals collection and services. The library has to employ different strategies for effective use of available online resources through E-ShodhSindhu. Central Library has to conduct the orientation programme for the best use of E-ShodhSindhu e-resources.

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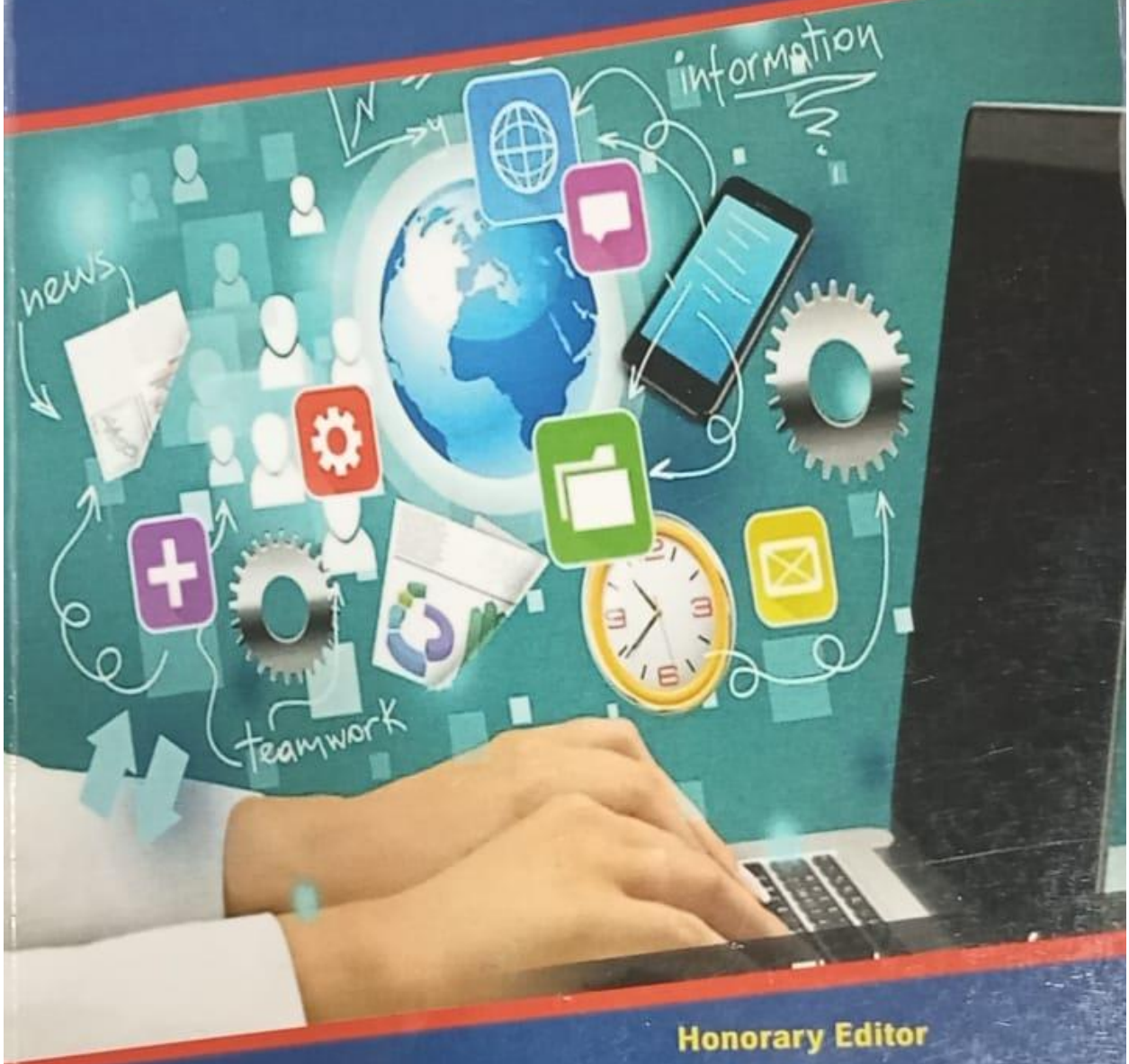
User Perceptions and Expectations from Academic Libraries in Digital Information Society



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Use of Social Media in Library Services

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Abstract - Traditional Libraries gives emphasis on storage and preservation of physical items, particularly books and periodicals those in which librarian were a custodian of the library. In the past years, libraries have increasingly developed into a provider of information resources and services that do not even require a building. It is about new demands of competence within education, trade and industry, the public's demand for new services, new media and information resources, the range of possibilities offered by the Internet, digital services etc. The main aim users ,it will help in discover user's need for effective and efficient library services. This paper is to focus on creatively engage in marketing library services through social media. Now a days for excellent library services social media has become an integral part. Libraries should design a workable plan with total emphasis on the delivery.

Keywords: Social Media, Library Services.

1. Introduction

Social Media deliver several opportunities to reach and interact with the society. In recent years social media and social network have grown amazingly. Social Media is being used all over world for manifold purposes in Libraries and Knowledge centre. Currently libraries and information centres are facing many problems and challenges. It is very difficult for library professionals to manage and share their resources with others manually. For solving these problems, many technological development has been discovered and creating new forms of information, new sources of information and new ways of providing information bypassing traditional institutional like libraries.

Now, the actual challenge for information professionals is not to handle the collection, staff and technology, but to turn these resources into services which are user oriented. Web 2.0 applications in libraries have acquired growing reputation all over world. It appears that the library must think about marketing its services more regularly through the internet, taking advantage of Social networks to get better access to its users and to promote information services. Social media is a powerful new form of communication.

2. Objectives of the Study

The study seeks to achieve the following objectives:

1 To investigate the problems in utilizing social media for marketing purposes in libraries.
2. To promote the library services
3. Review actual study on the Utilization of Social media platforms in library and information centres.

3. Social Media

Social media is the collective of online communications channels dedicated to community-based input, interaction, content-sharing and collaboration. Social Media can be described as a group of web-based and mobile applications that allow users to share and create knowledge in a real time social interaction. It is user-centric, multi-purpose and it is not time and location bound. Social Media consists of various users driven marketing channels, e.g. Face book, Twitter, Blogs, YouTube, Flickr, Pinterest. Social Media provides more opportunities to reach the user community target specific audiences and give users a chance to interact with Library. Libraries can market their services and products using different social media platforms, for Example publicize their different upcoming events and newly acquired information materials through the Face book. Different programs such as conference and workshops can be marketed by uploading videos on the YouTube. The pictures of different library events and services can be shared using Flickr. Blogs can be used to market library services among distance learners. Twitter and Instance messaging can be used to market a Library's Reference. Quora can be used for A Questions and Answers. Library services the most widely used social media platforms follow.

3.1 Face book

Face book is a social networking website intended to connect friends, family, and business associates. It is the largest of the networking sites,

with the runner up being My Space. Face book the largest number of active users and is easy to get started with. When looking for a business or information Face book is one of the first places many people look. It is a place for community members to connect online. Therefore every library in the Peace Library System should have a Face book page. Through the face book page / Accounts librarians can draw user's attention to useful hidden treasures of the library that library users have forgotten or are not aware of such a grey literature.

3.2 Twitter

Twitter is second most popular social media platform. It is micro blogging network of real posts and all post is limit to 140 characters or less. Twitter can be used to keep library staff and patrons updated on library's daily activities for exam frequently updated library collections. User can utilize this platform to type in short messages or status updates. Often library users prefer twitter to interact with librarians because this is more influential than other social media platforms and what happens on Twitter does not stay in twitter. Twitter is a marketing tool for libraries including tips, best practices, evaluation and assessment of a twitter account.

3.3 Blog

A blog is a discussion or informational website published on the World Wide Web consisting of discrete, often informal diary-style text entries ("posts"). Posts are typically displayed in reverse chronological order, so that the most recent post appears first, at the top of the web page. Blogs are popularly used in library to broadcast library news and market other library resources. Librarians can also develop subject specific blogs and play a leading role in advocating the use of blogs for scholarly communication and commenting on research findings.

3.4 Flickr

It is an image- and video-hosting website and web services suite that was created by Ludicorp in 2004 and acquired by Yahoo on 20th March 2005. In addition to being a popular website for users to share and embed personal photographs, and effectively an online community, the service is widely used by photo researchers and by bloggers to host images that they embed in blogs and media. Librarians can use it to market general library services to their users. Most students / users

are not aware of the different services offered in the library such as reservation of Books, Reference services and strategic dissemination of information. Flickr is good to sensitize users with library services.

3.5 Pinterest

Pinterest is a web and mobile application company that operates a software system designed to discover information on the World Wide Web, mainly using images and on a shorter scale, GIFs and videos. It provides great venues to market library resources. A library can make its own profile and create boards, pinning photos and video showcasing the library.

4. Advantages of using Social Media

Use of Social media by the library has now become Mainstream. As per the survey 80% librarians now feel that use of Social Media is important.

1. Financial costs of using Social media are perceived to be low. It requires little training.
2. It connects users with the library activities and engages them in library activities. It increases interactions with library users.
3. It helps gather feedback of libraries for redesign the library services.
4. To marketing the product and services of library.
5. To promote information on new arrivals on library resources and process to use it.
6. It also creates awareness and innovate the way users live.

5. Challenges of using Social Media

1. Social Media can require considerable time from Library Professional.
2. The Users can create a false account and do anything without being traced.
3. There are limited funds to support more advanced social media usage / features and the training that would be required to enable this.
4. Library professionals need to work hard to maintain engagement with library users.
5. Personal Data and privacy can easily be hacked and shared on the internet.

6. Factors such as internet connectivity, technological infrastructure and government restrictions on the use of Social Media may restrict access.

6. Conclusion

His research contributes about various techniques used to improve library services and resources through social media. It has practical implications for how to effectively promote future services and resources and contributes to future researchers wanting to explore library promotional techniques. By using social media libraries can fulfill users need. Study gathers that according to the changing needs of library users, libraries need to be changed correctly. Libraries should be facilitated with internet service and develop their web page and social media page. Social media is used by libraries to supply a merging of user services, news, content etc.

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USAGE OF E-SHODHSINDHU RESOURCES BY USERS OF SRI PADMAVATHI MAHILA UNIVERSITY: A STUDY

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Abstract

Based on the recommendation of an Expert Committee Ministry of Education has formed e-Shodh Sindhu merging three consortia initiatives, namely UGC-INFONET Digital Library Consortium, NLIST and INDEST-AICTE Consortium. The e-Shodh Sindhu will continue to provide current as well as archival access to more than 10,000 core and peer-reviewed journals and a number of bibliographic, citation and factual databases in different disciplines from a large number of publishers and aggregators to its member institutions including centrally-funded technical institutions, universities and colleges that are covered under 12(B) and 2(f) Sections of the UGC Act.

Keywords: E-Shodh Sindhu, UGC Infonet, Inflibnet, E-Journals, E-Resources.

Introduction

Modern libraries provides literature and information through electronic sources and online services to support the academic activity and satisfy the user's information needs, so it is considered as the backbone of any research organization. The development of technology is changing the pattern of library resources and also changing the process of storage and retrieval in the digital environment from the traditional physical environment. Now the modern library is acquiring e-resources through consortia approach. Consortia approach is one of the ways to maintain cooperation, coordination and collaboration between libraries for Resourcessharingandworkasatechnologyforcollectiondevelopmentandminimizethecost.

Sri Padmavati Mahila Visvavidyalayam (University for Women)was founded in the year 1983 by Sri N.T.Rama Rao, the then Chief Minister of Andhra Pradesh, with the fervent desire to train women students as better builders of the Nation and to inculcate skills of leadership in all aspects of life. The University was established under the Sri Padmavati Mahila Visvavidyalayam Act of 1983, which has come into force on the 14 of April 1983.It was started with ten faculties and 300 students and twenty staff members. Today the University has a student population nearly 4000 and an academic staff of 105 and 131 academic consultants.

Objectives of study

1. To look into the information search habits of Faculty Members and Research Scholars and PG Students using ICT facilities.
2. To study the knowledge of Faculty Members, Research Scholars and PG Students

in use of E- Shodh Sindhu Consortium

3. To know whether there is essential cooperation in terms of user orientation is available to the faculty members, PG Students and research scholars to use E-Shodh Sindhu Consortium.
4. To know regarding frequency of usage of E-Shodh Sindhu
4. To know the purpose of usage of E-Shodh Sindhu
5. To know about level of satisfaction in using E-Shodh Sindh
6. To identify the problems in facing E-Shodh Sindhu

Review of Literature

1) Liaol conducted a study on information seeking behavior of agricultural researchers as teachers in Taiwan. He investigated that the critical ways for the teachers to get needed Literature and the use pattern of information sources is primarily the primary sources of information

2) Majid2 and Tan investigated the information needs and information seeking behavior of Computer engineering undergraduate students at Nanyang Technological University (NTU), Singapore. The purpose was to investigate the types of information sources used by the students, the information formats they preferred, the importance of and reasons for using certain Information sources and the use of various electronic information sources. A questionnaire was Distributed to 200 randomly selected students and 102 completed questionnaires were returned. The study found that printed materials were the most preferred information format among the Students. The top five most preferred information sources, in the order of importance, were Books, lecturers, the Internet, friends and manuals. Unexpectedly, the use of databases and Electronic journals were quite low among the computer engineering students. The study Recommends a promotional campaign for introducing electronic information

3) Sbeba4 discusses agricultural information seeking behavior and use patterns among the African farmers and extension workers. Study suggests for establishment of agricultural Advisory board comprising both librarians and extension workers to make extensive use of Non book material as a means to overcome the handicap of illiteracy among farmers.

4) UNESCO (1998) observed that the rapid breakthrough in new information and Communication technologies would further change the way knowledge was developed, acquired and delivered. It was also important to note that the new technologies have offered opportunities to innovate on course content and teaching methods and to widen access to higher learning.

Methodology and Limitations

As discussed above, the present study was confined to Sri Padmavathi Mahila University. 2301 post- graduate students, 483 research scholars are studying in the University. Further there are more than 231 Faculty members working in the university. Due to the limited time frame, a sample survey random

Technique used questionnaire method was adopted. Total 50 questionnaires were distributed to the faculty members and of which 40 faculty members were responded to the survey. Further, of the 100 research scholars to whom questionnaires were distributed, only 55 were responded to the present study, further 125 PG Students were distributed and 76 responded. The collected primary data is analyzed and discussed under.

Data Analysis and Interpretation

The data collected by the questionnaires were analyzed and Interpreted and present in Tables & Figures

Table 1 Distribution of Respondents

S.No	Questionnaires distributed	Questionnaires received	Percentage
Faculty	75	40	53.33%
Research Scholars	100	55	55.00%
PG Students	145	76	52.00%

The study of data in Table 1 shows that 75 Questionnaires distributed among faculty members and 40 Questionnaires were received that amount to percentage of 53.33 %. 100 Questionnaires were distributed among research scholars which include both full time and part time and 55 Questionnaires were received that amount to 55 % and 145 Questionnaires were distributed and 76 received which amount to 52.00%.

Table 2 Internet Skills

S.No	Very Good	Fair	Uncertain	Total
Faculty	37(92.5%)	2(.05%)	1(.025%)	40
Research Scholars	40(72.0%)	12(21%)	3(.05%)	55
PG Students	45(59%)	20(26%)	11(14%)	76

The study of data in Table 2 describe 92.5 % of faculty had very good Internet Skills .05% are fair and .02 % are uncertain. Regarding Internet skills for scholars 72 % had very good Internet Skills 21 % were fair and .05 % were uncertain with their internet skills. Regarding PG Students.

Table 3 Awareness on E-ShodhSindhu

S.No	Faculty	Research Scholars	PG Students
Yes	37 (92.5%)	52(94%)	30(39%)
No	03(0.075%)	03(0.05%)	46(60%)
Total	40	55	76

Table 3 tells regarding awareness on E-Shodh Sindhu. 92.5 % faculty had awareness on E-Shodh Sindhu, 94% Scholars had awareness on E-Shodh Sindhu. 39 % of PG Students have awareness on E-Shodh Sindhu.

Table 4 Frequency of use of E-Shodh Sindhu

Library Visit	Faculty	Research Scholars	PG Students
Daily	3 (7.5%)	25 (45%)	06(7%)
Twice a Week	09(22.5%)	07(12.7%)	25(32%)
once a Week	15(37.5%)	08(14.5%)	15(19.7%)
Once in fortnight	13(32.5%)	15(27%)	30(39%)
Total	40	55	76

Table 4 shows that 45% of Research Scholars visit library daily, 32 % of PG Students visit library twice a week 37.5% of faculty visits library once a week, 39 % of PG Students visit library once in a fortnight.

Table 5 Search preference of respondents

Search Preference of Respondents	Faculty	Research Scholars	PG Students
Author	15(37%)	5(9%)	14(18%)
Title	19(47%)	15(27%)	28(36%)
Subject	8(20%)	20(36%)	15(19%)
Keyword	7(17%)	10(18%)	13(17%)
Publisher	1(.025)	5(9%)	06(7%)
Total	40	55	76

Table 5 explains that 37% of faculty search by author, 47% of faculty search by Title, 36% of research scholars search by subject, 18% of research scholars search by key word, 9% of research scholars search by publisher. Here we took only majority of respondents among different variables.

Table 6 Purpose of using E-Shodh Sindhu

Purpose	Faculty	Research Scholars	PG Students
To keep abreast with the latest developments	5(12.5%)	7(12.7%)	5(6.5%)
For research work	11(27.5%)	19(34.5%)	15(19.7%)
For prepare research article	18(45%)	18(32.7%)	21(27.6%)
For seminar, workshop, presentation	6(15%)	13(23.6%)	35(46%)
Total	40	55	76

Table 6 explain us 45% of faculty use E-Shodh Sindhu for writing research article, 34.7% of Research scholars use E-Shodh Sindhu for research work, 46% of PG Students use for seminar, workshop and presentation.

Table 9 Opinion towards E-Shodh Sindhu Consortia Resources

Opinion	Faculty	Research Scholars	PG Students
Excellent	6(15%)	13(23.6%)	15(19.7%)
Very Good	11(27.5%)	7(12.7%)	5(6.5%)
Good	5(12.5%)	19(34.5%)	21(27.6%)
Poor	18(45%)	18(32.7%)	35(46%)
Total	40	55	76

Table 8 explain us respondents view while using E-Shodh Sindhu 23.6% of Research Scholars view as Excellent, 27.5% faculty view it as very good while 32.7% Research scholars view it as good while 46% PG Students express their view as Poor.

Findings

1) While responding to present study research scholars have shown more interest55%
2) It is found that faculty had excellent Internet skills and majority of students are uncertain while using Internet.
3) Research scholars are more aware regarding awareness on E-Shodh Sindhu
4) Majority of research scholars use E-Shodh Sindhu on daily basis while majority off aculty use it as twice aweek
5) Majority of faculty search by title while scholars search by subject and PG Students by Title only.
6) Faculty use E-Shodh Sindhu for preparation of Article, Scholars uses it for research work while students use it for seminars and presentation.
7) Regarding popularity faculty, scholars and PG Students use Springer link,
8) Problems while accessing E-Shodh Sindhu faculty responds to Lack of sufficient Internet nodes in University Library, scholars respond to Slow Internet bandwidth, PG Students to Lack of knowledge to use.
9) With regard to E-Shodh Sindhu Consortia Resources faculty have poor opinion, scholars & PG Students had good in opinion.

Conclusion

E-Shodh Sindhu not only reduces budgetary expenses of various university libraries but also increases quality of producing articles and research production. It is highly recommended for sufficient training programmes on continuous basis for every academic year. Respondents recommended inclusion of some publishers in databases.

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BIOPLASTICS AND THE DAWN OF NEW MATERIALS- A REVIEW

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"**Bioplastics are the workhorse material** of the modern economy"

ABSTRACT

Plasticsthat have been universally used in our daily lives are now causing serious environmental problems. Petroleum derived plastics dominate the packaging industry even today. It accounts for the largest usage of plastics worldwide and is used in numerous applications.Millions of tons of these non- degradable plastics accumulate in the environment each year. Bioplastics are a suitable alternative to petroleumbased plastics. They are highly complex and sophisticated materials that can help make plastic products more sustainable and eco-friendly. Bioplastics today are a large family of materials with differing properties and applications. The review is an attempt to investigate the facts about different types of bioplastics, their current status, major advantages and other related issues.

Key words: Bio-plastics, Petro-plastics, Sustainability

INTRODUCTION:

Plastics have become a vital part of our life.The environmental crisis arising from the use of petroleum based non-degradable plastics led the globe to find alternatives. Biomaterial based plastic is one such alternative.They comprise bio-based materials featuring identical properties compared to their fossil-based versions as well as new materials featuring additional properties. These add-on qualities like biodegradabilityand bio-based property can reduce the impact on environment significantly.Moreover, the emission of greenhouse gases during production and degradation of bioplastics is very low when compared to conventional plastics.

BIOPLASTICS: THE NOVEL MATERIALS

Bioplasticsare novel materials of 21st century and would be of great importance to the material world (Mohanty etal.,2002).The keen interest in bioplastics started way back in early 20th century when Henry Ford usedcorn and soybean oils to manufacture his automotive parts (Stevens E.S.,2003). Bioplastics are made from a number of renewable resources such as plant oils, cellulose, starches, sugars, carbohydrates, bacteria and algae. Bioplastics are not single substances; they comprise of a whole family of materials with differing properties and applications. According to European Bioplastics,a plastic material is defined as a bioplastic, if it is either bio-based orbiodegradableor features both the properties(Eu.Bio.,2016). Bioplastics are eco-friendly alternative to traditional plastics and are extracted from renewable resources like corn, sugarcane, cellulose, potato or starch. These are 100% degradable, equally resistant and versatile, already used in agriculture, textile industry, medicine and forpackaging.

CLASSIFICATIONOF BIOPLASTICS:

The world of bioplastics has exploded, and there is an amazing breadth of materials that can be classified as bioplastics. The term bioplastic refers to several groups of plastics namely bio-based plastics(from renewable resources) and bio-degradable including compostable plastics.

Biobased plastics

Biobased plastics are those that are derived from plant-based polymers, such as corn starch, sugarcane or cellulose, potatoes, rice, soy, wheat and vegetable oil and are not derived from petroleum resources.The Business-NGO (non-government organization) Working

Group for Safer Chemicals and Sustainable Materials defines bio-based bioplastics as "plastics in which 100% of the carbon is derived from renewable agricultural and forestry resources such as corn starch, soybean protein and cellulose" (Alvarezetal.,2011)

Biodegradable bioplastics

Biodegradable bioplastics are fully degraded by microorganisms without leaving any visible toxic remainders. The term "biodegradable" refers to materials that can disintegrate naturally into biogas and biomass (mostly carbon dioxide and water) as a result of being exposed to a microbial environment and humidity (Alvarezetal.,2011)

Compostable bioplastics

Compostable bioplastics will biodegrade in a compost site. Microorganisms break it down into carbon dioxide, water, inorganic compounds and biomass leaving no toxic residues.The most commonly used raw material is corn starch, which is converted into a polymer with similar properties to traditional polyethylene plastic products. Other compostable plastics available are made from potato starch, soya bean protein, cellulose as well as from petroleum and its bye products. This shows that compostable plastics may be derived from both plantbased and petroleumderived polymers.

TYPES OF BIOPLASTICS:

Bioplastics are currently used in disposable items like packaging, containers, straws, bags and bottles, and in non-disposable carpets, plastic piping, phone casings, 3-D printing, car insulation and medical implants.

A. Starch based plastics

Starch is the key raw material for bioplastics which is found in seeds and in tubers or roots of the plants. Most of the starch produced worldwide is derived from corn (Asaf,2008). Today, thermoplastic starch, accounting for about 50% to 80% of the global bioplastics market, is the most significant and widely used bioplastic.Applications of thermoplastic starch are bags, yogurt tubs, cups, plant pots, cutlery, diaper foil, coated paper and cardboard.

Polylacticacid (PLA): Polylactic acid is the polymer with the highest potential for a commercial production as bioplastic.PLA is a 100% bio-based plastic that is currently being used in packaging applications.Polylactic acid, the secondmost important bioplastic of the world in regard to consumption in volume(Garima etal). It is derived from renewable resources like corn starch or sugar cane. PLA is biodegradable and suitable for the manufacture of compostable packaging products.

ii.PSM (Plastarch Material): PSM is a biodegradable, thermoplastic resin. It is composed of starch combined with several other biodegradable materials. PSM is currently used for a wide variety of applications in the plastic market, such as food packaging and utensils, personal care items, plastic bags, temporary construction tubing, industrial foam packaging, industrial and agricultural film, window insulations, construction stakes, and in horticulture (GGP,2009-10)

iii. MATER-BI : MATER-BI is biodegradable and compostable bioplastic synthesized mainly by starches, cellulose, vegetable oils and their combinations. BIO BIG is the world"s largest brand of certified compostable bags and films made from Mater-BI (NOVAMONT)

B. Cellulose based Bioplastics: Produced using cellulose esters and cellulose derivatives.

i.Cellophane: Cellophane is made from cellulose which is biodegradable.Cellophane films can be coloured and are well known as candy wrappings. The biodegradable films are available in a wide range of grades, and they can be used to pack products ranging from cheese to coffee and chocolates (O.J.P.C.,2018).

ii.Cellulose acetate: Cellulose acetate is thermoplasticwhich is rather expensive and rarely used in packaging applications.

iii.Polybutylene succinate (PBS): Biodegradable, particularly used in packaging industry.Other applications include disposable products such as tableware or medical articles.

In agriculture, PBS finds interest in the fabrication of mulching films or delayed release of materials for pesticides and fertilizers.

C. Microbial synthesis:

I.Poly hydroxybutyrate (PHB): Poly hydroxybutyrate (PHB) is biodegradable; used in a wide variety of fields including packaging, ropes, bank notes and car parts. PHB has potential applications in a wide variety of fields such as industrial, biomedical, agricultural, domestic, and automobile.

ii.Polyhydroxyalkanoate (PHA): PHAs are polyesters produced in nature by numerous microorganisms through bacterial fermentation of sugar or lipids (Jingnanetal,2009). They are biodegradable and are used in the production of bioplastics. PHA is often used for medical applications such as sutures, slings, bone plates and skin substitutes; it is also used for single-use food packaging.

D. Synthesis from oils:

Polyamides 11: PA11 a biopolymer derived from natural oil known by the trade name Rilson B commercialized by Arkoma. It is prized for its thermal resistance that makes it valued for use in car fuel lines, pneumatic air brake tubing, electrical anti-termite cable sheathing and oil and gas flexible pipes and control fluid umbilicals(Nifisaetal.,2015).It is non biodegradable.

E. Other Biopolymers :

Polyethylene(PE): Polyethylene (PE) is a bio-based polymer generally extracted from sugar used in carry bags, films and bottles.

Polyethylene terephthalate(PET): Polyethylene terephthalate (PET) is one of the major polymers produced worldwide representing about 18 % of world polymer production and comes in third after Polyethylene and Polypropylene. It is known for its use in beverage bottles.Coca Cola introduced Plant Bottle Technology where the PET had been made from bio-based mono-ethylene glycol from sugarcane and terephthalic acid from petrochemicals.

Polyglycolic acid (PGA): This is used in medicine and specialized applications.

Polyhydroxyvalerate (PHBV): Used for films and paper coatings, with possible markets including biomedical applications and veterinary science.

Polyvinyl alcohol (PHV): Used in packaging designed to dissolve in water to release products such as laundry detergent, pesticides, and hospital washables.

Polycaprolactone(PCL): Biodegradable polyester, with low melting temperature and easily biodegradable. Widely used for mulch, seeding containers andbiomedical applications.

Poly butyrate adipate terephthalate (PBAT): PBAT is a biodegradable and compostable biopolymerandis known for its flexibility and toughness which makes it ideal for combination with other biodegradable polymers that are brittlewith high modulus and strength.Widely used in garbage bags, wrapping films, disposable plastic products.

Polyethylene furanoate(PEF) PEF, a new polymer that is expected to enter the market in 2020. PEF is made entirely from vegetable raw materials and is also recyclable. It is considered to be the packaging material of the future, particularly for food and beverages.PEF finds applications in the packaging industry for fruit juices, milk, soft drinks, fresh tea or water.

Bioplasticspackaging: Bioplastic packaging is being used extensively in a wide array of industries including textiles, consumer goods , automotive and transport sectors.In 2018, global production capacities of bioplastics amounted to about 2.11 million tons with almost 65 percent of the volume destined for the packaging market,the biggest market segment within the bioplastics industry(Euro.Bio).There is a high demand for packaging made from bioplastics to be used for wrapping organic foods as well as for premium and branded products with a particular requirement. All types of bioplastics used in packaging offer one

overcome the environmental impact.Bio-PET and PLA are the major types of bioplastics
for packaging around the world.

Advantages of Bioplastics: Bioplastic is a much younger industry than conventional c
oil plastics. Bio-based plastics often shows good performance and a better environme
footprint when compared to conventional plastics. They have a less carbon footprint
helps to save resources and reduce crude oil dependency. Bioplastics can help the pla
industry and plastics consuming brands grow more sustainably. Bioplastics and
bioeconomy overall have the potential to unite the agricultural, chemical and indus
sectors. Bioplastics and bio-economy also help to create new jobs elsewhere both within
industry as well as in the entire value chain.

Disadvantages of Bioplastics:Although bioplastics show promising potential as
alternative to conventional plastics, it is equally important to consider their drawbacks. M
people believe that bioplastics are biodegradable. This is only partially true, as so
bioplastics are biodegradable while others are not (Grabianowski,2018). Surprisingly, m
bioplastics won't degrade at all, if placed in landfill with other garbage. Although bioplas
don't result in fossil-fuel emissions, they do require large amounts of fertilizers and pestici
(Grabianowski,2018). More over Bioplastics are basically designed to be composted,
recycled. Another drawback of bioplastics is their indistinguishability. To overcome th
users must be educated about bioplastics and proper recycling techniques to discern wh
bioplastics are biodegradable and which are compostable (Creative Mechanisms Staff, 201
Further, most bioplastics require high temperatures to degrade, and most cities lack t
infrastructure for proper bioplastic composting. As a result, many bioplastics end up in t
trash, are deprived of oxygen, and release harmful methane into the environment (Ch
2017).Waste collection and resource management needs to be standardized along with t
packaging industry to create some synchronized systems for waste to resource managemer
Bioplastics are often produced from genetically modified food crops such as corn, potatoe
and soybeans, a practice that carries a high risk of contaminating our food supply. Also, co
and soybean producers typically apply large amounts of chemical pesticides and fertilize
that pollute our air and water.

Innovations in the field of Bioplastics continues –

- Researchers around the world continue to develop greener varieties of Bioplastics th
can be more effectively reduce plastic pollution and the carbon footprint.
- More durable bioplastics are being designed for automotive,electronics and consume
goods such as Electrolux's new refrigerator made from corn and sugarcane bioplasti
material.
- Newer bioplastics are being made in laboratories from straw, wood chips and foo
waste.
- Bioplastics can be genetically engineered from Pseudomonas by the mutation of som
of the genes involved in the β-oxidation pathway.

Conclusion: Even though the production of bioplastics is costly, their applicationsare o
interest owing to the drawbacks of conventional plastics.Industrial progress in packaging
technology in future appears to be moving towards newer breed of bio-materials. The trend i
to maximize the production of bioplastics by enhancing the properties of bioplastics
producing microorganisms, plants and algae. It is clear that bioplastics can reduce many o
the environmental problems posed by the conventional plastics.

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BIODEGRADABLE PLASTICS –AN OVERVIEW

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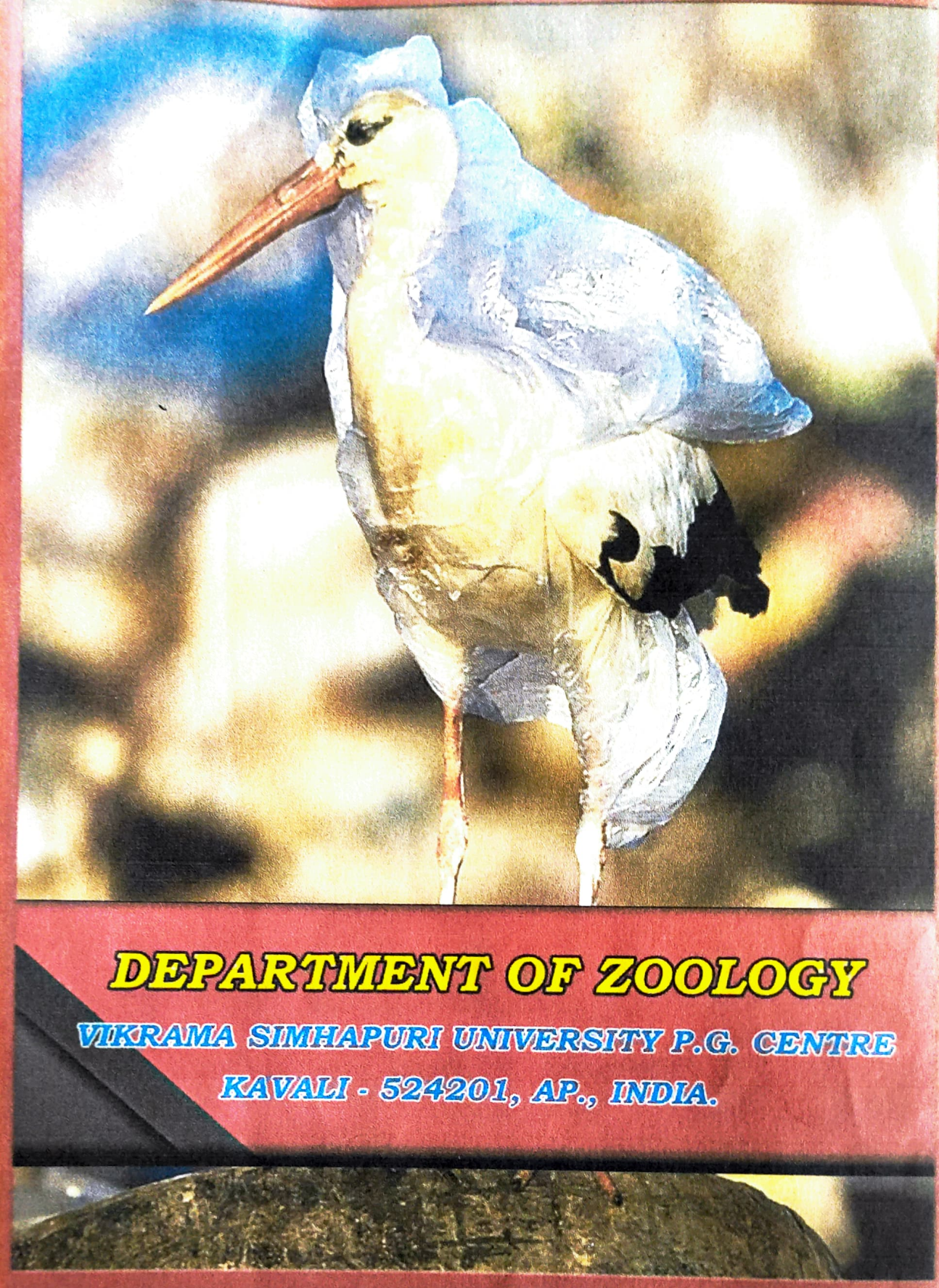
ABSTRACT

Plastics are synthetic or semi-synthetic materials which are typically polymers of high molecular mass obtained from petroleum and natural gas. Bioplastic is the universal term for polymers made of renewable biomass sources. Bioplastics are an alternative to traditional plastics. As a consequence, bioplastic is biodegradable in about 180 days in opposition to traditional plastics, which remain in the environment for 500 to 1000 years. Bioplastics are made of different sources of biomass, such as corn or potato starch and cellulose. These substances are naturally produced by plants. Biodegradable plastics are the type of plastics that undergo decomposition over a period of time under composting conditions. The global biodegradable plastics market accounts for less than 1% of the overall plastics market, however, it is expected to grow at a fast pace over the next 5 years. Organic



DEPARTMENT OF ZOOLOGY

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BOOKS/CHAPTERS/VOLUMES

INDIA VIETNAM

DEFENCE, STRATEGIC AND ECONOMIC COOPERATION

JAYACHANDRA REDDY G
RAMESH BABU V

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6

Trends in India's Trade with Vietnam: An Empirical Analysis

Venkata Prasad A and Krishnamoorthy D

Abstract

India and Vietnam share close to half a century of relations with the establishment of formal diplomatic ties that began in 1972 between India and the then-North Vietnam. The relations were derived from common historical linkages as colonies of Western powers striving to achieve independence. Bilateral ties between India and Vietnam have got strengthened in recent years with a focus on regional security issues and trade. The adoption of the 'Look East Policy', imbued with the economic element, marked an important turning point in India-Vietnam economic relations. Vietnam has played an important role in India's "Act East" policy, which was enunciated as an upgrading of the earlier 'Look East Policy' and also she has been a crucial partner in sub-regional, regional and multilateral forums. The need for economic development increased the importance of bilateral economic and commercial linkages between both the countries. These efforts received fillip from regional arrangements, as for example, ASEAN-India cooperation and Mekong - Ganga Cooperation. India is Vietnam's fifth largest trading partner in ASEAN; Vietnam holds the 19th position worldwide for India, both the countries made conscious efforts to expand the areas of economic cooperation and to increase the volume of trade and investment. India's total trade comprising exports and imports skyrocketed from the abysmal level of US $0.24 billion to the magnificent level of US $12.27 billion between the years 2001 and 2017. India and Vietnam will explore "substantive and practical measures" to achieve the bilateral trade target of $15 billion by 2020. Currently, India has 182 investment projects worth US $816 million in Vietnam, while Vietnamese businesses have a mere seven projects worth some US $6 million in India. The present paper reviews the performance of India's merchandise trade with Vietnam during 2000-01 to 2015-16 on the basis of the data released by the Ministry of Commerce and Industry, Government of India.

Key Words: ASEAN, Trade, Growth Rates, Commodity and Act East Policy

జంతుశాస్త్రం

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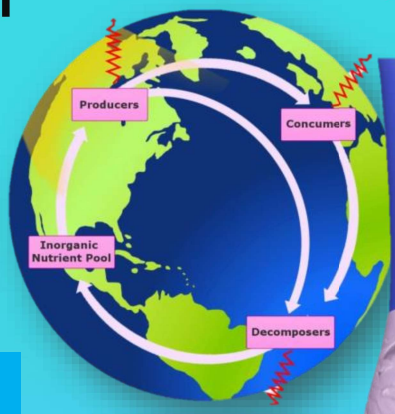

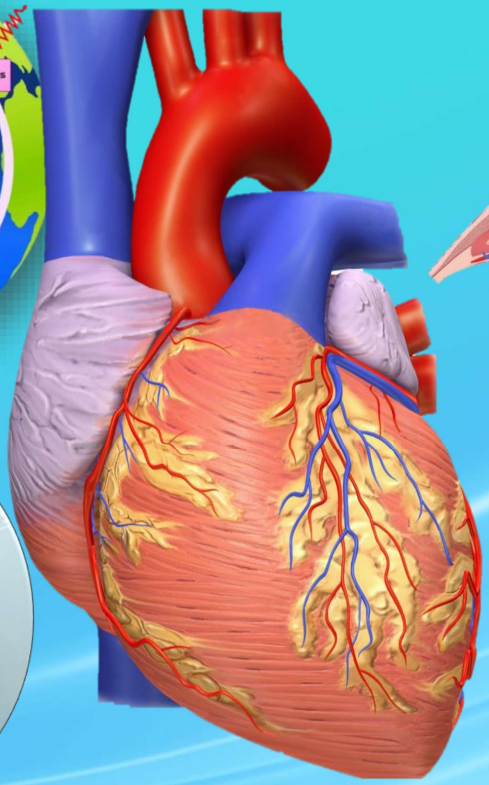

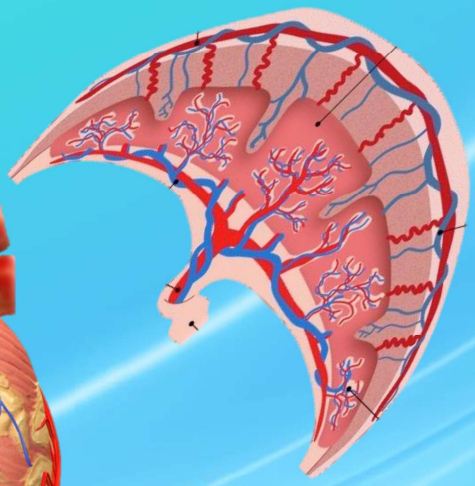

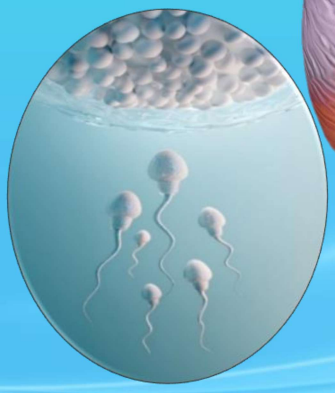

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శ్రీనివాస్ - చక్రపాణి -అనీల్ కుమార్

కూర్పు

డా.యస్. శ్రీనివాస్

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అకడమిక్ ఆఫీసర్, APSCHE, విజయవాడ

Dr . C. KRISHNA M.Sc., Tech., NET, Ph.D.
Regional Joint Director of Collegiate Education (FAC) Zone I & II,
& **Principal P R Government College (Autonomous), Kakinada**

It gives me immense pleasure to release this e-content for Telugu medium students of IV semester Zoology.

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I take this opportunity to congratulate the Zoology Departments of P R Government College (Autonomous), Kakinada and PRR & VS Government Degree College, Vidavaluru for this wonderful initiative.

This e – Book will be of great help to the students for preparation to the examinations.

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This compilation will be of great help to the students.

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I congratulate the Dr N. Sreenivas, Lecturer in Zoology, Department of P R Government College (Autonomous), Kakinada and Dr I. S. Chakrapani, Lecturer in Zoology PRR & VS Government Degree College, Vidavaluru for this good initiative.

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Students of both colleges and other colleges will be benefitted with this e - book to a maximum extent.

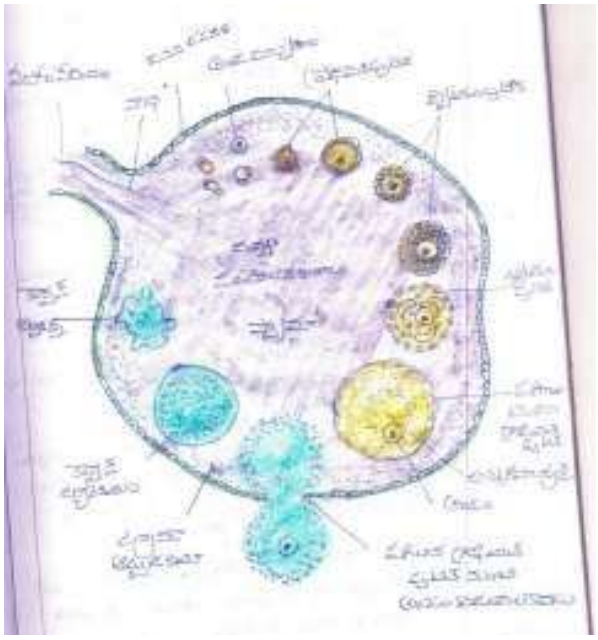
B. AHMAD ALI BABA

పిండోత్పత్తి శాస్త్రం

అండజననం (Oogenesis)

స్త్రీబీజకోశం నిర్మాణం

అండజననం అండాశయంలో జరుగుతుంది. అండ మాతృకణాల నుంచి అండాలు ఏర్పడే విధానాన్ని అండ జననం అంటారు. సకశేరుకాలలో ఒక జత స్త్రీ బీజకోశాలు (అండాశయాలు) ఉదర కుహరంలో పృష్ఠ దేహ కుడ్య ప్రాంతంలో అతికి ఉంటాయి. పక్షులలో ఎడమ స్త్రీ బీజకోశం మాత్రం ఉంటుంది. మానవులలో స్త్రీ జీవి రెండు X క్రోమోజోమ్ ల కలయికవల్ల ఏర్పడుతుంది. X క్రోమోజోమ్ పై TDF కారకం లోపించడంవల్ల పిండాభివృద్ధి సమయంలో బీజకోశ వల్కలం (Gonadal cortex) స్త్రీ బీజకోశంగా విభేదనం చెందుతుంది. స్త్రీ బీజకోశం ఏర్పడిన సమయంలో ప్రాథమిక బీజ కణాలు (Primordial Germ cells) స్త్రీ బీజకోశం/అండాశయంలోకి వలస చెందుతాయి. పిండాభివృద్ధి సమయంలో స్త్రీ బీజకోశం అభివృద్ధి చెందుతుంది. స్త్రీ బీజకోశం వెలుపల ఉపకళా కణాలతో కూడిన ఒక స్తరం ఏర్పడుతుంది. ఈ స్తరంలోని కణాలను <u>జనన ఉపకళాకణాలు (Germinal epithelial cells) అంటారు</u>. అండాశయంలోని మిగిలిన లోపలి ప్రాంతం సంయోజక కణజాలంతో నింపబడుతుంది. <u>దీన్ని స్ట్రోమా అంటారు</u>. జనన ఉపకళాకణాలు సమ విభజన చెందడం ద్వారా ఏర్పడే కొత్త కణాలు స్ట్రోమాలో చిన్న చిన్న గుంపులుగా ఏర్పడతాయి. ఒక్కొక్క గుంపును **<u>గ్రాఫియన్ పుటిక</u>** (Graffian follicle) గా పిలుస్తారు. ఒక గ్రాఫియన్ పుటికలో **బాగా అభివృద్ధి** చెందిన ఒక కణం అండ మాతృకణం (Oogonium) గా ఏర్పడుతుంది. మిగిలిన కణాలు పుటికాకణాలుగా ఉండి అభివృద్ధి చెందే అండానికి పోషక పదార్థాలను అందచేస్తాయి. అండ మాతృకణం విభజనలోకి ప్రవేశించడం ద్వారా ప్రాథమిక అండమాతృకణాలు (Primary oocytes)గా ఏర్పడతాయి.



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విడవలూరు, నెల్లూరు జిల్లా

డా.పి. అనీల్ కుమార్

జంతుశాస్త్ర అధ్యాపకులు &

ఆకడమిక్ ఆఫీసర్

APSCHE, అమరావతి, విజయవాడ

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Emerging Trends in Nanotechnology

Innovations, Health and Risks

S. Janardana Reddy

AGROBIOS

Contents

8

A Critical Review on Potent Prospects of Biogenic Metallic Nanoparticles in Cancer Therapy

N. RAVI KUMAR[1] K. VASAVI[2], A. T. VENKATRAMANAREDDY[1], G. L. N. PRASAD[3], I. S. CHAKRAPANI[4], N. NAGA RAJU[5] AND M. RAJASEKHAR[6]*

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ABSTRACT

Cancer is one of the deadliest diseases all over the globe, causing social and economic inequalities among people. The incidence is being increased each year and diagnosed with different types of cancers with drug resistance followed by metastasis. Many cancer cells have type specific cancer protein all over their surface, which is lacking in normal cells. The nanoparticles like metal, Biogenic metal and other types conjugate or bind to the cancer cells and helps to increase the specific antibodies to unravel the treatment mechanisms. Many works indicate that the nanoparticles help in drug delivery systems as a result unique cancer treatment will be enabled. Therefore, nanotherapeutics is rapidly developing in cancer treatment, diagnostics, biomarker identification, detection of multiple genes and matrix RNA. The conjugated nanoparticles allow to detect cancer related proteins, resulting in to new method of analyzing proteome of each tumor

3

Biogenic Nanoparticles: A Comprehensive Review to Explore Multidrug Resistance Mechanisms among Microbes

A. VASAVI[1], N. RAVI KUMAR[1], A. T. VENKATRAMANA REDDY[2], G. L. N. PRASAD[3], I. S. CHAKRAPANI[4], AND M. RAJASEKHAR[5]*

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ABSTRACT

Microbial resistance has been an intense hindrance in preventing diseases for many decades. The rapid emergence of resistance towards several antibiotics could help the bacteria to become stronger to the existing antibiotics and becoming fatal to the mankind. This multidrug resistance is paving a challenging threat to human beings globally due to indiscriminate use of synthetic antibiotics and several other chemical compounds. Several factors have been influencing in developing resistance either by vertical or horizontal gene transfer among microbial species through different ecosystems. Microorganisms are altering genetic makeup to tackle the existing antibiotics very rapidly. Therefore, there is an urgent need to overcome this resistance and to develop new forms of antibiotics that are cost-effective, biocompatible, showing fewer side effects and a single-step fabricated approach that helps for large scale production. Biogenic mediated metallic nanoparticles became a

ABOUT THE BOOK

Nanotechnology is an emerging interdisciplinary technology that has been booming in many areas during the recent decade, including material science, mechanics, electronics, optics, medicine, plastics, energy electronics, biology, agriculture, aquaculture and aerospace.

The approaches for engineered nanomaterials are developing exponentially along with the stakeholders in government, industry and public groups of [illegible] issues. There is also growing public concern caused by negative perceptions among some high profile groups that nano-enabled products are proliferating uncontrollably and being released without adequate testing of their safety.

Many of the fine particles presently contemplated harmless are likely to acquire unique properties when condensed to a nanomolecular size and could manifest toxic biological effects. It is well known that the toxicity of engineered nanoparticles (NPs) may depend on the physical and chemical characteristics of the particles.

Nanotechnology is evolving rapidly in industrial applications, medical imaging, disease diagnosis, drug delivery, cancer treatment, and gene therapy, and also to aid in [illegible]. Nanotechnology is at the cutting edge of rapid healthcare product development as it has many potential human health benefits, but it is [illegible] for its potential human health risks.

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type. Magnetic nanoparticles are also giving exciting results for cancer detection and treatment in vivo. These Nano formulations are being used with chemotherapeutic agents to reduce the toxic side effects of conventional formulations. Therefore, nanoparticles play crucial role in arresting the cell proliferation mechanisms. Apoptotic pathways, Cell cycle pathways, phagocytic mechanism's and epigenetic pathways. In this regard, it has been opined that biogenic metal nanoparticles would overcome the obstacles of cancer treatment. Biogenic nanoparticles have displayed potential access towards the tumor cells with high specificity, smaller size, and bioavailability. Tumor cells promising response to the biogenic nanoparticles is opening a new avenue in the cancer therapy. In this review, an overview of the use of biogenic metallic nanoparticles in drug delivery and treatment of cancer has been discussed.

Keywords: Cancer, Green nanotechnology, Biogenic nanoparticles, Cancer therapy,

INTRODUCTION

Cancer has been identified as one of the lethal diseases in the world (Bray *et al.*, 2018). Cancer has been accepted as a disease of humans in which a tumor can feed, expand, and invade. Structurally tumor is a complex tissue that consists of several cells that multiply and lose control of their proliferation and evade an immune response which leads to metastasis. A tumor cell undergoes several alterations that include undefined proliferation, inhibition of apoptosis, induction of angiogenesis, evasion, and invasion of the immune response. These alterations, in turn, create instability that leads to modification in energy metabolism, genome instability, genetic diversity, and immune evasion. These manifestations considered as hallmarks of cancer. The causes of cancer can be classified broadly into external and internal factors. Exposure to the chemicals and microorganisms like viruses can trigger an internal cancer initiation (Manzoor *et al.*, 2016), while external factors include mutations in the genes, hormonal imbalances, immune system abnormalities could strategically promote the origin of carcinogenesis (Anand *et al.*, 2008). Traditionally cancer treatment involves complex methodologies. Despite the treatment practices the metastasis has been increasing day by day. Definitely the drugs which have been using in the cancer treatment should act as one of the hallmark targets for the inhibition of cancer metastasis.

For the past two decades, there has been a paradigm shift in cancer treatment and therapeutics from traditional cytotoxic drugs to the usage of novel nano drugs. Functionally targeting cancer is a multifactorial concept and has constantly been evolving from pre genomic chemotherapy to the emergence of combinational therapy (Al-Lazikani *et al.* 2012). As the existing oncotherapeutics are evicting less response, there has been an emergence of novel technologies for the enhancement of drug response.

The usage of nanotechnology is one of the recent advancements for drug therapeutics in the present century. Nanotechnology involves the engineering of the matter at the nanoscale (10^{-9} m). Nanotechnology acts as one of the best alternatives to detect even a single cancer cell in vivo and interferes with enhancing the drug delivery to the target site. Several severe side effects are involved in the treatment of cancers like chemotherapy, radiation therapy, immunotherapy, vaccination, stem cell transformation, photodynamic therapy, or the combination of the therapies. The side effects conventional cancer therapeutic agent treatment includes toxicity, limited bioavailability and fast clearance of the drug from the site of target. For instance, the commonly used chemotherapeutic drug 5- fluorouracil induces constriction of blood vessels, cardiotoxicity, and myelotoxicity (Macdonald,1999). Similarly, doxorubicin using in the cancer treatment evicts cardiotoxicity, renal toxicity, and myelotoxicity (Avilés *et al.* 1993). Keeping in view the instances of conventional cancer therapy we are exploring the biogenic metal nanotherapy, a newer approach involving the biogenic nanoparticles for cancer treatment

Nanomedicine is the newest concept of nanotechnology in which the bioengineering of materials at nanoscale for efficient disease diagnosis, drug delivery, and therapeutics. Nanomedicine employs the usage of nanomaterials like carbon nanotubes, nanoshells, nanoparticles, nanowires, and quantum dots (Jaishree and Gupta, 2012). Among the nanomaterials, metal nanoparticles stabilized with biological metabolites from plants, animals, and microbes have been occupying a good stage in the present world. In this context, we are aimed to give comprehensive glimpses of biological nanoparticles and their applications in cancer therapeutics.

ASSOCIATION OF CANCER, NANOTECHNOLOGY, PLANTS AND MICROORGANISMS

There is an emergence of the need for cancer treatment with minimum side effects in contrast to the existing conventional cancer therapies. Phytochemicals from the plants would mediate a cheaper means by employing novel strategies in interactions with the tumor cell environment (Singh *et al.* 2016). Medicinal plants showed a ray of hope for cancer treatment in terms of providing compounds that are highly specific towards the cancer cell. The green compounds, when given in small quantity similar to the nano level, were dynamic in the pharmacokinetics. The plant compounds, when capped onto the surface, noble metals, provides a higher target specificity and long run of bioavailability in the tumor environment. New approaches in nanotechnology research include drug delivery diagnosis and treatment has opened a new avenue in the cancer treatment (Klefenz, 2004). The remarkable properties of nanoparticles like size, surface area to volume made them ideal for

several biological applications (Salata, 2004). Though the synthesis of nanoparticles carried out in different ways of physical and chemical methods, biological method of synthesis has paved an alternate way in the synthesis of metal nanoparticles (Rai *et al.* 2014). Living organisms like fungi and bacteria are also used to synthesize nanoparticles, but the plant-mediated synthesis provides an eco-friendly platform devoid of using toxic and harmful chemicals. Rapid and one-time synthesis can be exploited through plant-derived synthesis. Besides different size and shape of nanoparticles are produced using plants products contrary to microorganisms (Iravani, 2011).

Nanoparticles in Cancer Therapy

Inorganic and organic nanoparticles have been using in therapeutics over a decade. Inorganic nanoparticles include iron, copper, silver, zinc, titanium. While organic nanoparticles are synthesized by conjugating with carrier molecules. They include chitosan, polylysine, liposome, *etc.* Liposome, a lipid nanoparticle is a form of vesicle-mediated carrier nanoparticle for the drug delivery at the target site.

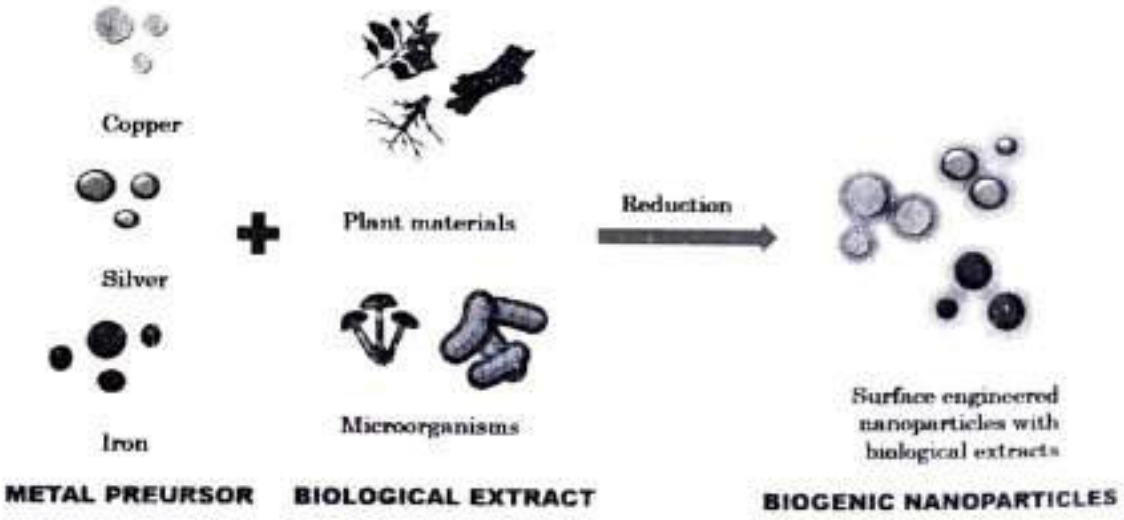

FIG. 1: Synthesis of biogenic metal nanoparticles

The commercial usage of the liposome nanoparticles has not achieved due to their instability, leakage, oxidation (Petersen *et al.* 2016). Organic nanoparticles are generally less stable due to their instability at high temperatures (Maier-Hauff *et al.* 2011). On the other hand, metallic nanoparticles showing a better alternative for cancer treatment. Herbal medicine has been in practice from the ancient days to the present. Numerous plant products were discovered to cure diseases. Phytochemical drugs act as good anti-cancer over chemical drugs and are less toxic. But the lack of targeting methods the drugs have not been achieved target specificity. The metal nanoparticles conjugated with metabolites of plant

and microbes displaying a significant result in the in-vitro treatments. These biogenic nanoparticles have a good advantage over conventional chemotherapies. Figure -1 describes the synthesis of Biogenc metal nanoparticles

Dynamics of Interactions of Nanoparticles with Cancer Cells

The nanoparticles target delivery to the cancerous cells is accomplished in two ways, either by active targeting or by passive targeting. The basic principle involved in the active targeting is the ligand-receptor efficacy. The active targeting is performed by the recognition of tumor-specific surface receptors by the nanoparticle surface ligands. The ligands that are present on the surface of nanoparticle are actively involved in binding includes peptides, sugars, antibodies, phytochemicals (Bazak *et al.* 2015; Saha *et al.* 2010). Similarly, the receptor moieties include the sugars, proteins that are exposed on the cancer cell surface (des Rieux *et al.* 2013; Yu *et al.* 2010).

Challenges are also taking place in the active targeting of nanoparticles. The biogenic nanoparticles that are targeted should be available for a longer duration towards active antigen or receptor. This prospect is being affected due to a lack of proper blood supply to the cancerous cell (Alhaddad *et al.* 2012; Klein, 2018). Attempts having been made to escape this drawback and to enhance the bioavailability and internalization of nanoparticles. The tailoring of the surface with biogenic phytochemical and microbial metabolites paves as one of the alternatives to overcome this prospect in active targeting. Encapsulation of nanoparticles with biogenic materials have increased the therapeutic efficacy and also helps in escaping the lysosomal and endosomal environment.

The lack of tumor specificity and selectivity in active targeting searched for the passive targeting of nanoparticles. Enhanced permeability and retention effect (EPR) play an essential role in passive targeting. The large-sized nanoparticles are internalized in the tumor tissues. These nanoparticle does not penetrate the tight junctions of endothelial cells and increases their plasma half-life. The abnormal vascularization of tumor tissue is exploited in selective targeting to solid tumor tissue. The nanoparticles that are accumulated enhances their concentration over time and extravasation within the tumor tissues due to a lack of efficient lymphatic drainage. This EPR based nanotherapy proves superior to oncotherapy in a selective localizing high concentration of nanoparticles in tumor tissues with minimal side effects (Greish, 2010; Swartz *et al.* 2007). Passive targeting of nanoparticles in tumor tissue was described pictorially in Figure -2 and the role of different biogenic metallic nanoparticles in cancer studies was given in Table-1.

TABLE 1: Role of biogenic metallic nanoparticles in cancer studies

Sl. No.	Metal precursor	Source of Plant/ Microorganism	Type of biological extract	Cancer cell/ Cell lines	Activity on cancer cell	Reference
1	Gold	*Curcuma longa* (Plant)	Root extract	MCF-7, MDA-MB 231	Enhanced inhibition	(Vemuri *et al.* 2019)
2	Gold	*Paracoccus haeundaensis* BC74171T (Bacteria)	Extracellular extract	HEK293, HaCaT, A549	Antiproliferative	(Patil *et al.* 2019)
3	Gold	*Halymenia dilatata* (Seaweed)	Extracellular extract	HT-29	Cytotoxic	(Vinosha *et al.* 2019)
4	Gold	*Acacia Senegal* (Gum Arabic)	Bark exudate	HepG2	Inhibitory effect	(Gamal-Eldeen *et al.* 2016)
5	Gold	Trapa natans (Plant)	Leaf extract	A431	Cytotoxic	(Saber *et al.* 2018)
6	Silver	Spinacia oleracea (Plant)	Leaf extract	C2C12	Cytotoxic	(Ramachandran *et al.* 2017)
7	Silver	Commelina nudiflora (Plant)	Leaf extract	HCT116	Reduced cell viability, increased cytotoxicity	(Kuppusamy *et al.* 2016)
8	Silver	Acalypha indica (Plant)	Leaf extract	MDA-MB-231	Cytotoxic	(Krishnaraj *et al.* 2014)
9	Silver	*Humicola* (Fungus)	Extracellular	MDA-MB-231	Cytotoxic	(Syed *et al.* 2013)
10	Silver	*Vitex negundo* L (Plant)	Leaf extract	HCT15	Cytotoxic	(Prabhu *et al.* 2013)
11	Silver	Citrullus colocynthis (Plant)	Callus extract	HEp-2	Reduced cell viability	(KS *et al.* 2011)

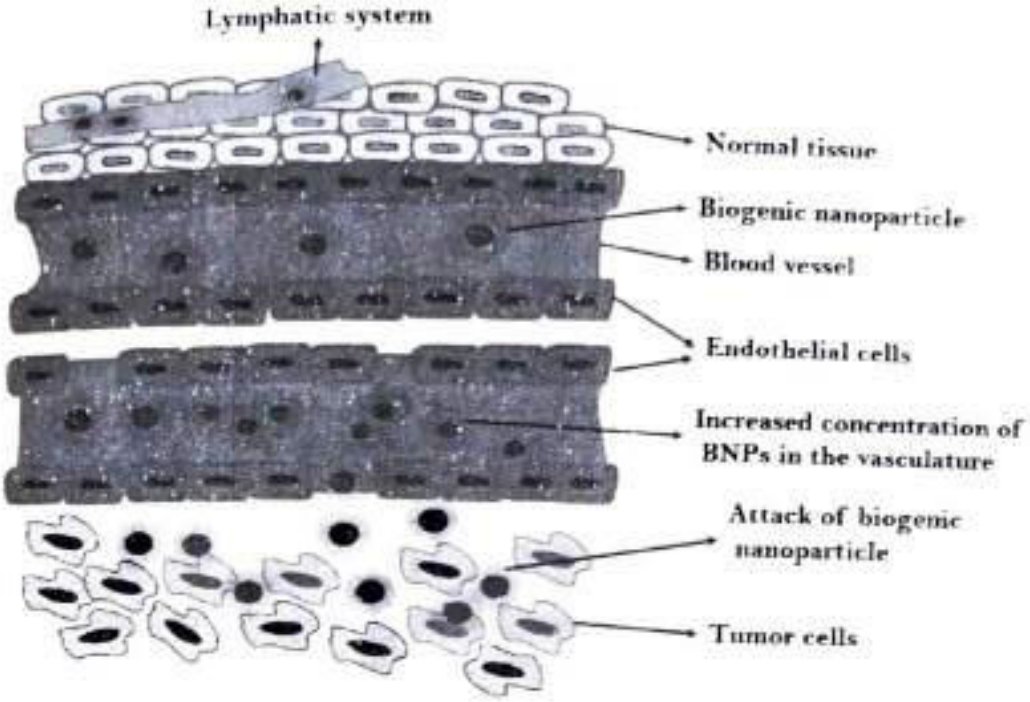

FIG. 2: Passive targeting of nanoparticles in tumor tissue

Biogenic Gold Nanoparticles in Cancer Therapeutics

Gold nanoparticles are excellent nanoparticles with remarkable absorption capacity and scattering of light. The gold nanoparticle can convert optical energy into heat energy through non-radiative electron relaxation dynamics. The surface of the gold nanoparticle can be easily tailored and have remarkable stability and biocompatibility. They can be easily functionalized with high drug loads and less toxicity. AuNPs can be synthesized in the shape of a solid sphere, shell, cage, rods, and chains (Karathanasis and Ghaghada, 2016). As the nanoparticles are water-soluble and biocompatible drugs can be quickly delivered to the target site. From the favorable surface characteristics and fewer toxicity mechanisms, gold nanoparticles can be efficiently targeted to cancer cells, ligands, and malignant cells only be in disturbed.

The primary reason for considering nanoparticles in cancer therapies is selectively functionalizing the surface to deliver the drug to the tumor. To accomplish the functionalizing of the AuNP, the functionalizing agent should be attached to the surface layer. However, the feasible and maximum surface should be provided to advantage the surface volume ratio. Smaller, spherical nanoparticles have more surface area than the larger nanoparticles. As the radius decreases surface volume increases. Gold nanoparticles comprise numerous applications in medicine like medicals devices (Hashimoto *et al.* 2013), cancer stem cell therapy (Shen *et*

al. 2016), and biosensors (Sattarahmady *et al.* 2016).

The cancer cell inhibition was exhibited by chitosan biogenic nanoparticles. There was a lower level of cell viability of MCF-7 breast cancer cell lines when treated with biogenic chitosan conjugated gold nanoparticles (Bilal *et al.* 2019). *Mangifera indica* seed extract mediate synthesized gold nanoparticle study observed the suppression of gastric tumors (Vimalraj *et al.* 2018). Pollen extracts of *Phoenix dactylifera* (Date Palm) acted as good conjugates of gold nanoparticle (DPP-GNPS) for the treatment of human breast adenocarcinoma cells. MCF-7 breast cell lines displayed an apoptotic cell death invitro when incubated with the date palm gold nanoparticles. The apoptotic death was due to the modulation of pro-apoptotic protein p53 and anti-apoptotic protein Bcl-2(Banu *et al.* 2018). The Au NPs synthesized using tea leaves have effectively internalized into prostate and breast cancer cell lines (Nune *et al.* 2009). The mechanism of action of Biogenic nanoparticles was described in Figure-3.

The studies on the possible pathway elucidation for MCF-7 breast cancer cell line inhibition by Ferulago angulate leaves hexane (extract FAHE) demonstrated that flow cytometric analysis of annexin-V induced the apoptosis of MCF-7 (Karimian *et al.* 2014). It also further revealed that MCF-7 cells were arrested in the G1 phase of the cell cycle and suppressed by an intrinsic apoptotic pathway.

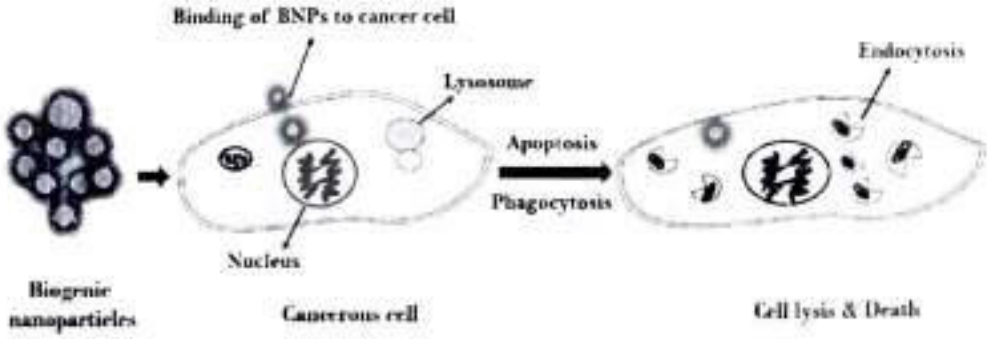

FIG. 3: Attack of biogenic nanoparticles on cancer cell

Biogenic Silver Nanoparticles in Cancer Therapeutics

Biogenic silver nanoparticles are fabricated by using eco-friendly, nontoxic chemicals, and biodegradable polymers. The phytoconstituents include polyphenols (Nadagouda and Varma, 2008), polysaccharides (Huang and Yang, 2004), polymetalates (Troupis *et al.* 2002), etc., These acts as both reducing agents and capping agents and stabilize the silver ion into a colloidal silver nanoparticle (Nguyen *et al.* 2019). Silver has been using by the humankind since from the ancient days as in the

form of utensils and in the Ayurveda for treating ailments. The silver nanoparticles were acted as effective antimicrobials in ancient times (Wu *et al.* 2016). In the recent century usage of silver has been increasing in broad range of applications like dietary supplements, immune-boosting, sanitizing sprays (Rogers *et al.* 2018; Wasukan *et al.* 2015). Among metal nanoparticles, silver nanoparticles harbored with many attractive features that help in the usage of biology and medicine (Ullah Khan *et al.* 2018). The recent approaches of eco-friendly synthesis of silver nanoparticles not only add green-biogenic flavor but also helps as a new platform for cancer cell therapies.

The polysaccharide, Galactomannan isolated from the Punica granatum fruit, was conjugated with silver in preparing silver nanoparticles. The silver nanoparticles were stabilized by the capping agents as colloidal particles. This polysaccharide mediated silver nanoparticles displayed enhanced and selective cytotoxicity on human adenocarcinoma, colorectal carcinoma. The possible mechanism for the cytotoxicity was by the involvement of caspase-mediated cell death (Padinjarathil *et al.* 2018). Bilal *et al.* (2019) investigations on MCF-7 breast cancer cells revealed that biogenic silver nanoparticles synthesized from *Convolvulus arvensis* extract were inhibiting the MCF-7 cells. It also showed that C-AgNPs also inhibited the log phases of *S. aureus* and *E. coli*. The work of Rolim *et al.* (2019) exhibited the green tea extract mediated silver nanoparticles were effectively inhibiting cancer cell lines. Further, the size of the biogenic nanoparticle also a vital role in cancer therapy. Small size (10-30 nm) and spherical biogenic nanoparticles from the tea extract stabilization displayed the synergetic cytotoxic effect against the human leukemia cell lines (MoLT-4) and breast cancer cell lines (MCF-7) (Yadav and Mendhulkar, 2018). The biogenic potentiality of silver nanoparticles on lung cancer was also highly efficient. Apoptotic pathways were displayed when *Artemisia oliveriana* extract tailored silver nanoparticles were given to lung cancer cell lines (A549). The A549 cellular uptake showed substantial expression of apoptotic genes such as Bax, Bcl-2, caspase-3, caspase-9, and miR-192 (Fard *et al.* 2018). The observation of biogenic silver nanoparticles from the extracts of *Leptolyngbya* strain JSC-1 on HeLa cell line displayed the inhibition of cancerous cells due to the induction of apoptosis. (Zada *et al.* 2018). The biogenic nanoparticles were multifunctional besides inhibiting the cancer cell lines. The biogenic nanoparticles capped with the root extract of *Phoenix dactylifera* were significantly reduced the cell viability of MCF-7 breast cancer cell lines. They also exhibited the multifunction of biogenic silver nanoparticles by inhibiting the bacterial growth also (Oves *et al.* 2018). Phytochemicals capped on the biogenic nanoparticles from *Olax nana* Wall. ex Benth were also multifunctional. The stabilized O-AgNPs demonstrated theranostic properties towards red blood cells and macrophages (Oves *et al.* 2018). Eco-friendly stabilized silver nanoparticles from the extracts of *Rhynchosia suaveolens* demonstrated dose-dependent inhibition of variety of cancer

cell lines like human prostate carcinoma cell line (PC-3), human ovarian carcinoma cells (SKOV3), human lung adenocarcinoma cell line (A549) by the elevation of caspase -3 and caspase-7 activity (Bethu *et al.* 2018). Attempting the *Calotropis gigantean* capped silver nanoparticles against Ehrlich's ascites carcinoma (EAC) exhibited the inhibition of EAC cell line by upregulating Bax and caspase-3 genes along with the downregulation of Bcl-2 gene (Maity *et al.* 2018).

Further fungal extracts also act an as good stabilizing agents for the synthesis of biogenic silver nanoparticles. Novel fungus *Piriformospora indica* extracts showed excellent capping activity towards the formation of P-AgNPs. The studies demonstrated high cytotoxicity against MCF-7, HeLa, HepG2 cell lines (Aziz *et al.* 2019). *Aspergillus niger* extract stabilized silver nanoparticles against the colon cancer cell line, HT-29 revealed that the spherical nanoparticles were potentially cytotoxic by induction of caspase-3 apoptotic pathway (Chengzheng *et al.* 2018).

LIMITATIONS OF BIOGENIC NANOPARTICLES IN CANCER NANOTHERAPY

1. Toxicity of biogenic nanoparticles invivo

Metallic nanoparticles as synthesized from the green chemistry; their interaction varies in vitro and invivo. Pure metals like silver, gold, and copper were used in traditional medicinal practices since ancient times, the history of ayurvedic medicine revealed the use of silver, gold as potent therapeutic agents (Nowack *et al.* 2011). However, toxicity, side effects, bioavailability, membrane susceptibility should be thoroughly assessed before using on human beings. Most of the nanoparticles, including biogenic nanoparticles showing minimum to moderate toxicity when treated on animal models. The toxicity of metal nanoparticles invivo would mainly be tracked to size, concentration, and morphology (Minai *et al.* 2013; Stensberg *et al.* 2011). Moreover, in nanotechnology, the nano-bio interfaces play a crucial role in cancer therapeutics. Nanoparticles should be primarily checked with single protein coronas like bovine serum albumin, tubulin, human serum albumin and as well as with complex protein coronas like yeast extract proteins, fetal bovine serum albumin (Durán *et al.* 2015).

2. Biological clearance and bioavailability

The metallic nanoparticles, when introduced in vivo, their kinetics have a significant concern in the removal. Micelles and polymeric nanoparticles are easily driven away from the organs in a short time, while the metal nanoparticles are looking more time for the clearance from the body (Zhou *et al.* 2011). The studies of biogenic nanoparticles clearance were highly effective in the renal cells. Glutathione coated biogenic nanoparticles

were cleared through urination. The bioavailability of the biogenic metal nanoparticles contrasts with the typical metallic nanoparticles, and their degree of bioavailability is attributed to high and low respectively. However, the detailed mechanism of clearance and biodegradable pathways is still unclear and needs further investigations before going to clinical studies (Rengan *et al.* 2015).

CONCLUSION

The biocompatibility of nanoparticles has been exploring in the decade. Studies on the biogenic nanoparticles reported both positive and negative ways. Most of the studies *in-vitro* and reported the nontoxic levels in cell lines and biogenic nanoparticles acted as reducing agents on the growth of cancer cell lines through a mechanistic approach of apoptosis. The stimulation of the apoptotic pathway exerted the apoptotic protease caspase-3, upregulated the p53 pathway, and also elevated the sub-G1 arrest (Mukherjee *et al.* 2014). The acidic environment around the tumor tissues might have attracted the biogenic nanoparticles towards the cancerous tissue and involvement of releasing of phytoconstituents from the green colloidal nanoparticles (Gurunathan *et al.* 2013; Mukherjee *et al.* 2014). On the other hand, in vivo studies of biogenic metal nanoparticles revealed toxic levels to the treated individuals. The bioavailability, clearance of the metals would play a crucial role either in elevating or diminishing the toxicity. More studies to be conducted in reducing the harmfulness *in vivo* before going to the clinical trials.

For the past few years, the use of nanoparticles in cancer therapeutics is being increased. A report from the article "Nanotechnology Market Outlook 2020" forecasted the global nanotechnology market would reach high by 2020 (Anon, 2020). If the barriers of the biogenic nanoparticles are reduced, there will be a definite increase in utilizing the biogenic nanoparticles in the tumor treatments. It would certainly create a new era in cancer therapeutics.

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2021-22

BOOKS/CHAPTERS/VOLUMES

Recent Updates on the Bioactive Compounds of Ginger (*Zingiber officinale*) on Cancer: A Study with Special Emphasis of Gingerol and Its Anticancer Potential

Effect of Ginger and Its Compounds in Cancer Subjects

Handbook of Oxidative Stress in Cancer: Therapeutic Aspects pp 1-18 | Cite as

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Abstract

Medicinal plants have been used as therapeutic agents since the origin of mankind. Many medicinal plants like *Tinospora cordifolia, Andrographis paniculata, Curcuma longa, Withania somnifera, Zingiber officinale,* etc. are used to treat cancer. Ginger is reported to show anticancer effect in many cancer types like liver cancer, gastric cancer, oral cancer, prostate cancer, breast cancer, and ovarian cancers in animal models and cell lines. To date, over 400 bioactive compounds have been identified in ginger, they are gingerols, shogaols, and paradols. These compounds possess antioxidant, anti-inflammatory, antimicrobial, and anticancer properties. Gingerol especially shows anticancer effects in different cancer subjects. Gingerol

may act on the TNF-α, IL-6, NF-κB, cyclooxygenase-2 (COX-2), and caspase-3, and other tumor-metabolic pathway factors in the prevention of cancer. We hope that this chapter will attract more attention on ginger's therapeutic potential and impact on cancer subjects.

Keywords

Ginger Bioactive compounds Gingerol Cancer

Introduction

The biological term cancer refers to a set of diseases in which the cells of an organ or tissue split uncontrollably and acquire the ability to attack other tissues. Cancer is a global health problem, and it is the top cause of deaths in the world. Cancer occurs through the mutations by stepwise process which results in malignancies. Metastasis is the process whereby cancer cells rupture from a malignant tumor and travel to and invade other tissues in the body (Butt and Sultan 2009).

The most common types of cancer are liver cancer, esophageal cancer, breast cancer, oral cancer, lung cancer, prostate cancer, ovarian cancer, and stomach cancer. According to GLOBOCAN 2020 database in 2020, there were 19.1 million new cases of cancer and 10 million deaths from cancer worldwide, and the new cases will be upto 20 million globally by 2025 (Ferlay et al. 2019). The principle malignant conditions of the cancer are breast cancer (2.26 million cases), lung cancer (2.20 million cases), stomach cancer (1.08 million cases), liver cancer (0.90 million cases), esophagus cancer (0.60 million cases), pancreatic cancer (0.49 million cases), and colorectum cancer (0.73 million cases) in 2020 (Table 1).

Table 1

New cancer cases and deaths as per global cancer statistics 2020

S. no	Cancer type	No of cases (2020)	No of deaths
1.	Breast cancer	2,261,419	684,996
2.	Lung cancer	2,206,771	1,796,144
3.	Prostate cancer	1,414,259	375,304
4.	Skin cancer	1,198,073	63,731
5.	Colon cancer	1,148,515	576,858
6.	Liver cancer	905,677	830,180
7.	Cervical cancer	604,127	341,831
8.	Esophageal cancer	604,100	544,076
9.	Thyroid cancer	586,202	43,646
10.	Pancreatic cancer	495,773	466,003
11.	Leukemia	474,519	311,594
12.	Kidney	431,288	179,368
13.	Oral cancer	377,713	177,757

India has 1.32 lakh new cancer cases in 2020, also the lowest rates of cancer in the world. Breast cancer, oral cancer, cervical cancer, and lung cancer are the top four cancers in India. Cancer deaths in India doubled from 1990 to 2016. It has been reported that genetic mutations, viruses, smoking, heavy metal ingestion, and dietary patterns are actively involved in cancer pathogenesis (Noonan et al. 2007). Despite huge progress and efforts have been made in the field of medicine for the prevention and treatment of cancer for years, cancer still remains the leading cause of deaths around the world (Figure 1).

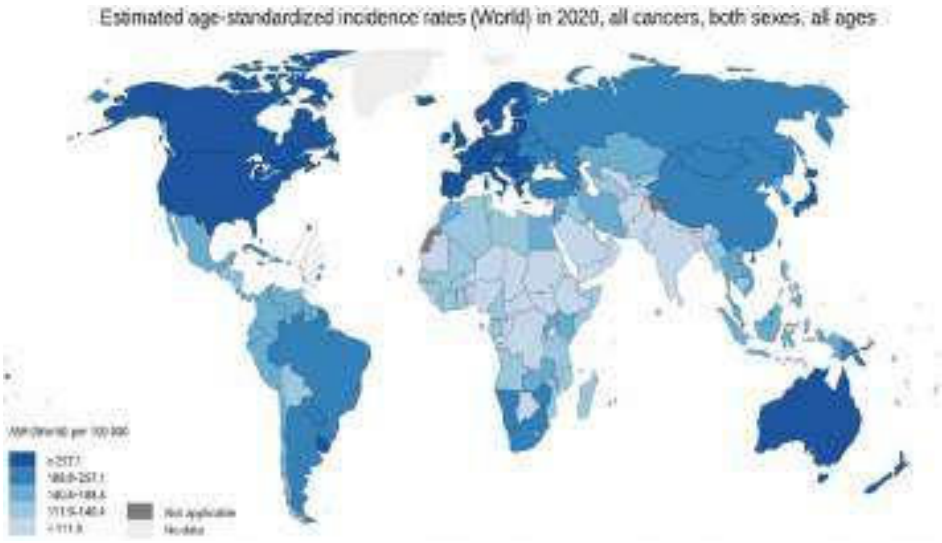

Figure 1

Cancer patients in the world as per the Global Cancer report 2020 by WHO. Source:https://www.uicc.org/news/globocan-2020-new-global-cancer-data# (https://www.uicc.org/news/globocan-2020-new-global-cancer-data#)

Carcinogenesis

Carcinogenesis is the process by which a normal cell is transformed into a tumor cell and its progression to a clinically observable tumor with high probability of metastasis. Cancer is considered a process with three steps: 1. initiation, 2.promotion, and 3. progression (Weston and Harris 2003). This process can vary depending on the etiology of cancer. Normally, cancers are caused by chemical agents, viruses, and others by mutations of DNA, epigenetic changes of DNA (Baylin and Jones 2016).

Mechanism of Cancer

Cancer: Reactive Oxygen Species (ROS)

Cancer is one of the stress-related disorders. During cancer condition, many free radicals or reactive oxygen species (ROS) are produced. The existence of oxidative stress resulting from increased free radicals has been postulated in cancer. Animal models and human studies and *in vitro* experiments suggest a role for oxidative stress, via an increased formation of free radicals in the pathophysiology of many complications, such as neurological, cardiovascular, renal, cancer, rheumatoid arthritis, cancer, and diabetes (Brownlee 2001). According to Sies (Sies et al. 2017), oxidative stress is defined as a shift in balance in cellular oxidation-reduction reactions in favor of oxidation, which leads to damage to the cell and formation of molecular products that are indicators of oxidative stress.

Reactive oxygen species are radicals or ions or molecules that have a one unpaired electron in their outermost shell of electrons. Due to this nature, ROS are highly reactive. Examples of ROS are superoxide (O_2-), hydrogen peroxide (H_2O_2), hydroxyl radicals (OH), and nitric oxide (•NO). ROS and oxidative stress have been implicated in many diseases like cancer, diabetes, and hepatitis. ROS plays an important role in various cascading of the signals for the cancer cells to survival, proliferation, resistance to apoptosis, neovascularization, invasion, and extravacation. (Cullen et al. 2003). In order to survive from oxidative stress condition, cancer cells adapt and acquire many mechanisms to counteract the potential toxic effects

of ROS stress in order to promote proximal protumorigenic signals. ROS also alters the DNA-binding sites of redox-sensitive transcription factors such as hypoxia-inducible factor-1 alpha (HIF-1α), NFκB, activator protein-1 (AP-1), and p53 (Trachootham et al. 2008). The antioxidant enzymes like SOD, CAT, GPx, GR, and GSH may act on these ROS, and hence these antioxidant enzymes activities are depleted in various cancer subjects.

Warburg (Liberti and Locasale 2016) described about cancer as metabolic alterations that represent a hallmark of cancer cells. Metabolic alterations and redox alterations which are important steps of cancer cell transformation make the mitochondria an attractive therapeutic target. Increased knowledge in the field of redox biology, its reactions, signaling networks, and interplay in disease and physiology has enabled not only a better realization of potential benefits but also grave dangers of ROS with respect to cancer phenotypes and drug resistance.

Cancer Biomarkers

A thorough understanding of the roles of cancer biomarkers is essential for diagnostic purposes. A biomarker is "a characteristic that is objectively measured and evaluated as an indicator of normal biological processes, pathogenic processes, or pharmacologic responses to a therapeutic intervention." Because early diagnosis of cancer will treat cancer patients early, we can save the patient's life. Cancer biomarkers are produced by tumors or by the body in response to the presence of cancer. Cancer biomarkers can be used to determine the presence of malignancy and for the study of disease transmission. The important cancer biomarkers are Urokinase plasminogen activator (uPA), Carbonic anhydrase XII (CAXII), Cyclooxygenase (COX), Cytochrome P450 (CYP450), Telomerase, and Matrix metalloproteinases (MMPs).

The medical treatments for cancer are surgery, radiotherapy, and chemotherapy. These types of treatment are usually accompanied by a large number of side effects on patient health, like nausea, loss of appetite, weight loss, anemia, spinal cord injury, kidney damage, and mucositis. Hence, there is need for alternative therapy for cancer. So herbal medicine is practiced to treat cancer.

Medicinal Plants for the Treatment of Cancer

Medicinal plants are used to treat many diseases like diabetes, cancer, epilepsy, alzheimer's, cough, fever, and other diseases. Drugs from medicinal plants focus on the most important active principles in terms of the quantity and the pharmacological actions. The information available on these medicinal plants has allowed the quantification of the active principle and the production of bioactive compounds. The bioactive compounds of medicinal plants have different chemical, pharmacological properties and actions. This has enabled us to evaluate the anticancer drugs from medicinal plants.

Many medicinal plants have been reported to possess anticancer properties. Due to the development of resistance against cancer effects, various plant-derived drugs have gained much attention in the recent years. Hence, it is of importance to focus on medicinal plants with anticancer properties that are easily available, culturally acceptable, and economically free. Herbal medicine has been used for thousands of years to cure cancer. Chemotherapeutic and chemopreventive effects of many herbal plants are attributed to phytochemicals, quinines, which are reported to induce antitumor effects *in vovo* and *in vitro* of cancer cells.

Recently, many well-known plant-derived compounds have been studied in animal models and cell lines. Among the above described plants and their formulations, *Terminalia chebula, Panax ginseng, Arachis hypogaea, Rauwolfia vomitoria, Azadirachta indica, Zingiber officinale, Commiphora mukul,* and *Rosa rugosa* are reported to be beneficial for cancer with less side effects as compared to conventional drugs. Hence, these medicinal plants could be a relatively safer and better therapeutic alternative for cancer treatment (Figure 2).

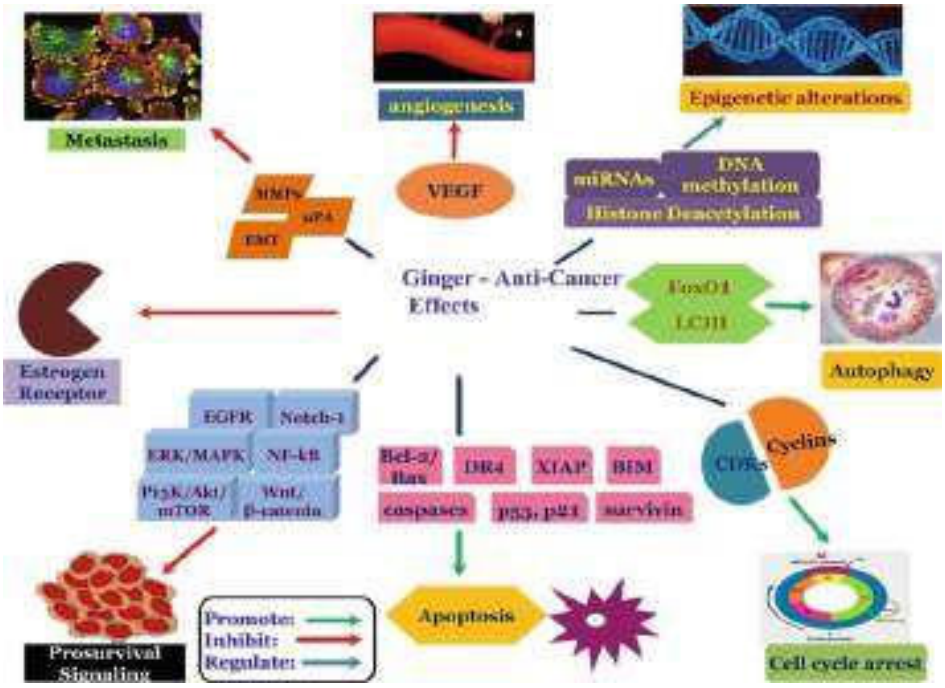

Figure 2

Ginger and anticancer mechanism

Ginger

Ginger is the rhizome of *Zingiber officinale*. Roscoe belongs to the family Zingiberaceae. Ginger has been used as a spice, food, supplement, and flavoring agent. Ginger is used to cure diseases and symptoms, such as headache, nausea, cold, rheumatism, diarrhea, and arthritis. It is also used as a carminative, digestant, and antiflatulent (Ali et al. 2008). Ginger and its compounds are used as medicine in India, China, Burma, Germany, Japan, Indonesia, and the United States.

Ginger is reported to possess various medicinal properties like antibacterial, antiviral, antifungal, antiparasitic, anti-insecticidal, antianalgesic, antimutagen, anticarcinogenic, antispasmolytic, and anti-inflammatory and antioxidant activities (Shanmugam et al. 2021). Ginger have radioprotective, hepatoprotective, gastroprotective, nephroprotective, and neuroprotective properties, and its mechanism of action at the cellular level has been studied by many scientists (Ali et al. 2008; Shanmugam et al. 2009, 2021) (Figure 3).

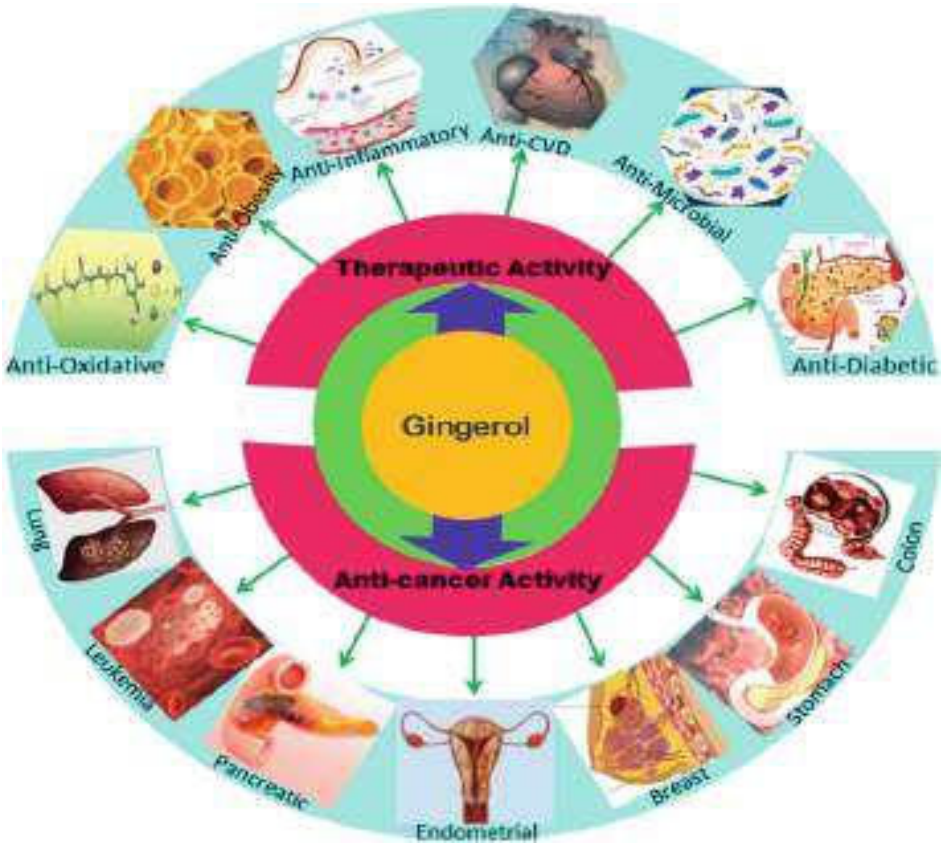

Figure 3

Pharmacological and anticancer properties of Gingerol

Compounds of Ginger

The main constituents in ginger are terpenes, phenolic compounds, carbohydrates (50–70%), and lipids (3–8%). The terpenes (monoterpenes, sesquiterpenes, and sesquiterpene alcohols) are of 20–25%. The terpene compounds of ginger are zingiberene, α-farnesene, β-sesquiphellandrene, β-bisabolene, and α-curcumene. It has been identified that ginger has monoterpenes (such as α-pinene, camphene, myrcene, α-phellandrene, geranial, citronellal, neral, linalool, borneol, and alpha-terpineol). Phytosterols, amino acids, minerals, proteins, vitamins (vitamin A and nicotinic acid), and raw fiber, ash, are present in ginger (Shukla and Singh 2007).

The phenolic compounds of ginger are gingerol, shogaol, and paradols. In ginger, gingerols are in higher concentration. Ginger-specific smell and odor are due to the presence of gingerol and shogaols. The other compounds of ginger are 6-paradol, 1-dehydrogingerdione, 8-gingerdiol, 10-gingerdiol, 4-gingerdiol, 6-gingerdiol, 6-gingerdione, and 10-gingerdione. Ginger also contains diterpenes, galanolactone, diterpenoid, and ginger glycolipids (Yeh et al. 2014). Ginger has ascorbic acid, alkaloids, beta-carotene, and polyphenols. Ginger also has key volatile oils such as oleoresins, bisabolene, cineol, phellandrene, citral, borneol, and citronellol, vitamin B6, vitamin c, and linoleic acid. As per the available information, there are more than 400 bioactive compounds in ginger (Shukla and Singh 2007) (Figure 4).

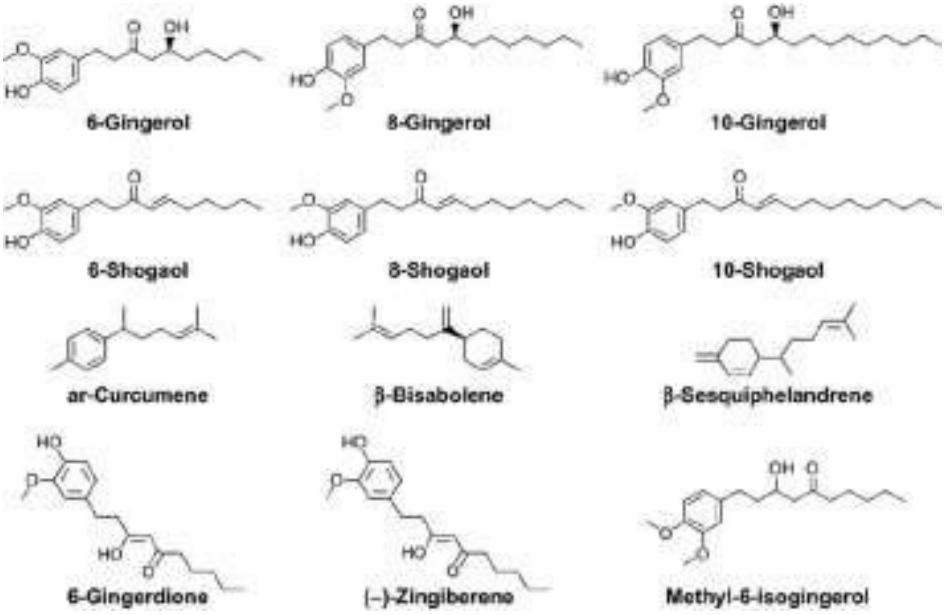

Figure 4

Compounds of Ginger

Anticancer Effects of Ginger

Ginger has anticancer properties. In the methanolic, ethanolic, aqueous, n-hexane, and ethyl acetate, benzene extracts of ginger, many bioactive compounds are present which show antiproliferative, cytotoxic, and antiangiogenic activities. These pharmacological effects are due to bioactive compounds of ginger, which show antioxidant, anti-inflammatory, antioxidant, antihyperglycemic, antitumorigenic, and antilipidemic activities. These compounds may modulate the genetic expression and cause induction of apoptosis in cancer cells.

The anticancer effect of ginger may be due to the reduction of initiation, promotion, and progression. Hence, ginger can be used as anticancer agent (Zhang et al. 2017). Ginger has been reported to show its positive effects against many cancers, like liver cancer, gastric cancer, pancreatic cancer, breast cancer, prostate cancer, and other types of cancers. Ginger also has anticancer effects in different cancer cell lines in vitro, like lung, ovarian, liver, colon, cervical, and prostate cancer, through the stimulation of apoptosis and the reticence of cell proliferation (Zhang et al. 2017) (Table 2).

Table 2

Effect of ginger and its compounds on different cancer subjects

S. no.	Ginger extract/compounds of ginger	Study type	Subjects	Dose	Potential mechanisms	Referen
1	Ginger ethanolic extract	*In vivo*	Wistar rats	50 mg/kg	NADH dehydrogenase activity elevated	Ali et al. 2008)
2	Ginger extract	*In vitro*	HepG2 human hepato-cellular carcinoma cells	1.11 mg/mL	Increasing the level of ROS levels increased and elevated p53 levels, thus promoting apoptosis	Li et al. (2013)
3	6-gingerol	*In vitro*	He La human adenocarcinoma cervical cells	60, 100, and 140μM	Cyclin A, cyclinD1, and cyclin E1 levels decreased, and caspase levels increased	Zhang et al. (2017
4	10-gingerol	In vitro	Human and mouse breast carcinoma cells	50, 100, and 200μM	Cell growth and cell division are reduced	Bernard et al. (2017)
5	6-gingerol,10-gingerol,6-shogaol, and 10-shogaol	*In vitro*	PC-3 human prostate cancer cells	1,10, and 100μM	Inhibiting prostate cancer decreased, and the expression of MRP1 and GSTπ are lowered	Liu et al. (2017)

S. no.	Ginger extract/compounds of ginger	Study type	Subjects	Dose	Potential mechanisms	Referen
6	6-shogaol	*In vitro*	LNCaP, DU145, and PC-3 human prostate cancer cells	10, 20, and 40μM	Cyclin D1, surviving, c-Myc, and Bcl2 expression are decreased Inhibition of STAT3 and NF-κB signals	Saha et al. (2014

Ginger has an antitumor activity by modulating of genetic pathways. It helps for the activation of suppressing gene of the tumor. Furthermore, ginger can inhibit the vascular endothelial growth factors and modulate apoptosis; thus, ginger supplementation can reduce cancer. Ginger extract prevents the initial stage of colon cancer. Supplementation of ginger to the mice with carcinogen 1,2-dimethylhydrazine (DMH) inhibited the levels of tissue cholesterol, HMG CoA reductase, free fatty acids, and triglycerides (Manju et al. 2006). Hence, ginger treatment reduces the risk of cancer by antioxidative compounds.

For instance, it has been identified that the terpenoids, compound of ginger, induce apoptosis in uterus cancer cells via the activation of tumor protein p53. Water and organic solvent extracts of ginger reported to show anticancer activities in THP-1 AMoL cells in vitro. These reports show that ginger has anticancer activity (Prasad and Tyagi 2015).

Ginger constituents ([6]-gingerol, [10]-gingerol, [6]-shogaol, and zerumbone) show anticancer effects. They are effective against many cancers (Habib et al. 2008). Habib et al. (2008) reported that ginger extract inhibits liver carcinogenesis in wistar rat through the downregulation of elevated NF-κB and TNF-α. Hence, ginger may act as an anticancer agent, which may be helpful in treatment of cancer subjects. Ginger ingredients inhibit the development of diethylnitrosamine-(DEN-) induced premalignant phenotype in rat hepato-carcinogenesis. It has been reported that supplementation of ginger prevented decrease of the content of metallothionein and endostatin in the liver and elevated the growth factors induced by the carcinogen in wistar albino rats. Ginger also reverses the altered serum-hepatic tumor markers (Mansour et al. 2010).

Wang et al. (2008) reported that beta-elemenean compound of ginger induces caspase-3, −7, −9 activities, decreases Bcl-2 expression, which releases cytochrome c, and elevated the levels of cleaved caspase-9 and poly (ADP-ribose) polymerase in cells. Application of ginger extract to mouse skin afforded significant inhibition of TPA-caused epidermal edema (56%) and hyperplasia (44%) (Katiyar et al. 1996). Kim et al. (2005) also reported that ginger induces programmed cell death in cell lines. Ethanol extract of ginger has antitumor-promoting effects in mouse skin tumorigenesis model, and it was concluded that animals pretreated with ginger showed depleted tumor compared with unginger-treated rats.

Zingerone with a dose of 100 mg mL suppressed LPS-induced NF-kB activities in cells. Dietary zingerone reduces proinflammatory cytokines. This study reports zingerone anti-inflammatory activity due to suppressing the activation of NF-kB, production of IL-1b, and the infiltration of inflammatory cells (Ganaie et al. 2019). Ganaie et al. (2019) also reported the anticancer effect of zingerone due to activation of cytochrome P4502E1 and suppression of NF-kB-p65, iNOSCOX-2, and PCNA in cancer subjects.

Zerumbone, seen in ginger, shows antiproliferative and anti-inflammatory effects and mediates its activity through the modulation of NF-kB activation (Takada et al. 2005). Zerumbone also inhibits the activation of NF-kB, and this inhibition may provide basis for the prevention and treatment of cancer. The antihepato-carcinogenic effect of zerumbone was due to suppression of PCNA and elevation of Bax and depletion of Bcl-2 protein expression (Gross et al. 1998). Hence, zerumbone may act as anticancer agent in liver cancers

(Fuzer et al. 2017). Fuzere et al. (2017) reported that zerumbone induces the phase II detoxification enzymes depletion in rat liver epithelial cell line RL34. Hence, Zerumbone may act as a potential activator for the Nrf2-dependent detoxification pathway and provides a new insight into cancer management (Tsuboi et al. 2014) (Figure 5).

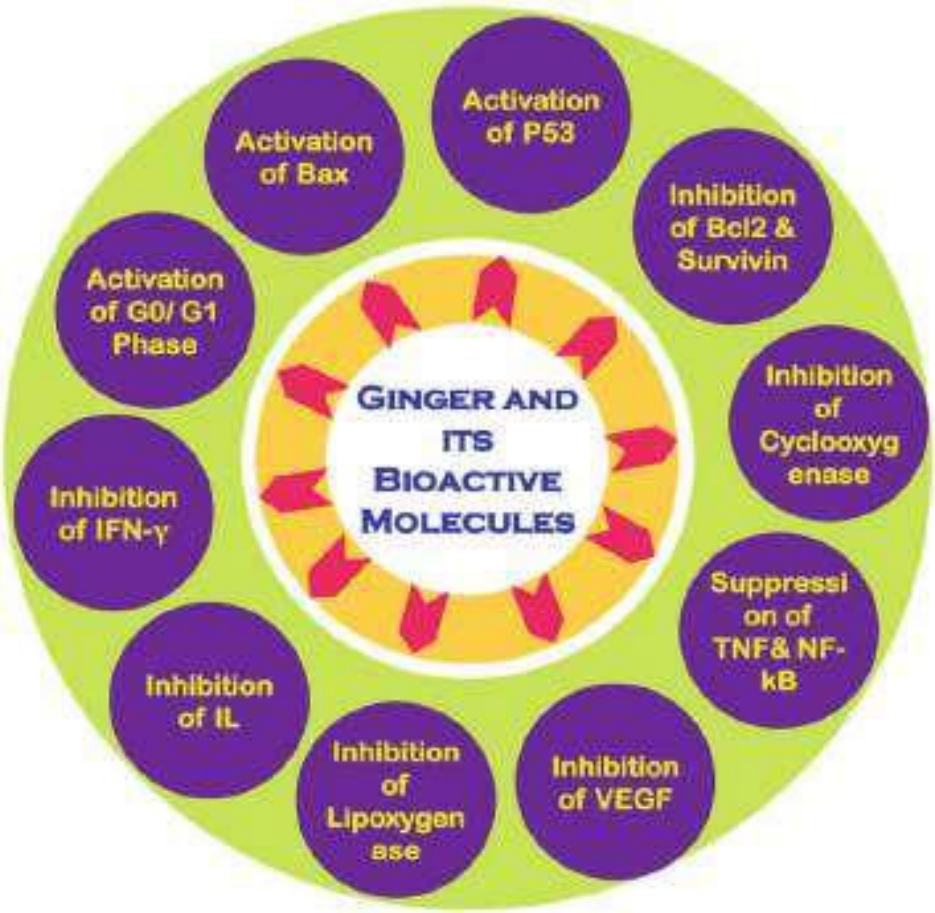

Figure 5

Suppression of tumors markers by ginger and its compounds

Ginger-Bioactive Compound: Gingerol and Its Anticancer Effects

Gingerols are part of the phenolic compounds and volatile organic compounds of ginger. 4-, 6, 8-, 10-, and 12-gingerol are types of gingerol. 6-gingerol is the main compound which is responsible for the strong aroma of ginger. The biological properties of gingerols are antimicrobial, anticancer, antioxidant, anti-inflammatory, and antiallergic (Akinyemi et al. 2015).

6-gingerol has been identified to show anticancerous effects. Gingerol helps in the suppression of the hyperproliferation, inflammatory processes, and transformation that engaged in various steps of angiogenesis and metastasis. For instance, through the activation of CD8+ T cells, it inhibited B16F10 melanoma cells of pulmonary metastasis in mice. Antitumoral activity showed by 6-gingerol through induction of reactive oxygen species (ROS) which, trigger p53 activation, apoptosis, and arrest the cell cycle (Lee et al. 2008). The study found that 6-G induced arrest of the cell cycle in both cell lines by reducing the expression of cyclin A and CDKA. In addition, Radhakrishnan et al. (2014) reported that 6-G induced cell death by apoptosis in the cell line with the mutated p53 gene. [6]-gingerol stimulated death receptor-mediated apoptosis in glioblastoma cells or p53-mediated apoptosis in skin tumor cells (Nakamura et al. 2004).

6-gingerol demonstrates an important potential to treat pancreatic cancer and has been shown to have a potential inhibitor of metastasis in *in vitro* and *in vivo* studies by different mechanisms, including a reduction in the expression of MMP and inhibiting angiogenesis (Kim et al. 2005). 6-gingerol targets many cellular molecules which promote cancer, for cell survival, cell proliferation, invasion, and angiogenesis. 6-Gingerol supplementation alters STAT3, NF-κB, Rb, MAPK, Akt, ERK, PI3K, and caspase-3/7, cIAP1. Thus, gingerol treatment may modulate molecular targets of cancer components, so gingerol may have the therapeutic potential for preventing and treating many cancers.

In vitro and *in vivo* analysis of [10]-gingerol has been reported against the metastatic triple negative breast cancer (TNBC) [97]. In addition, it was experimented that 10-gingerol inhibits cervical cancer (Zhang et al. 2017). A study carried out by Martin et al. (2017) showed the anticancer activity of 10-G *in vivo* and *in vitro* in triple negative breast cancer models through proapoptotic activity and the inhibition of metastasis. The activity of 10-G in vitro was dose dependent, finding that at the highest concentration (100μM) colony formation was completely inhibited and extensive cell death occurred. 10-gingerol caused a considerable upsurge in the initiation of caspase-3 and inhibited orthotopic tumor growth of spontaneous breast cancer metastasis. Zhang et al. (2017) reported that 10-gingerol inhibits metastasis to multiple organs like lung, bone, and brain.

Therapeutical Potential of Gingerol and Its Effect on Metabolic Pathways in Cancer

Anticancer mechanisms of gingerol include free radical scavenging effect, antioxidant effect, modulation of various enzymes of inflammation, modulation of cell cycle proteins, induction of apoptosis, and arrest the cell cycle at G2/M phase in carcinoma which will provide basis for inhibition of tumor progression in experimental animals. TNF-α, IL-6, NF-κB, cyclooxygenase-2 COX-2, and caspase-3 are the most important cancer metabolic factors.

Free Radical Scavenging and Antioxidant Activity of Gingerol

Gingerol possesses antioxidant activity due to their free radical scavenging activity. It has been investigated that gingerol may modulate the antioxidant enzymes and suppress the lipid peroxidation products in cancer subjects. Hence, gingerol may prevent the pathogenesis of cancer-related disorders by its free radical scavenging activity. Alsahli et al. (2021) reported anticancer activity of gingerol in colon cancer, breast cancer, by elevating antioxidant enzymes and depleting lipid peroxidation in cancer condition.

Effect of Gingerol on Apoptotic Genes

Apoptosis is one of the prerequisites to maintain the normal and healthy internal milieu. Alteration in the normal process of apoptosis may raise cell survival and support the tumor growth and progression (Kim et al. 2005). Gingerol plays a vital role in the elevation of different proapoptotic genes and at the same time depletion of the antiapoptotic genes and by this way balances the apoptosis process. An interesting study showed that gingerol induces apoptosis in scleroderma lung fibroblasts without affecting normal lung fibroblasts. Furthermore, gingerol has shown an antitumor activity and was involved in the apoptosis induction and the modulation of key apoptotic proteins such as Bax and bcl-2 (Yu et al. 2011).

A study has reported that growth arrest and apoptosis of B cell lymphoma occur through the downregulation of c-myc, bcl-XL, and p53 with the treatment of gingerol. Another report in human breast cancer cell line showed that CD437 induces G0-G1 arrest and apoptosis via regulation of p21WAFI/CIPI, Bcl-2, and Bax in a p53-independent manner after treatment with gingerol. Another study on p53-null cells, as well as TR9-7 cells, reported that gingerol induces apoptosis in tumor cells via a p53-dependent pathway, and Bax acts as downstream effectors of p53.Gingerol induces apoptosis in a range of tumor cell lines through activation of caspase-3, cytochrome c release, and depletion of bcl-2 (de Lima et al. 2018).

Gingerol has shown an apoptotic effect by inhibiting various genes such as proteintyrosine kinase, protein kinase C, c-myc mRNA expression, and bcl-2 mRNA expression and also mitochondrial pathway. Earlier studies have shown that gingerol possesses an apoptotic activity in different types of cancer cells such as human colon cancer cells, stomach, and skin tumors, breast cancer cells, and prostate cancer cells (Nakamura et al. 2004). Gingerol may lower the incidence of various cancers and also induce apoptosis in MBT-2 cells and G2/M arrest of T24 cells (Park et al. 2014). Experimental studies showed that the downregulation of the expression of antiapoptotic protein occurs with gingerol treatment (Nakamura et al. 2004).

Effect of Gingerol on Tumor-Suppressor Genes

Tumor-suppressor genes play a vital and significant role in the inhibition of cancer formation and its progression. An alteration or mutations may occur in a gene, then tumor suppressor gene loses its ability to perform normal function and it transforms into tumor gene. p53 is one of the important suppressor genes, and it is the guardian of all genes and regulates the various cellular and molecular pathways and prevents the formation of cancer.

Numerous *in vivo* and *in vitro* reports showed that gingerol has a significant role in cancer prevention or inhibition. Another study showed that gingerol downregulates the expression of p53, as well as the survival genes egr-1,c-mycandbcl-XL in B cells. Another report also indicated that gingerol inhibits cell cycle progression of immortalized human umbilical vein-endothelial cells via upregulating the CDK inhibitors p21WAF1/CIP1, p27KIP1, and p53 (Park et al. 2014).

Another tumor-suppressor gene, phosphatase and tensin homolog deleted on chromosome ten (PTEN), has a role in the progression of the cell cycle and apoptosis. The alteration or mutation of PTEN gene has been noticed in several types of cancers. A study of the gingerol has shown that PTEN increases the gingerol-induced apoptosis, whereas inactive PTEN decreases/inhibits the gingerol-induced apoptosis.

In mice, [6]-gingerol suppressed the promotion of skin cancer. Park et al. (Park et al. 2014) reported that [6]-gingerol inhibited TPA skin tumor promotion in addition to the inhibition of epidermal ornithine decarboxylase activity in ICR mice. In a study, Surh et al. [1999] reported antitumor-promoting properties of both [6]-gingerol and [6]-paradol. [6]-gingerol treatment attenuated the skin papilloma genesis and inhibited the tumor-promoter genes, TNF-alpha production, and activation of epidermal ornithine decarboxylase in ICR mice (Nakamura et al. 2004).

Effect of Gingerol on Cycloxygenase Enzyme

COX is an inducible enzyme in the conversion of arachidonic acid to prostaglandins (PGs). There are two types of cyclooxygenase COX-1 that play a vital role in physiological functions and COX-2, an enzyme responsible for inflammation and pain. COX-2 is upregulated or overexpressed in various types of cancers (Pournaderi et al. 2017). It was previously stated that gingerol inhibits the critical stage of tumor initiation and promotion stages and COX inhibition. Gingerol also inhibits the COX2 expression on colon cancer cell lines (Nonn et al. 2007). Previous reports states that gingerol plays an important role in the downregulation of the expression of COX-2 and finally suppresses the cancer progression (Kim et al. 2005). Gingerol plays a significant role in the cancer prevention via controlling the activities of various genes in the initiation, promotion, and progression stage of tumor development and progression.

NF-κB and Gingerol in Cancer Prevention

NF-κB family of transcription factors shows an important role in immune, inflammatory response and also stimulates the development and progression of cancer. In this regard, an important study demonstrated that gingerols have anticancer, antioxidant, and anti-inflammatory effects via the downregulation of the transcription factors NF-κB, AP-1, and Egr-1 (Han et al. 2002) and repression of the genes for cell adhesion molecules (chemokines, TNF, Cox-2, and MMP-9). Another study showed that gingerol has been involved in the suppression of NF-κB activation and NF-κB gene products (Plummer et al. 1999). An important study in pancreatic cancer cells reported that gingerol shows a vital role in the suppression of NF-κB activation by inhibiting IκB kinase, ultimately induces IκBα phosphorylation, and inhibits the NF-κB downstream gene expression. [6]-gingerol inhibited both the vascular endothelial growth factor (VEGF) and basic fibroblast growth factor(b-FGF)-induced proliferation of human endothelial cells and caused cell cycle arrest in the G1 phase (Vijaya Padma et al. 2007). Recently, anticancer and anti-inflammatory potential of 6-gingerol was reported by inactivating NF-kB through the suppression of the proinflammatory TNF-alpha (Kim et al. 2005 ; Habib et al. 2008). Numerous studies have shown that gingerol is a potent inhibitor of NF-κB activation.

Kim et al. (2005) reported that 6-gingerol regulates tight junction-related proteins and suppresses invasion and metastasis of pancreatic cancer cells. 6-gingerol mediated through NF-κB inhibition via inhibition of the extracellular signal-regulated kinases (ERK) pathway. Thus, 6-gingerol suppresses the invasive activity of PANC-1 cells.

Impact of Gingerol on Angiogenesis

Angiogenesis is a complex process involving widespread interaction between the cells, soluble factors, and ECM components. During cancer development, tumor growth is triggered by many signals in chain reaction manner. In cancer formation, there are stages and angiogenic factors such as vascular endothelial growth

factor (VEGF), basic fibroblast growth factor (bFGF), angiogenin, transforming growth factor (TGF-α, TGF-β), and epidermal growth factors, which play vital role in tumor angiogenesis through cancerous tumor cells by releasing molecules and sending signals to surrounding normal host tissue. VEGF is a crucial survival factor for endothelial cells in the process of physiological, tumor angiogenesis, and it induces the expression of antiapoptotic proteins in the endothelial cells (Shukla and Singh 2007). Many reports showed that many medicinal plants suppress the VEGF and other factors of cancer. We also reported that gingerol is best inhibitor of VEGF in different types of cancer (Weng et al. 2010).

In vitro studies on hepatic cancer cell lines conducted so far have demonstrated that ginger suppressed the growth of human hepatic cancer cell lines by inhibiting the phosphorylation of tyrosine-kinase receptor IGF-1R, inducing apoptosis by activating Caspase 9 and downregulating Bcl-2 and cyclooxygenase-2 (COX-2), modulating the levels of VEGF and its receptor (VEGFR-2), NF-κB, p53, and extracellular signal-regulated kinase 1/2 (ERK1/2), reducing the expression of lipogenic enzymes, certain types of RTKs, and their downstream pathways, and activating adenosine monophosphate-activated protein kinase (AMPK) and ROS-mediated lysosomal membrane permeabilization. Based on various liver carcinogenesis animal models with the intake of ginger, the inhibition of hepatoma growth, restriction of hepatic cancer cell line progression, and activation of apoptosis were observed; the probable mechanisms behind might be associated with suppression of hepatocyte progenitor cell/stem cell population, activation of AMPK protein in the liver, and modulation of self-renewal pathways and their related genes. *In vitro* and *in vivo* studies reported that gingerol suppresses the proliferation of human vascular endothelial cells and also abrogates the FGF-2-induced angiogenic response. Moreover, gingerol has the ability to inhibit both VEGF and its receptor in various cancer types; it might be useful as an antiangiogenic agent. Hence, gingerol acts as anticancer agent against many cancers through suppressing proliferation, angiogenesis, NF-κB, and NF-κB-regulated gene products.

Conclusion and Future Perspectives

Cancer is one of the deadliest diseases and a major health problem in the world. The present modes of treatments like chemotherapy and radiotherapy are very expensive and also exhibit many side effects in cancer patients. Ginger and its bioactive compounds are used to treat cancer. Gingerol a bioactive compound of ginger has been shown to target multiple signaling molecules in cancer metabolism and provides a basis for its therapeutic applications for cancer subjects. Moreover, most of the known activities of gingerol are based only on *in vitro* and *in vivo* studies, and some clinical studies in human subjects. Therefore, more extensive and well-controlled animal and human studies are required to demonstrate efficacy of gingerol and other compounds of ginger against cancer.

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CHANGING INFORMATION LANDSCAPE AND ITS TRANSFORMATION IN LIS EDUCATION

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2022

USE OF INFORMATION TECHNOLOGY AMONG POSTGRADUATE PROFESSIONAL COURSE STUDENTS IN RAYALASEEMA AREA, ANDHRA PRADESH: A STUDY

Dr. Sudhakar, E. &Kiran Kumar, E.

Abstract

In this paper researchers studied Use of Information Technology among Postgraduate Professional Course Students in Rayalaseema Area, Andhra Pradesh: A Study, distributed 2000 questionnaires in colleges and collected 1655 questionnaires. It is found in this study the Use of information Technology library information resources, services (electronic & print), and library expressed their opinion about library working hours, physical facility, library information resources and services excellent and good.

Keywords: Use of Information Technology; Professional colleges; Library and Information resources; ICT sources and services; Rayalaseema Area.

Introduction

Education is the passport to accelerated economic growth. It is the key to build human capital. Human capital is the vital ingredient in building a nation. Education is a crucial building block, that recognized as pre-requisite for the general development programme. Since long time immemorial education formed a continuous basis for the development of society, "Education in whatever form has to respond expeditiously and effectively to the changing needs in an ever-changing society" as change is the only unchanging law. Education is a process of learning with the aim to develop the capabilities in the people at all levels. In this process, schools, colleges and universities play a vital role. The present educational system in India comprises both academic and professional studies by offering courses leading to bachelors and master's degree.

Objectives of the Study

The following are the specific objectives of the study:

- To know the purpose of Information Technology services using by Postgraduate Professional course students in the library.
- To assess the suitable place to access the Internet services to the students.
- To understand the Utilization of different Internet services by the students.
- To identify the problems faced by Postgraduate students in accessing Information Technology services.
- To examine the overall satisfaction of postgraduate students with IT based Information services.

Methodology

The present study focuses on the availability of Information technology resources, services and their utilization in professional college libraries in Rayalaseema area.

Selection of Sample

Selection of sample is carried out at two levels namely college level and user level. The libraries of postgraduate professional colleges which are conducting M.Tech, MBA and MCA courses are known as postgraduate professional college libraries. There are 32 postgraduate professional college libraries in Rayalaseema area of Andhra Pradesh established on or before the year 2000. Rayalaseema area covers the districts of Anantapur, Kurnool, Y.S.R (Kadapa) and Chittoor. All 32 postgraduate colleges were taken for the study. The libraries which are attached to colleges are established in the year on 2000 before 2000 is a sample for the present study. The population of this study consists of postgraduate students of these college libraries. There are a total number of 4204 users registered in the college libraries. As the population is large in terms of cost, time and labourinvolved, the investigator selected a sample of 1655 users out of 4204 users as using proportionate random sampling method.

Data analysis and Interpretation

Table 1: Distribution of users according to their gender

S.No.	Gender Wise	Frequency	Percentage
1	Male	962	58.12
2	Female	693	41.87
	Total	**1655**	**100**

It is evident from the table-8.1 that out of total respondents gender-wise distribution of the M.Tech, MCA and MBA students 1655 respondents surveyed, majority of the users (58.12%) are males and remaining (41.87) of there are females. Hence it can be concluded that majority of the users (58.12%) are males and remaining (41.87) of there are females.

Education qualifications

The success of IT application in libraries totally depends on the extent of users acceptance and their satisfaction. User community should always be kept well informed about latest IT application and its developments at regular intervals so that they can understand and make optimum use of IT based library services.

Table 2: Distribution of respondents according to their education qualifications

S.No.	Education	Frequency	Percentage
1	M.Tech	626	37.82
2	MCA	532	32.14
3	MBA	497	30.03
	Total	**1655**	**100**

The above table it can be observed that 37.82% are having M. Tech qualification, 32.14% are having MCA qualification and the remaining 30.03% are having MBA qualification. Hence it can be concluded that a high percentage of respondents are studying M.Tech qualification, the remaining respondents are studying MCA and MBA.

Frequency of visit to the library

Professional College Libraries is a place for research and education. Users visit the library to get their required/need information. When users get needed information, they get full satisfaction and visit the library again and again. Library may provide electronic information resources and services.

Table 3. Frequency of visit to the library

S.No.	Frequently	M.Tech	MCA	MBA	Total
1	Daily	156(9.42%)	122(7.37%)	102(6.16%)	380(22.96%)
2	Once in a week	198(11.96%)	185(11.17%)	153(9.24%)	536(32.38%)
3	Twice in week	188(11.36%)	149(9.0%)	159(9.60%)	496(29.96%)
4	Once in month	84(5.07%)	76(4.59%)	83(5.02%)	243(14.68%)
Total		**626(37.82%)**	**532(32.14%)**	**497(30.03%)**	**1655(100%)**

Table 3. shows that frequency of visiting library majority of 536(32.38%) respondents visit library once in a week, followed by 496(29.96%) respondents visit library Twice in a week, 380(22.96%) respondents visit library daily. The remaining respondents visit library 243(14.68%) once in a month. Hence it can be concluded that majority of the respondents visit library 536 (32.38%) once in a week, followed by 496(29.96%) visit library twice in a week.

Average time spent in the library per day

Professional College Libraries Serious readers normally spend more time in libraries. Libraries are by their very nature, the centers for the spread of knowledge and information.

Table 4: Time Spent in the Library Per Day

S.No.	Time spent	M.Tech	MCA	MBA	Total
1	Less than one hour	86(5.19%)	78(4.71%)	74(4.47%)	238(14.38%)
2	1to 2 hours	327(19.75%)	183(11.05%)	166(10.03%)	676(40.85%)
3	2to 3 hours	124(7.49%)	135(8.15%)	143(8.64%)	402(24.29%)
4	More than 3 hours	89(5.38%)	136(8.21%)	114(6.88%)	339(20.48%)
Total		**626(37.82%)**	**532(32.14%)**	**497(30.03%)**	**1655(100%)**

The duration of visit is taken as less than one hour, 1 to 2 hours, 2 to 3 hours, more than 3 hours. From the above table 4 shows that 676 (40.85%) of respondents spent time 1 to 2 hours per day in the library, followed by 402 (24.29%) spent time 2 to 3 hours, 339(20.48%) spent more than 3 hours and the remaining 238(14.38%) spent time less than 1 hour in the library. Hence it can be concluded that majority of the respondents 40.85%spent time1 to 2 hours per day in the library, followed by 24.29%spent time 2 to 3 hours.

Most frequently used Location of Internet

Electronic resources can be accessed from anywhere in the world through Internet. Generally College library users access Internet and e-resources from library, department, or in campus at different locations. The following table presents the location, from where the users generally access internet resources.All the libraries that are taken for the study have Internet facility. Internet can be accessed via different service providers.

Table 5: Most frequently used Location of Internet access by the users

S.No.	Location of Internet access	Frequency	Percentage
1	Home	213	12.87
2	Library	374	23.80
3	College	292	17.64
4	Internet cafe	653	39.45
5	College hostel	123	7.43
Total		**1655**	**100**

It is evident from the table 5 that majority of the respondents 653(39.45%) prefer to access Internet in Internet café, 374(23.80%) of the respondents prefer using Internet access from College Library, 292(17.64%) of the respondents using Internet in college, 213(12.87%) of the respondents using Internet in Home and remaining 123(7.43%) of the respondents using Internet in College hostels. Hence it can be concluded that majority of the students 39.45% prefer to access Internet in Internet café, followed by 23.80% of the respondents prefer using Internet access from College Library.

Facilities and services of Internet used

Internet is a dynamic source of information. Users' opinion regarding adequacy of Internet accessing were sought and presented here. The users were asked about frequency of access to internet for different purpose.

Table 6. Most frequently using services on Internet by the respondents

S.No	Purpose	Frequency	Percentage
1	Web search engines	252	15.23
2	E-mail	218	13.17
3	Online reference sources	116	7
4	Online indexing, abstracting and full text databases	126	7.16
5	Online library catalogs (OPAC/Web OPACs)	79	4.77
6	Open access electronic journals and magazines	165	9.97
7	Online newspapers	95	5.74
8	Virtual libraries	85	5.13
9	Other libraries' websites	41	2.48
10	Online books	96	5.8
11	Web directories / Subject directories	35	2.11

12	Online bookstores / publishers	38	2.29
13	Online audio, video and multi-media collections	128	7.73
14	Blogs / Weblogs	78	4.71
15	Chatting	28	1.69
16	Others	75	4.53
Total		**1655**	**100**

Table 6 depicts that the majority of the respondents 252(15.23%) used web search engines. followed by 218(13.23%) of the respondents using e-mail, 165(9.97%) of the respondents using open access electronic journals and magazines, 128(7.73%) of the respondents using Online audio, video and multi-media collections, 126(7.16%) of the respondents using Online indexing, abstracting and full text databases, 116(7%) of the respondents using Online reference sources, 96(5.74%) of the respondents using online books, 95(5.74%) of the respondents using Online newspapers, 85(5.13%) of the respondents using Virtual libraries, 79(4.77%) of the respondents using Online library catalogs (OPAC/Web OPACs), 78(4.7%) of the respondents using Blogs / Weblogs, 75 (4.77%) of the respondents using other resources, 41 (2.48%) of the respondents using other libraries' websites, 38 (2.29%) of the respondents using Online bookstores / publishers, 35 (2.11%) of the respondents using Web directories / Subject directories and remaining 28(1.69%) of the respondents using chatting. Hence it can be concluded that majority of the respondents 252(15.23%) used web search engines. followed by 218(13.23%) of the respondents using e-mail.

Sources used academic Information needs

Table 7. Distribution of respondents according to their sources used

S. No	Academic information	Frequency	Percentage
1.	Google	818	49.42
2.	Classmates/Friends through Social Networking	433	26.16
3.	Professional Societies	152	9.18
4.	Databases	138	8.34
5.	Other websites	114	6.89
Total		**1655**	**100**

It is evident from the table 8 that majority of the respondents use for academic information needs 811 (49.42%) Google, followed by 433(26.16%) of respondents information needs classmates/friends through social networking. 152(9.18%) respondents information needs in professional societies, 138(8.34%) of the respondents using information needs for databases and remaining 114(6.89%) of the respondents using academic information needs for other websites. Hence it can be concluded that majority of the respondents use for academic information needs 811 (49.42%) Google, followed by 433(26.16%) of respondents information needs classmates/friends through social networking.

Suggestions

A few suggestions are put forward by the researcher based on the observations gathered from the study.

- Need to Improve IT facilities, Provide needful info on usage of internet, WI-FI should be provided college campus.
- Develop IT communication in library, Increase computers with high band width and more computers.
- Better to have a digital library, Give training classes to students, Improve facilities of study oriented programs, Must improve IT in library and speed internet.

Conclusion

All most all professional college libraries provide user training programs and computer literacy skills programs to their users. Majority of the respondents state that the library staff has helped you to utilize the Information Technology products in your library. The respondents (Students) stated that the user training and computer literacy programme is very useful for using of e-resources provided by their libraries

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Transformation of Learning Resource Centres in the Digital Era

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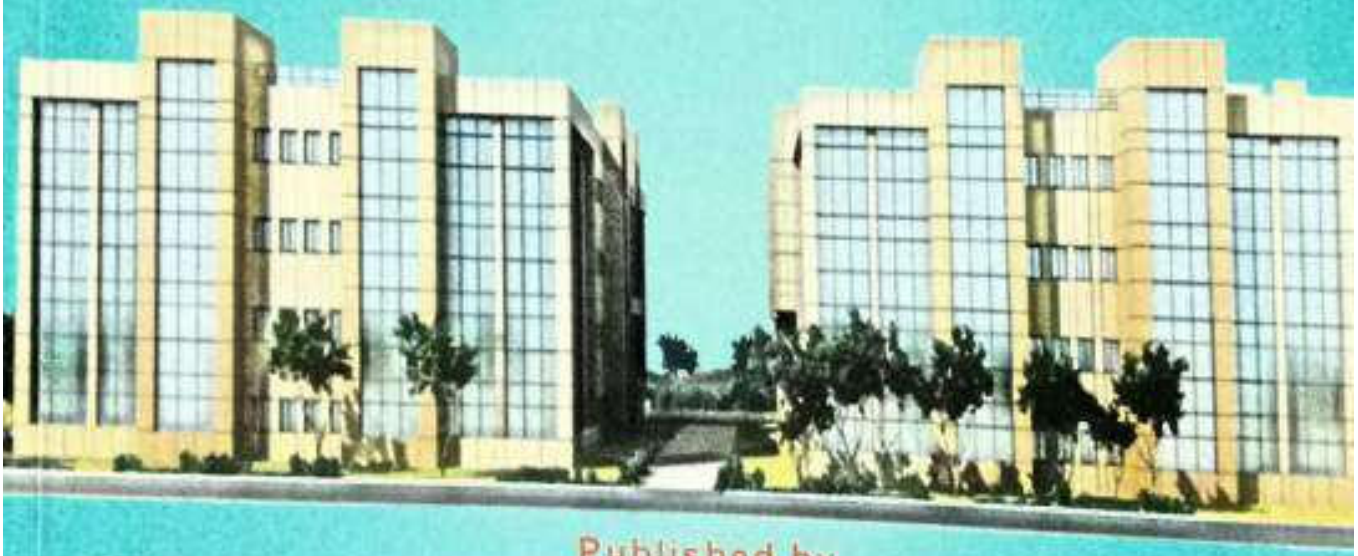

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Awareness and Usage of E-Shodhsindhu Consortium by Faculty and Research Scholars of Nagarjuna University: A Study

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Abstract

The term "virtual library" refers to a library without walls where customers can access any sort of knowledge in electronic format without restriction. A digital library is a great resource for academic communities since it allows them to access electronic journals, databases, and e-books. The e-ShodhSindhu is that the Consortium for educational e-resources merging three consortia, i.e. UGC-INFONET Digital Library Consortium, INDEST-AICTE Consortium and N-LIST in December 2015. The e-ShodhSindhu is supposed to provide current and depository access to E-Resources i.e. e-books, e-journals, e-journal archives, on-line databases to its member establishments at a negotiated rate of subscription. The main purpose of this paper is to find out user awareness and usage of e-ShodhSindhu Consortium by Faculty Members and Research Scholars of AcharyaNagarjuna University (AU), in Andhra Pradesh.

Keywords: Virtual Library, e-ShodhSindhu, Digital Library, e-Resources

Introduction

The significance of the name Acharya Nagarjuna University comes from the fact that it was established by the great Buddhist preceptor and philosopher Acharya Nagarjuna on the banks of the Krishna River many years ago. He turned it into a great centre of learning that drew many teachers and students from all over the world. The University was established by Act 43 of 1976 of the A.P. State Legislature and Governed by Act 4 of 1991 covering 6 Universities in the State.

The present Acharya Nagarjuna University is not very far from the haloed spot, as it derives its moral and intellectual sustenance from Acharya Nagarjuna in which context the University has been renamed Acharya Nagarjuna University through the A.P. Universities (Amendment) Ordinance, 2004, promulgated by the Governor of Andhra Pradesh. The aspirations ofthe southern coastal districts of Andhra Pradesh to pursue Post-Graduate educationnearer their homes resulted in the establishment of Acharya Nagarjuna University.

Dr.B.R.Ambedkar Memorial Library

The library building's plinth area is roughly 3,000 square feet in total. The Circulation, Periodicals, Reference, Acquisition, Binding, and Technical Sections, in addition to the Administrative and Computers Sections, perform the majority of the library's functions. The Dr. B.R.A.M. Library is open from 8 a.m. to 8 p.m. on all working days and from 8 a.m. to 1 p.m. on the first Saturday and Sunday of each month. For seating and reading purposes, the library mostly uses wooden chairs and tables. Steel book racks that meet specific criteria are utilized for shelving. For the year 2016, a total of Rs. 57,72,079 was spent on 270 publications, including daily newspapers, general magazines, and foreign and Indian periodicals.

Objectives of the Library

- To inspire and encourage all who would seek knowledge through higher education and research.
- To provide quality instruction and research for the advancement of science and technology.
- To promote teaching and research studies in disciplines of societal relevance.
- To bridge the gap between theory and practice of the principles of higher education.
- To develop the human talent necessary for the industry.

Table 1: Dr.B.R.Ambedkar Memorial Library Collection

SLNo.	ResourceName	Description of Resource/URL	Total
1.	**Print and Non-Print Resources**		
1.1	Books	TextBooks	1,35,796
1.2	ForeignJournals(Print)	AllSubjects	49
1.3	IndianJournals(Print)	AllSubjects	162
1.4	GeneralMagazines	English,Telugu, etc	28
1.5	Newspapers	English,Telugu, etc	15
1.6	BackVolumes	AllSubjects	2766
1.7	CD-ROMs	MagazinesandSubjectRelated	471
2.	**University subscribed e-Resources**		
2.1	E-ShodhSindhu	http://www.inflibnet.ac.in/ess/eres.php?memID=93	-
2.2	DELNET	http://www.delnet.nic.in/	-
3.	**e-Journals subscribed for the year 2021 through E-ShodhSindhu**		
3.1	AmericanChemical Society	https://pubs.acs.org/	51
3.2	AnnualReviews	https://www.annualreviews.org/	43
3.3	EconomicandPolitical Weekly	https://www.epw.in/	1
3.4	JSTOR	https://www.jstor.org/	3165
3.5	SpringerLink	https://link.springer.com/	1725
3.6	Taylor&Francis	http://www.tandfonline.com/	1078
4.	**Databases subscribed for the year 2021 through E-ShodhSindhu**		
4.1	WebofScience	http://webofknowledge.com/	-
4.2	InstituteofStudiesin Industrialdevelopment	http://isid.org.in/	-
4.3	J-gatePlus	https://jgateplus.com/search/	-

The variables used for this study are broadly divided into two, namely classificatory variables and study variables. The variables are selected by the literature reviewed for the purpose.

- University
- Gender of the respondent
- Age of the respondent
- Academic position of the respondent
- The academic area of the respondent

Objectives of the Study

The proposed work considered Science and Social Science Research's magnitude in Nagarjuna universities for E-ShodhSindhu effects. Before deciding the research prioritiesfor this study, previous research studies were utilized. An analysis of prior results has been undertaken, and some differences in the past research were identified. Based on the identified variations, the following research objectives are formulated by the researcher:

- To know the users' awareness about E-ShodhSindhu resources available in Nagarjuna university
- To know the usage pattern of the E-ShodhSindhu
- To identify the intent of accessing E-ShodhSindhu electronic resources.
- To evaluate the impact of E-ShodhSindhu electronic resources on the academic community of higher education.
- To find out the strategies adopted by user store cooperate data through E-ShodhSindhu electronic resources.
- To determine the user's challenges and problems while using the E-ShodhSindhu electronic resources.
- To find out the required training programs to improve the usage of E-ShodhSindhu electronic resources.
- To analyse the satisfactory level the users while using E-ShodhSindhu electronic resources
- To study the infrastructural facilities provided by the University Libraries associated with the E-ShodhSindhu electronic resources.

Population of the Study

The research excludes PG students and administrative employees. This population is not having much awareness and usage of E-Shodh Sindhu. To obtain samples from both classes, the investigator divided the users into two categories based on their academic status and picked preventative sample from each category to perform the analysis. As a result, the following groups have been formed.

Faculty – Comprised faculty members from the relevant university departments.

Research Scholars – Includes those pursuing Ph.D. and M.Phil. Degrees in university departments

Table 2: Total Population in the Study Area

Variables		Status of the Respondents	ANU	% of Total Population
Position of Respondents	**Faculty**	Professors	28	4.32
		Associate Professors	41	2.34
		Assistant Professors	34	10.65
		Research Scholars	1238	82.69
		Total	**1341**	**100**
Gender		Male	863	51.52
		Female	478	48.48
		Total	**1341**	**100**
Academic area		Science	686	47.18
		Social Sciences	655	52.82
		Total	**1341**	**100**
Grand Total of Population			**1341**	

From the above table we understood that the total population of ANU is 1341 and faculty are 103 and scholars are 1238.

Table 3: Distribution of Respondents based on Subject of Study and Universities

Subject		Acharya Nagarjuna University (ANU)
Science	N	104
	%	45.81
Social Sciences	N	123
	%	54.19
Total	**N**	**227**
	%	**100.00**

Table 4: Source of Information the Respondents Generally Consult

Source of Information		Academic Status		Universities
		Faculty	Research Scholars	ANU
University Library	N	38	153	42
	%	21.71	21.34	18.50
Internet	N	71	308	107
	%	40.57	42.96	47.14
Interaction with Friends / Colleagues	N	31	86	21
	%	17.71	11.99	9.25
Interaction with Teachers	N	25	118	44
	%	14.29	16.46	19.38
Family Members	N	4	36	5
	%	2.29	5.02	2.20
Personal Book Collection	N	6	16	8
	%	3.43	2.23	3.52
Total	**N**	**175**	**717**	**227**
	%	**100**	**100**	**100**

Table 5: Availability of Library Consortium Facility based on Academic Status, Subject of Study and University

Available Library consortium		Academic Status		Subject of Study		University
		Faculty	Research Scholars	Science	Social Sciences	ANU
E-Shodh Sindhu	N	68	322	181	209	158
	%	38.86	44.91	41.14	46.24	69.60
DELNET	N	37	161	96	102	34
	%	21.14	22.45	21.82	22.57	14.98
Any Other	N	70	234	163	141	35
	%	40.00	32.64	37.05	31.19	15.42

Table 6: Frequency of Visiting E-ShodhSindhu Resources

Frequency of Visit		Academic Status		Subject of Study		ANU
		Faculty	Research Scholars	Science	Social Sciences	
Daily	N	23	54	53	24	17
	%	13.14	7.53	12.05	5.31	7.05
Once in a week	N	46	27	27	46	20
	%	26.29	3.77	6.14	10.18	8.81
2-3 times in a week	N	43	241	152	132	114
	%	24.57	33.61	34.55	29.20	50.22
2-3 times in a month	N	39	223	106	156	52
	%	22.29	31.10	24.09	34.51	22.91
Occasionally	N	24	172	102	94	24
	%	13.17	23.99	23.18	20.80	10.54

Table 7: Respondents spending time on E-ShodhSindhu Resources

Time spent in E-Shodh Sindhu		Academic Status		Subject of Study		SPMU
		Faculty	Research Scholars	Science	Social Sciences	
Less than One hour	N	47	296	188	155	47
	%	26.86	41.28	42.73	34.29	35.61
1-2 hours	N	79	246	142	183	64
	%	45.14	34.31	32.27	40.49	48.48
2-3 hours	N	27	142	85	84	16
	%	15.43	19.80	19.32	18.58	12.12
More than 3 hours	N	22	33	25	30	5
	%	12.57	4.60	5.68	6.64	3.79
Total	N	175	717	440	452	132
	%	100.00	100.00	100.00	100.00	100.00

Table 8: Usage of E-Journals based on Academic Status of Acharya Nagarjuna University

Usage of E-Journals		Academic Status															
		Faculty (N=30)					WS	WAM Score	Rank	Research Scholars (N=192)					WS	WAM Score	Rank
		1	2	3	4	5				1	2	3	4	5			
American Chemical Society	N	9	10	6	5	5	92	2.63	4	22	44	41	61	24	597	3.11	5
	%	25.71	28.57	17.14	14.29	14.29				11.46	22.92	21.35	31.77	12.50			
Annual Reviews	N	17	5	7	3	3	75	2.14	6	42	10	26	65	49	645	3.36	3
	%	48.57	14.29	20.00	8.57	8.57				21.88	5.21	13.54	33.85	25.52			
Economic and Political Weekly	N	10	12	4	3	6	88	2.51	5	21	16	69	30	56	660	3.44	1
	%	28.57	34.29	11.43	8.57	17.14				10.94	8.33	35.94	15.63	29.17			
JSTOR	N	7	6	8	7	9	110	3.14	1	35	24	22	61	50	643	3.35	4
	%	20.00	17.14	17.14	20.00	25.71				18.23	12.50	11.46	31.77	26.04			
Springer Link	N	7	6	11	4	7	103	2.94	2	48	18	47	43	36	577	3.01	6
	%	20.00	17.14	31.43	11.43	20.00				25.00	9.38	24.48	22.40	18.75			
Taylor and Francis	N	10	6	6	4	9	101	2.89	3	20	31	31	74	36	651	3.39	2
	%	28.57	17.14	17.14	11.43	25.71				10.42	16.15	16.15	38.54	18.75			

Table depicts the usage of E-Journals from E-ShodhSindhu by the Faculty and Research Scholars of Acharya Nagarjuna University. Based on the weighted arithmetic mean the purposes are ranked.

Major Findings

It is evident from the table that all the faculty members have completely preferred and gave first rank for JSTOR followed by Springer Link (2nd rank), Taylor and Francis (3rd rank), American Chemical Society (4th rank), Economic and Political Weekly (5th rank) and Annual Reviews (6th rank). That means majority of the faculty preferred the usage of E-Journal 'JSTOR'.

The table analyses that all Research scholars have completely preferred and gave first rank to Economic and Political Weekly followed by Taylor and Francis (2nd rank), Annual Reviews (3rd rank), JSTOR (4th rank), American Chemical Society (5th rank) and Springer Link (6th rank). This means that majority of the research scholars from Acharya Nagarjuna University preferred the usage of E-Journal 'Economic and Political Weekly'.

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II SEMESTER





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ANIMAL DIVERSITY-II

BIOLOGY OF CHORDATES

SREENIVAS-CHAKRAPANI-ANILKUMAR

Biology of Chordates

(Text book for UG II-Sem Zoology)

Dr.N.Srinivas, Dr.I.S.Chakrapani & Dr.P.Anilkumar

1/e Oct.2022

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ANIMAL DIVERSITY-II

BIOLOGY OF CHORDATES

MODULE-I (PROTOCHORDATES)

1.1. General Characters and Classification of Chordates upto classes.

1.2 Salient features of Urochordata and Cephalochordata Salient features of Cyclostomes

1.3 General Characters and Classification of Fishes upto sub class level,

1.4. Structure and life-history of *Herdmania*, Significance of retrogressive Metamorphosis.

MODULE-I

INTRODUCTION

Animal kingdom is basically divided into two sub kingdoms:

(a) Nonchordata- including animals without notochord.

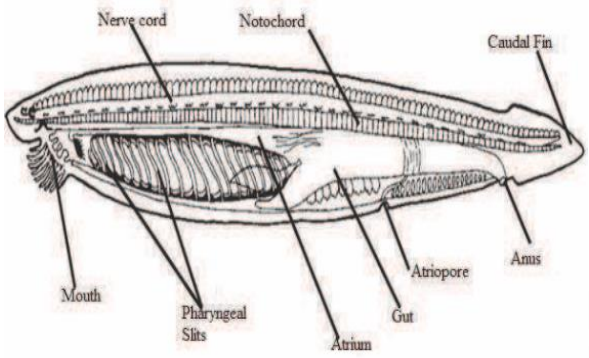
(b) Chordata- This comprising animal having notochord or chorda dorsalis. While the Chordata has a notochord at some stage during the life, it is not known to exist in the Nonchordata.

- The Chordata is the animal phylum with which everyone is most intimately familiar, since it includes humans and other vertebrates However, not all chordates are vertebrates.

- All chordates have the following features at some stage in their life (in the case of humans and many other vertebrates, these features may only be present in the embryos).

- Pharyngeal slits – a series of openings that connect the inside of the throat to the outside of the

"neck". These are often, but not always, used as gills.



- Dorsal tubular nerve cord – A bundle of nerve fibers which runs down the "back". It connects the brain with the lateral muscles and other organs.

Pharyngeal slits dorsal nerve cord & Notochord

- Notochord – cartilaginous rod running underneath, and supporting, the nerve cord.

- Post-anal tail – an extension of the body posts the anal opening.

ORIGIN OF CHORDATES

It is believed that chordates originated from invertebrates. However, it is difficult to determine from which invertebrate group of the chordate developed.

It is almost constant that chordate ancestors were soft bodied animals. Hence, they were not preserved as fossil.

Many theories have been put forward to explain the evolution of chordates, few of them are as follows:

(a) COELENTERATE THEORY:

According to this theory chordates developed from coelenterates.

It is belived that radial symmetry coelenteron, cnidoblasts etc, disappeared and advanced characters developed to give rise the chordates.

This theory infers that chordate might have acquired higher characters independently. This theory is not acceptable.

(b) ANNELID THEORY: This theory suggests that the chordates have evolved from an annelid stock, like many chordates the annelids show bilateral symmetry, metasmerism, head, lateral coelome complete digestive tract, closed circulatory system, haemoglobin, etc.

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BIOLOGY OF CHORDATES

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2.1. *Scoliodon*: Morphology, structure of Heart, Brain and sense organs.

2.2. Migration in fishes and types of scales - Dipnoi fishes

2.3 Characters and Classification of Amphibia upto orders

2.4. Rana : Morphology, respiratory system, structure of heart, Brain and reproductive systems only.

MODULE-II

External Features of Dogfish (Scoliodon):

Shape, Size and Colour:

Dogfish (Scoliodon) has a long, laterally compressed spindle-shaped body tapering at both ends. The fully grown specimen measures from 30 to 60 cm in length. The colour of the body is dark grey above and pale white beneath, while the portions of the caudal fin are more or less dark. Body surface is rough due to backwardly directed spines of placoid scales embedded in the dermis.

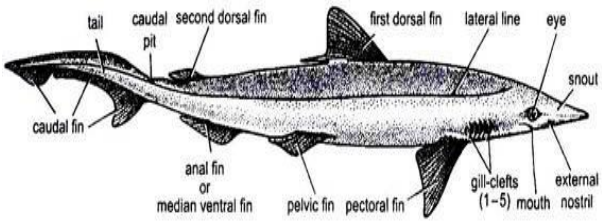

Fig. 14.1. *Scoliodon*. External features.

Division of Body:

The body is divisible into head, trunk and tail, though there are no distinct boundaries between these regions.

(i) Head:

The head is strongly compressed dorso-ventrally and is produced in front into a wedge-shaped snout or rostrum.

(ii) Trunk:

The trunk is almost elliptical in transverse section. Its thickest part lying in front of the middle of the body. The trunk gradually tapers behind into the tail.

(iii) Tail:

The tail is laterally compressed and is bent upwards at a small angle and fringed with a caudal fin. Such a tail is known as heterocercal tail.

Fins:

Dogfish (Scoliodon) is provided with two sets of fins which are flattened expansions of the skin supported by cartilaginous rods and horny fin rays- these are unpaired or median fins and paired lateral fins.

(i) Median Fins:

The median fins are two dorsal fins, a ventral or anal fin and a caudal fin. The first dorsal fin is large and triangular in shape and is situated a little in front of the middle of the body. It has a basal lobe. The second dorsal fin is also triangular in outline but is very small and is situated midway between the first dorsal and the tip of the tail. The caudal fin extends along the dorsal and ventral

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ANIMAL DIVERSITY-II

BIOLOGY OF CHORDATES

MODULE-III (REPTILIA)

3.1. Characters and Classification of Reptiliaupto orders

3.2. *Calotes*: Morphology, digestive system, urinogenital system and Brain

3.3. Identification of Poisonous snakes

MODULE-III

REPTILIA: CHARACTERS AND CLASSIFICATION

Reptiles are cold-blooded vertebrates, breath by lungs and having the body covered by scales or scutes.

General characters:

- They are inhabitants of terrestrial and aquatic (both marine and freshwaters) environments.
- Their skin is dry, cornified and usually covered by **epidermal** scales or scutes. There are a few integumentary scent glands secreting pheromones during breeding seasons.
- Single external nasal opening is present on the snout. Ear drums are slightly depressed.
- Two pairs of pentadactyle limbs are present. The limbs end in clawed digits.
- The cloacal opening is either transverse or longitudinal.
- A post-anal tail is present.
- The heart is composed of two auricles and a partially divided ventricle. There are right and left systemic arches.
- The kidney is metanephric type.
- Mullerian duct persists as oviduct in female and Wolffian duct is retained as vas deference in male. Males possess copulatory organs.
- Twelve pairs of cranial nerves are present.
- Vomero-nasal organ (Organ of Jacobson) is well-developed.
- Single occipital condyle in the skull is present for the attachment with atlas.
- Mandible consists usually six pieces of bones.
- Vertebrae are procoelous. Sternum is greatly developed with ribs.
- Cleidoic eggs are large. The calcareous shell serves for protection against desiccation and external injury. The shell is porous for gaseous exchange.
- Fertilisation is internal.
- Embryos are provided with extra-embryonic membranes, like amnion, chorion and allantois.

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BIOLOGY OF CHORDATES

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4.2. Pigeon (*Columbia livia*) : Exoskeleton, respiratory system, structure of heart,
4.3. Migration in birds and its significance, Flight adaptation in birds
4.4. Dentition in Mammals,

MODULE-IV

GENERAL CHARACTERS OF AVES

Introduction:

Class Aves includes birds, bipedal vertebrates. Birds are unique in having feathers as their exoskeleton. Aves originated from therapod dinosaurs in Jurassic period and modernized in the cretaceous period. **T.H.Huxley** called birds "G**lorified reptiles"**. **J.Z. Young** described them as the "**Masters of air**" . Ornithology is the study of birds.

General characters of Aves

- Birds are cosmopolitan and found in all continents, seas and most islands.
- Their wide occurrence is due to their power of flight, which enables them to reach places unreachable to other animals.
- Most of them can fly and a few have lost the power of flight.

Body temperature:

- They are **homeothermic** (**warm blooded**) and the body temperature provides high metabolic rate for quick energy supply.
- Birds are **endothermic**, and expend a lot of energy to keep warm.

Body form and appendages:

- The body is boat shaped and streamlined.
- It is divisible into **head, neck, trunk** and **tail.**
- The forelimbs are modified into wings for flight which are supported by powerful flight muscles attached to the sternum.
- Each fore limb has 1 to 3 digits and each hind limb has 1 to 4 digits.
- The hind limbs are used for perching, walking, hopping, wading, swimming etc.
- Skin is dry and thin except for uropygial or oil gland on the tail.
- Body is covered by epidermal horny skeleton of feathers which conserve body heat, help in flight and provide colouration to the birds.

Endoskeleton:

- The endoskeleton is bony, but delicate and light.
- Skull is **monocondylic**, i.e., with single occipital condyle.
- Sternum is usually large and with a median keel for the attachment of flight muscles.
- Bones are pneumatic, i.e., contain air cavities to reduce weight.

Digestive system:

- Mouth has a wide gap and jaws are covered with horny sheaths to form strong beaks.
- Beaks are adapted to various modes of feeding: seed-crushing, fruit-scooping, fish-tearing, nectar-sipping, wood-chiselling, grain-pickling etc.
- Teeth are absent and food is swallowed un masticated.
- The **crop** stores and softens food.
- Alimentary canal often has additional chambers; **crop and gizzard.**
- Gizzard is muscular to crush and churn the softened food.
- Some birds keep stone in the gizzard to effectively crush seeds and grains. Alimentary canal leads to the cloaca.
- The cloaca is divided into three linear compartments: i.e., anterior **coprodaeum** middle **urodaeum**

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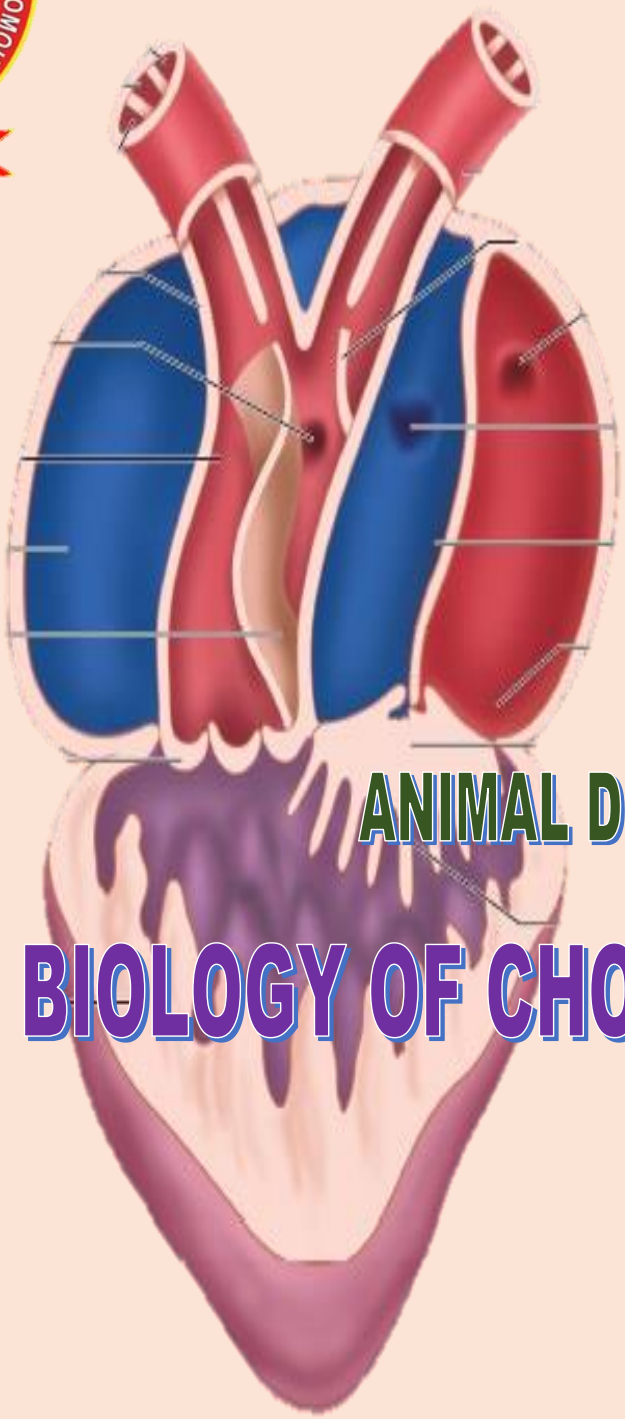

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ANIMAL DIVERSITY-II

BIOLOGY OF CHORDATES

SREENIVAS-CHAKRAPANI-ANILKUMAR

ISBN 978-93-5768-302-9

Lectures on Materia Medica of Selected Remedies

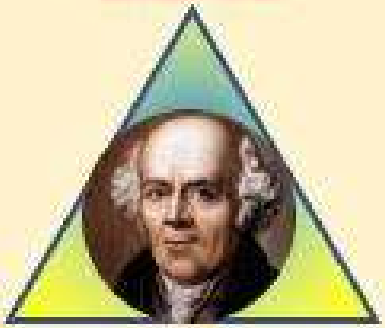
Lectures
O. Ramachandra Rao

Lecture Transcript
Dr. I. S.Chakrapani

Homoeo Learning Classes

From August 11, 2021 to January 11, 2022

Master E.K.



Dr.Samuel Hahnemann

Dr. E.V.M. Acharya

Sri Ogirala Ramachandra Rao

Conducted By:

Sri Ogirala Ramachandra Rao

Guntur

Ph: 9441890096

FOREWORD

Those were the days of COVID-19 pandemic. Everywhere it was panic, turmoil, confusion, fear and doubt. Uncertainty, altered daily routine, social isolation & apprehensions ruled the society then. Restrictions & lock downs were the order of the day. Amidst this public psyche, we struggled a lot in discharging our duties in the dispensaries. As an ardent Homeopath, after a few days of observation, I could manage to serve the needy, by Master's grace, following the guidelines imposed by the government then.

While restricted at home, how to utilize this leisure was a big question. In a casual talk, Sri PSR Anjaneyulu, Nellore suggested me to conduct Homoeo classes online for the young generation. While I was hesitating, he encouraged me, saying that an online transaction of content was easier than conventional methods of teaching, and that would go a long way in the creation of learning resources. I hesitantly nodded.

I discussed the issue with a few enthusiastic youngsters like Prabhu, Aparna, Ravichandar, Padmaja and others. They started working as a team, and got it materialized. There was a brief discussion as to which platform must be selected, later on we decided to go online by youtube live streaming. We floated the idea to Sriman E.Anantakrishna, for which he was very happy and blessed us profusely. After a few initial hiccups during the trial run, it went on successfully from 11th August, 2021, on the birthday of Master EK.

These classes were received very well across the globe, an unexpected response! We were happy, at the same time it doubled our responsibility. I continued the classes, referring to the class notes of Master EK lectures, Kent, Dr.EVM Acharya's lectures, and of course the experiences provided by our Maser in the dispensary. More than 500 people, enthusiastic to learn Homeopathy followed the classes with utmost devotion, for which I wondered a lot. Many of those already working in our dispensaries followed and refreshed their knowledge. There were a few health issues, but the classes went on continuously till 11th January 2022 successfully. It was again a realization for all of us that when we start a work beneficial to all, resources and personnel come to us effortlessly.

While listening to the classes, Smt. Leela of Hyderabad made lecture notes in Telugu meticulously. Varchaswi & Tejaswi with the help of Sri Tarakeshwara Rao digitalized this notes diligently, and brought out a good volume. The same was provided to all by different social media. After some days, a few doctors have requested for English version of the lecture notes. This is taken as the Master's instruction, work is endorsed to Dr.I.S.Chakrapani, Nellore and the result is this compilation. Hope this will serve the purpose.

Vasudeva

Yours

Ogirala Ramachandra Rao

Guntur

Before you start using this notes…

Let me say a few words...

After this mission of 'Online Homoeo Classes' was over, there was a period of brief silence. We took over the routine of our dispensaries.

On 23rd March 2022, Sriman Ogirala Ramachandra Rao called me and talked about the 'instruction'. A few members who followed the classes happened to be doctors, and they wanted the English version of this notes, as it was a bit difficult to follow in Telugu. As it is true with most of the young generation, an English version is always solicited. By His instruction, I took up the task.

I started working. I tried to prepare some notes based on the version in Telugu. While going through, I used to get a number of doubts, so I preferred watching the particular video lesson again, and then finishing the notes. This took lot of time, which practically became very difficult to cope up amidst the hectic daily work schedule. Sri Tarakeswara Rao came to my rescue, he started providing the draft notes of each remedy, one remedy a week. My 'bit rate' was slow, and the pace was not matching. Slowly I could gain the momentum to share the notes weekly. Lesson was about punctuality and keeping up the word.

Smt.Leela, from Hyderabd followed the classes ardently and made notes in Telugu. Her daughters, Chy.Tejaswi & Varchaswi carefully digitalized this notes. It helped me a lot, forming the basis for this notes in English. I would like to tell you that it is not exactly a translation. At times, I went beyond, at times I made a precise of the content. During this work, I consulted Dr.J.T.Kent, Master EK's lecture notes & Dr. EVM Acharya's homoeo classes, as per need. Preference was given for a concise expression, so that an enthusiastic learner easily finds the crux. Sri Subbarao of Tenali helped me improvise the presentation. Actually, when I accepted the assignment, I was afraid whether I could find time to complete. But the lesson was that, time is elastic & work gives us energy to work. The work is complete by 13.09.2022.

I thank Smt. Swarna & Chy. STG Sekhar for bringing out this compilation. They worked hard to re-align the content and made it into a book. The page is set so that wider margins will be useful to the young learners to make their own notes in the book itself.

I sincerely thank all those mentioned above. Without their dedicated contribution, this work would have not been shaped up as it is today.

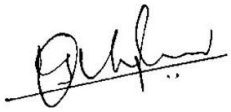
I thank Sriman ORR for his benevolent guidance. Thanks to the invisible presence of Mater EK and Dr.EVM Acharya which guided me to be on the right path.

I humbly submit that merits of this work belong to all the people mentioned above. Errors if any, crept by chance are all mine. Please bring them to our notice for further correction.

Hope this work will serve the purpose of learning Homeopathy.

Submitted to the Lotus feet of Masters..

Vasudeva.



Chakrapani.

Contents

Dr. EVM Acharya DHMS., was the Medical Director of Master EK Homeo Vaidyalayams under the aegis of Master EK Spiritual Service Mission. He was a healer par excellence. He trained hundreds of young learners in Homeopathy.

Sri Ogirala Ramachandra Rao is serving Master EK Homeo dispensary at Guntur, AP, Guntur.

Dr. I.S. Chakrapani has been actively working in the fields of Epidemiology, Phylogenetics, Drug development, Pharmacognosy and Computational biology. Since long, he has been serving in Master EK Homeo Dispensary at Nellore, AP, India.

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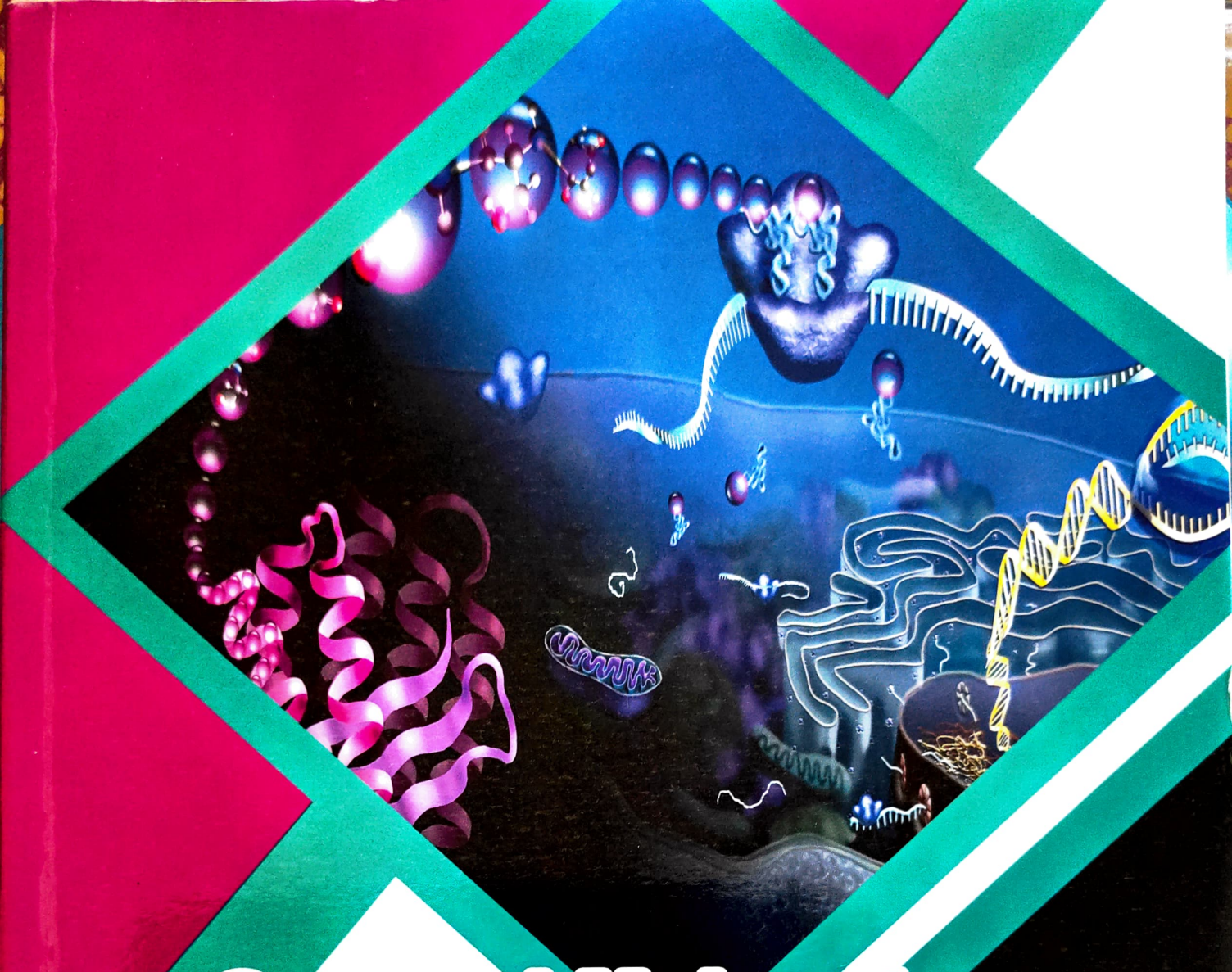

Cell and Molecular Biology

Dr. A. Indira Priyadarsini

Dr. I. S. Chakrapani

αIP

CELL AND MOLECULAR BIOLOGY

FIRST EDITION

Authors

Dr. A. Indira Priyadarsini

Dr. Inavolu Srinivasa Chakrapani

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CONTENT

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Dr.I.S.Chakrapani has been working as Asst.Professor in the Dept of Zoology, PRR & VS Govt. College, Vidavalur,Nellore Dist,AP. He did his PG & Ph.D from Sri Venkateswara University, Tirupati. He has got more than 20 years of teaching & research experience. He has a commendable flair for research work and has been actively working in the fields of phylogenetics, herpetology and computational biology. He has published more than 25 papers in journals of national and international repute and presented in many conferences. He has been member in various committees of Collegiate Education, AP. He contributed much to the LMS developed by the the Commissionerate of Collegiate Education, AP. He served as IQAC coordinator and master trainer for Skill Development Courses & Life Skill Courses.

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DEPARTMENT OF ZOOLOGY

PATHOLOGY IN AQUACULTURE

B VOC CA e BOOK CORE XI

Compiled by

SREENIVAS- CHAKRAPANI- ANILKUMAR

FACTORS CAUSING DISEASES

The health of aquaculture organisms, including fishes, is due to a state of physical well-being. Abnormal changes in the body arises from two factors, one for which the aquatic environment is important (dietary deficiency, attack of pathogens and other stresses) and other is due to cold-bloodedness of the fish (fish's inability to maintain its body temperature).

Nutritional imbalance results in formation of thyroid tumours, anaemia, liver degeneration, visceral granuloma, pigmentation impairment and deficiency symptoms associated with vitamin imbalance.

Physical and environmental stresses play significant role in the maintenance of healthy conditions. Although, many pathogens of aquaculture species are generally found in the aquatic environment, yet their presence may not lead to the occurrence of disease.

Disease results due to interaction between the species, the disease agent and the aquatic environment. The balance between these three major factors determines the state of health of aquatic species. Disturbance in any of these three factors may lead to the disruption of the relationship, resulting in the causation of disease.

Resistance of the Host:

The resistance or susceptibility of the cultured species to the disease causing agents is governed by its age, exposure experience and physical barriers (such as exoskeleton, skin and mucous membranes). The physical barriers generally restrict the entry of toxic, infectious and parasitic agents.

The physiological defences comprise the white blood corpuscles that engulf pathogens, avoidance mechanisms, detoxi-fication of chemicals from water or diet by the liver, storage of certain metals by the bones and local tissue reactions. The source of fish's physiological ability to defend itself is the overall nutrition it consumes.

(a) Immune response:

An important means of disease resistance is the immune system of fishes and its specific activity against biological agents such as viruses, bacteria and parasites. The immune system operates through antigen-antibody reactions. The antibodies of fish (teleost) are serum proteins

(immunoglobulins) that belong to IgM or IgG class.

These are functionally classified as agglutinating, precipitating and virus neutralising. By the stimulation from certain antigens (bacteria, virus, etc.) the agglutinating antibodies are formed. These antibodies bind the antigens rendering them less toxic and more vulnerable for easy phagocytosis.

On the other hand, the precipitating antibodies are less important in fish and they generally cause precipitation of soluble antigens which are easily discarded through tests. Virus-neutralising antibodies cling onto the virus particles making them inactive.

In fishes antibody formation is temperature dependent. Lowering of temperature may delay or suppress antibody formation and would thus affect the immune response of that fish. Certain behavioural factors, such as pheromone released in crowded condition, may also suppress antibody formation.

Population with previous exposure (to a specific antigen), will be less susceptible as those on a first encounter. Moreover, young ones are more susceptible to diseases than older ones, due to their fragile defence system.

(b) Environment:

Environment often plays a vital role in disrupting the balance between the pathogen and the host. Often the culture animals live a healthy normal life in the presence of pathogens. However, during environmental stress the pathogen gets the upper hand and the balance tips in favour of the disease.

At the time of selection of the site for aquaculture the environmental parameters required were adequately considered so that the relevant stress factors are minimum.

The minimum water quality conditions necessary to maintain good fish health are:

Dissolved oxygen — 5 mg/1
Range of pH — 6.7-8.6
Free CO_2 — 3 mg/1 or less
Ammonia — 0.02 mg/1 or less
Alkalinity — at least 20 mg/1

Temperature plays a vital role on a number of other variables in the environment. With increase in temperature solubility of toxic compounds increases creating unfavourable conditions. As has been discussed above antibody formation is temperature dependent. Wound healing is temperature dependent as the repair of dermis is suppressed by low temperature.

Ailments from Environmental Factors are:

(1) Chill and cold weather results in drop of water temperature and the fish shows congestion of gill apparatus and dull appearance.
(2) Alteration in pH of water results in too acidic (pH at or below 5.5) or too alkaline (pH at or above 9) and the fish shows a sign of ailment. Mucus secretion gets enhanced. In too alkaline case, the gills appear burnt and the fins give a rot look. It may result in fatal ailment, if not duly treated.
(3) Depletion in dissolved oxygen content of water results in asphyxia and the fish shows signs of suffocation—mouth gets wide open, gill opercula get raised and the gills spread wide apart.
(4) Constipation and indigestion results in queer movements and listlessness of fish. The fish may remain stationary in mid-water or stand on its head or lie at the bottom on its side. Stomach appears swollen and the scales get erected.
(5) "Egg binding" illness of the females occur during the breeding time. The body of the female fish becomes greatly swollen due to accumulation of ripe eggs that could not be released.
(c) Genetic resistance — As fishes are known to adapt to disease in nature, these traits of resistance can be developed to resist those infections.

Even the disease- resistant fish that survives may develop a carrier state, which is harmful if the disease carrier is to be introduced into new areas where the disease would not otherwise occur. Thus, by maintaining a high level of genetic diversity in a stock, the ability increases to withstand the stress of infectious diseases.

HOST PARASITE RELATIONSHIPS

The contraction of infection is direct in most parasites and pathogens. The disease causing agents freely swim on to the host or contact it by contiguity, or through a vector (the fish leech transmits Trypano- plasma in cyprinids causing sleeping sickness — Trypanoplasmosis), or infection may be caused through the food medium which is already infected. For example, transmission of cestode (Ligula) through infected copepods (harbouring the larval stages of the parasite) which is subsequently eaten up by the fish.

Sign of Sickness and Effect on Fish:

Sickness in fishes may vary, but there are some common external symptoms, which are:

(1) Fish becomes listless,

(2) Loss of balance occurs and the ailing fish is unable to maintain its normal position,

(3) The diseased fish tends to lie on its side either floating at the surface or resting at the bottom,

(4) Slimy, grey excretions appear on the skin,

(5) Fading of normal colour occurs and the gills appear pale and

(6) The fins (including tail fin) do not function normally and with vigour.

The parasites of fish extract their nutrition from the host but do not harm it. However, they cause loss of anabolic material and render the host weak.

They, thus, directly or indirectly harm the fish as described below:

(1) Cestodes (Eubothrium) cause mechanical damage as their large-scale multiplication blocks the lumen of the gut.

(2) Trematodes (Diplostomum) cause cataract in the fish eye and impairs vision.

(3) Acanthocephalans (Pomporhynchus) heavily perforates the intestine.

(4) Ligula (cestode) multiplies to such an extent that it constitutes about half the total weight of the host fish. The parasite consumes a substantial part of the fish's food and thus, retards its growth.

(5) 'White spot' and 'black spot' cause irritation in the skin and the fish scratches to bleeding.

(6) Argulus from its poison glands discharges toxic substances that may hasten the death of the host fish.

(7) The common aquatic fungus (Saprolegnia parasitica) is a secondary parasite that invariably causes death to the host fish.

3. Fish swim in circles, then rest on the bottom and again begin to whirl in circles.

4. The posterior third of the body becomes black in colour. The dark area is sharply delimited from normal part of the body that lesions due to damage of the sympathetic nerve, which are responsible for pigmentation (pigment motor function).

5. Malformations of vertebral column, which lead to bind the vertebral column in various directions.

6. Retraction and malformation of jawbones & the mouth remaining open.

7. Fish cannot feed and die from exhaustion.

Diagnosis:

1. Case history.

2. Clinical signs.

3. Cut sections of the skull. Gill arches and vertebrate stained with Giemsa stain, will reveal the spores located in cartilage or surrounded by bone.

4. Fluorescent antibody techniques help in diagnosis of the disease.

Prognosis:

Morbidity rate among young salmonids will usually reach 100%. Mortality rate among heavily infected young salmonids is 100%.

Treatment and control:

1. There is no therapy for treatment of infected fish.

2. Prevent movement of infected fish to non-infected farms.

3. Slaughter of infective fish.

4. Hygienic disposal of dead fish.

5. Drying the fish farm & disinfection the bottom with calcium oxide.

6. The water in the hatcheries and rearing tanks must be free from spores.

7. Disinfection of hatcheries and equipment with 1% of sodium hydroxide, potassium hydroxide.

8. Separation of fry & fingerlings is important element in preventing infections.

9. Imported fish must be conducted with certification, that the fish is free from whirling disease.

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Retinal blood vessel segmentation using AI

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I.S. Chakrapani ; Shubhi Gupta ; Narender Chinthamu ; Hemant Singh Pokhariya ; B Ravindra Babu. ; Annam Takshitha Rao All Authors

Abstract: Retinal microvascular is a dependable marker of abnormalities in vessel morphology, that have been linked to a variety of clinical disorders, both in ocular and metastati... **View more**

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Abstract:
Retinal microvascular is a dependable marker of abnormalities in vessel morphology, that have been linked to a variety of clinical disorders, both in ocular and metastatic disease. However, accurate vessel segmentation, which would be intricate- and time-intensive, is required for objective and statistical evaluation of the retinal blood vessels. In terms of segmenting retinal vessels, artificial intelligence (AI) has shown a significant amount of promise. In this study, the fundus images retinal blood vessel is segmented using deep learning methods. The data set required for this study is collected from the Kaggle website and pre-processed using various techniques to make it compatible with the deep learning models. The pre-processed images are then segmented using deep learning models such as LadderNet and UNet. The efficiency of the deep learning models are validated using performance metrics such as Intersection of Union (IoU), accuracy and F1 score. This study shows an accuracy of 0.98% using the UNet deep learning model and it is deemed to be an efficient model than the pre-existing models.

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Contents

Retinal blood vessels, classification of the blood vessels and their structural details is crucial for the computer-aided identification and treatment of various ailments. Numerous research has focused at how these eye abnormalities relate to the properties of the retinal blood vessels. Some fatal systemic ailments, such as cardiovascular conditions and neurological conditions, can also be shown in fundus imaging. It is hypothesized that a number of retinal blood vessels morphological features are connected to illness susceptibility and advancement. The very first step to scientifically evaluating the fundus image vasculature and statistically understanding the morphological features is retinal blood vessels segmentation, which is the segmentation of visible vessels from a fundus image. These methods enable for the collection of statistical data that is nonintrusive or in vivo. The primary goal of recognising and pinpointing retinal vessels is to differentiate the various vascularization structure tissues of the retina from the perspective of the fundus image. Scientist's attention has been drawn to the recognition of retinal vessels due to the availability of non-invasive fundus imaging technology and the key details obtained from of the vascularization framework for the identification and prognosis of a broad range of retinal pathogenesis. Using fundus camera equipment, retinal blood vessels can be imaged efficaciously and non-invasively. Developing scientific proof encompassing translational evidence suggests that morphologies in retinal blood vessel sections are initial markers of cardio-metabolic risk and outcome similar to any illness. As a result, data from large population-based-related appears to work is required to determine the essence of these morphometric leanings. Numerous processes have been used to investigate retinal images. While these offer a variety of retinal vessel lists, they are frequently restricted in terms of research and numerical value, and have constrained processing, including the ability to distinguish between venous system and capillaries. As a result, developing a reliable method for retinal image examination technique and generating a rich quantification of retinal vasculature in large numbers of fundus cases.

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Applications of Deep Learning (DL) Techniques in Detecting Breast Cancer and Malignant Cells

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I. S. Chakrapani ; Neha Tyagi ; Swati Tyagi ; Pankaj Kunekar ; D. Lakshmi Padmaja ; Kumud Pant **All Authors**

Abstract: According to the most recent statistics, the most common type of cancer globally is the breast carcinoma and kills close to 900,000 people annually. Early and accurate di... **View more**

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Abstract:
According to the most recent statistics, the most common type of cancer globally is the breast carcinoma and kills close to 900,000 people annually. Early and accurate diagnosis of the illness can increase the likelihood of successful treatment and lower the mortality rate. In fact, an early diagnosis can help stop it from spreading and prevent the premature victims from getting it. Researchers who study cancer have a number of difficulties when attempting to differentiate between benign and malignant tumors as well as attempting to make judgments about benign and metastatic breast carcinoma. Examine the effectiveness of automated deep learning algorithms at identifying malignant cells in women's breasts and cancer stage. This paper suggests applying deep learning algorithms to whole-slide pathology images in order to possibly increase diagnostic efficacy and accuracy. The convolutional neural networks (CNN), sparse auto encoders (SAE), and stacked sparse auto encoders are illustrations of techniques of deep learning were used in this research work. There are numerous public mammographic databases available. The methods discussed in this paper are put to the test using the mini-MIAS mammographic database. The stacked sparse auto encoder performs better, this method has to be tested in a clinical setting before being used. It has higher accuracy and precision as compared to CNN and SAE. Better diagnostic performance was achieved by several deep learning methods. Deep learning algorithms are used to better reliably identify tiny tumors while detecting breast cancer via a mammogram.

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Contents

According to a reputable source like the Centers for Disease Control and Prevention (CDC), breast carcinoma is one of the frequently causing type of cancer in women. Depending on a number of variables, there are wide variations in the probability of healing breast cancer and the nature of a woman's tumour. 2 of the biggest factors are the disease's stage when she receives her diagnosis and aspects. This cancer develops in tissue cells. Most of the time one of the two breast regions named as the lobules or the ducts is where the cancer first appears. A cancerous condition called adipose tissue, which is found in your breast, is also possible both the fibrous connective tissue and tissue. Unchecked cancer cells could potentially frequently spread to unaffected tissue of breast and can reach to the lymph nodes situated below the arms [1].

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IoT Based Mobile App for Continuous Health Monitoring of the Person

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***Abstract*—In the sphere of medicine, IOT is meant to keep people safe and healthy plays a crucial part in communicating with doctors and patients through the use of health monitoring equipment and lowering healthcare costs in the future years. The internet of things (IoT) is making the world a smarter and more efficient village by allowing a variety of sensors and smart gadgets to gather and analyse data for a variety of reasons. As a result of these smart things, the healthcare system is growing wiser. When basic health facilities lack comprehensive medical care infrastructure, emerging countries gain. However, there is currently no specialized architecture for smart health units that can allow for this gathering and transferring patient health information to headquarters hospitals where live patient assistance is offered. Here, a smart IoT-based healthcare system is proposed, which includes a smart medical kit linked to sensors and a server for frequent health tracking. This smart medical kit is associated with sensors to measure the health parameters like body temperature, blood pressure, and heart rate for the effective function of the body. The proposed idea can alert the patient and their relatives in case of any abnormalities in their health parameters and also get suggestions from the doctor without physical contact with the doctor.**

Keywords—Heart rate, Temperature, Blood Pressure, IoT, Blynk.

I. INTRODUCTION

The Internet of Things (IoT) has become a globally acknowledged network technology and heavily researched area. Sensors are employed in practically every product today, from ordinary items to Sensor-based exhaustive medical systems, and industry surveillance systems are now booming. [1]. The Internet of Things (IoT) makes our lives smarter, efficient, and productive. The prototype device [2] uses a mobile phone as the data transferring platform to deliver user-friendly speech recognition and alert functionality. Because of insufficient and ineffective healthcare services to satisfy the expanding demands of a growing population with chronic conditions, health care is becoming ever more difficult to manage. Many smart or medical sensors have emerged as a result of technological advancements, which continually assess individual patient behavior and properly forecast a problem. Data collected by such sensors may be utilized for a variety of reasons by a variety of actors, including physicians, patients, family, and healthcare facilities. Reports that explain the patient's health state are created by combining analytics and sensor data. This platform may also include data from a variety of sensors to provide mechanisms for monitoring, processing, visualizing, storing, and sending notifications about a patient's status and vital signs in real-time through Internet standards. Different types of sensing devices are employed in healthcare, depending on their qualities, usefulness, and efficiency. The growth of the IoT in the field of medicine is shown in Fig. 1 and the statistics taken from the grandviewresearch.com website.

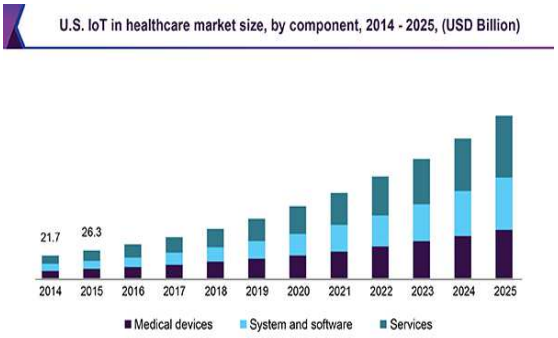

Fig. 1. IoT in health care

These networked IoT devices produce massive amounts of data that suppliers must handle well, which might be a big burden. The Internet of Things Analytics (Particle) process is used to address the difficulty of storing and analyzing large amounts of data. Using approaches such as information extraction and information analytics, the raw data is transformed into meaningful and therapeutically significant information. It is expected that by 2020, more than 50-55 % of raw data analysis approaches would be able to better handle the stream of data created by instrumented devices and applications. Mobile phone-based health assessing solutions are growing increasingly mostly as the information and technology revolution continues. These technologies can gather significant health data and deliver comments to doctors and patients [3]. Enabling everyone to assess their health to seek emergency treatment in the case of any unconditional emergency can save a person's life. In the long term, the adoption of such process moves may save the government money on medical expenditures [4]. Integrating cellular data with a healthcare system based on an open-source Android architecture has become fairly straightforward as a result of the high accessibility of mobile internet access [5].

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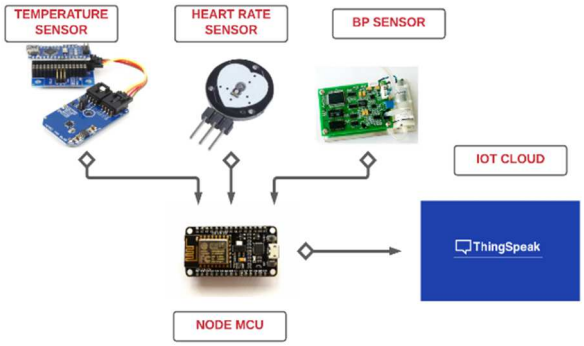

Fig. 2. Block diagram

The implementation of IoT in health monitoring systems has provided us with significant growth in the improvement of contemporary medical treatment [6]. Sensors have gotten smaller as a result of advancements in VLSI technology, allowing for the creation of wearable solutions. Devices are getting more effective and powerful as a result of persistent internet access. IoT-based health monitoring gadgets keep an eye on a patient 24 hours a day, seven days a week. The gadgets create essential signals by assessing statistical data at every critical point [7]. Patients may be remotely monitored and appropriate actions are taken in the event of an emergency since IoT-based gadgets are always linked to the internet. Health tracking systems and IoT-based health tracking systems have considerable distinctions. IoT integration in health monitoring systems is a difficult challenge [8]. The following are some of the difficulties: The majority of IoT efforts have yet to be deployed successfully. The Internet of Things produces a massive amount of data, which necessitates the use of specialized big data for proper management. For IoT systems, security is a major concern. In the case of flawed or obsolete security systems, hackers might readily get sensitive private data from users. Because it is not up to date with current security measures, obsolete infrastructure might cause difficulties. Fig. 2 shows the overall block diagram of the proposed idea.

II. Literature Survey

Pang and his team demonstrated a monitoring approach using an Android smart phone. The system may capture and process data on the server and send it to the smart phone terminal through a socket, allowing it to monitor the target location from anywhere within the range of a wireless network. Sensor data is collected from temperature, humidity, infrared, and CO2 sensors. A pervasive health system [9] using mobile phones was created to help chronic patients manage their diseases while out and about. This system includes patient health monitoring, diaries for various illnesses or symptoms, and social sharing of recorded information. Analyzes IoT-based patient monitoring. Chronically ill patients can benefit from an IoT-based patient monitoring system [10]. This method's goal is to improve patients' quality of life by giving them more control over their diet and exercise habits. Instructions to obtain measurements through sensors and recommendations and exercises are equally effective in improving patients' eating habits as the created model for the system [11]. Current human health monitoring systems have some flaws, such as a rising number of users and submitted data, no user assurance, poor real-time performance, and low data usage. This project develops an IoT-based health monitoring system [12]. The device can continually monitor heart rate, blood pressure, pulse, body temperature, and other vital indications. In this project, wireless sensors save data for health monitoring. The data is integrated using the Internet of Things to enable real-time monitoring (IoT). The proposed approach improved the current health monitoring platform's accuracy and stability [13-14]. The author in suggests a smart monitoring system based on IoMT. This study describes a full health paradigm that includes a remote health-monitoring system. It gathers critical patient information and sends it to the physicians. This technique saves time for both the patients and the doctors. In the event of an emergency, the physicians will be able to assist the patient right away [15]. Many scholarly publications discuss IoT-enabled versus non-enabled health monitoring systems, both in terms of functionality and cost. R. Ali Khan et al. explain the system design of a wireless body area sensor network for health monitoring purposes [16-17]. Authors in proposed a mobile phone accessory-based wireless health monitoring system [18]. The patient's heart rate is communicated utilizing a smart phone with this method. It is made up of a single microcontroller chip. This type is the least but it has the benefit of extending the battery life.

III. Proposed System

A smart health assessment system checks body temperature, blood pressure, and heart rate using a variety of sensors, with the values being relayed using an ESP8266 with the support of an IoT platform to provide a comprehensive picture of one's health.

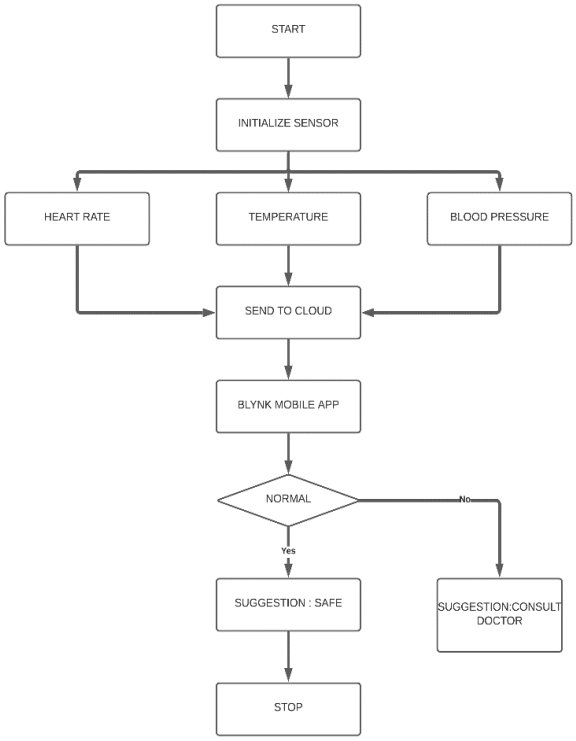

Fig. 3. Proposed Idea

The proposed concept is shown in Fig. 3. With a smart patient health monitoring system, the most fundamental physical parameters of the patient are measured and sent to the cloud for further analysis. A system for tracking the measured data in real time. Any disparities between the observed values and those established by the doctors as the standard of care will be communicated to the patients and their loved ones. A

direct effect of this is that the patient will be able to obtain prompt first aid without having to wait for or engage with the doctors personally.

The suggested system adds additional sensors to the physical layer, resulting in a significant shift in the healthcare paradigm, and analysis. Sensors are attached to the patient's body in various locations and wirelessly linked to the microcontroller. Heart Beat Sensor: Pulse waves, or changes in the volume of a blood artery caused by the heart pumping blood, are measured by an optical heart rate sensor. The range of heart rate for humans is shown in the table: 1. An optical sensor and a green LED are used to detect pulse waves by monitoring volume changes. To mitigate the influences of ambient light such as visible and infrared rays, the detector block utilizes an optic filter calibrated for pulse wave recognition. This facilitates the gathering of high-quality pulse impulses even in wide spaces. Furthermore, by leveraging optic sensor systems that had been developed over a long period, ROHM was capable of increasing the sensitivities of the sensing panel.

TABLE. I. HEART BEAT SENSOR

Sl. No.	Age	Heart Rate
1	Less than 1 month	120-60
2	1-12 months	80-140
3	1-2 years	80-130
4	2-6 years	75-120
5	6-12 years	75-110
6	>12 years	60-100

A. *Temperature Sensor*

A temperature sensor is a device that employs an electrical signal to produce temperature measurement in a readable form, often a thermocouple or a resistance temperature detector. A thermometer is the most standard form of the temperature gauge, and it is used to detect exactly cold or hot something that is. Temperature meters are used in the geotechnical profession to monitor structural changes induced by seasonal oscillations in concrete, buildings, soil, water, bridges, and other structures. A temperature sensor is a gadget that senses an item's degree of warmth or coolness. How effectively a temperature meter works is determined by the voltage across the diode. The resistivity of the diodes varies in direct proportion to the temperature change. Whenever the temp drops, so does the resistance, and vice versa.

B. *Pressure Sensor*

The Blood Pressure Sensor is a non-invasive blood pressure monitor for people. Systolic, diastolic, and mean arterial pressure are all measured using the oscillometric approach. The pulse rate is also properly considered. Blood pressure is one of the most important essential indicators (BP). Moving blood exerts pressure on the vascular walls. Blood pressure is defined as the ratio of systolic to diastolic pressure. A mercury sphygmomanometer is used to check blood pressure. In this procedure, blood pressure is calculated using the height of the mercury column. The oscillometric method has been used for automated blood pressure monitoring since 1981. As technology progresses, devices for non-invasive oscillometric blood pressure monitoring are being developed. As technology progresses, devices for non-invasive oscillometric blood pressure monitoring are being developed. Such a gadget is the Blood Pressure Sensor: The diastolic and systolic pressure is monitored via oscillometric sensing and the disparity capacitive or variable piezo resistance concept, respectively. Fig. 4 depicts a normal human Systolic vs. Diastolic blood pressure chart which is taken from bloodpressureuk.org.

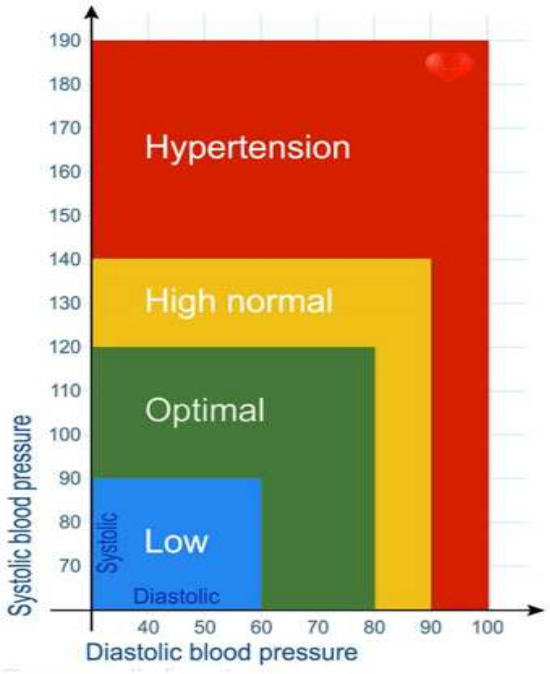

Fig. 4. Blood pressure range.

C. *Node-MCU*

Node MCU is an open-source IoT platform that includes both software and hardware. It performs the function of as like as the microcontrollers like Arduino and many. It is based on the ESP8266 microcontroller. It may be connected to the computer by USB connection, and programs can be installed onto it. A Wi-Fi module is included. The Node MCU is linked to a variety of health monitoring sensors, and data is gathered. These data are transferred to the cloud with the aid of the Wi-Fi module. It may be viewed from anywhere using e-mail from the cloud.

IV. RESULTS AND DISCUSSION

Sensors in the proposed system measure and communicate all body variables in real time to the cloud, which is powered by an Internet of Things platform. It displays the heart rate at any given point in time during the day. Wearers of wearable devices can enjoy more comfort as a result of this feature. This method captures data that is more exact and accurate. If you compare it to the manual techniques, it saves you valuable time. Because data is collected on a constant basis, the burden on doctors is reduced as a result of these statistics. It is possible that the other specialist will also receive these numbers by email. The health status of a patient, for example, can be recognized and compared to established parameters defined by his or her family, and major health alarms can be triggered depending on the detected data. The temperature from the temperature sensor is monitored regularly, and the data in the Blynk app are updated regularly. The temperature measured graph is shown in Fig. 5, Fig. 6. The wearable blood pressure sensor measures both systolic and diastolic blood pressure. The systolic blood pressure is shown in Fig. 7, Fig. 8 and the diastolic blood pressure is shown in Fig. 9, Fig. 10. The heartbeat sensor is used to determine the heart rate. The heartbeat rate graph of the patient is shown in Fig. 11, Fig. 12.

Application software is designed to show the output status of the patient's body condition. Through this, uneducated people could also get to know their health condition with the help of a sensor is attached to the body. This particular sensor measures four important parameters. The detectable four parameters incorporated here are temperature, systolic, diastolic, and heart rate. As shown in Fig. 5 and Fig. 6. the temperature monitor is abnormal and normal respectively. Normally, a human's average temperature would be 98.6 degrees Fahrenheit. This tested output denotes us through the alert symbol accompanied with an alert beep. If the temperature is above the normal state, then the alert symbol and a beep sound will get initiated. From this Doctor, a visit has to be done by the patient for checking if any abnormality is noticed. The graph is depicted for legible understanding to uneducated people at the moment after testing. In Fig. 5, since the temperature exceeds the normal temperature, an alert beep is noticed. In 15 minutes, 1 hour, 6 hours, 1 day the temperature is noticed as 130 degrees, 120 degrees, 125 degrees, 124 degrees respectively. In Fig. 6, since the temperature doesn't exceed the normal temperature, an alert beep is not noticed. So that the patient could take self-care by him or herself. In the output, one of the patient's outputs is 140 degrees, so the alert is shown due to its abnormality. While another one is 101 degrees, so the alert is not shown due to its normality.

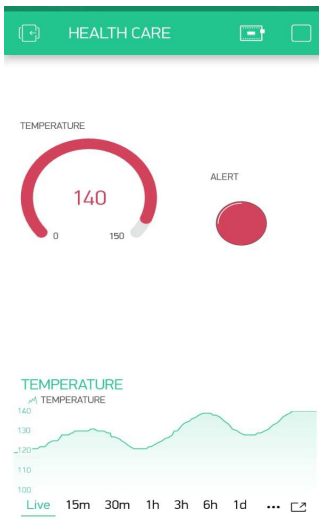

Fig. 5. Temperature monitor - abnormal

As shown in Fig. 7 and Fig. 8. the systolic monitor is abnormal and normal respectively. Normally, a human's average systolic pressure would be 80 to 120 mm Hg. This tested output denotes us through the alert symbol accompanied with an alert beep. If the systolic pressure is above the normal state, then the alert symbol and a beep sound will get initiated. From this Doctor, the visit has to be done by the patient for checking, if any abnormality is noticed. The graph is depicted for legible understanding to uneducated people at the moment after testing. In Fig. 7, since the systolic pressure exceeds the normal state, the alert beep is noticed. In 15 minutes, 1 hour, 6 hours, 1 day the systolic pressure is noticed as 120 mm Hg, 135 mm Hg, 140 mm Hg, 132 mm Hg respectively. In Fig. 8 since the systolic pressure doesn't exceed the normal state, an alert beep is not noticed. So that the patient could take self-care by him or herself without visiting the doctor. In the output, one of the patient's outputs is 134 mm Hg, so the alert is shown due to its abnormality. While another one is 120 mm Hg, so the alert is not shown due to its normality.

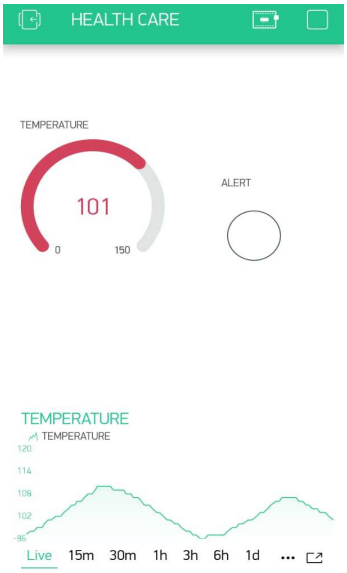

Fig. 6. Temperature monitor - normal

Fig. 7. Sysytolic monitor. – abnormal

As shown in Fig. 9 and Fig. 10. the diastolic monitor is abnormal and normal respectively. Normally, a human's average diastolic pressure would be 60 to 80 mm Hg. This tested output denotes us through the alert symbol accompanied with an alert beep. If the diastolic pressure is above the normal state, then the alert symbol and a beep sound will get initiated. From this Doctor, the visit has to be done by the patient for checking, if any abnormality is noticed. The graph is depicted for legible understanding to uneducated people at the moment after testing. In Fig. 9, since the diastolic pressure exceeds the normal state, an alert beep is noticed. In 15 minutes, 1 hour, 6 hours, 1 day the diastolic pressure is noticed as 82 mm Hg, 78 mm Hg, 90 mm Hg, 92 mm Hg respectively. In Fig. 10, since the diastolic pressure doesn't exceed the normal state, an alert beep is not noticed. So that the patient could take a self-care by him or herself without visiting the doctor. In the output, one of the patient's outputs is 99 mm Hg, so the alert is shown due to its abnormality. While another one is 73 mm Hg, so the alert is not shown due to its normality.

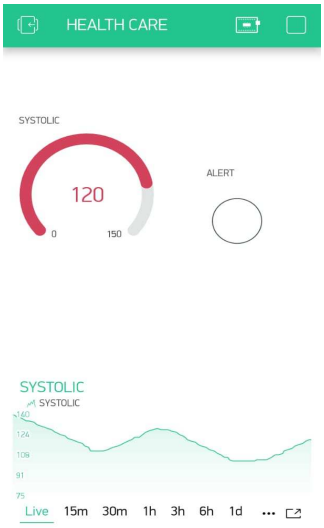

Fig. 8. Sysytolic monitor. - normal

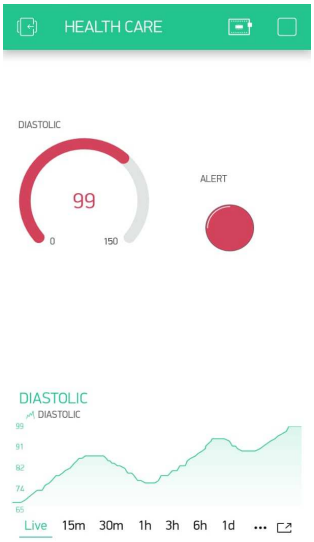

Fig. 9. Diastolic monitor. - abnormal

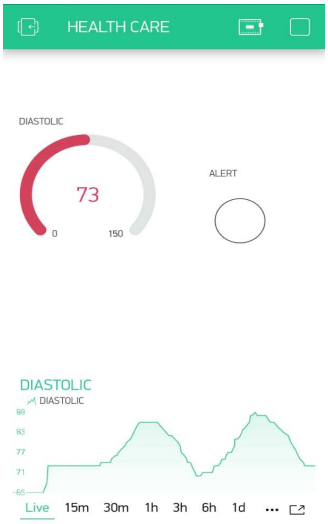

Fig. 10. Diastolic monitor. - normal

As shown in Fig. 11 and Fig. 12. the Heart rate monitor is abnormal and normal respectively. Normally, a human's average Heart rate would be 60 to 100 beats per minute. This tested output denotes us through the alert symbol accompanied with an alert beep. If the diastolic pressure is above the normal state, then the alert symbol and a beep sound will get initiated. From this Doctor, the visit has to be done by the patient for checking, if any abnormality is noticed. The graph is depicted for legible understanding to uneducated people at the moment after testing. In Fig. 11, since the heart rate exceeds the normal state, an alert beep is noticed. In 15 minutes, 1 hour, 6 hours, 1 day the heart rate is noticed as 78 beats per minute, 82 beats per minute, 97 beats per minute, 95 beats per minute respectively. In Fig. 12, since the heart rate doesn't exceed the normal state, an alert beep is not noticed. So that the patient could take self-care by him or herself without visiting the doctor. In the output, one of the patient's output is 98 beats per minute, so the alert is shown due to its abnormality. While another one is 68 beats per minute, so the alert is not shown due to its normality.

Fig. 11. Heart rate monitor abnormal

Fig. 12. Heart rate monitor – normal

The sensor's data is fed to the controller, which subsequently sends it to the IoT device. These values are uploaded in the Blynk app so that we can able to monitor them easily. The usual body temperature for a healthy person is between 97- and 99-degrees Fahrenheit. A healthy person's heart rate ranges from 60 to 100 beats per minute. The human body's typical systolic and diastolic rates are fewer than 120 and 80, respectively. If any of these numbers are abnormal, the controller will notify the patients, their families, and their physicians, who will administer emergency first aid.

V. CONCLUSION

A low-cost, simple-to-implement health monitoring system is provided, which solves the shortcomings of the existing method of measuring the health parameters by

making it a more effective technique of monitoring patients' health parameters. It offers the advantages of being less expensive, taking less time, and using less power. The accurate measurement of a patient's heart rate and other health data is achievable, and it plays an important part in the medical monitoring system. IoT allows sensors to relay data wirelessly to a server. Basic physical characteristics are monitored regularly. It is more comfortable for the patient to utilize these wearable gadgets. This approach records values that are more exact and accurate. It saves time compared to the manual way. The doctors' workload is decreased since these values are continually recorded. In the future, machine learning and artificial intelligence algorithms will be used to analyze a component of the design. Automated diagnosis, prescription, and repost analysis the system will be supplemented by the generator.

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Analyzing the Occurrence of Stroke using Machine Learning-A comparative Study on Supervised Learning Models

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***Abstract*—Stroke is blood coagulation or bleed in the brain which could cause permanent damage and affects mobility, intelligence, vision, and communication. Stroke is considered a health-related crisis circumstance and can cause long-term neurological damage, complication, and often death. Most of the stroke is classified as ischemic and haemorrhagic. Stroke has been observed to have abnormal ECG signals. Therefore, if the individuals have their bio-signals monitored in real-time, they can get proper treatment rapidly. Most stroke diagnosis forecast systems are based on image processing tools namely CT and MRI, which are costly and hard to use in clinical practices. Stroke is the consequent driving cause for death around the world and quite possibly the most dangerous infection for persons over the age of 65. It causes ill-effects to the cerebrum like "coronary failure" which causes ill-effects to the heart. When a stroke sickness occurs, it causes enormous clinical care and permanent disability, yet in some cases, it also results in death. Like clockwork, someone dies of a stroke every 4 minutes, yet up to 80% of stroke could be averted if the medical specialist could forecast the incidence of stroke in initial phases. In this project, we have designed an ML model for predicting stroke utilizing the KNN algorithm, SVM algorithm, and NB algorithm. Followed by comparing KNN, SVM, and NB algorithms utilizing error and accuracy. Among KNN, SVM, and NB algorithms, the Support Vector Machine algorithm has the highest accuracy of 96.66%. This project hence helps in predicting the stroke effects and provides a customized warning. Therefore, it urges clinical patients to fortify the inspiration of wellbeing prosperity and brief changes in their medical care practices.**

Keywords—ECG signal, Stroke, MRI, CT, Machine Learning.

I. INTRODUCTION

The first paragraph after a heading is not indented (Body text style). The World Health Organization(WHO) interpreted Stroke-"Fast-growing clinical indications of severe disruption of brain activity, having indications persisting 24 hours or greater or resulting in death, without reason apart from vascular origin"[1]. A stroke occurs when the blood dispense to some portion of the brain is hindered, preventing cerebrum tissue from obtaining oxygen and nutrients. A stroke is a health crisis and prompt treatment is vital. Early treatment can lessen the brain damage and other consequences. Stroke is one of the main dangers to general wellbeing throughout the world [15].

With the enhancements in medical services, more individuals endure stroke yet many need to adapt to the physical, mental, social environment, bringing about expanded individual and public expenses. The socio-economic effect of stroke is extensive around the world [16].

It is estimated that 4.5 million people die of stroke a year around the world and more than 9 million stroke survivors. Nearly one of every four males and almost one of five females over the age of 45 can expect to have the illeffects of stroke in case they live to the age of 85. Recurrence of stroke expands the level of inability and demise of patients [14].

Stroke is the leading cause of death in the United States, as per the Centers for Disease Control and Prevention. It is a non-communicable infection that accounts for more than 11% of all deaths worldwide [12]. Constantly, more than 795,000 persons in the US have experienced the health impacts of stroke. It is the fourth remarkable inducement for demise in India [2]. The worldwide lifetime threat for stroke in 2016 for people beginning at the age of 25 was 24.9%. The most noteworthy worldwide lifetime threat for stroke was identified in East Asia (38.8%) followed by Europe (31.7%). The most reduced stroke threat was identified in eastern sub-Saharan Africa with a percentage of 11.8.

With the enhancement of innovation in the healthcare sector, foreseeing the circumstance of stroke can be modeled by utilizing ML [11]. The algorithms in ML are valuable in creating precise predictions and providing the right examination. The obstruction with this model is that it is being prepared on literary information and not on clinical cerebrum scans [10], [18].

The dataset is selected from Kaggle with different characteristics as its features. Initially, the dataset is Pre-processed (i.e.) cleaning and preparing for the ML model to recognize. Following that Label Encoding is executed to transform the string to integer data type. Then the dataset is parted as learn and validation data. Subsequently, a model is created utilizing this new data through three supervised ML techniques. Accuracy is determined for these various techniques and analyzed to become the finest prepared model for the forecast. Succeeding legitimate examination, the paper concludes with the most appropriate algorithm for stroke analysis.

II. Literature Survey

To get the required knowledge about different ideas related to the stroke analysis, existing literature was taken into account. The research paper on "Computer methods and programs in Biomedicine, provides the computational analysis of stroke prediction over 10 years and classifies the patient's stroke probability occurrence into five different categorizations [3]. The research paper [22] determines a model condition for stroke pre-analysis algorithm with dormant modifiable ill effects. The paper [23] utilizes a Decision tree algorithm to extract the attributes, a principal component analysis algorithm to lessen the dimension and the adopted back propagation neural network classification algorithm is used to establish a classification model. In the paper [24] principle component analysis algorithm is used for decreasing the dimensions and picks up the most involved features for stroke prediction. The research paper [4] suggests the forecast of thromboembolic stroke disorder by utilizing Artificial Neural Networks. Though this model has an accuracy of over 85%, neural Networks require higher processing time and to train. The research work [21] utilized the random forest algorithm to predict the ill effects of the patient suffering from a stroke. This specific work cannot be utilized on any further new stroke types later on. The article [25] provides the application interface for clinical information perception and the board for nervous system specialists in stroke grouping and expectation framework called Stroke MD. The research work [26] proposes the utilization of three various calculations to foresee the chance of stroke and inferred that the Decision tree has the most noteworthy exactness (about 75%). In any case, this model couldn't suit this present reality model.

Other paragraphs are indented (Body text Indented style). According to the journal article [27], the algorithm for stroke detection was developed using Random Forest, Decision Tree, and Multilayer Perceptron. The accuracy rates achieved for the 3 strategies were fairly similar, with just minor variations. Decision Tree had a measured efficiency of 74.31 percent, Random Forest had a determined efficiency of 74.53 percent, and multi-layer perceptron had a determined efficiency of75.02 percent. [28] Demonstrates the application of a supervised learning method to evaluate cardiac stroke. They built the model using several machine learning approaches such as Naive Bayes, Decision Tree, and SVM and then compared their results. The methods they utilized had the highest accuracy of 60%, which is rather low. The researchers of [29] utilized several data categorization algorithms to forecast the stroke risk. The dataset was obtained first from the Region of Saudi Arabia's Hospitals. C4.5, Jrip, and MLP were the three classifiers' methods utilized (MLP). The algorithm achieved an accuracy of about 95% using these techniques. Despite the article's claim of 95 percent accuracy, the duration required for training and prediction is longer since the scientists utilized a mix of sophisticated algorithms.

According to a study published in [30], three distinct algorithms may be used to forecast the risk of a stroke. Decision Trees, Nave Bayes, and Artificial Neural networks are implemented. This study revealed the Decision tree had a maximum accuracy of 75 percent. However, depending on the outcomes derived from the confusion matrix, this concept could not be applied to real-world instances. The investigators in [31] used the Cardiovascular Study database to forecast strokes. They developed a unique automated feature selection method that picks resilient feature extraction methods on a cautious mean that presented. For more effectiveness, they coupled this technique with the SVM Classifier. However, this enabled the production of a lot of variables that gradually decrease the effectiveness of the algorithm. The article [31] suggests employing Neural Networks to forecast stroke illness. The Back-propagation technique was employed for estimation. This model obtained an accuracy of about 89 percent. However, due to the complicated design and growing neurons, NN consumes a long time to educate and even more processing time.

The article can be interpreted in the following manner: Section II goes into detail about the literature review. Section III describes the research's purpose. Section IV describes the study materials and methods. Section V explains in detail how the three machine learning techniques KNN, SVM, and NB, works. Section VI goes through the project's execution. Section VII examines the results in terms of accuracy, precision, and recall. Section VIII suggests the best approach for predicting strokes.

III. Objective Of This Research

Stroke stays as significant wellbeing trouble both for the people and for the public medical care system [17]. The objective of this study is to apply the fundamentals of ML on huge data to viably analyze the occurrence of stroke dependent on conceivably modifiable risk factors.

IV. Materials And Methodology

This section briefly explains the Dataset, Algorithms, and Train and test datasets.

A. Dataset Description

The dataset is collected from Kaggle and it is the documentation of around 5000 people's information on their health status. The dataset contains 10 attributes and the labelled response.

1) Age: This attribute is numerical data and it is the age of the patient.

*2) Gender:*It is categorical data about the patient's gender.

*3) Hypertension:*It is numerical data about whether the patient is hypertensive or not.

*4) heart disease:*It is numerical data on whether the patient had any previous cardiac issues.

*5) ever_married:*It is categorical data about the patient's marital status.

*6) work_type:*It is categorical data on a patient's employment status.

*7) residence_type:*This is categorical data on the patient's occupancy scenario.

*8) avg_glucose_level:*This is numerical data on the patient's body glucose level.

*9) BMI:*It is the ratio of mass to the square of the person's height and it is numerical data.

*10) smoking_status:*It is categorical data on whether the patient smokes or not and how often he/she smokes.

*11) Stroke:*It is the numerical data on the stroke attacks. This is the decision:making attribute.

B. *Algorithm*

The occurrence of stroke can be predicted by employing three Machine Learning algorithms namely (1) Support Vector Machine (SVM) (2) K Nearest Neighbour (KNN), (3) Naïve Bayes (NB) algorithm. The motivation behind using these algorithms is that these algorithms are very notable in modeling accurate predictors and have been utilized in few comparative research works. These models are assessed by comparing the confusion matrices [6].

C. *Data Splitting*

Parting the data into various sets is a procedure usually utilized in ML. The data is generally parted into a learning and validation dataset to prepare and track down the model parameters and to evaluate the model prediction with the parameters such as accuracy or error [5]. The training dataset was utilized to fit the model and testing dataset for the evaluation.

V. PREDICTIVE TECHNOLOGY

For predicting the stroke based on the given attributes three machine learning algorithms are used includes KNN, SVM, NB. The KNN is the laziest algorithm that predicts the stroke occurrence based on the nearest sample. The SVM predicts the stroke based on the hyper plane drawn in the plotted data. Finally, the Naïve Bayes predict the stroke by the Bayesian formula. All three algorithms used in this work are detailed with a flow chart in the upcoming sections.

A. *K Nearest Neighbor Algorithm*

KNN is the least complex ML algorithm dependent on supervised learning. The KNN was first proposed by Cover and Hart in 1968 [7]. KNN algorithm deduces the analogy between new data with available datasets and places the new data into the most suitable category. KNN algorithm is commonly used in Classification problems and for Regression problems.

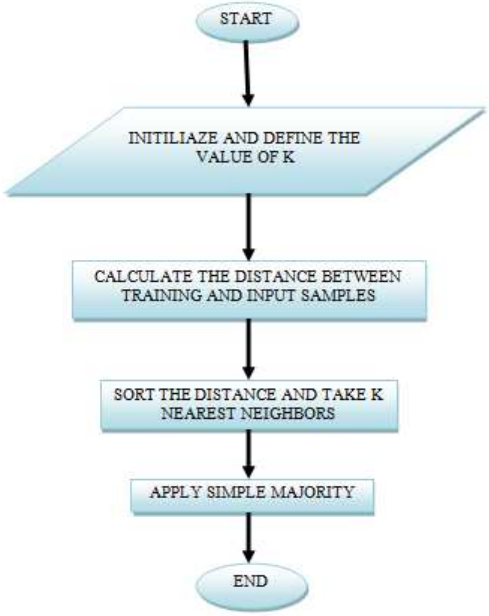

Fig. 1. Block diagram of KNN algorithm

KNN algorithm is shown in the Fig. 1, which is a non-parametric algorithm as it doesn't make any presumption on the available data. The K value is chosen to reduce the training and validation error. The K value is the number of neighbour data available for classification. Predominantly, an odd number is chosen as the K:value. KNN algorithm has the advantage of being simple and less complex. There's no compelling reason to build a model, tune parameters and make extra assumptions. The disadvantage of the KNN algorithm is it comparatively gets slower as the number of independent variables increases. In the Fig. 2, the classification of KNN algorithm is explained.

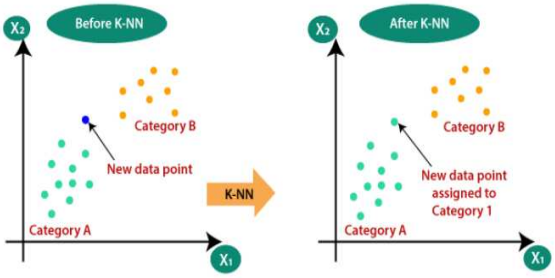

Fig. 2. Classification of KNN algorithm.

(Source: https://www.javatpoint.com/k:nearest:neighbor:algorithm:for:machine:learning).

B. *Support Vector Machine Algorithm*

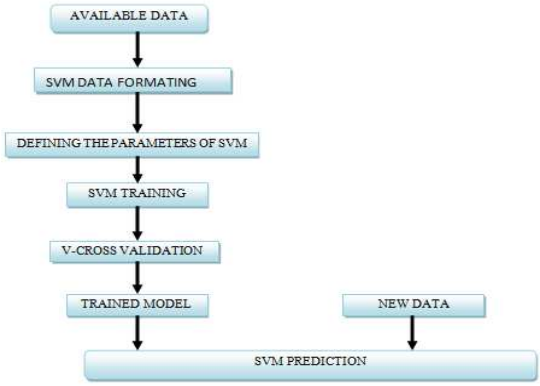

Fig. 3. Block diagram of SVM algorithm

Fig. 3 describes the SVM which is an ML algorithm based on Supervised Learning and is most commonly used for Classification and Regression problems. In 1963, the SVM algorithm was initially developed by Vladimir N. Vapnik and Alexey Ya. Chervonenkis. The target data is plotted in the n dimensional plane, where 'n' indicates the number of attributes available in the dataset [8]. After plotting, the hyper plane is being drawn. The ideal hyperplane will be the one with the greatest margin, since bigger margin guarantees, slight deviations in the data points will not influence the result of the model. The performance of SVM completely depends on the kernel selection. Yet, the ideal selection of kernel for some problems is not found. The advantage is that it functions admirably with a clear margin of partition. It is viable in high level dimensional planes furthermore in situations in which the quantity of measurement is more than samples. Fig. 4, shows the classification of SVM Algorithm. The disadvantage is that it doesn't perform well when the data has more noise and with an enormous dataset since the training time is more.

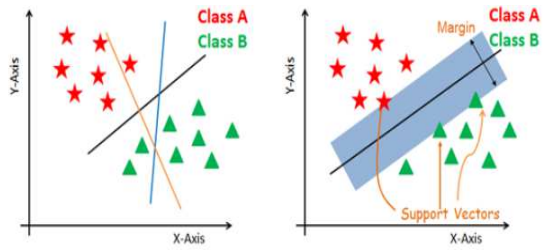

Fig. 4. Classification of SVM algorithm.

(Source: https://heartbeat.fritz.ai/understanding:the:mathmatics:behind:support:vector:machines:5e20243d64d5).

C. *Naïve Bayes Algorithm*

Naïve Bayes based on Bayes theorem is an ML algorithm dependent on supervised learning and most commonly utilized for classification problems. It is mostly utilized in text characterization that incorporates a high dimensional training dataset. It helps in building quick ML models that can make a speedy prediction. It is a probabilistic classifier. The advantage of the NB algorithm is that it is one of the less complex and quick algorithms which is used for text classification [9]. It executes well in multi class predictions than other algorithms. The disadvantage is that it cannot learn the relationship between features as it assumes all features are independent. The types of NB algorithm are Gaussian, Multinomial and Bernoulli. It's a gathering of computations that contains an average guideline as no attribute depends on the other. NB is shown in the Fig. 5. Bayes theorem is expressed as (1):

$$P\left(\frac{A}{B}\right) = \frac{P\left(\frac{B}{A}\right)P(A)}{P(B)} \quad (1)$$

Where, *P(A)* → Prior probability, *P(B)* → Marginal probability, *P(A/B)* → Posterior probability, *P(B/A)* → Likelihood probability.

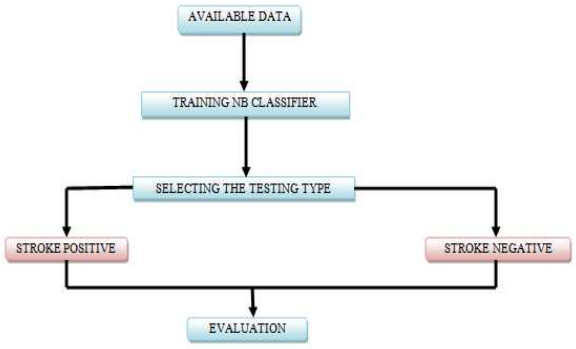

Fig. 5. Block diagram of NB algorithm

VI. Implementation ofthe Project

To complete this project, basic Python programming, Matlplotlib, and Sklearn libraries are employed. The block diagram is depicted in Fig. 6

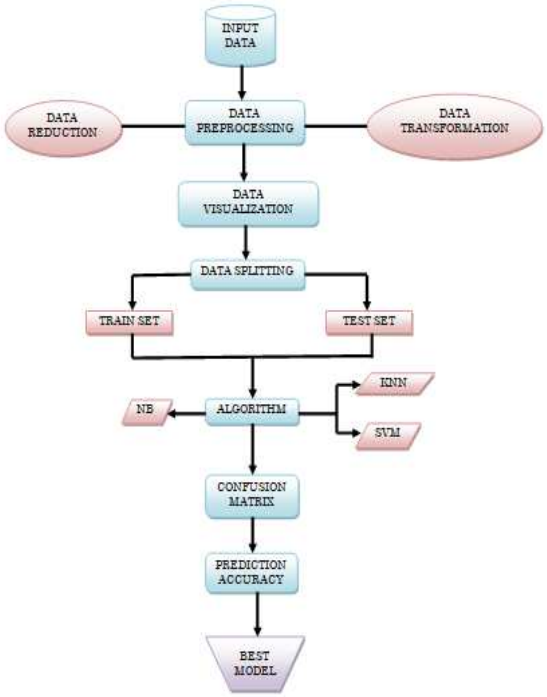

Fig. 6. Block Diagram to analyze the stroke prediction

1) Input Data: The data of around 5000 people have been collected from Kaggle. It contains risk factors like a lifetime, gender, hypertension, cardiac issue, marital status, employment type, habitation, Blood sugar level, BMI, and Smoking status.

2) Data Pre:processing :Data pre:processing is done to check the duplicate and missing values in the dataset. Followed by Label encoding, a type of data transformation is performed to convert categorical data to numerical data in the columns 'marital status, 'employment type', 'residence type', and 'smoking status. Data reduction is performed to balance the stroke positive and negative cases. Finally, the standardized data is acquired to proceed with further ML processing.

3) Data Visualization: Data visualization is performed to obtain a clear view of the dataset. Data visualization is the graphical representation of data.

4) Data Splitting: The final dataset is separated into features and labels and further into training andtesting dataset in the ratio of 7:3 using Scikit learn library.

5) Algorithm: Three algorithms namely KNN, SVM, and NB have been utilized to train the set and to validate the dataset to predict the most appropriate model.

6) Confusion matrix: Confusion matrix is employed to estimate the value of Accuracy, Precision, and Recall.

7) Best model: The level of accuracy of the three ML models is identified and the best model for stroke prediction is obtained.

VII. Result and Discussion

The dataset which is collected from Kaggle contains 10 attributes and around 5000 samples. The data is parted into two categories as training dataset and testing dataset in the ratio of 7:3. For analyzing the stroke prediction, three ML algorithms have been utilized namely KNN, SVM, and NB to develop an appropriate model. Confusion matrix elements like

True Negative, False Positive, True Positive, and False Negative have been utilized to analyze the model using performance metrics namely Precision, Recall, and Accuracy.

1) True Positive (TP): The patient is affected by stroke in real:time and the model also predicts the same.

2) False Positive (FP): Though, the patient is not affected by stroke in real:time the model predicts that the patient is affected by stroke.

3) True Negative (TN) : The patient is not affected by stroke in real:time the model predicts the same.

4) False Negative (FN) : Though, the patient is affected by stroke in real:time the model predicts that the patient was not affected by stroke [13].

*5) Precision:*It is the small portion of suitable illustration among the recovered illustrations [19].

6) Recall: Also known as Sensitivity that is the small portion of suitable illustrations that are recovered [20].

7) Accuracy: It is used to decide the best model. It is the percentage of correct prediction in the test.

Table I gives the formula for performance metrics employed in the machine learning algorithms like KNN, SVM, and NB. Table II compares the performance analysis of the ML algorithms.

TABLE. I. FORMULA OF PERFORMANCE METRICS

Performance Metrics	Formula
True Positive rate	TP/Actual positive
True Negative rate	TN/Actual negative
False Positive rate	FP/Actual negative
False Negative rate	FN/Actual positive
Precision	TP/(TP+FP)
Recall	TP/(TP+FN)
Accuracy.	(TP+TN)/(TP+TN+FP+FN)

The accuracy of the three algorithms is taken to analyze the best method to predict the stroke. The accuracy of the three ML algorithms is plotted in Fig. 7. The accuracy value of Naïve Bayes is 95.33%, Support Vector Machine is 96.66% and finally, the accuracy of K Nearest Neighbour is 94.0%. From this, it is identified as the accuracy is very high for the Support Vector Machine algorithm and the accuracy value is very less in the K Nearest Neighbour method. For the best model, the accuracy value should be high. The model is designed for predicting stroke. So the model accuracy is very important. From this comparison, the Support Vector Machine is found to be good.

TABLE. II. PERFORMANCE SURVEY OF THE MACHINE LEARNING ALGORITHMS

Algorithm	Accuracy	Precision	Recall
Naïve Bayes	95.3333	93.58974	97.3333
Support Vector Machine	96.66667	97.36842	96.1039
K:Nearest neighbor	94.0	93.50649	94.7368

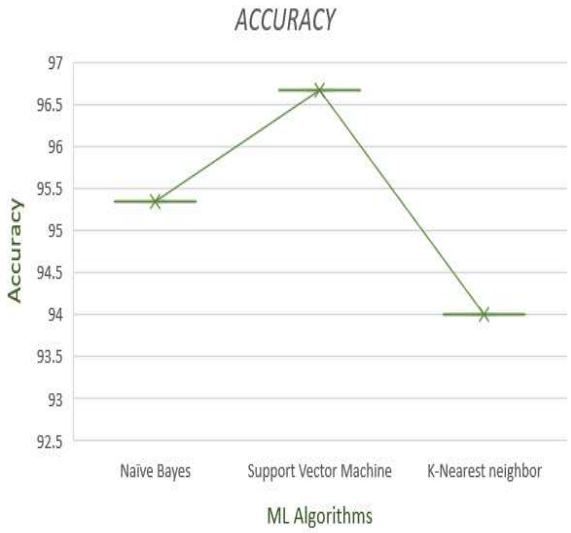

Fig. 7. Comparison of 3 ML algorithms based on accuracy.

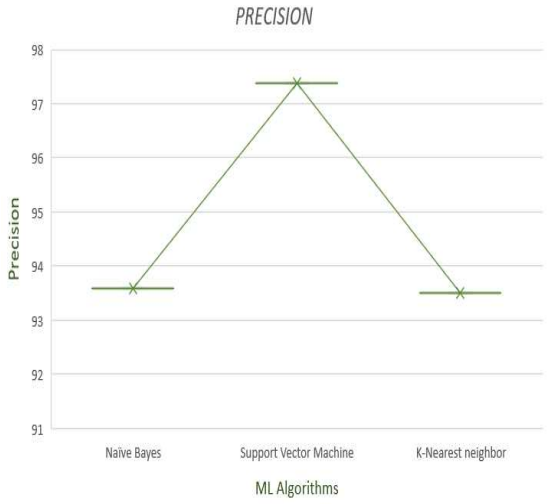

Fig. 8. Comparison of 3 ML algorithms based on precision

The precision of the three algorithms is taken to analyze the best method to predict the stroke. The precision of the three ML algorithms is plotted in Fig. 8. The precision value of Naïve Bayes is 93.58%, Support Vector Machine is 97.36% and finally, the precision of K Nearest Neighbour is 93.50%. From this, it is identified as the precision is very high for the Support Vector Machine algorithm and the precision value is very less in the K Nearest Neighbour method.

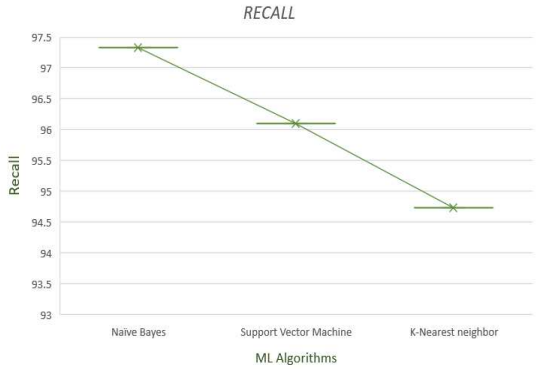

Fig. 9. Comparison of 3 ML algorithms based on recall.

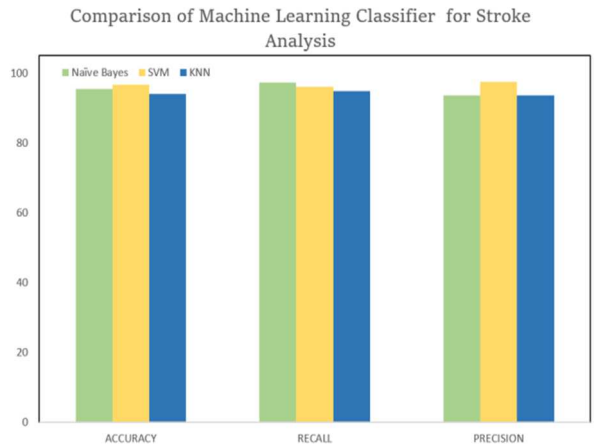

Fig. 10. Bar graph for analyzing the performance of Machine learning Algorithms.

The recall of the three algorithms is taken to analyze the best method to predict the stroke. The recall of three ML algorithms is plotted in Fig. 9. The recall value of Naïve Bayes is 97.33%, Support Vector Machine is 96.10% and finally, the accuracy of K Nearest Neighbour is 94.73%. From this, it is identified as the recall is very high for the Naïve Bayes algorithm and the recall value is very less in the K Nearest Neighbour method. Fig. 10 shows the Bar graph for analyzing the performance of Machine Learning Algorithms.

VIII. Conclusion

This project can be anticipated to develop a mobile application to give a customized message based on every patient's degree of effects from stroke and a lifestyle remedy message on the hazard factors of stroke. Further advancements in this research can incorporate foreseeing different infections separated from a stroke. This model completely predicts the occurrence of stroke and might have been used in guiding patients and their families for planning clinical preliminaries. This methodology gives a steady advantage beyond current clinical practice that can convert into significant advantages for populace wellbeing and work with the adoption of ML based danger predictors in clinical practice.

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