



# ST. ALOYSIUS' COLLEGE

**AUTONOMOUS**  
**JABALPUR- 482001**  
**MADHYA PRADESH, INDIA**

## CRITERION-1



### CURRICULAR ASPECTS

**Key Indicator – 1.3**

**Curriculum Enrichment**

**Metric No.: 1.3.3**

**Percentage of programmes that have components of  
Field projects / Research projects / Internships during  
the last five years.**

**Document Name**

**Sample Evaluated Project report/Field work  
Report submitted by the students**

**2021-22**



**ST. ALOYSIUS' COLLEGE**

**(AUTONOMOUS), JABALPUR(M.P.)**

Reaccredited 'A+' Grade by NAAC (CGPA 3.68/4.00)

College with Potential for Excellence (CPE) by UGC

DST-FIST Supported & Star College Scheme by DBT.

# **SAMPLE PROJECT REPORTS**

**2021-22**

## **FACULTY OF COMMERCE**



A  
STUDY  
ON  
E - BANKING



# Field Project Work Report

प्रोजेक्ट (परियोजना) कार्य

.....  
**A STUDY ON E - BANKING**  
.....

(Title of Field Project Work)



For the partial fulfillment of  
B.A./ B.Sc./ B. Com./ BBA/ BCA Degree  
बी.ए. / बी.एस.सी. / बी.कॉम. / बी.बी.ए. / बी.  
सी.ए. / की डिग्री की आंशिक प्रतिपूर्ति हेतु

Session : **2021-22**.....



## St. Aloysius' College

**(Autonomous)**

Reaccredited 'A+' by NAAC (CGPA 3.68/4.00)  
College with Potential for Excellence by UGC  
DST-FIST Supported & Star College Scheme by DBT  
Jabalpur, Madhya Pradesh, India



## Field Project Work Report

### परियोजना कार्य रिपोर्ट

A STUDY ON E-BANKING

(Title of Field Project Work)

For the partial fulfillment of B.A./ B.Sc./ B. Com./ BBA/ BCA Degree  
बी.ए./ बी.एस.सी./ बी.कॉम./ बी.बी.ए./ बी.सी.ए./ की डिग्री की आंशिक प्रतिपूर्ति

हेतु

Session : ... 2021-22 : .....

MEGHNA PATEL

Name of student/ Students (छात्र का नाम)

B. Com (Hons.) 1<sup>st</sup> Year

Class (कक्षा)

1210052

Roll No (अनुक्रमांक)

HDFC BANK, VIJAYNAGAR

Name of the organization, where the work was completed (संस्था का नाम जहाँ  
कार्य पूर्ण किया गया)

DR. KOMAL RAWAT

Name of Supervisor (पर्यवेक्षक का नाम)



**St. Aloysius College**

**(Autonomous)**

Reaccredited 'A+' by NAAC (CGPA – 3.68/4.00)

College with Potential for Excellence by UGC ,

DST FIST Supported & Star College Scheme by DBT

Jabalpur (M.P.) India



**Institute information and consent letter for Field Project Work**  
परियोजना कार्य के प्रशिक्षण हेतु संस्थान की जानकारी एवं सहमति पत्र

1. Name of the Institute/Trainer/Business and Registration (संस्थानव्यवसाय का /प्रशिक्षक/ नाम एवं पंजीकरण):  
HDFC Bank, Vijaynagar
2. Nature of the Institution (Private / Government / Semi-Government / Other)  
संस्था का स्वरूप ( अन्य/ अर्धशासकीय/शासकीय/ निजी)  
Private
3. Name of the area of expertise of the Institute in which work is done (संस्थान के मार्गदर्शक क्षेत्र का नाम, जिसमें कार्य किया जाता है)  
Banking
4. Number of persons holding various posts/working under the institute (संस्थान के अंतर्गत विभिन्न पदों / कार्य करने वाले व्यक्तियों की संख्या) confidential to Institution
5. Maximum number of students, which can be trained by the institution (अपेक्षित अधिकतम विद्यार्थी संख्या जिनको संस्थान प्रशिक्षण दे सकता है)  
two (2)
6. Scope of employment in organized / unorganized sectors after training from the institution) संस्था से प्रशिक्षण के उपरान्त संगठित असंगठित क/्षेत्रों में रोजगार की सम्भावना):(i).....100%.....  
).....ii).....  
).....iii).....
7. Other Specific Information (अन्य विशेष जानकारी)

Consent is given to provide Field Project work to the students of **St. Aloysius Collage (Autonomous), Jabalpur** by the institution.  
संस्था द्वारा **संत अलॉयसियस महाविद्यालय जबलपुर, (स्वशासी)** के विद्यार्थियों को प्रशिक्षण प्रदान करने की सहमति प्रदान की जाती है।

Seal and Signature (संस्था का मुहर)

Name of the Head of the Institution / Authorized Person  
(संस्था प्रमुख/अधिकृत व्यक्ति का नाम/)



## Field Project Feedback Form

### परियोजना प्रतिपुष्टि प्रपत्र

To be filled by the head of the institution / authorized officer / guide of the concerned external organization (if any)

सम्बंधित बाह्य संस्था (यदि कोई हो) के संस्था प्रमुख / अधिकृत अधिकारी / मार्गदर्शक द्वारा भरा जाये

Name of trainee student (प्रशिक्षु विद्यार्थी का नाम):

Meghna Patel

Name of College (महाविद्यालय का नाम):

St. Aloysius

Class कक्षा : B.Com (Hons) 1st Year

Section & Roll No. (वर्ग तथा अनुक्रमंक): 1210052

| S.No<br>स.क्र. | Base of Evaluation<br>मूल्यांकन का आधार  | Given Grade<br>प्रदत्त श्रेणी<br>(A/B/C) # | Remark<br>टिप्पणी |
|----------------|--|--|-------------------|
| 1.             | Student's regular attendance<br>विद्यार्थी की नियमित उपस्थिति  | A  |                   |
| 2.             | Theoretical knowledge acquired by the student<br>विद्यार्थी द्वारा प्राप्त सैद्धान्तिक ज्ञान   | A  |                   |
| 3.             | Skills and practical knowledge acquired by the student during the tenure<br>कार्यावधि में विद्यार्थी द्वारा अर्जित कौशल व्यवहारिक ज्ञान                | B  |                   |
| 4.             | Student's interest and seriousness towards the work.<br>कार्य के प्रति विद्यार्थी की रुचि गंभीरता  | A  |                   |
| 5.             | Student's attitude and behavior during the learning period<br>कार्यावधि में विद्यार्थी का सीखने के प्रति रवैया एवं व्यवहार                             | A  |                   |
| 6.             | Co-ordination with colleagues and other members and ability to work in teams<br>सहकर्मियों व अन्य सदस्यों के साथ सामंजस्यसमूह में कार्य करने की क्षमता | B  |                   |
| 7.             | Overall grade of the student<br>विद्यार्थी की समग्र श्रेणी   | A  |                   |

# Grade (श्रेणी) : A-> Excellent (उत्कृष्ट) .B-> Good (अच्छा) C-> Normal (सामान्य)

Date (दिनांक): 5/4/22

Name of Authorized Person (अधिकृत व्यक्ति के हस्ताक्षर)

Place (स्थान): Jabalpur

Name and Seal (नाम व मुहर)





Date

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# PROGRESS

## REPORT-I

### INTRODUCTION.

E-banking or electronic banking is a form of banking in which funds are transferred through an exchange of electronic signals rather than through an exchange of cash, cheques, or other types of papers documents. Whenever someone withdraws cash from an Automated Teller Machine (ATM) or pays for groceries using a debit card, the funds are transferred via electronic banking. Online banking typically offers bank statements, electronic bill payments, funds transfers between a customer's savings accounts, loan applications and transactions, and purchasing or sales of investments, all of which allow customers to maintain their accounts without making a trip or visit to bank itself.

The banking industry has seen many technologies changes in the last years which has shaped it from manually intensive industry into one



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that is technologically dependent.

### SCOPE.

The traditional mode of banking is manual; it is paper based. It is now no longer acceptable in the changing economy. The banking sector, if it is to survive in the 21<sup>st</sup> Century, shall have to change the entire banking structure. It shall have to provide better, economical and quick monetary services through the use of advance electronic technology. The customer of the banking are fast becoming computer literate. The needs of customers have also changed. They require the services of bank at home, in offices, 24/7 a day, anywhere, anytime & anyhow. The banks are quite alive to the changing needs of the customers. The scope of E-banking is now fast expanding in the developed and also under-developed countries of the world.

### DETAILS OF THE WORKPLACE.

This project report has been completed at HDFC Bank. The Housing Finance Corporation Limited (HDFC) with the tagline 'we understand your world', it is a private sector bank. The bank is situated at

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Vijaynagar, Jabalpur. It is well known as the premier executive housing finance company in India. All branches are linked to each other through an online real time basis.

### PURPOSE AND RELEVANCE.

This study is basically based on primary & secondary data, this includes understanding E-banking in India, introduction, scope & background of E-banking, also the innovations that took place in E-banking and various other details to E-banking. These objectives were achieved during the short period of survey at bank. Through this report we come across the importance and necessity of e-banking in the coming future as it is time saving and easy to understand. It is also noticed that the awareness and use of e-banking is growing with a great pace amongst the new age group and to the customers as it has many types of e-services like bill payments and doing any kind of transactions.

Approved  
K. D. D. D.



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# PROGRESS

## REPORT - II

### WORK FLOW.

Research methodology is a methodology for collecting all sorts of information & data pertaining to the subject in question. The objective is to examine all the issues involved & conduct situational analysis. The methodology includes collecting information and finally analysing the information obtained.

Data collection is a most essential aspects of any research, the whole results depends on the data collected and the information processed. There are two types of data collected:-

- 1) Primary data
- 2) Secondary data.

### • PRIMARY DATA :-

It is a unique information source gathered directly by the specialists for an explicit reason. Primary information was gathered by the bank authorities.

It was firstly collected from annual reports & officials & workers.

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## ◦ SECONDARY DATA:-

It is gathered from other than primary sources, who already gathered the information. Secondary data was gathered from published materials, books and websites and records.

## DETAILS OF INFORMATION COLLECTED .

### ◦ Services offered by HDFC online Net-banking.

With HDFC Bank Net banking, users can do the following transactions via their desktop.

◦ HDFC Bank customers can transfer funds between their own accounts or to another account of HDFC bank or different bank of the third party using an internet banking facility.

◦ With internet banking features, customers can also request for issues of Demand Draft & Cheque Book, the opening of new accounts and closure of Loan Accounts.

◦ Other services offered by HDFC Bank are :-



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- Bill payments.
- online Ticket Booking.
- LIC & other Insurances payments
- Mutual Funds' Investments.
- Credit Card dues payments.
- Tax payment income, services.

## LITERATURE REVIEWS.

This study reveals that awareness level of income group above 10,000 per month was high as compared to other income groups. It was shown that it also depends on the size of family & Gender is also a crucial issue for the acceptance of Internet banking. Gupta & Mishra (2012) examined the new emerging trends of E-banking in Indian banking industry. The study found that there were many challenges faced by banks in E-banking and there are many opportunities available for banks. It also concluded that banks should contribute intensive efforts to render better service to their customers.

Approved  
K. D. D.

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# PROGRESS

# REPORT - III

## ANALYSIS OF INFORMATION.

During the survey at HDFC bank the information collected was of e-banking and various other services offered by banks through net banking. The method used to analyze the data is descriptive and also primary & secondary data is also used to analyze. After the completion of survey and studying the results obtained are these :- background of e-banking, importance, scope, features, and the innovations that took place, also the services that are provided through net banking and their procedures and steps to get the results. Internet banking helped improving the profits and reduced the physical presence of the person itself in the banks. It is also considered as the cheapest delivery channel as it is free of cost and charges. It has helped in cutting costs, improving innovations, maintaining e-business



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services. Also, it is analyzed that mostly customers check the transactions history and their account balances, so E-banking has eased the physical presence and time of customer at the bank to get such simple information about their accounts. E-banking provides faster delivery of services to wide range of its customers. Although there are also challenges, even after the challenges the completion of the survey and study gives away the expected results.

## CHALLENGES.

New days' electronic banking is a norm rather than an exception for the banks. But in spite of numerous assistance for the customer to make banking easy and convenient, there are many challenges which customer are facing in the adoption of E-banking. Some are stated below:-

1. Customers refuse to adopt E-banking services because of security threat- E-banking frauds

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like internet theft spamming etc. are still very much widespread.

2. Customers are having a threat of loss of private information due to technical faults.
3. The risk of revealing the financial information of the customers to others.
4. Communication through an internet might not be the best base for bank and customer relation as belief might partially be lost.

Awareness among customers about the E-banking facilities and procedures is still at lower side in Indian scenario. Less awareness of new technologies and their benefits is among one of the most ranked barriers in the development of e-banking.

Amal  
Kumar

## Field Project Working Notebook

| S.No.<br>क्रमांक | Date<br>(दिनांक) | Time<br>from-to<br>(समय से-तक) |      | Details of the work done (किये गए<br>कार्य की जानकारी) | Signature<br>of the<br>student<br>(छात्र के<br>हस्ताक्षर) | Sign of<br>related<br>Authorities<br>(संबंधित<br>अधिकारियों के<br>हस्ताक्षर) |
|------------------|------------------|--------------------------------|------|--|---|--|
| 1                | 1/2/22           | 11am                           | 3pm  | Introduction of<br>E-banking.                          | <u>m Patel</u>  |  |
| 2                | 2/2/22           | 11am                           | 3pm  | Types of E-banking                                     | <u>m Patel</u>  |  |
| 3                | 3/2/22           | 11am                           | 3pm  | Types of E-banking.                                    | <u>m Patel</u>  |  |
| 4                | 4/2/22           | 11am                           | 3pm  | Functioning of<br>Automated Teller<br>machine (ATM)    | <u>m Patel</u>  |  |
| 5                | 5/2/22           | 11am                           | 3pm. | Features of<br>Tele banking                            | <u>m Patel</u>  |  |
| 6                | 8/2/22           | 10am                           | 3pm. | Knowing about<br>the types of<br>cards.                | <u>m Patel</u>  |  |
| 7                | 9/2/22           | 10am                           | 2pm  | Importance &<br>function of<br>various cards.          | <u>m Patel</u>  |  |
| 8                | 10/2/22          | 10am                           | 2pm. | Details about<br>the workplace.                        | <u>m Patel</u>  |  |





|    |         |      |     |   |               |  |
|----|---------|------|-----|---|---------------|--|
| 9  | 11/2/22 | 11am | 3pm | Introduction of the various services.           | <u>n/late</u> |  |
| 10 | 12/2/22 | 11am | 3pm | Knowing about the types of accounts.            | <u>n/late</u> |  |
| 11 | 14/2/22 | 11am | 3pm | Procedures about logging in to the HDFC portal. | <u>n/late</u> |  |
| 12 | 15/2/22 | 11am | 3pm | Procedure of various accounts.                  | <u>n/late</u> |  |
| 13 |         |      |     |   |               |  |
| 14 |         |      |     |   |               |  |
| 15 |         |      |     |   |               |  |



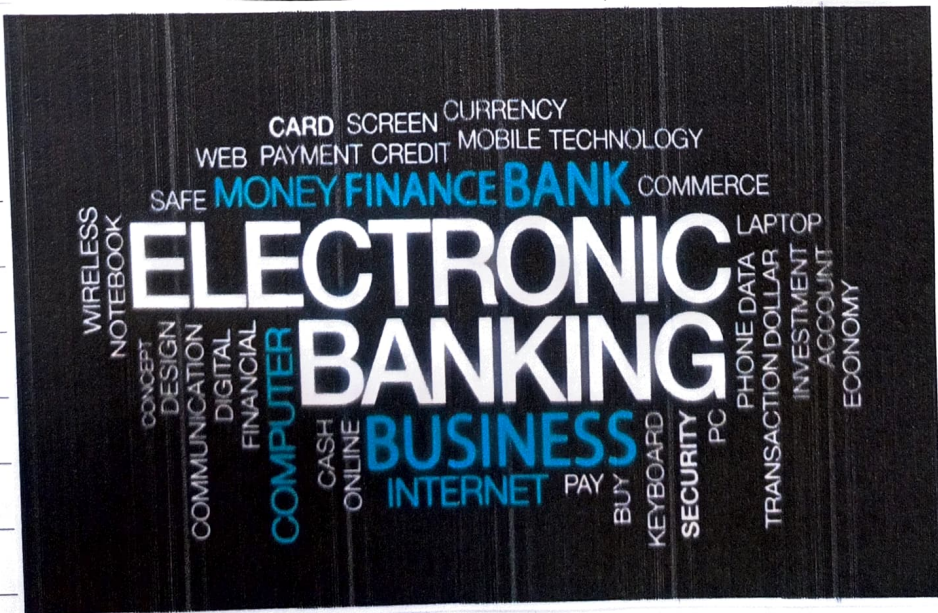
Total Hours Worked (कुल कार्य के घंटे): 60 Hours.

P-4

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*A*  
*Study On*  
*e-Banking*



## Declaration of Student's Original Work

### विद्यार्थी की मौलिकता का घोषणा पत्र

I ..... MEGHNA ..... PATEL ..... hereby declare that this Field Project report is based on the original work done by me, in which published and unpublished material has been used after due approval. I also declare that the submitted report has not been submitted for any other degree / course in the past / present.

मैं ..... एतद द्वारा घोषणा करती / करता हूँ कि यह परियोजना रिपोर्ट मेरे द्वारा किये गए मूल कार्य पर आधारित है, जिसमें प्रकाशित एवं अप्रकाशित सामग्री का प्रयोग विधिवत स्वीकृति के उपरान्त किया गया है। मैं यह भी घोषणा करती / करता हूँ कि प्रस्तुत रिपोर्ट किसी अन्य डिग्री / पाठ्यक्रम हेतु पूर्व / वर्तमान में प्रस्तुत नहीं किया गया है।

Name of student/ Students (छात्र / छात्रा का नाम) : MEGHNA PATEL  
Class (कक्षा) : B. Com (Hons) 1<sup>st</sup> Year  
Roll Number (अनुक्रमांक) : 121 0052  
Signature with date (हस्ताक्षर दिनांक सहित) : m Patel  
4/04/22



**Approval letter by guide / Supervisor**  
**(निर्देशक का अनुमोदन पत्र)**

I ..... Dr. Komal Rawat ..... hereby certify that the above mentioned report is the actual report of the student's project work done under my supervision. It has been submitted to St. Aloysius College (Autonomous), Jabalpur after my approval.

मैं ..... एतद द्वारा प्रमाणित करती / करता हूँ कि उपरोक्त वर्णित रिपोर्ट विद्यार्थी द्वारा मेरे निर्देशन में किये गए परियोजना कार्य रिपोर्ट की वास्तविक रिपोर्ट है। यह संत अलॉयासियस महाविद्यालय (स्वशासी), जबलपुर में मेरे अनुमोदन के पश्चात प्रस्तुत की गयी है।

Date..... 6/4/22  
Place..... Jabalpur

Signature

Name..... Dr. Komal Rawat  
Asst. Professor  
Commerce

## Work Completion Certificate

(After the completion of the work, attach the given certificate on the letter head of the external institution here)



We understand your world

This is to Certify that (name) Meghna Patel ..... Class B:Com (Hons.) of St. Aloysius College (Autonomous), Jabalpur, has completed his/ her Field Project work by being present in this institution from 1<sup>st</sup> Feb. 2022 to 15<sup>th</sup> Feb. 2022 ..... and has worked/ trained in the field of E - banking .....

(Name) Meghna Patel ..... is extremely hardworking, dedicated and result-oriented. He / she did good / excellent work during his/ her tenure in the organization. We wish him/her a golden future.

With best wishes

Date: 5/4/22 .....

Place: Jabalpur .....

.....  
Signature of the Authorized Person

Deepak Tripathi .....

Name and Seal



## Acknowledgement

I..... MEGHNA PATEL ..... of class B. Com(Hons.) 1<sup>st</sup> Year.  
St. Aloysius' College (Autonomous), Jabalpur would like to express my  
gratitude towards our Principal Rev. Dr. G. Vazhan Arasu for giving me this  
great opportunity to do this Field Project Work.

I would like to express my gratitude to my guide teacher Dr. Karnal Rawat  
Department of ..... Commerce. ..... for his / her constant  
guidance, advice, encouragement & every possible help in the completion of  
this work.

The field project opportunity I had with [Name of the Company]  
..... HDFC Bank, Vijaynagar ..... was a great  
chance for learning and professional development. I express my deepest  
gratitude and special thanks to the [name of authorized person]  
..... Deepak Tiwari ..... who  
in spite of being extraordinarily busy with her/his duties, took time to listen to  
my queries, to guide me on the correct path and allowed me to carry out my  
field project at their esteemed organization.

I am extremely grateful to all my teachers and friends who helped me in the  
successful completion of this field project work.

With great pleasure, I would also like to extend my sincere gratitude and  
thanks to my parents for their support.

I am grateful to everyone who supported me or guided me directly or  
indirectly.

Signature  
m Patel

Name of the student : MEGHNA PATEL

.....

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What is project report?

What are the benefits of project-based work?

About the bank industry

## **Chapter- I**

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2. Background
3. Literature review
4. Project work plan, relevance and target return
5. **Details of the concerned workplace/institution**

## **Chapter- II**

1. Project Work Flow
2. Details of Information Collection
3. **Analysis of information**

## **Chapter- III**

1. Conclusions, returns and analysis
2. Challenges in project work
3. **Recommendations**

# FINAL REPORT.

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## WHAT IS PROJECT REPORT ?

A series of activities that allow the student to study and do research on the content of the subject, they act by themselves using their abilities, personal experience, and aptitude to implement the assignment. A learning experience which aims to provide students with the opportunity to synthesize and analyze knowledge from various areas of learning, including a foreign language, and then critically and creatively apply it to real-life situations.

## What are the benefits of project-based work?

Project based learning also have other advantages for students. The following are the advantages:-

- Deeper engagement and interaction with learning content.

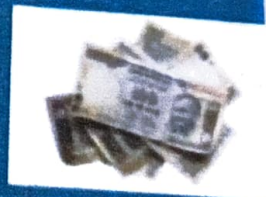


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- Encouragement of higher thinking and problem-solving skills.
- Development of peer and professional networks.
- Engagement with potential employees and career mentors.
- Fostering of 21<sup>st</sup> Century skills like collaboration and communication.
- A sense of mastery and self-efficiency.
- Gaining valuable career insights.
- Learn how to manage projects and assignments more efficiently.
- Get to explore students curiosity.

# Banking sector





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## ABOUT THE BANK INDUSTRY

Banks play a major role in the entire financial system by mobilizing deposits from households spreads across the nation and making these funds available for investments, either by lending or buying securities. Today the banking industry has become an integral part of any nation's economic progress and is critical for the financial wellbeing of individuals, business, nations, and the entire globe. In this study we will see more about the bank.

A bank is a financial institution that accepts deposits from public and creates credit.

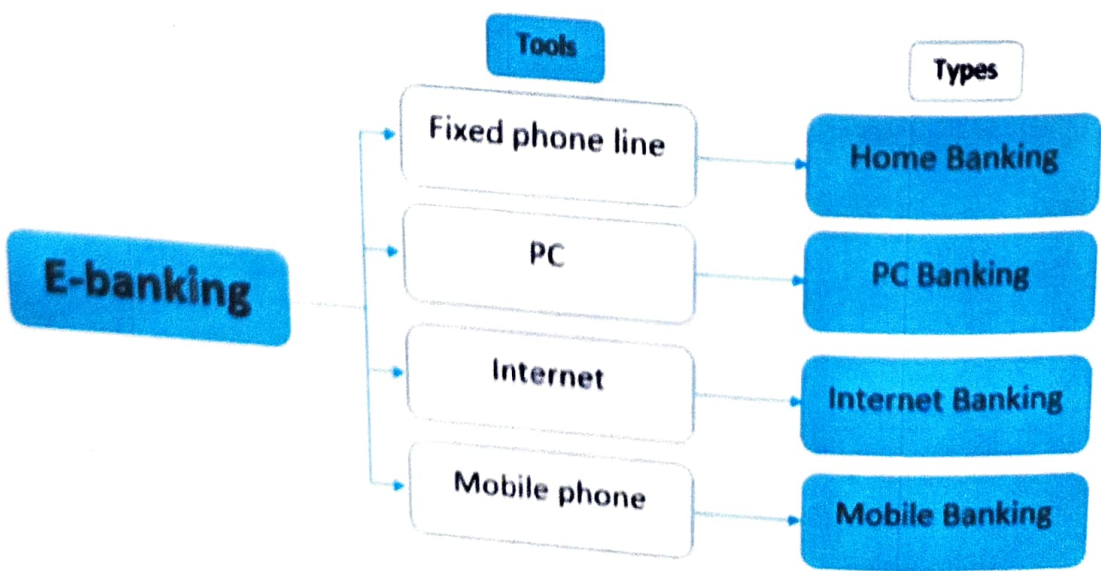
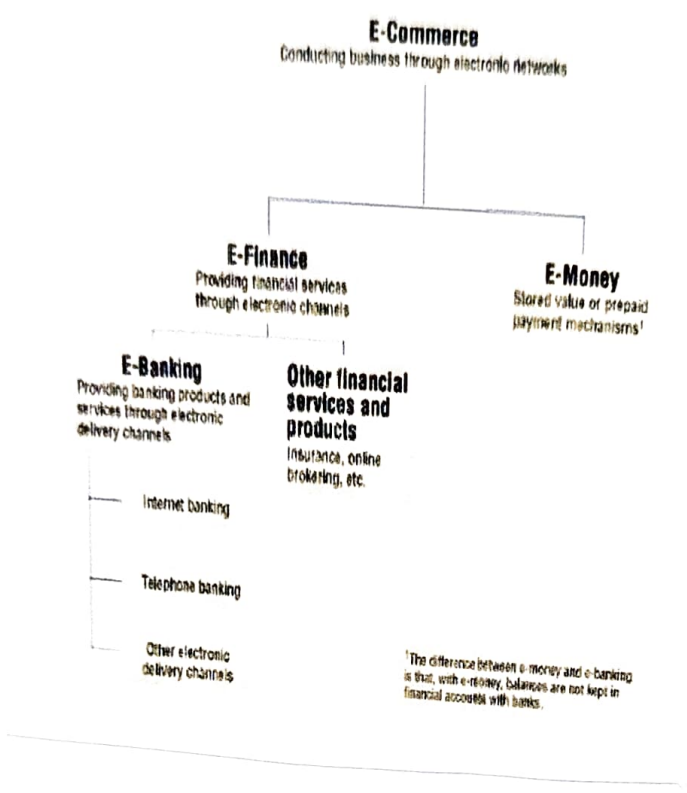
Principle type of banking in modern industrial world is commercial banking & central banking.

Banking can be defined as the business activity of accepting and safeguarding money owned by others individuals and then lending out to make profit.

A banker of a bank is a person, a firm or a company engaged in this business of lending & accepting.



# What is electronic banking?



# E-BANKING

## INTRODUCTION

E-banking or Electronic banking is a form of banking in which funds are transferred through an exchange of electronic signals rather than through an exchange of cash, cheques, or any other type of paper documents. Whenever someone withdraws cash from an Automated teller machine (ATM) or pays for groceries using a debit card, the funds transferred via electronic banking. Online banking typically offers bank statements, electronic bill payments, funds transfers between a customer's accounts, loan applications and transactions, and purchasing or sales of investments, all of which allow customers to maintain their accounts without making a trip or visit to the bank itself.



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The banking industry has seen many technological changes in the last years which has shaped it from manually intensive industry into one that is technologically dependent. Alternatives to traditional branch banking have attracted increasing attention as internet usage started to spread over the markets. Bank started to use the internet for providing new services to their customers.

Internet banking system allows individuals to perform banking activities at home via internet. Most of the internet banks are traditional banks which also offer online banking while others are online only and have no physical offices.

Internet banking transactions states that customers use the internet to get access to their personal or business bank accounts online anytime and to undertake banking transactions through the use of bank's website. Internet banking allows customers to do their banking transactions anytime and providing control over their accounts.



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## SCOPE

The traditional mode of banking is manual. It is paper based. It is now no longer acceptable in the changing global economy. With the widespread internet technology, the business is also electronic - electronic commerce, electronic import & export, electronic mobile banking etc. The banking sector, if it is to survive in the 21<sup>st</sup> century, shall have to change the entire banking structure. It shall have to provide better economical and quick monetary services through the use of advance electronic technology. The customers of the banking are fast becoming computer literate. They are now able to interact more fluently with the provision of basic electronic services. The needs of the customers have also changed. They require the services of banks at home, in offices, 24 hours a day, seven weeks a day, anywhere, anytime, and anyhow. The banks are quite alive to the changing needs of the customers.

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They have fully realized that if they are to compete, they shall have to provide electronic delivery of financial services to the customers. They are rendering services such as electronic fund transfer, payments by phone services, personal computer banking, sales transfer, electronic check conversions, etc. The scope of E-banking is now fast expanding in the developed and also under-developed countries of the world.

## BACKGROUND

### THE GROWTH OF E-BANKING IN INDIA.

Till 1990's banks were adopted to traditional method over branch banking. After financial reforms, the banks showed the innovative movement towards banking services. The Indian Banking sector has accepted computerization since 1993.



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The first initiative of computer banking was taken by the former governor of RBI, Dr. C. Rangarajan.

The Rangarajan committee reports in the years 1984 and 1989 recommended computerization of banking process which led to computerization of banking in India. In order to avoid hassle on mechanization of the banking system, bank management signed an agreement with the Employees Unions of Bank in the year 1983, for mechanization of banking operations, which allowed the use of electronic/electric machines. However, this agreement had limited scope as it restricted the use of electronic devices in certain specific areas only. Later in the year 1993 another agreement was signed with the Indian Bank Association for consenting to using of computers, which eventually paved the way of computerization of banking operations. The computerization was a giant step that led to further development of e-banking in India.



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Following is the list of various innovations and developments that took place in E-banking:-

## AUTOMATED TELLER MACHINES (ATMs) :-

Automated Teller Machines or ATM are machines which provided customers to perform banking services like cash withdrawal, make deposits, check balances, cash transfer. The Automated Teller machines called ATM assist in performing banking transactions without the aid of a bank teller. An ATM apart from performing cash dispensing facility also provides following services:-

- a) Cash deposit
- b) Balance Enquiry
- c) Mini Statement of account
- d) Bills payments.
- e) Cheque book request
- f) Money transfer.



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## TELE BANKING :-

Telephone banking is second type of e-banking innovation as this service facilitates the banks customers to perform a range of financial transactions over the telephone, without visiting any bank branch or automated teller machine. Moreover, the timing of Tele banking is longer as the institution offer 24/7 services to their customers.

These are the following types of transactions which customers can perform through their tele-banking:-

- i Obtaining account balance.
- ii List of latest transactions
- iii Electronic bill payments.
- iv. Fund transfer between a customer.

## SMART CARD :-

A smart card is also known as a chip card, or an integrated circuit card (ICC) its a pocket-sized plastic card that has embedded in form of computer chip. They are mostly used as payment cards.





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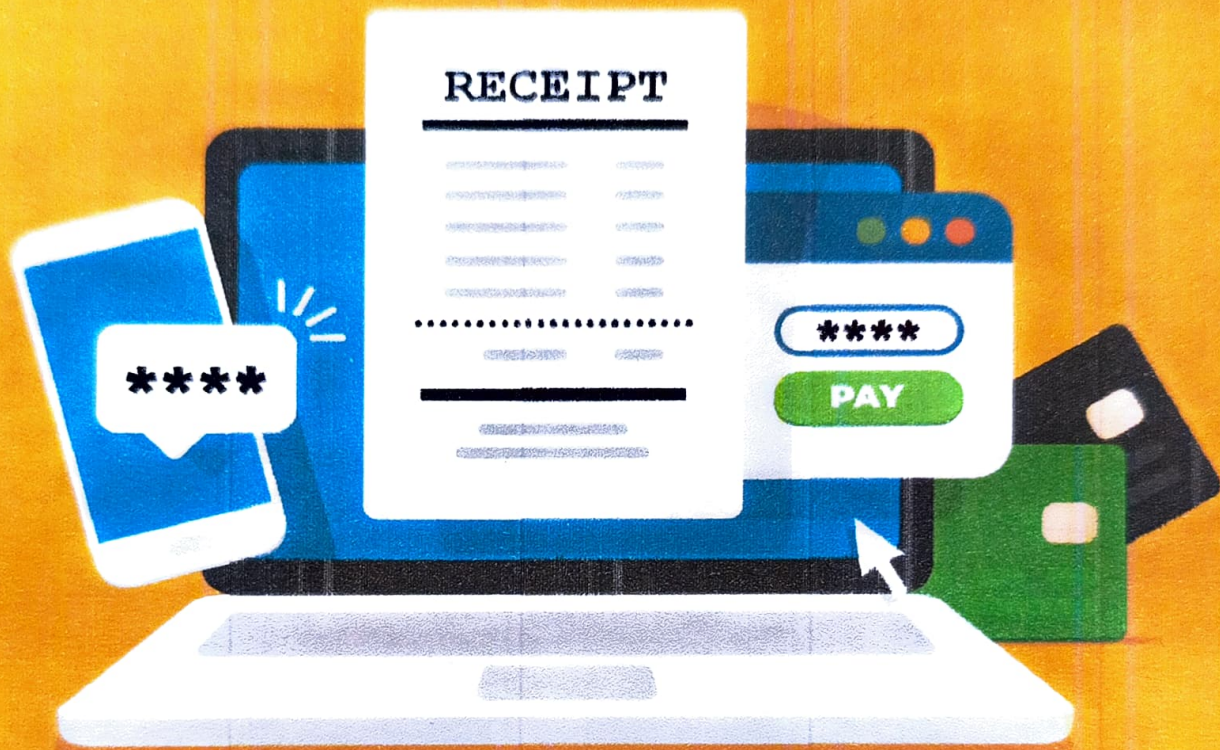
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## DEBIT CARD :-

Debit cards are also known as a bank card. Debit card looks like credit cards or ATM cards, it is a plastic payment card that can be used instead of cash when making purchases but operate like cash. Debit cards are different from credit cards as they pay later but debit cards is a way to pay now. While using a debit card money deducts from the customers' account quickly.

## CREDIT CARD :-

A credit card is a financial instrument issued by banks with a pre-set credit limit, helping you (customers) make cashless transactions. The card issuer determines the credit limit based on your credit score and your income. Once you get the credit card bill, you can repay the amount you have spent within a certain period without any interest. After this grace period, interest is applied on your balance or repayment amount.



# RECEIPT

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## ELECTRONIC BILL PAYMENT

Electronic bill is a type of e-banking innovation that allows a customer to transfer money through financial transactions or credit card account to the creditor or vendor such as a public utility, departmental store or an individual to be credited against a specific account.

## Advantages of E-Banking

- Electronic banking has many advantages making the life easier and banking faster.
- It saves a lot of time lining up in the bank.
- Since every bank is connected there are no geographical limitations letting the operations performed.
- It makes the bank to manage the data.
- It makes the transaction easy by eliminating the labour, time, capital, resources needed during the transaction.
- Technological developments provide security and privacy to consumers or customers.

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## FEATURES OF E-BANKING

- Easily adoptable by customers.
- Easy to maintain
- Cost effective solution.
- Enable the bank to reach its customer on net.
- Enables customer to access anywhere and anytime.
- Reduces rush of customers at bank.
- Balance and transaction history search
- Transaction history export.
- Order new statements.
- Mobile banking.
- Transfers
- Pay bills.
- SMS banking services.



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## LITERATURE REVIEW

The study reveals that awareness level of income group above 10,000 per month was high as compared to other income groups. It was shown that it also depends on the size of family. Gender is the crucial issues for the acceptance of internet banking. Gupta & Mishra (2012) examine the new emerging trends of E-banking in the Banking Industry. The study found that there are many challenges faced by E-banking in banking sector and there are many opportunities available with the banks. It concluded that the banking sector need to master a new business model by banking building management and customer services. It also suggested that banks should contribute intensive efforts of better service renders to their customers. Chavan (2013) described the benefits and challenges of Internet banking in an emerging economy. It observed that online banking is now replacing the traditional banking practices. It showed that online banking has a lot of benefits which



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add value to customer satisfaction in terms of better quality of services offerings and at the same time enables the bank gain advantage over the competitors. It also discussed some challenges in an emerging economy. Trivedi & Patel (2014) analysed the problems faced by customers while using e-banking facilities in India. It observed that the most of the customers know about the e-banking services offered by their bank. The study found that there is a significant difference amongst different problems identified while using e-banking services. It also found that some problems affect more and some problems affect less in use of banking services. It concluded that all the reasons are not equally responsible for not using e-banking services. Haq & Khan (2015) analysed the challenges and opportunities in the Indian Banking sector. The study showed that only 28 per cent banking clients were using internet banking after the evaluating the population characteristics. It found that there was no significant relationship in between age and use of cyber banking. It also depicted that there is no relation in



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between gender and the adoption of internet banking. It observed that qualification in terms of education and income of the respondents were playing the role in the acceptance of online banking.

Bankers' Perspective on E-banking, Sharma, Himani (2011): The enquiry reveals that customers generally use e-banking on services on persuasion of bankers. The bankers are convinced that e-banking helps in improving the relationship between the bankers and customers and that it would bring patent improvement in the overall performance of banks.

# WORK PLAN

## RELEVANCE

## TARGET RETURN

This project work is completed at HDFC Bank within 15 days. The method used to complete the survey is empirical and descriptive in nature. This study is basically based on primary and secondary data, this report includes understanding E-banking in India, introduction, scope, background of e-banking, also the innovations that took place in e-banking, and various other details related to e-banking. These objectives were achieved and realized during the short period of survey at bank. This study is on e-banking is very essential for customers, through this report we come across the necessity and importance of e-banking in the coming future as it is less time consuming and easy to understand if the person is well educated and is well known with the networks. It is also noticed that the use of e-banking is growing with a great pace against the customers.





**HDFC BANK**

We understand your world

**Full Form of HDFC**



**Housing  
Development  
Finance  
Corporation**

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# DETAILS OF THE WORKPLACE.

## About HDFC Bank.

This project work has been completed at HDFC bank. The Housing Development Finance Corporation Limited (HDFC) with the tag line "we understand your world", it is a private sector bank.

The bank is situated at Vijaynagar, Jabalpur. The whole survey is completed at this institution within the time period of 15 days. It is well known as the premier executive housing finance company in India. All branches are linked to each other through an online real time basis. HDFC bank provides all types of banking services.

These includes :-

## SAVINGS ACCOUNTS :

These accounts are primarily meant to inculcate a sense of saving for the future, accumulating funds over a period of time.



# Primary and Secondary Products



## Primary

Advances and  
Deposits

Loans

## Secondary

Cards

Investment

Forex

Private  
banking

Premium  
Banking

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Types of Savings accounts:-

1. Regular
2. Savings Max
3. Institutional Savings
4. Senior Citizens A/c
5. Kids Advantage
6. Corporate Salary

## CURRENT ACCOUNTS :

Current Accounts are very popular among companies, firms, public enterprises, businessmen who generally have higher number of regular transaction with the bank.

## FIXED DEPOSITS :

A fixed deposit i.e. FD, is an investment instrument offered by banks to their customers to help save money. With an FD account you can invest a sizeable amount of money at a predetermined rate of interest for a fixed period.



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## DEMAT ACCOUNTS:

Demat Accounts is a short for Dematerialisation account and makes the process of holding investments like shares, bonds, government securities, Mutual funds, Insurance, doing away the hassles of physical handling and maintenance of paper shares and related documents.

## SAFE DEPOSITS LOCKERS:

A safe deposits lockers is an individually secured container - usually a metal - box that stays in a safe of a federally insured bank. Safe box lockers are used to keep valuables, important documents, and sentimental keepsakes protected.

## SALARY ACCOUNTS.

A salary account is a type of savings account, in which the employer of the account holder deposits a fixed amount of money as 'salary' every month.

**Educational Loans**



**Mortgage**



**Life Insurance**

**Products and  
Services**



**Mutual Funds**



**General  
Insurance**



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## LOAN SERVICES

- PERSONAL LOAN
- HOME LOAN
- VEHICLE'S LOAN.
- GOLD LOAN.
- EDUCATIONAL LOAN.

Other services that are card services (credit card, debit card), Investments and Insurance services, bonds, bills pay, online payment, wholesale banking, retail banking, etc.

## CHAPTER - II

# PROJECT WORK FLOW

Research methodology is a methodology for collecting all sorts of information & data pertaining to the data subject in question.

The objective is to examine all the issues involved & conduct situational analysis. The methodology includes doing field work, collecting information & finally analyzing the information obtained. The method used in the study consistent of using both primary & secondary data. The primary data has been collected with the help of bank as well as the personal observation book, magazine ; whereas for the secondary data journals and reports has been referred.

Data collection is a most essential aspects of any research the whole results depends on the data collected and the information processed.

The methodology adopted in this report will be helpful for interpretation & analysis. These following are the types of data collected :-

1. Primary data
2. Secondary data.



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## Primary Data :-

It is a unique information source gathered directly by the specialists for an explicit reason. Primary information was gathered by the bank authorities. It was firstly collected from annual report of the bank and from the officials and workers at the bank.

## Secondary Data :-

It is gathered from other than the primary, who already gathered the information. Secondary Data was gathered and collected from published materials, books, websites and records. Secondary data based on the E-banking, net-banking services that are provided by HDFC Bank and to know the importance of the e-banking according to the growth of the technology and the networking generations.

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## Details of Information collected

The following information collected are about the products of HDFC bank and the steps of certain products :-

### ◦ HDFC BANK NET BANKING

HDFC Bank is one of the largest Private Bank in India to provide Internet Banking Services to retail as well as corporate HDFC bank customers. You can avail services like Fund transfer, Bill payment, apply for new debit / credit card, open a new FD / RD Account and book tickets and much more without paying additional charges provided you have an internet connection and your mobile number that is registered with the bank.

To avail these services, you must however register for HDFC net banking facilities.

### ◦ REGISTRATION FOR HDFC NET BANKING.

To register, you can visit the bank and fill the HDFC Net Banking Registration Form or else you



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you can register through HDFC Bank ATM.

## Online Registration.

If you want to register online through net banking follow the following steps as mentioned below:-

### Phone Banking :-

Account holder can also register for for HDFC net banking services by calling HDFC mobile banking numbers. To register you need to provide required informations such as customer id / Debit card number / ATM number.

### ATM :-

If the account holder wants to register for HDFC net banking through ATM, they need to visit, the nearest HDFC ATM and enter required details such as HDFC debit card number, card pin, etc. Select Net banking registration and follow the steps displayed on the screen.

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## Bank Branch :-

To register for HDFC net banking facility through Bank Branch, download the net banking registration form from the bank website and submit the duly-filled form with the required documents to the nearest bank branch. Accounts-holders can also get the registration form from the HDFC bank branch and submit the same to complete the process of HDFC net banking.

## • LOGIN INTO HDFC NET BANKING ONLINE :

You can login to HDFC net banking online, by following the steps as mentioned below:-

1. Visit the official homepage of HDFC bank net banking by clicking on the official website.
2. Now, click on continue to login.
3. On the next page, you need to enter your user's name and password and click on login button.




[Click here](#)

\*T&amp;C Apply

[Transact](#)
[Enquire](#)
[Request](#)

## Select Transaction Type



[Transfer within the bank](#)  
(Re. 1 to Rs. 25 Lacs per day)

[View Demo](#)



[IMPS P2A - Instant Transfer](#)  
(365 days, 24X7)  
(Re. 1 to Rs. 25 Lacs per day)  
(IMPS- Account No.)

[View Demo](#)



[Transfer to other bank \(NEFT\)](#)  
(Also for Credit Cards Payment)  
(Re. 1 to Rs. 25 Lacs per day)

[View Demo](#)



[Transfer to other bank \(RTGS\)](#)  
(Rs. 2 Lacs to Rs. 25 Lacs per day)

[View Demo](#)



[IMPS P2P - Instant Transfer](#)  
(365 days, 24X7)  
(IMPS- Mobile No.)

[View Demo](#)



[Transfer to eCMS Account](#)  
(Virtual Account)  
(Re. 1 to Rs. 10 Lacs per day)



Credit Cards

Account Summary

Transact ▶

Enquire ▶

Request ▶

Debit Cards

Debit Card Status

Transact ▶

Enquire ▶

Your Bank A/c details are just a **misted call** away!

- A/c balance: 18002703333 • Get Mini Statement: 18002703355
- Request Cheque Book: 18002703366 • A/c statement: 18002703377



click here to expand

Credit Card Account

Active Credit Cards

Total Unbilled Amount: INR 0.00 ▼

| Card No.   | Card Type                         | Name       | Total Unbilled Debits |
|------------|-----------------------------------|------------|-----------------------|
| [Redacted] | VISA PLAT<br>FREEDOM CARD<br>INTL | [Redacted] | INR 0.00              |

[View](#)

| Available Credit | *Statement Balance |
|------------------|--------------------|
| 30,000.00        | 0.00               |

you can check your transactions in view tab

Unable to recall your Credit Card PIN? Reset your PIN Instantly. [Click here to view demo](#)

Note:



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## ◦ TRANSFER MONEY VIA HDFC NET BANKING.

HDFC customers can transfer funds from their HDFC A/c to another party's account through net banking facility. Before transferring funds, users must add and get the details of the beneficiary account.

Following are the steps to transfer funds:-

1. Firstly you need to login to your HDFC Net banking portal.
2. Click on Fund transfer Tab.
3. Next, select the transfer type as per your requirement, now click on Go button.
4. You need to choose the drawer account, beneficiary, Amount & transfer description, etc.
5. Accept the terms and conditions and click on Continue.
6. Verify the transaction details and confirm.
7. Save the reference number for the future reference.

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## • CHECK BALANCE VIA HDFC BANK NET BANKING :-

You can also avail Bank Balance check online facility through net banking :-

1. To know about HDFC bank balance, you need to login to your account on the official website of the bank.
2. Enter your user name and password.
3. Now, after login you can check the bank balance of your account on the net banking dashboard.
4. You can also know about previous transactions, get a mini-statement etc. by using Net Banking facility.



Credit Cards

Account Summary

Transact

Credit Card Payment

Insta Loan

SmartEMI

Insta Jumbo Loan

SmartPay

Credit Card Upgrade

Balance transfer on EMI

## Credit Card Payment

### Pay HDFC Bank Credit Card Bill



Select Payment Type

- Select Card Payment Type -

- Select Card Payment Type -
- Registered HDFC BANK Credit Card
- Other HDFC BANK Credit Card

**Note:**

- Only HDFC Bank Credit Card Payments can be made through this option.
- Payment made after 18:00 hrs will be processed on the next working day.
- A maximum of 5 beneficiaries can be added.

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## ◦ CREDIT CARD BILL PAYMENT THROUGH NET BANKING.

To make credit card bill payment through HDFC Bank Net Banking, you simply need to Register for HDFC credit card net banking. If you have an existing savings account in the bank, the amount will be instantly transferred from the account when you make the payments.

The following are the steps to make credit Card bill payment through net banking :-

- 1) log in to the official website by clicking on the portal.
- 2) click on 'Bill Payment'.
- 3) Complete the registration process by entering your credit card details and clicking on the submit.
- 4) Enter the OTP sent on your registered mobile Number to complete the registration process.
- 5) After completing the registration, how to make payments click on 'View / Pay Bills' select the biller.
- 6) Select the A/c where the funds must transfer, Enter the Amount to be paid and click on 'Pay Now'.
- 7) click on submit to complete the payment.



[Accounts](#)[Funds Transfer](#)[BillPay & Recharge](#)[Cards](#)[Demat](#)[Mutual Fund](#)[Request](#)[Debit Cards](#)[Debit Card Status](#)[Transact](#)[Enquire](#)[Request](#)[Debit Card Hotlisting](#)[Instant Pin Generation](#)[Re-issuance of Hotlisted](#)

Dear Customer, Please [Click here](#) to Apply for a LIFE TIME FREE\* HDFC Bank Credit Card (Apply)

( Kindly ignore in case you already have a HDFC Bank Credit Card or have applied earlier. H card according to the Bank's internal guidelines. T&C Apply)

[Click here](#) to Register a Card.

[Click here](#) to make Credit Card Payment.

To know more [click here](#)

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## ◦ SERVICES OFFERED BY HDFC ONLINE NET BANKING.

- ▶ With internet banking features, customers can also request for issues of Demat Draft and cheque books, the opening of new accounts and close of Loan Accounts.
- ▶ Other services offered by HDFC Bank are -
  - Online Ticket Booking
  - opening of FD/ RD A/c.
  - LIC and other insurance premium payments
  - Mutual Funds' Investments.
  - Credit Card dues payments.
  - Tax payment income, Services, State Govt.

HDFC Bank offers a bunch of products and services to meet every needs of the people.

The company cares for both, individuals as well as corporate and small and medium enterprises.

For individual, the company has a ranges of accounts, investments, pension schemes, different types of loans and card that assist the customers. The customers can choose the



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suitable one from the range of products which will suit their life-stage and needs.

For organizations the company has a host of customized solutions that range from funded services, non-funded services, value addition services, mutual funds etc.

These affordable plans apart from providing long term value to the employee helps in enhancing goodwill of the company.

## ANALYSIS OF INFORMATION

During the survey at HDFC bank the information collected was of E-banking / Net banking and various other services that are available through E-banking. The method used to analyze the data is descriptive and also primary & secondary data is also used to analyze. After the completion of survey and studying the results obtained that are :- background of e-banking, importance, features and the innovations that took place, also the services that are

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provided through net banking and their procedure and steps to get the results. Internet banking helped improving the profits and reduced the physical presence of the person itself in the banks. It is also considered as the cheapest delivery channel as it is free of cost & charges.

It has helped in cutting costs, improving innovations, maintaining and improving e-services. Also, it is analyzed that mostly customers check the transactions history and their account balances,

so e-banking has eased the physical presence of customer at the bank to get such simple information about their accounts. E-banking provides faster delivery of services to wide range of its customers. Although there are

also challenges that occurs in e-banking is that there may be server problem or the network lacking, so the transactions sometimes get delayed. Even after the challenges the completion of survey gives away the expected results.

This study conducted is very useful as after the completion of survey gives away the expected results and it helped understanding what E-banking is and why is it important.



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and also the services that are available.

The results obtained were upto the expectation and was conducted at HDFC bank in a survey.

# CONCLUSION

This study consists of chapters consisting of Introduction, methodology, review of literature, overview of banking industry, details of Net banking, Introduction of HDFC bank, Project Work flow, etc. It gives the new insight to the e-banking users and beneficiaries. Online banking is just like normal banking, with one big exception, you don't have to go to the bank for transactions. Instead, you can access your account any time and from any part of the world, and do so when you have the time, and not when the bank is open.

Based on the above findings, it can be concluded that technology has greatly influenced the bank customers' encouraging them to conduct banking in an innovative manner. They have good awareness regarding ATMs and internet banking. Adoption of ATMs was highest followed by internet banking, credit card and mobile banking. Variability of adoption of ATMs and internet banking is



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high among different age groups, here youngsters are leading. It is further found that awareness and adoption of ATMs and internet banking is dependent on education where highly educated have high rates of adoption. Income is closely associated with the adoption of ATMs, internet banking where the high income groups are ahead of others but the picture is different in mobile banking providing that it is the cheapest e-banking delivery channel.

The research findings clearly suggest that the drive towards ease of banking and convenience is favoured by the customers and therefore banks should find alternative strategic routes designed to improve service delivery either human based or technology based. It is important to understand that no technology can replace human interface. Technology will facilitate the transaction but it will be the man or woman behind the technology that will matter the most and have the last word.

# What Users Expect from a Mobile Banking App



**94%**

Checking a balance  
or transactions



**58%**

Transferring money  
between accounts



**48%**

Depositing a check  
using the phone  
camera



**47%**

Paying bills



**36%**

Finding the nearest  
ATM or bank branch



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The study reveals about the awareness and efficiency of HOFC bank net banking practices which will further help bank to review its present practices and improving them in future and future, also the findings will bank to chalk more innovative E-banking practices.

## RETURNS / FINDINGS

- In the bankers' view regarding preference in the net banking usage based on occupation, this study revealed that self-employed are at the top and then it is the salaried class who makes the greatest use.
- The study states that most of the respondents are banking with HOFC bank holding the largest percentage of regular savings account.
- The customers are nearly ready to opt for the net banking in future.

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- The study reveals that large number of customers are not using online banking services because they are not aware and there is no face-to-face interactions.
- The customers who use net banking services mostly prefer both net banking and mobile banking services as there is no charge on transactions done online.
- It is found that server down is the major problem in online banking services.
- Online banking services help to reduce the cost of transactions, save time, they are user friendly, and they can be accessed from any places. All these features have positive impact on the people for using online banking services.
- The process of starting online banking services is very flexible and is easy to understand.



# TOP CHALLENGES HINDERING THE GROWTH OF THE ONLINE BANKING SECTOR



## CHALLENGE 1

TRADITIONAL BANKING HABITS



## CHALLENGE 2

SECURITY AND FRAUD INSTANCES



## CHALLENGE 3

CROSS-BORDER TRANSACTIONS

# CHALLENGES

Nowadays electronic banking is a norm rather than an exception for the banks. But inspite of it offers numerous assistances for the customers to make banking easy and convenient but there are many challenges which customers are facing in the adoption of E-banking. Some of the challenges are stated below:-

1. Customers refuses to adopt E-banking services because of security threat E-banking frauds like spyware, internet theft spamming etc. are still very much widespread.
2. Customers are having a threat of loss of private information due to technical faults.
3. Insufficient knowledge of using electronic banking and lack of preparedness by customers and banks in technological adoption.
4. Insufficient Infrastructure for setting up of E-delivery networks.





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5. The bank's management, supervisor and governing authorities are facing several challenges in adoption of E-banking.
6. The risk of revealing the financial information of the customer with others, hence customers are having a fear of privacy issue.
7. Communication through an internet might not be the best base for bank and customer relation as belief might partially be lost.

### • SECURITY RISK

The most serious threat faced by e-banking is that it is not safe and secure all the time. There may be loss of data due to technical defaults.

A large number of customers refuses to opt for e-banking due to uncertainty and security concerns.



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## • PRIVACY RISK

The risk of disclosing private information & fear of identity theft is one of the major factors that inhibits the customers from opting for e-banking facilities.

## • CUSTOMER AWARENESS.

Awareness among consumers / customers about the e-banking facilities and procedures is still at lower side in Indian scenario. Banks are not able to disseminate proper information about the use, benefits and facility of internet banking. Less awareness of new technologies and their benefits is among one of the most marked barriers in the development of e-banking.

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# RECOMMENDATIONS

- Banks should adopt some new policies and incentives to the only online banking customers for making large numbers of transactions.
- Banks should provide more facilities like training program, awareness camps to all types of customers.
- Banks should improve the online banking service quality of website design, home page of bank website and server availability.



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6. [www.google.com](http://www.google.com)

~~Approved  
K. D. Sub~~



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Reaccredited 'A+' Grade by NAAC (CGPA 3.68/4.00)

College with Potential for Excellence (CPE) by UGC

DST-FIST Supported & Star College Scheme by DBT.

# **SAMPLE PROJECT REPORTS**

**2021-22**

## **FACULTY OF MANAGEMENT**





**ST. ALOYSIUS COLLEGE**  
**(AUTONOMOUS), JABALPUR (M.P.)**

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***SESSION : 2021-2022***

***MAJOR PROJECT REPORT***  
***ON***

***A Study of Performance Appraisal  
Management System in Little  
Kingdom Sr. Sec. School, Jabalpur***

***BACHELOR OF BUSINESS ADMINISTRATION***  
***3<sup>rd</sup> Year***

**Submitted To:**

**Dr. Rashmi A. Patras**  
**(Faculty Guide)**  
**Head**

**Department of Management**

**Submitted By:**

**Rishika Arya**  
**B.B.A. Final Year**



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**Head**

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**Rishika Arya**

**B.B.A. Final Year**





# ST. ALOYSIUS' COLLEGE

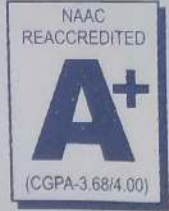
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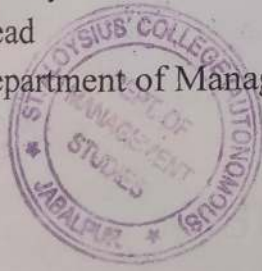
## CERTIFICATE

This is to certify that the field study report/project report entitled “**A Study of Performance Appraisal Management System in Little Kingdom Sr. Sec. School, Jabalpur**” as a Human Resource specialization, submitted by Ms. Rishika Arya in partial fulfillment of Bachelor of Business Administration degree for the academic session 2021-22 has been duly completed as a record of bonafide work under our guidance in practice of St. Aloysius College (Autonomous), Jabalpur, M.P.

This report is up to the standard both in respect of its contents and literacy presentation after being referred to the examiner. With suggestions given, she has done her project by herself.

I extend my best wishes for her future endeavors.

**Dr. Rashmi A. Patras**  
Faculty Guide  
Head  
Department of Management



Date:



LITTLE KINGDOM SCHOOL

# Secondary School

## CERTIFICATE

### OF APPRECIATION

THIS IS TO CERTIFY THAT MR./MS. RISHIKA ARYA OF BBA  
3RD YEAR, ST. ALOYSIUS COLLEGE (AUTONOMOUS) HAS  
SUCCESSFULLY COMPLETED HER SURVEY IN OUR  
ORGANIZATION

**Mrs. Swapna Rajak**

Head of Academics



Roll No.

# ACKNOWLEDGEMENT

I Rishika Arya, BBA 3<sup>rd</sup> year student, would like to express my special thanks of gratitude to my Human Resource Development teacher Mrs. Rashmi A. Patras, Head of Department, Department of Management, for their able guidance and support in completing my project work.

I would also like to extend my gratitude to the Head of Academics, Little Kingdom Sr. Sec. School, Mrs. Swapna Rajak, for allowing me to conduct my survey in their organization.

Submitted By  
Rishika Arya  
Rishika

Roll No. 

# DECLARATION

I Rishika Arya, BBA final year student, solemnly and sincerely declare that the project report entitled "A study of Performance Appraisal Management System in Little Kingdom Sr. Sec. School" is my own work and I have done this project under the supervision of Mrs. Rashmi A. Patras (HOD, Department of Management).

I also declare that the content of this report is purely part of this comprehensive project work and has not been submitted to any other university for anything.

Submitted By's  
Rishika Arya  
@Rhya



Roll No. 

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**ADHARTAL**



**TILHARI**



Roll No.

Date.....

# COMPANY PROFILE

## About The Organization :

Little Kingdom School is alternatively also known as L.K.S.

The school was established in 1991.

It started with one room, with 5 students strength, and now has 3 branches in Jabalpur, Madhya Pradesh.

It is a Co-ed school affiliated to Central Board of Secondary Education [CBSE].

It is a citadel of sublime knowledge and noble ideas. This school is nestled in a harmonious and congenial ambience which amalgamates the best of Indian exuberant cultural traditions with most modern scientific learning, making it truly the most unique educational institution of its kind.

The school has been the pioneer of Play Group in, Jabalpur, Madhya Pradesh.





Roll No. Vision :

"To be the pre-eminent centre of learning in the country producing future leaders with global prospective."

Mission :

"We at Little Kingdom aim to redefine your; child's future with grace and confidence by imparting education, with the best teaching practices to inculcate good working habits and let the children imbibe social and cultural values."

"Our mission is to prepare our students to be truly global citizens and life long learners. We aim to provide our students with education of the highest academic order. Our aim is to prepare them for life."





## Board Of Directors :

Chair person : Mrs. Rohini Dhruva  
Gaikwad

M.H.Sc. (Child Development), B.Ed

She is the founder of school. Because of her other schools of Jabalpur adapted playgroup classes. She was the principal of the school until her retirement.

Director : Mr. Udit Gaikwad

B.Com, MBA

(Marketing & HR)

He is the son of chairperson, who has managed the school with excellence.

Director : Mrs. Palak Tiwari Gaikwad

B.Sc (Electronic Media)

M.F. (Mass. Comm.)

She is wife of Udit Gaikwad. She plays a major part in the growth and development of school. With a world full of changes her skills made the school grow and cope up with dynamic environment.



# CONCEPTUAL STRATEGIES

## ABOUT PERFORMANCE APPRAISAL

### # Meaning :-

A performance appraisal system manages the employer performance process of an organization to evaluate the job performance of a team. It includes capturing qualitative and quantitative feedback and turning them into actionable insights.

It is a mechanism for tracking the performance of employees consistently and measurably.

It allows the organization to ensure that employees and department across the organisation are working effectively towards achieving the business' strategic goals.

## # Definition :-

According to Gomej-Meja ;  
Performance Appraisal involves the identification, measurement and management of human performance in organization.

According to Beach ;  
Performance appraisal evaluates systematically performance of individual with regard to his or her performance on the job and his potential development.

According to Slabbert & Swanepeel ;  
Performance appraisal is a formal and systematic process by means of which the relevant strengths and weaknesses of the employees identified, measured, recorded and developed.

According to Edwin. B. Flippo ;  
Performance appraisal is the systematic, periodic and an impartial rating of an employ's excellence in matters pertaining to his present job and his potential for a better job.



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## # Objectives :-

Performance Appraisals are done kept with following objectives in mind:

1. To maintain record to determine compensation packages, wage structure, salaries, raises etc.
2. To identify the strengths and weaknesses of employs to place right men on right job.
3. To maintain and assess the potential present in a person for further growth and development.
4. To provide a feedback to employs regarding their performance and related status.
5. It serves as a basis for influencing working habits of the employs.
6. To review and retain promotional and other training programmes

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## # Features / Characteristics :-

1. **Clear Appraisal Objectives** - An effective performance review system will always have specific review/appraisal attributes to match the employ's job description.

2. **Accurate, Valid & Reliable Data** - An accurate, valid and reliable data helps the management make strategic decisions, as it ensure a fair and transparent performance appraisal system that earns trust of employs.

3. **Well Defined Performance Criteria** - Effective performance appraisal management system has standards and top-rated appraisal forms, rules, and appraisal procedures along with well-defined performance criteria and standards.

4. **Less Time Consuming** - Effective performance appraisal management systems are designed to be economical and less time-consuming to get maximum benefits.



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5. **Matches Needs** - It matches the needs of organization. For instance; if your organization supports cross-functional, matrix teams, your performance appraisal system should be tailored in such a way that the employees working in matrix teams are not left out. The managers with whom the employees are working with, be it the primary manager or cross-functional manager, should be able to rate that particular employee.

6. **Managers Are Mentors** - The success of an appraisal system depends mainly on the managers, who do the administrative and feedback tasks. The managers should not only focus on the negatives of employees but also highlight the achievements to motivate them. The managers should not act as a mere boss, but be trained enough to coach the employees and help them to walk on the path of development.

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7. **Continuous Feedback** - Modernized performance appraisal systems are the most effective ones. The system is not an annual process anymore, but a process that happens throughout the year. The ratings at the end of the year are not a surprise to the employees because of continuous feedback delivered by managers on the employee's performance. This will allow employees to fill the gaps in their performance and skills.

8. **Measures What Matters** - The behaviour of the employees that are relevant to the job should be taken into account during the appraisal process, not his/her personal behaviour. An employee should be evaluated based on the competencies and his/her ability to achieve the goals, not on his problems with colleagues or attitude, which is irrelevant to the job.



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## # Need :-

1. Reception of Employ Feedback - A performance appraisal is not meant solely to assess employees. It's also designed to receive employee comments, suggestions and grievances and to factor them into the organization's policies in the future. The importance of appraisals can't be understood since they form most critical channel of communication.

2. Constructive Criticisms of Performance - The importance of a performance appraisal is best illustrated through how it allows for constructive criticisms of performance. Constructive criticism isn't about finding flaws with employees. They can also be suggestive and involve recommendations that employs can internalize to improve their productivity and performance.

3. Expression of Work Trends And Patterns - A through performance appraisal provides both micro & macro level analysis of an organization. Such

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a trajectory may be positive or negative or even remain static, but the essential aspect about performance appraisal in this context is that it allows a comprehensive assessment of entire organization.

4. Interaction with Experts - In order to carry out the various types of performance appraisals, organizations are bound to consult with experts from outside. This consultation provides impartiality of opinion, originality of ideas, as well as depth of insight, all of which are crucial for assessing employs. It also help in building a network of professional relationships.

5. Collaboration Between Management and Employes - The significance of a performance appraisal resolves around the fact that it isn't a one-way street. Employes also get to contribute meaningfully to the process instead of simply being the ones whose performances are being evaluated. Whenever an organization uses a performance appraisal to frame its upcoming objectives or to modify past



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it's expected to do so through collaboration between employers and employees. Not only it creates a better spirit but also allows for accountability and transparency within an organization.

6. Rewards or Warnings for Employes - Employes can't and shouldn't be rewarded or penalized based on random decisions or, worse still, through favoritism. A performance appraisal, by providing a report on an employ's performance, prepares the grounds on which incentives or penalties can be issued to guide employ performance in future.

7. Identifying Structural Flaws - Sometimes even with adequate resources and talented personnel, organizations struggle to maximize their output or meet their objectives. This is where performance appraisal is needed as it helps organizations locate structural issues that may be holding them back.

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## # Nature :-

Performance Appraisal is a systematic and objective method of judging the quality of an employ in performing his job and a part of guiding and managing career development.

It is a process to obtain, analyse and record the information about the relative worth of an employ to the organization.

Performance appraisal is an analysis of an employ's recent successes and failures, personal strengths and weaknesses, and his/her suitability for promotion or further training.

It is also the judgement of an employ's performance in a job based on considerations other than productivity alone.

It is done periodically, but on continuous basis.



# # Scope :-

**Performance Feedback - Performance Appraisal**  
 Provides feedback helps managers to get give on employ's performance. Feedback enables employs to avoid mistakes and improve productivity. Employ's are interested in knowing results, as the feel satisfied and happy after knowing it. It motivates them to perform better in future.

**Employ's Compensation - Providing**  
 Decides the right remuneration to employs is important for every organization. It should be paid fairly to all, according to their efforts, performance and skills. Performance appraisal makes it easy to measure it and award employs accordingly. Employ's performing better is rewarded more.

**Validation of Selection Process - Performance**  
 Appraisal enables the validation of the selection process. Selecting a proper selection channel is a must for recruiting better human resources.

Validation of a selection procedure helps in finding out its positive and negative aspects and thereby helps the company in selecting a suitable tool for selection.

Identify Employ's Training Needs - Training and development programmes helps in improving the productivity of man power. It should be provided by the organization to its employes from time to time to improve its skills and confidence level. Performance Appraisal helps supervisors in detecting the deficiencies in the performance of employes due to lack of skills & knowledge.

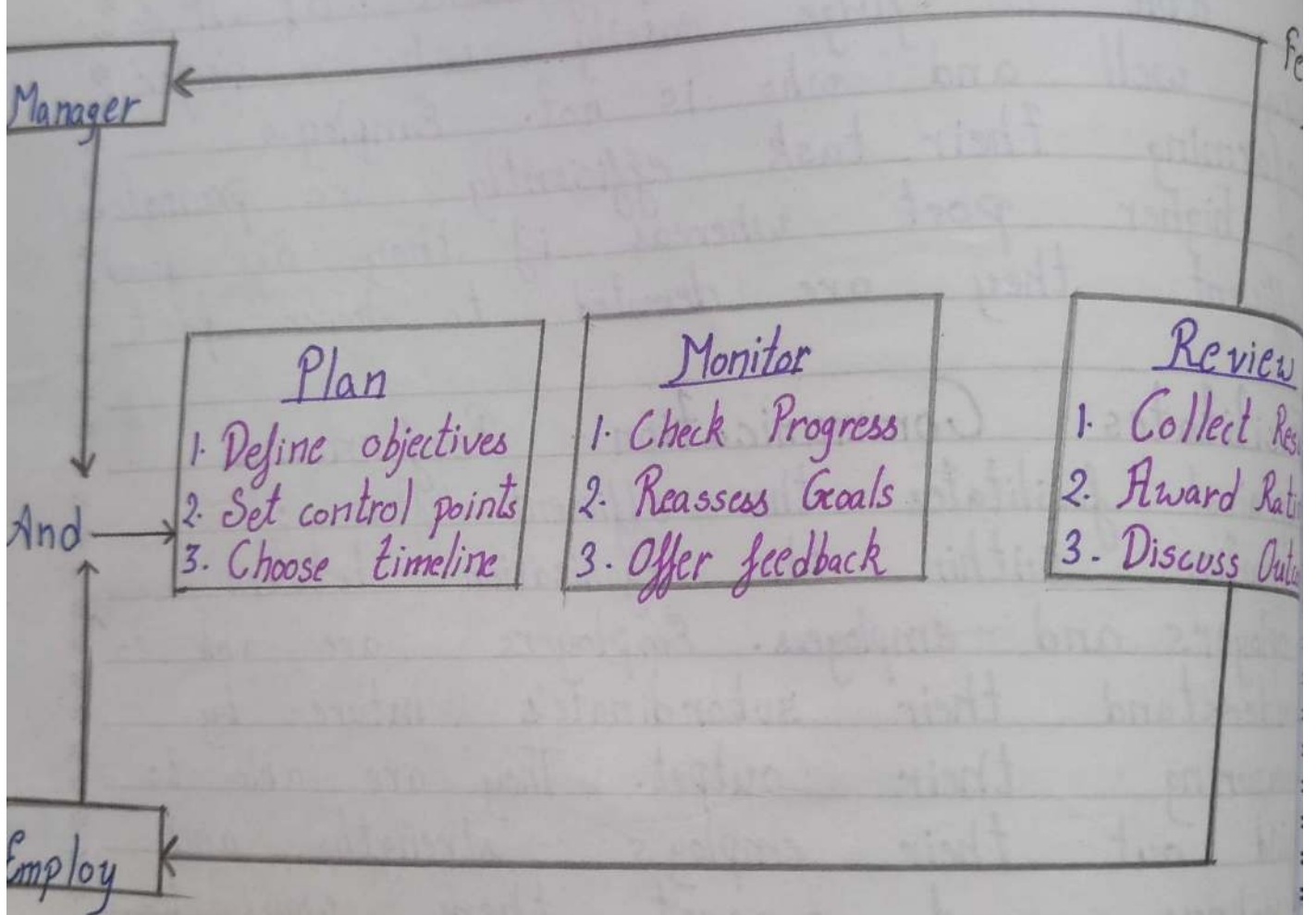
Motivates Employes - Performance appraisal helps in motivating employees towards their workers through targeted roles and objectives. Employes are able to evaluate the efficiency of their workers through this. When employes know that their results will be checked it will motivate them to perform well.



Helps in Promotion and Demotion -  
The process of promotion and demotion to  
employers is an important decision to be  
taken by managers. Performance appraisal  
helps them in taking these decisions  
fairly and properly without bias.  
Through performance appraisal, they are  
able to measure the performance of all &  
are able to judge easily who is perfor-  
ming well and who is not. Employees  
performing their task efficiently are promoted  
to higher post whereas if they are found  
inefficient they are demoted to lower post.

Facilitates Communication - Performance  
appraisal facilitates the efficient flow of  
information within the organization between  
employers and employees. Employers are able to  
understand their subordinate's nature by  
measuring their output. They are able to  
find out their employees strengths and  
weakness and suggest them ways to  
overcome their deficiencies. This develops  
better employer-employee relations  
which create better trust and  
confidence among them.

# Management Objective By (Process Flow)





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## # Method

• Management By Objective [MBO] - MBO is a method where managers and employees together identify, plan, organize and communicate objectives to focus on during a specific appraisal period. After setting clear goals, managers and subordinates periodically discuss the progress made to control and debate on the feasibility of achieving those set objectives.

This performance appraisal method is used to match the overarching organizational goals with objectives of employees effectively while validating objectives using the SMART method to see if the set objective is specific, measurable, achievable, realistic and time-sensitive.

At the end of the review period, employees are judged by their results. Success is rewarded with promotion and a salary hike whereas failure is dealt with transfer or further training. This process usually lays more stress on tangible goals and intangible aspects like interpersonal skills, commitment, etc. are often brushed under the rug.

## Pre-assessment

- Online objectives of review
- Find competencies and review
- Design simulation exercises
- Choose a rating method

## During Assessment

- Explain the purpose and policies
- Use competency-exercise matrix
- Conduct exercise and discussion
- Note strength and weaknesses

## Post Assessment

- Collect feedback from reviewers
- Evaluate the validity of review
- Share the feedback with employees
- Provide further training if required



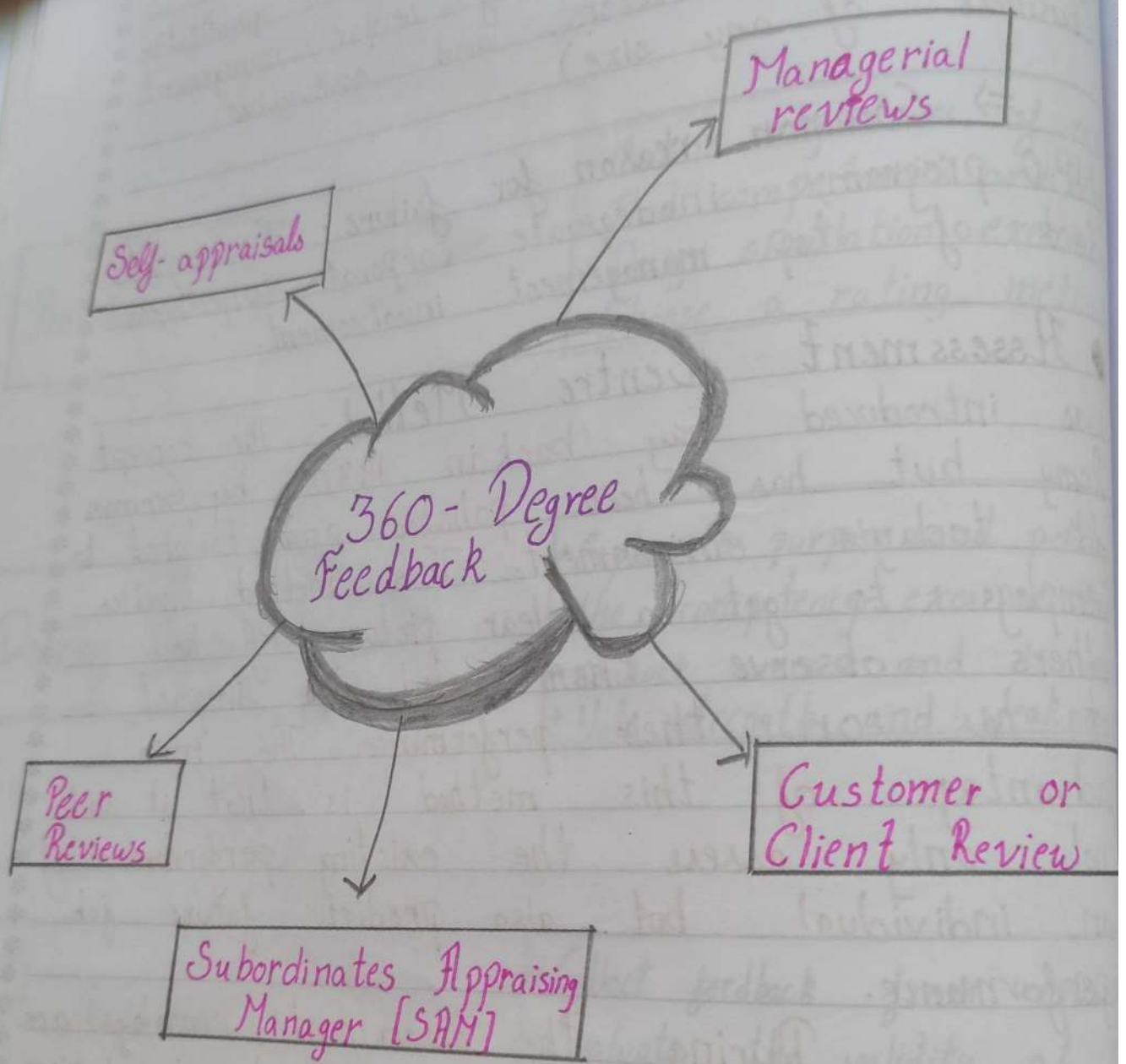
⇒ Ideal For - Measuring the quantitative and qualitative output of senior management like managers, directors, and executive (business of any size)

⇒ Common reason for failure - Incomplete MBO program, inadequate corporate objectives, lack of top management involvement.

● Assessment Centre Method - The concept was introduced way back in 1930 by German Army but has been polished and failed to fit today's environment. This method enables employs to get a clear picture of how others observe them and the impact it has on their performance. The main advantage of this method is that it will not only assess the existing performance of an individual but also predict future job performance.

During the assessment, employs are asked to take part in social-simulation exercises like in-basket exercises, informal discussions, fact-finding exercises, and other that ensure success in a role. The major

⇒ Ideal For - Manufacturing organizations,





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service-based companies, educational institutions and consulting firms to identify future organizational leaders and managers.

⇒ Common reason for failure - The major drawback of this approach is that it is a time and cost intensive process that is difficult to manage.

● 360-Degree Feedback - It is a multidimensional performance appraisal method that evaluates an employ using feedback collected from the employ's circle of influence namely managers, peers, customers, and direct reports. This method will not only eliminate bias in performance reviews but also offer a clear understanding of an individual's competence.

This appraisal method has five integral components :

1. Self-Appraisals - It offers employs a chance to look back at their performance an understand their strengths and weaknesses. However, if self-appraisals are performed without structured forms or formal procedures, it can become lenient, fickle and biased.



1. Managerial Reviews - Performance reviews by managers are a part of the traditional and basic form of appraisals. These reviews must include individual employee ratings awarded by supervisors as well as the evaluation of a team or program by senior managers.

2. Peer Reviews - As hierarchies move out of the organizational picture, coworkers get a unique perspective on the employ's performance making them the most relevant evaluator. These reviews help determine an employ's ability to work well with the team, take up initiatives and be a reliable contributor. However, friendship or animosity between peers may end up distorting the final evaluating results.

4. Subordinates Appraising Manager [SAM] - This upward appraisal component of the 360° feedback is a delicate and significant step. Reportees tend to have the most unique perspective for from a managerial point of view. However, reluctant or fear of retribution can skew appraisal results.



5. Customer or Client Reviews - The client component of this phase can include either internal customers such as users of product within the organization or external customers who are not a part of the company but interact with this specific employ on a regular basis. Customer reviews can evaluate the output of an employ better, however, these external users often do not see the impact of processes or policies on an employ's output.

⇒ Ideal For - Private sector organizations than public sector organizations as peer reviews at public sector organizations are more lenient.

⇒ Common Reason for Failure - Leniency in review, cultural differences, Competitiveness, in effective planning and misguided feedback.

# Behaviorally Anchored Rating Scale

1  
Have no plan or schedule of work and no concept of realistic due dates

2  
Make a list due dates and revise them but are frequently surprised by unforeseen events

3  
Develop a comprehensive schedule, observe target dates and update status of operations relative to plans, making schedule modification as quickly as necessary

4  
Usually satisfy time constraints, with time and cost overruns coming up infrequently

5



Behaviorally Anchored Rating Scale (BARS) - It brings out both the qualitative and quantitative benefits in performance appraisal process. BARS compares employ performance with specific behavioral examples that are anchored to numerical ratings. Each performance level on a BAR scale is anchored by multiple BARS statements which describe common behaviors that an employ routinely exhibits. These statements act as a yardstick to measure an individual's performance against predetermined standards that are applicable to their role and job level.

The first step in BARS creation is generation of critical incidents that are typical workplace behavior. The next step is editing these critical incidents into a common format and removing any redundancy. After normalization, the critical instances are randomized and assessed for effectiveness. Remaining critical incidents are used to create BARS and evaluate employ performance.

⇒ Ideal For - Businesses for all sizes and industries can use BARS to



to assess the performance of their workforce from the entry level agent to c-suite executives.

- ⇒ Common Reasons for Failure -
- High chance for subjectivity in evaluations.
- Hard to make compensation and promotion decisions.
- Time-consuming to create and implement demands more from managers and senior executives.

Psychological Appraisals - It comes in handy to determine the hidden potential of employes. This method focuses on analyzing an employes future performance rather than their past work. These appraisals are used to analyze seven major components of an employ performance such as interpersonal skills, cognitive abilities, intellectual traits, leadership skills, personality traits, emotional quotient, and other related skills.

Qualified psychologists conduct a variety of tests to assess an employ effectively. However, it is a rather slow and complex process and the



Quality of results is highly dependent on the psychologist who administers the procedure.

Specific scenarios are taken into account while performing psychological appraisal. For instance, the way in which an employ. deals with an aggressive customer can be used to appraise his/her persuasion skills, behavioral response, emotional response, and more.

⇒ Ideal For - Large enterprise can use psychological appraisals for an array of response including development of leadership pipeline, team building, conflict resolutions, and more.

⇒ Common Reason for failure - Absence of proper training, lack of trained professionals to administer reviews, and nervousness or anxiety of candidates can skew results.

Roll No.

## Human - Resource Accounting Method-

This method analyses an employ's performance through the monetary benefits he/she yields to the company.

It is obtained by comparing the cost of retaining an employ and the monetary benefits an organization has ascertained from that specific employ.

When an employ's performance is evaluated based on cost accounting method, factors like unit-wise average service value, quality, overhead cost, interpersonal relationships, and more are taken into account. Its high-dependency on the cost and benefit analysis and the memory power of the reviewer is the drawback of human resources accounting method.

⇒ Ideal For - Startups and small businesses where the performance of one employ can make or break the organization's success.



## ## Elements :-

1. Defined Goals and Objectives - An effective Performance Appraisal system must employ clearly defined goals and objectives. This can be achieved through various input parameters formulated by the supervisors or managers, enabling the employes to improve in their job performance and to achieve their defined goals thereby contributing to the overall growth of the organization.

2. Continuous Feedback - Measured and accurate feedback and reviews are important aspects of a good, (feedback i.e.), performance appraisal process. Employes love to have feedback not only from their immediate managers on the task assigned but also for their teamwork contributions, accomplishing multiple tasks/projects handled by different departments. This would give a complete picture of employ contribution, so a 360° feedback would be the solution.

3. Configurations Flexibility - Companies that strive and thrive for competitiveness & innovation, place appraisal system as an



Roll No.

integral and continuous process in order to have productive employs. Every organization has own rating scales or own appraisal methods to appraise or rate their own employs. So, employ performance management solution should provide configure different KRA depending on job description.

4. Self-Evaluation- Real-time employ assessment should be in place right from goal or task creation to completion, self-assessment of a task, immediate supervisor and manager assessment, cumulative tasks rating, point in time rating. Employes who disagree with a rating should be given an opportunity to challenge the rating & get an explanation, if required, of how rating was derived which might be questionable to him.

5. Compensation and Rewards - Every employ deserves the best compensation, rewards and recognition for their achievements. The compensation and rewards are sustained with incentives, bonus, variable pay and an increase in salary, rewards for key accomplishments and other monetary



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benefits. Some of these are guaranteed ones and some are not which should be clearly communicated to all the employs by their top-level authorities.

6. People Analytics - Data driven insights related to employs can help HR department or manager to take proactive decisions. Analytics helps department in figuring out how good or bad is the relationship between manager or employ.

7. Overall Assessment - Employee Performance management application should contain setting of tasks/goals, self evaluation, immediate supervisor or manager feedback, performance rating and progress on the goals, constructive feedback, people analytics, compensation management and reward and recognition.

Roll No.

# PROJECT WORK

## RESEARCH METHODOLOGY

### # Objectives of Project Report:-

→ The first motive of this report is to understand the Performance Appraisal Management System at Little Kingdom Sr. Sec. School. Since I was found of the system there and the staff there, it made my task of digging deeper easy.

→ The next objective is to study the various practices adopted for Performance appraisal at Little Kingdom School i.e. how the organization give appraisals to its employees, what benefits the staff receive, what methods are used to calculate their appraisal, are they involved in their appraisal process, and is the process fair or not.



Roll No.

→ Lastly the aim of the report is to know the impact of performance appraisal on employee's efficiency and working.

For example - Are the employees motivated after their appraisal or not? Do they understand the process or not? Does it improve

their interpersonal relationships?

Are they satisfied with the system? Do they develop personally by being a part of

Performance Appraisal Management System.

Roll No.

## # Significance of Project Report -

→ The report work helped to have a better understanding on Performance Appraisal Management System of an organisation.

→ It helps in evaluating various methods used by the organization to do their Performance Appraisal i.e. what techniques they use? what amount of involvement of staff is their in the appraisal process? and so on.

→ It helps to know the satisfactory level of the staff working in the organization.

→ It helped to know the efficiency of performance appraisal management system at Little Kingdom School.

→ It helped to analyze how employees are motivated and affected due to performance appraisal.



## # Sample Area

The total area under investigation which are sampled at random or according to restricted process.

The sample area of my research is:  
Little Kingdom Sr. Sec. School

## # Sample Size

Sample size refers to the number of participants or observations included in a study.

The sample size of my research is:  
20 employs at Little Kingdom School.

## # Data Collection Method

The methods I used in collecting my data are :

→ Primary Data - Data that has been generated by the researcher himself/herself, through interviews, surveys, experiments, etc. It is collected from first-hand sources.

Roll No.

→ Random Sampling - It is a part of sampling technique in which each sample has an equal probability of being chosen. It is meant to be an unbiased representation of total population.

→ Questionnaire - It is an instrument that consists of a set of questions to collect information from a respondent.

→ Interview - It is generally a qualitative research technique which involves asking open-ended questions to converse with research respondents and collect elicited data about a subject.

### # Data Interpretation Technique

→ Use of Graphs - Use of bar graphs, and i.e. chart or graph that present statistical data with rectangular bars, and Pie Charts, i.e. a circular presentation of statistical data, is done to interpret results.

→ Interpretation of statistical data - The responses collected through questionnaires, are used as statistical data to interpret results.

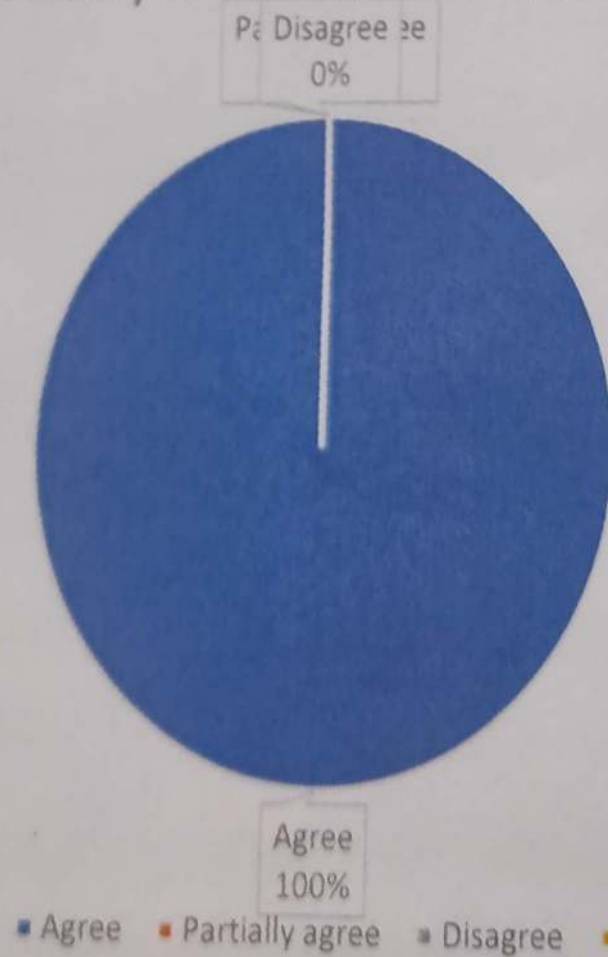


## Data Interpretation Results:

Length of Service - For this question, out of 20 respondents, 1 is working in the school for less than one year. 10 respondents are working in school between 1 to 5 years. 5 respondents are working in school between 5 to 10 years and 4 respondents are working for more than 10 years in the organization.

Other than designation, environmental changes, political changes, societal changes, legal changes, technological changes, etc., an employ's length of service can have a forceful influence on how they perceive performance appraisal. For instance; if an employer is with the organization for less than one year, they might not have their appraisal. Also if he/she is in organization during any unfavourable change in environment, like a pandemic, they may not be able to have appraisal till there is a negative impact of pandemic in the school.

### Is it necessary to have Performance Appraisal





2) Does Performance Appraisal of your job profile done?

Out of 20 respondents, 18 employees i.e. 90% are done with their performance appraisals. The remaining 2 i.e. 10% are not yet done for the same. As mentioned ~~in~~ previously, that, length of service has an influence on how employees perceive performance appraisal, so here the 1 employee is new to the school with service of 5 months, which is why she did not had her appraisal.

Same goes with the other one, as she joined the school during pandemic, she did not had any appraisal meeting even though she served the organization for  $1\frac{1}{2}$  years.

3) It is necessary for performance appraisal to be conducted in an organization. Do you agree?

In this question, all the 20 respondents have fully agreed that appraisal should be carried out, which is a very good result. It is because the employees know the vitality of appraisals,

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Why is it carried out, and the employees have the understanding of the performance appraisal management system.

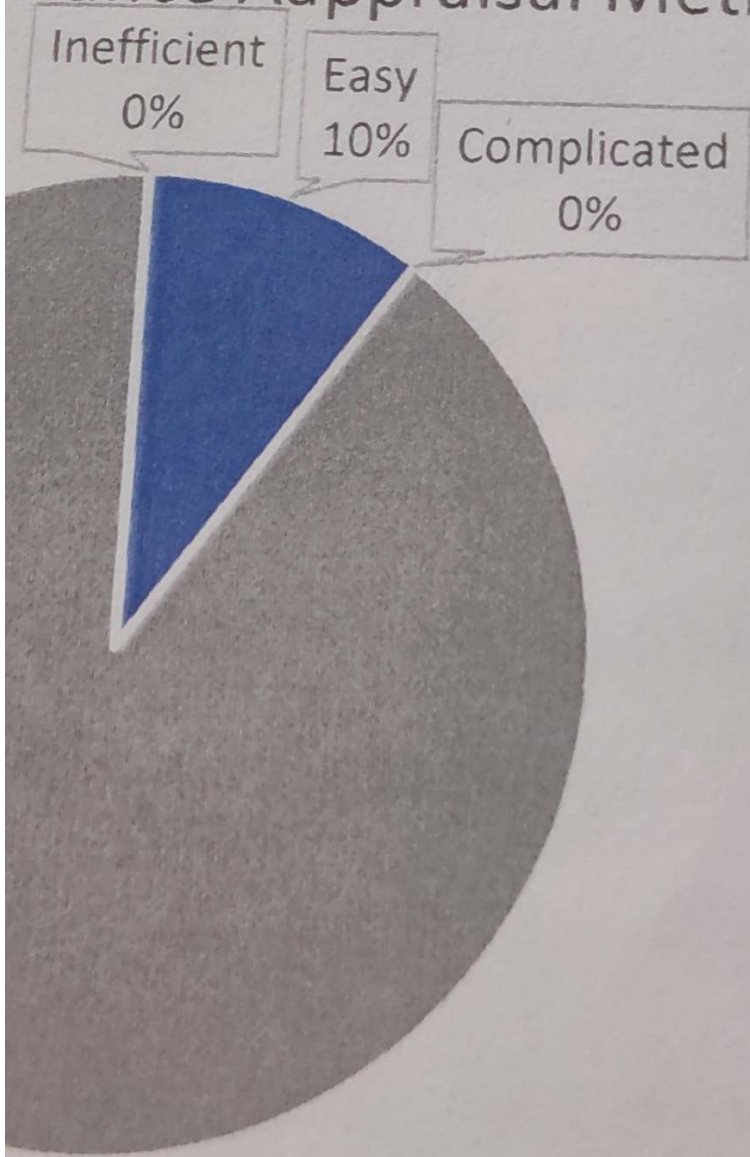
4. How often is performance appraisal carried out in your organization?

Out of 20 respondents; 18 i.e. 90% gave a solid response that the appraisal is done on yearly basis. One respondent, who is the transportation incharge said that his appraisal happens within two years. According to him, his targets or salary figures changes every 18 months. The remaining one employ/ respondent, whose designation is coordinator, has mentioned that her appraisal is carried out every 3 years.

When asked why, she said that it requires proper and long training periods to achieve the targets. Any new techniques intr. before getting introduced and implied at school has to first be checked by the coordinators and then implied. After the implement proper observations reports are made. Since the success for this takes time so is the appraisal.



# Performance Appraisal Method



■ Efficient ■ Inefficient

# Performance Appraisal Technique

The organization is:

In this question, all 20 respondents chose Human-Resource Accounting Method as the technique used in their performance appraisal by the school. This also means that the staff is aware of their evaluation is done, and are the benefits they receive on their performance.

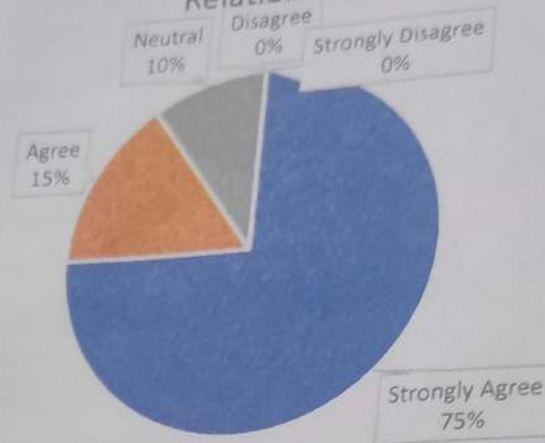
How would you rate the performance appraisal method in your organizations?

Out of 20 respondents, 18 has agreed that the method is efficient. The remaining two said it is easy. One of them is transportation incharge and other is mother teacher. For them it is easy to understand what is happening with them but is it efficient or not they cannot make the call as they don't find any reason to go indepth.

Does performance appraisal help to improve inter personal skills?  
For this question, out of 20

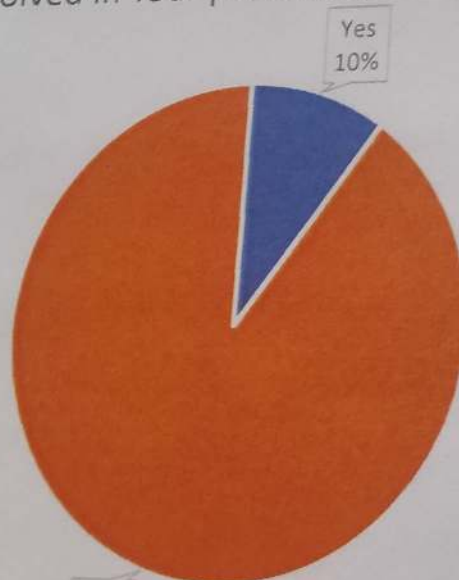


### Performance Appraisal Helps to improve Interpersonal Relationship



■ Strongly Agree ■ Agree ■ Neutral ■ Disagree ■ Strongly Disagree

### Are you Involved in Your performance Appraisal Process



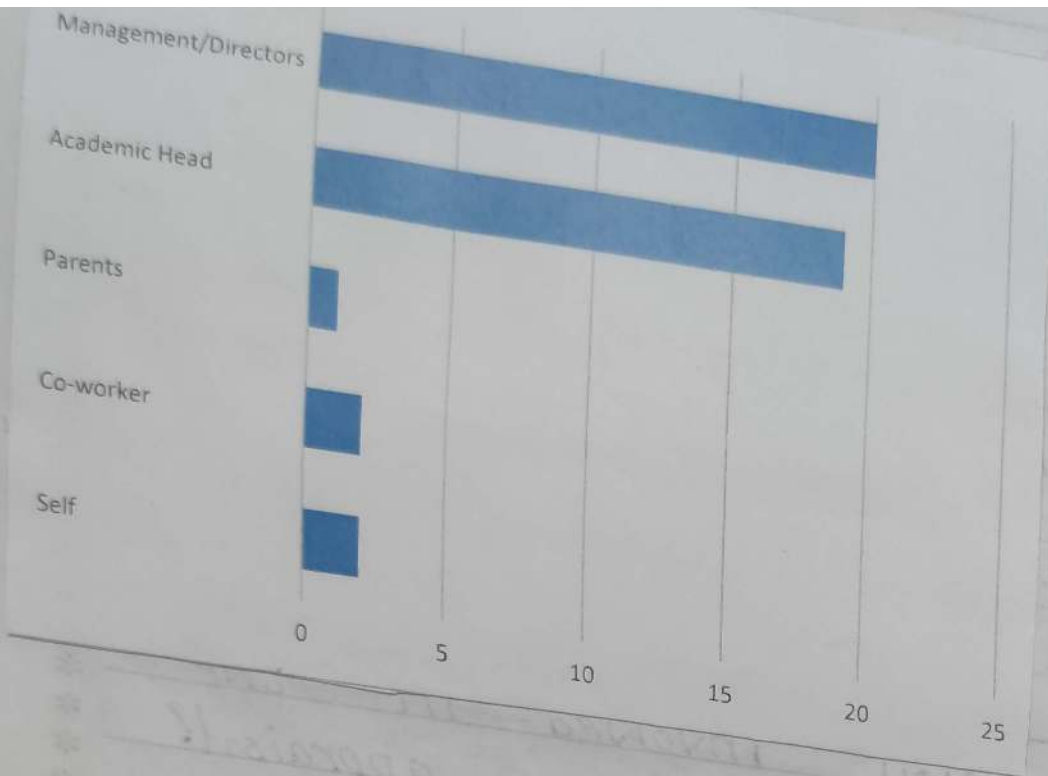
■ Yes ■ No

respondents, 18 employees agree that the appraisal help them to improve interpersonal relationships. The remaining 2 given a neutral response. This because they do not yet had their appraisal. One because she just joined the school and the other had joined during pandemic which is why they are still trying to understand the procedure and adjust with it.

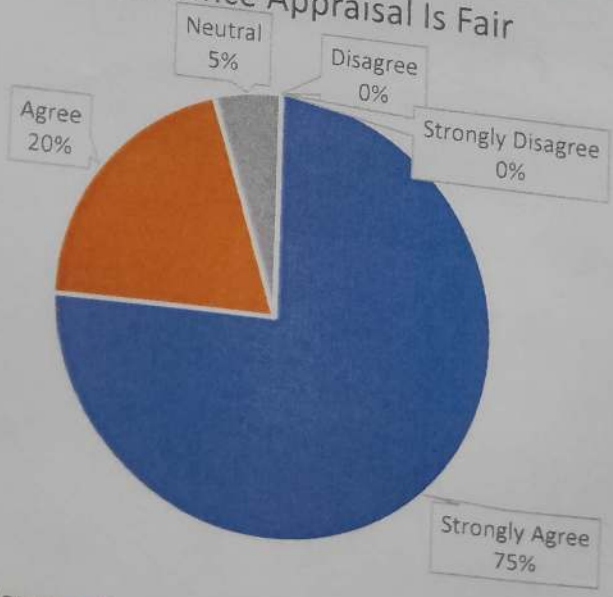
8b Are you involved in the process of performance appraisal? Out of 20 respondents, 18 are not involved in appraisal process. The other 2 with designation of Coordinator and Head of Academics, are involved, this means that there is only top management's involvement in appraisal of employees.

9b Who all are involved in your performance appraisal? For this question, all the 20 respondents says that management/Directors are involved in their





Performance Appraisal Is Fair



■ Strongly Agree   
 ■ Agree   
 ■ Neutral   
 ■ Disagree   
 ■ Strongly Disagree

a appraisal. 19 respondents says that Academic Head is also involved in the same. The one disagreed is transportation incharge as his appraisal is done only by management / Directors.

Only 2 respondents with designation of H. Head of Academics and Coordinator, involvement of self and co-worker.

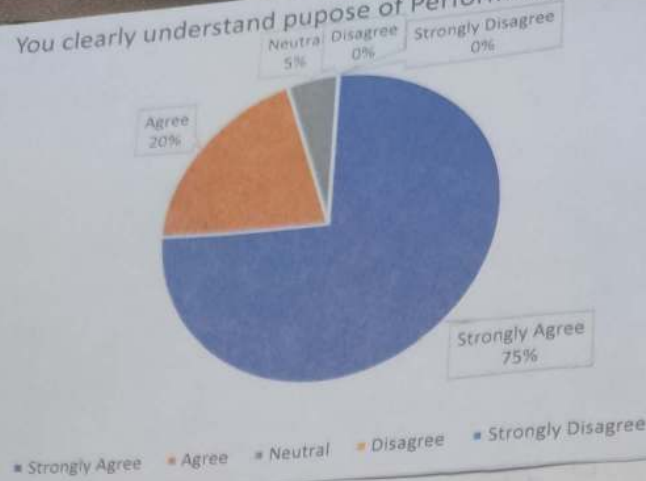
The mother teacher said that the student's parents are involved in her appraisal process.

10b Is performance appraisal at your organization fair?

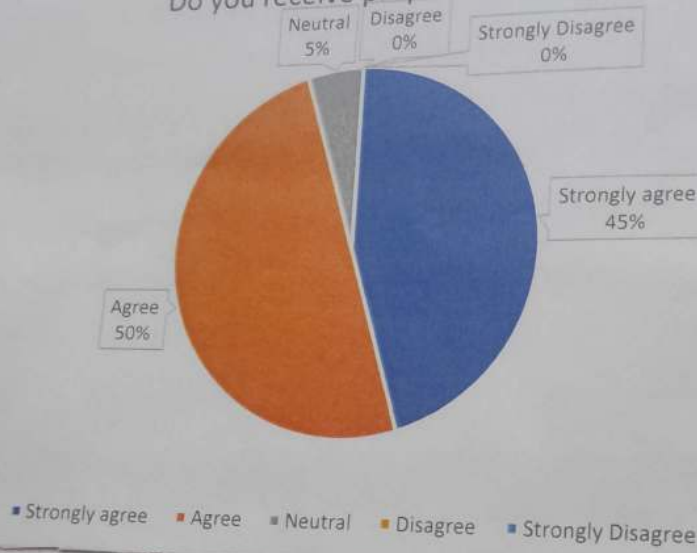
Out of 20 respondents, 19 have agreed that the performance appraisal at the school is fair. There is 1 employ with a neutral opinion since she still haven't done with appraisals yet. So we can say that the appraisals are fair at Little Kingdom Sr. Sec. School.



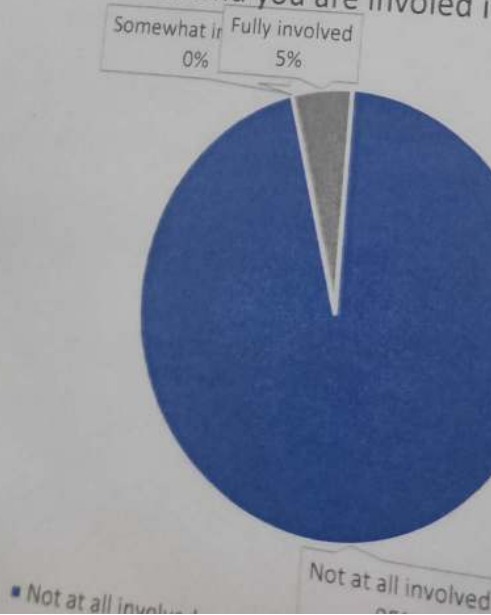
### You clearly understand purpose of Performance Appraisal



### Do you receive proper feedback



### To what extend you are involed in setting goals



Roll No. 

11) I clearly understand the purpose of performance appraisal.

Again 19 respondents have agreed that they understand the purpose behind the performance appraisal and the one who joined the organization/school 5 months back, is still having a neutral response. So we can say that the staff knows the purpose behind their appraisals.

12) Do you receive specific and accurate feedback from the management on your performance?

Similarly for this question 19 respondents agree to receive specific and accurate feedback. Remaining one with neutral choice is still left out to have her appraisal.

13) To what extent are you involved in setting goals?

Out of 20 respondents, 19 says that they are not at all involved in setting goals. The remaining one is fully involved in the same. It is because she is the Head of Academics - i.e.



14) In your opinion, what does your organization strive to achieve through performance appraisal?

All the respondents said that the school strives to achieve 'Targets for future performance' through performance appraisal.

12 respondents also said that another factor to achieve through performance appraisal is 'Promotion'. These are the employs who are in the organization for 5 or more than 5 years, and had been promoted once atleast.

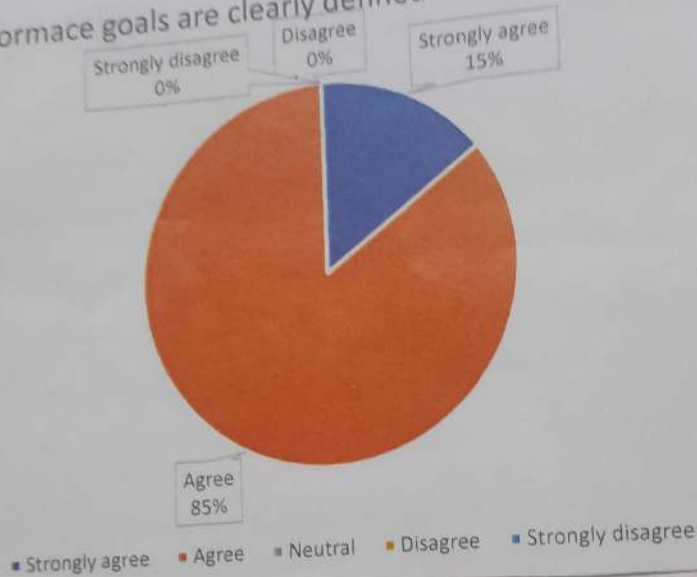
2 respondents - the Head of Academics and the Coordinator has said that the motive of these appraisals also includes 'Training'.

0 respondents said that the school also strive to achieve 'salary increment' through performance appraisals. These are the employs who served the organization for more than 5 years and got increment atleast two times.

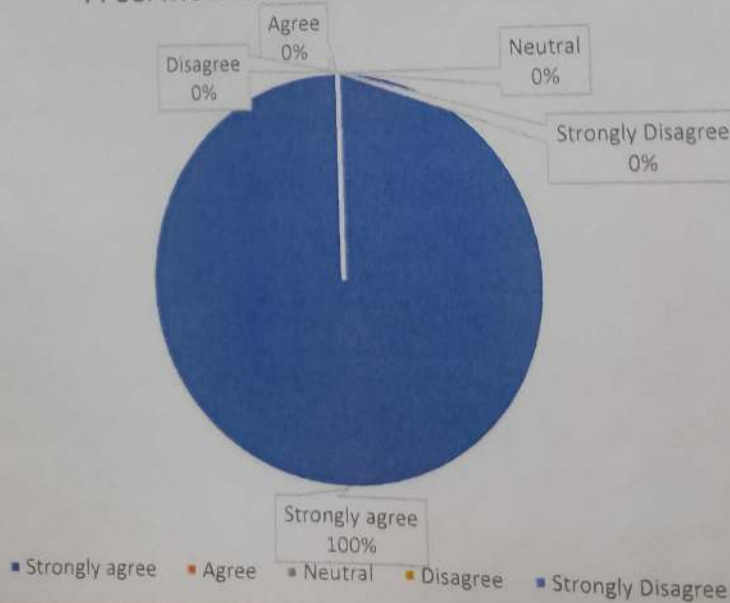
### Promotion, Pay increment and Performance Appraisal



### Performance goals are clearly defined in Appraisal Process



### I Feel more motivated after Appraisal





15) Is your promotion, pay increment and benefits based on performance appraisal?

All the respondents agree that their promotions; pay increments and benefits are based on their performance appraisal.

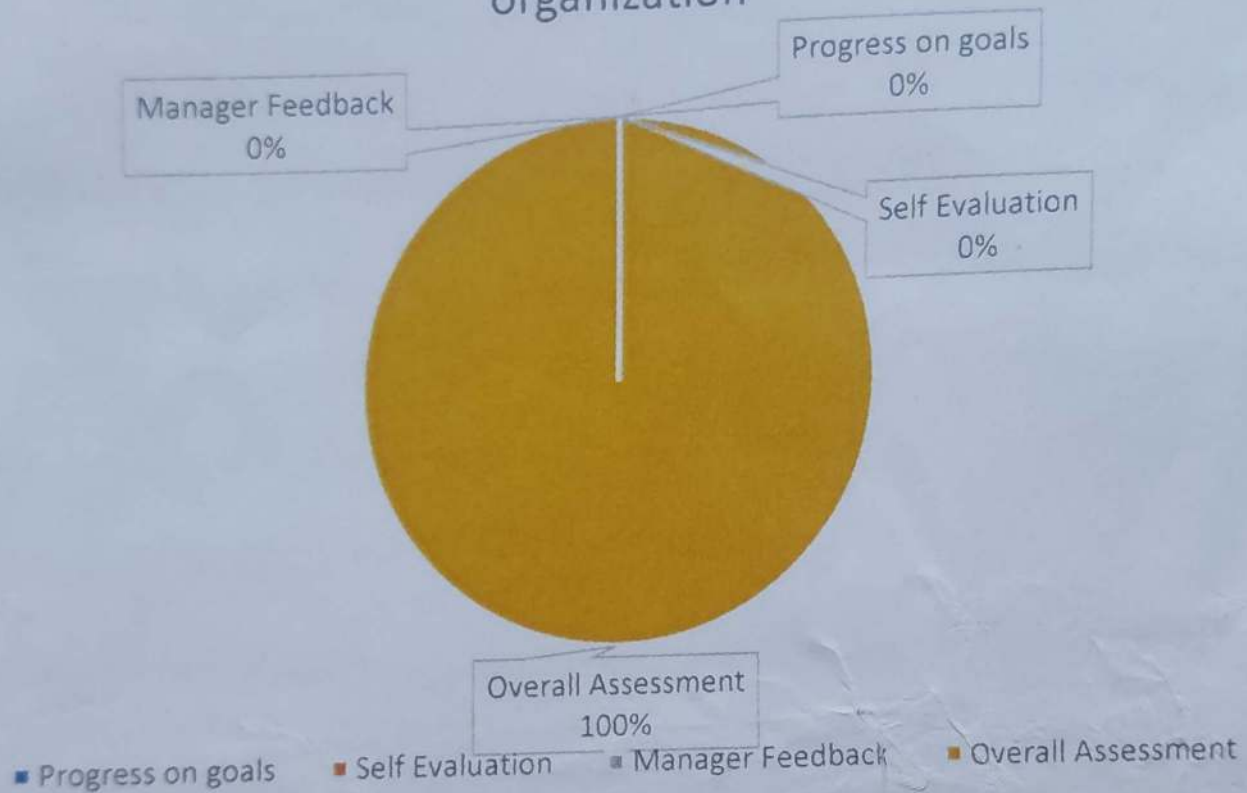
16) Performance Goals are clearly defined in your appraisal process.

All the respondents agreed that the performance goals are clearly defined in their appraisal process.

17) I feel more motivated after performance appraisal.

All the 20 respondents agree that they feel more motivated after Performance Appraisal. This is a positive response for school, as this tells us that the staff at the organization have a proper understanding of the appraisal process and have a positive impact of their appraisal.

## Elements of Performance Appraisal used in your organization



... clearly States Performance target



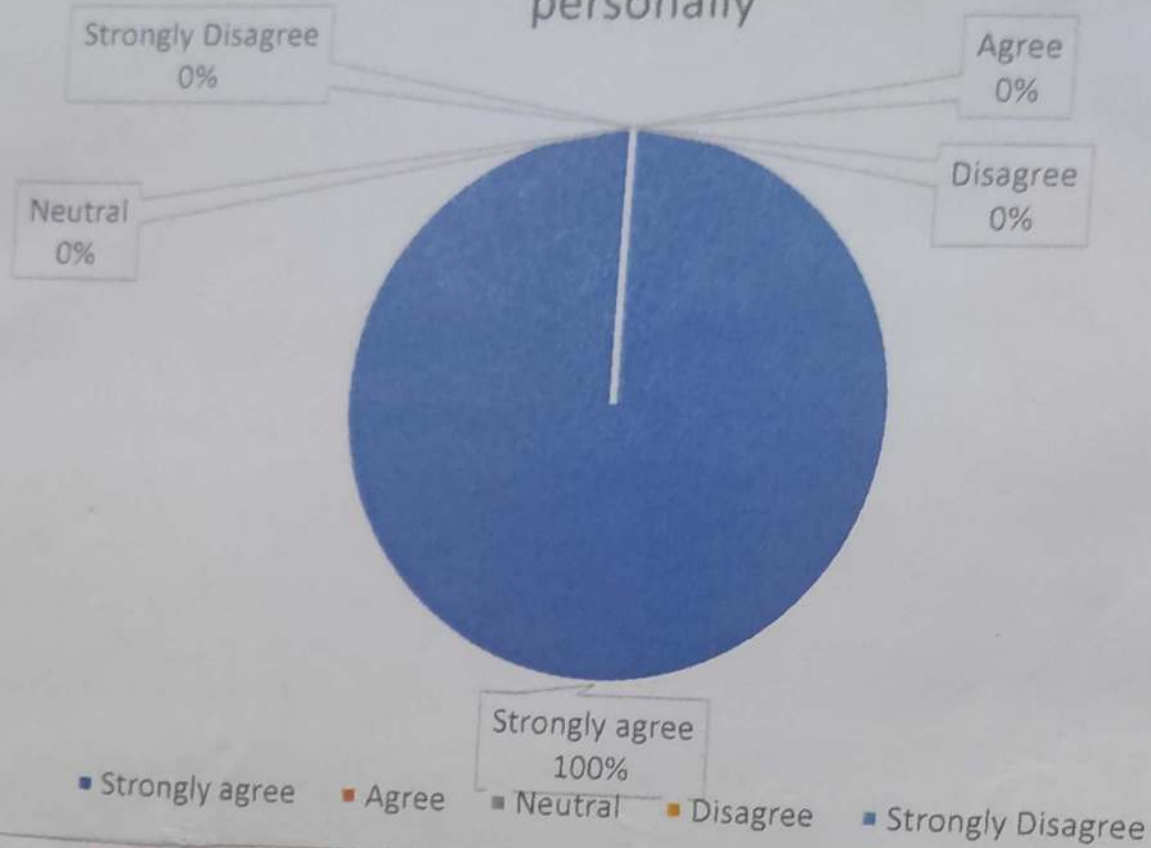
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18) Performance review improves job performance. All respondents agree to this statement which proves that their work is carefully monitored and suggestions from higher authorities are given to help the staff to improve.

19) What are the Elements of Performance Appraisal used by your organization? The element used in/by the school is 'overall assessment'. This shows that the management values all the duties of their staff and make the analysis on the same base.

20) The performance appraisal clearly states my performance targets. For this question, all the respondents has agreed that the performance targets are clearly stated in their appraisals. This means that the staff knows where to focus and what should be improved.

Participation in Performance Appraisal made you develop personally



Overall Satisfaction level of ...



21) Since participating in Performance Appraisal, I have developed personally. All the respondents agrees that they have developed personally after having appraisals. This means that the school management tells the staff those areas where the staff have to develop or upskill themselves.

22) What is the overall satisfaction level of your Performance Appraisal Management System? For this question, all the respondents said that they are satisfied with the Performance Appraisal Management System at Little Kingdom Senior Secondary School which is very good for the organization as it is helping the employs to know their strength and weakness and work upon them.

# CONCLUSION

→ The employees who have served the organization for less than a year and the employees who joined during pandemic do not have clear idea on appraisal process.

→ The employees who served the organization for more than 3 years have now become familiar with the process and have now become familiar with the process and have shown a positive view about the same.

→ Because of pandemic employees didn't get much monetary benefits but enjoyed other advantages.

→ Only the staff working in Top lower level are involved in their appraisal and in setting goals.

→ All the staff finds the appraisal process easy and efficient.



→ They all have clear understanding of Performance Appraisal and receive proper feedback from management.

→ The promotion, pay increment and benefits are all based on Performance Appraisal and the goals are well-defined.

→ The performance appraisal method used in the organization is Human Resource Accounting method. ~~used~~ ~~is~~

→ The element of Performance Appraisal used in organization is overall assessment.

# SUGGESTION

1) Greater involvement of employees: For the appraisal to reach its potential and be of benefit to all involved there needs to be a higher level of employee involvement in the system than there is at present.

One of the key factors of Performance Appraisal was to ~~be~~ have the manager and employee jointly identify ways to improve the employee's performance, and establish a development plan to support the employee in achieving their goals.

When employees are involved, they take greater interest as they are given more of a voice. Greater employee participation is known to create an atmosphere of cooperation, reduces tension and rater-ratee conflict which could be caused by the appraisal.

2) Parents and Students' feedback as criteria of Performance Appraisal:

The school should use feedback forms and suggestion boxes to be filled by parents and students about performance



of teacher and other staff. This should be included as a criteria used to measure performance appraisal of staff.

3) A consistent, one-for-all appraisal structure ~~company~~ organization-wide : The most obvious issue with the current appraisal system in place in organization is the level of the survey showed that some appraisal are carried out more than once a year and yet others stated they have only one appraisal meeting in three years. There is also inconsistency in relation to who is setting the goals, what the goals are based on and whether employs feel the appraisal is efficient or inefficient. The organization should look to introduce a framework of performance appraisal within the school that sets out a number of important objectives such as fairness, confidentiality, employ development and mutual involvement. This framework would need to be explained to all involved in the process and training provided so as to ensure managers & employs are aware of how the system works and can stick to guidelines.

Roll No. 

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LITTLE KINGDOM Sr. Sec. SCHOOL, JABALPUR

Survey Questionnaire

Name of the employee: \_\_\_\_\_

Gender

- Male
- Female

Designation: \_\_\_\_\_

Length of Service:

- Less than 1 year
- 1 to 5 years
- 5 to 10 years
- More than 10 years

Does performance appraisal done for your job profile?

- Yes
- No

Do you agree that it is necessary for performance appraisal to be conducted in an organization?

- Agree
- Partially agree
- Disagree

How often is performance appraisal carried out in your organization?

- Yearly
- Within two years
- Other \_\_\_\_\_

The Performance Appraisal techniques used in your organization are:

- 360° Appraisal
- Management by Objective (MBO)
- Psychological Appraisal
- Human-Resource Accounting Method
- Other: \_\_\_\_\_

How would you rate the performance appraisal method in your organization?

- Easy
- Complicated
- Efficient
- Inefficient

Does performance appraisal help to improve interpersonal relationship?

- Strongly agree
- Agree
- Neutral
- Disagree
- Strongly disagree

Are you involved in process of Performance Appraisal?

- Yes
- No

Who all are involved in your Performance Appraisal? (can choose multiple)

- Self
- Co-workers
- Parents
- Academic Head
- Management/Directors

Is Performance appraisal in your company is fair?

- Strongly agree
- Agree
- Neutral
- Disagree
- Strongly disagree



I clearly understand the purpose of performance appraisal

- Strongly agree
- Agree
- Neutral
- Disagree
- Strongly disagree

Do you receive specific and accurate feedback from your management on your performance?

- Strongly agree
- Agree
- Neutral
- Disagree
- Strongly disagree

To what extent are you involved in setting goals

- Not at all involved
- Somewhat involved
- Fully involved

In your opinion, what does your organization strive to achieve through performance appraisal? (can choose multiple)

- Training
- Promotion
- Demotion/Transfer
- Lay Off
- Salary increment
- Targets for future performance
- Other \_\_\_\_\_

Is your promotion, pay increment and benefits based on Performance Appraisal?

- Yes
- No

Performance goals are clearly defined in your appraisal process.

- Strongly agree
- Agree
- Neutral
- Disagree
- Strongly disagree

56

The f... I feel more motivated after performance appraisal.

- Strongly agree
- Agree
- Neutral
- Disagree
- Strongly disagree

How w... Performance review improves job performance.

- Strongly agree
- Agree
- Neutral
- Disagree
- Strongly disagree

Does pe... What are the elements of Performance Appraisal used in your organization?

- Progress on goals
- Self Evaluation
- Management Feedback
- Overall Assessment

e you... The Performance appraisal clearly states my performance target.

- Strongly agree
- Agree
- Neutral
- Disagree
- Strongly disagree

Pa... Since participating in performance appraisal, I have developed personally.

- Strongly agree
- Agree
- Neutral
- Disagree
- Strongly disagree

What is the overall satisfaction level of your Performance Appraisal Management System

- Satisfied
- Partially Satisfied
- Unsatisfied





**ST. ALOYSIUS' COLLEGE**

**(AUTONOMOUS), JABALPUR(M.P.)**

Reaccredited 'A+' Grade by NAAC (CGPA 3.68/4.00)

College with Potential for Excellence (CPE) by UGC

DST-FIST Supported & Star College Scheme by DBT.

# **SAMPLE PROJECT REPORTS**

## **2021-22**

## **FACULTY OF SCIENCE**

**“SURVEY, COLLECTION AND ANTIBACTERIAL SCREENING  
OF GANODERMA LUCIDIUM”**

***Dissertation***

Submitted for Partial Fulfilment for the  
Degree of

**MASTER OF SCIENCE**

**IN**

**MICROBIOLOGY**

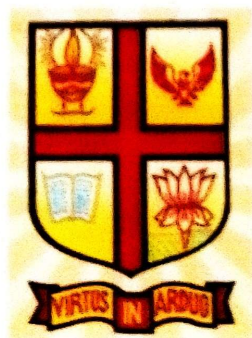
Under the guidance of

**DR. S. S. SANDHU**

Director, DIC  
(RDVV, Jabalpur)

Submitted By

**JITENDRA**



*Jitendra*  
8/6/22

**DEPARTMENT OF BOTANY AND MICROBIOLOGY**

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**SESSION : 2021-2022**





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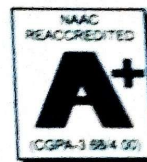
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## CERTIFICATE

This is to certify that the Dissertation work entitled “SURVEY, COLLECTION AND ANTIBACTERIAL SCREENING OF *GANODERMA LUCIDIUM*” is submitted by **JITENDRA** as a partial fulfillment for the Degree of “Master of Science” in Microbiology, St. Aloysius' College, (Autonomous) Jabalpur (M.P.) for the academic year 2021-2022. The dissertation has been duly completed under the supervision and guidance of **Dr. S. S. SANDHU**, Director, Bio-Design Innovation Centre, R.D. University, Jabalpur, (M.P.).

Date:

  
DR. FR. G. VAZHAN ARASU

Place: Jabalpur (M.P.)

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Ref. DIC/ 53

Date 06/06/ 2022

## CERTIFICATE

This is to certify that the work entitled "**SURVEY, COLLECTION AND ANTIBACTERIAL SCREENING OF GANODERMA LUCIDIUM**" is a dissertation work carried out by Jitendra, Master of Science (M.Sc. 4<sup>th</sup> Sem.), Department of Microbiology, St. Aloysius College, Jabalpur has duly completed his work under my guidance and supervision. No part of this dissertation has been submitted elsewhere for any other degree or diploma. He has done his work sincerely.

Prof. S.S.Sandhu

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# DECLARATION

I hereby declare that the dissertation work entitled “**SURVEY, COLLECTION AND ANTIBACTERIAL SCREENING OF *GANODERMA LUCIDIUM***” submitted to SL Aloysius’ college, (Autonomous) Jabalpur, M.P. for the partial fulfillment of the degree of **Master of Science (Microbiology)**, is an authentic documentation of my own work carried out under the Supervision of **DR. S. S. SANDHU**, Director, Bio-design Innovation Centre, R.D. University, Jabalpur, (M.P.). The matter embodied in this dissertation has not been submitted for a degree of any other academic qualification of any University or examining body in India or abroad.

Date: 06/06/2022

Place: Jabalpur



**JITENDRA**

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# INTRODUCTION



## INTRODUCTION

Mushrooms or fly agaric are fleshy, spore-bearing fruiting fungal bodies that are usually produced above ground, or on their food sources. As long as we found records from ancient times, and perhaps long before humans have consumed mushrooms. Our cultural relationship with mushrooms dates back to the time of the tribes where mushrooms were often considered special and even sacred. This deep spiritual connection with mushrooms extends around the world-from Mesoamerica to the deepest parts of Africa and even Europe, people have a long history of using psychedelic mushrooms for ceremonial and religious gatherings.

"Magic mushrooms" have long been used in civilization since the tribal era, but have been largely abandoned in Europe as we transitioned to civilization and culture. However, in the Americas where Aztecs and other Mesoamerican cultures focused on spirituality and religious rituals, magical mushrooms continued to be used until the Spaniards discovered the area. Archaeological evidence suggests that magic mushrooms have been used throughout history. Hallucinogens such as *Psilocybe hispanica* and *Psilocybe mairei* have been found to be depicted in rock paintings and caves in Europe and North Africa. A prominent example is the Tasiri Cave in southern Algeria. Here, 4,444 species of fungi are depicted in a rock painting dating back 7,000 years. The rock painting near Villar del Humo in Spain, also, shows the mushrooms used in the ritual, dating back about 6,000 years (Roy *et al.*,2015).

It was not till 1916 that western scientific technological know-how first took a hobby in magic mushrooms. Dr. William and E.Safford perused Spanish reports, coming across the point out of mushrooms claimed that mushroom of such homes did now no longer exist. By the 1930s, encouraged via way of means of Safford's claims, more than one botanist and ethnobotanists made their manner to Central America to find out the name of the game and to look if Mesoamerican mushrooms had been simply peyote as Safford claimed. In 1955, R. Gordon Wasson have become the primary white guy to take part in a mushroom ritual in Oaxaca, Mexico. Wasson recorded his stories after which later retook mushrooms together along with his spouse and daughter. An year later, Wasson lower back to Mexico with mycologist Roger Heim in which the pair become aware of seven species of hallucinogenic mushrooms earlier than returning to New York. In 1957, Wasson published -Seeking the Magic Mushroom, formally introducing 'magic mushrooms' to the relaxation of the world.



Mushrooms are classified as fungi and have been used in medicinal and food products for centuries. Mushrooms come in edible, medicinal and toxic varieties. Since 1928, after Alexander Fleming discovered *penicillin*, studies on the use of the medicinal properties of mushrooms and the manufacture of drugs from them have been officially investigated and conducted. Today, some mushrooms and their by-products are used to make medicines for a variety of purposes. Lichens were also used in ancient medicine, but in modern medicine fungi and yeast are the main products. Mushrooms may have been used for medicinal purposes in the early days, but after 1928, modern medicine began to extract medicines from mushrooms. *Reishi* or *Ganoderma lucidum* mushrooms are used in ancient Chinese medicine and are considered to be the longest-used mushrooms for medical purposes (Waktola *et al.*, 2018).

In recent years, various kind of mushrooms have been confirmed, and a number of mushrooms have been cultivated for medicinal purposes. *G. Lucidium* (Polyocracies) mushroom is a medicated mushroom commonly known as Rishi. *Ganoderma lucidum* is a mushroom traditionally used in Chinese medicine for the prevention and treatment of human disease. Studies on *G. lucidum* and its products have reported beneficial biological, health-preserving and therapeutic effects. This mushroom is a valuable herb due to its biological activity such as immunomodulation, cardiovascular, respiratory, antitumor, antiviral, antihepatotoxicity. The species showed antibiotic activity against organisms such as *Pseudomonas* sp. and *Bacillus subtilis*. Fungal polysaccharide has been shown to possess antioxidant, anti-inflammatory, antibacterial, antifungal and antiviral activities and can be obtained via solid substrate fermentation (SSF) or submerged-liquid fermentation (SLF). However, owing to the inherent nature of the solid substrate in SSF, fungal growth occurs through mycelial colonization of the substrate bed (Nahata *et al.*, 2013).

*Ganoderma lucidium* is a fungus found in all Asian countries. *G. lucidium* is also known as *Rishi* mushroom. The exterior of the mushroom is shiny and features a dark colour and a woody texture. Other *Rishi* mushrooms, require their own ideal conditions for their growth and cultivation. *G. lucidium* belongs to the Rishi family and describes porous basidiomycetes with double-walled basidiomycetes. Its morphological features are the shape and size of the spores, the microstructure of the crust, and the colour. For a long time, it has been used in the Vedic methodology as a preliminary source of medicines for



Reishi is a genus of porous fungi of the family Reishi, and contains about 80 species, and many from the tropics. They are highly genetically diverse and are used in traditional Asian medicine. Reishi has double-walled basidiomycetes, which distinguishes them from other polypore's. They are sometimes called shelf fungi or bracket fungi.

#### Scientific classification-

|          |   |                        |
|----------|---|------------------------|
| Kingdom  | : | Fungi                  |
| Division | : | Basidiomycota          |
| Class    | : | Agaricomycetes         |
| Order    | : | Polyporales            |
| Family   | : | Ganodermataceae        |
| Genus    | : | <i>Ganoderma</i>       |
|          |   | <i>P. Karst (1881)</i> |



**Etymology-** The name Reishi is derived from the Greek word's genos "brightness, brilliance", that is, "gloss" and derma "skin".

**History-**The genus Reishi was established as a karst genus by karst in 1881. It contained only one species, the *Ganoderma lucidum* (Curtis) Karst. Previously, this taxon was characterized as *Boletus lucidus* Curtis (1781) and then *Polyporus lucidus* (Curtis) Fr. (1821) (Carsten1881). *P. lucidus* species are characterized by having a lacto (shiny or polished) cap and stem, which is *Ganoderma*. It is a feature that Murrill suspected to be the reason for Karsten's division, as it contained only one species, *Ganoderma lucidium*. Patouillard revised Karsten's Reishi genus to a total of 48 species, 1889 Monograph, including all species with pigmented spores, attachment tubes, and lactate-studded mountains. Brought the classified. Until Marill studied Reishi in North America in 1902, previous studies focused only on European species, including *Ganoderma sp.* for example *Ganoderma lucidum*. Resinaceum Boud (1890) und *G. Valesiacum*Boud (1895).

**Phylogeny-** This genus was named by Karsten in 1881. Members of the Reishi family have traditionally been considered difficult to classify due to lack of credible morphological features, excess of synonyms, and widespread misuse of names. Until recently, the genus was divided into two sections-Reishi with a glossy cap surface (like *Ganoderma lucidum*) and Elfving with a blunt cap surface (like *Ganoderma applanatum*).

(<https://en.wikipedia.org/wiki/Ganoderma>)

REVIEW  
OF  
LITERATURE



## REVIEW OF LITERATURE

The fungal mushroom has a wide variety of pharmaceutical interest biotic compounds. These biotic compounds can be used against a number of diseases caused by microbes. Mushrooms are the best source of minerals, vitamins and essential amino acids. Therefore, at present a huge work is carried out by research community for isolation of biotic compounds.

In a study, *G.lucidum* was grown artificially in polypropylene bags using a variety of inexpensive and readily available substrates. Five wood such as *Swietenia mahagoni*, *Dipterocarpus turbinatus*, *Tectona grandis*, *Gmelina arborea*, *Michelia champaca*) saws were used as substrates and cultivated with calcium carbonate ( $\text{CaCO}_3$ ) and rice or wheat bran, respectively. Wheat bran has been found to be more effective as a dietary supplement than rice bran. However, *S. Mahagoni* with wheat bran took 6 days, 33 days, 60 days for mycelial growth, primitive formation and harvest, with subsequent yields of 235, 2 g / kg, substrate that showed the highest mushroom yield with biological efficiency is 7.6%. (Roy *et al.*,2015).

Another research work was carried out to evaluate the inhibitory effect of various Reishi extracts against *Staphylococcus aureus* (MTCC 3160) and *Salmonella Lucidum* cause Typhoid fever by using agar well diffusion method and broth dilution method (MTCC1249). Methanolic extract of mushroom showed higher MIC and Zone of Inhibition (ZOI) (MIC: 50  $\mu\text{g}$  / ml and ZOI: 2). (12 mm) against *Staphylococcus aureus* and typhoid fever Agar well diffusion method. (Dandapat *et al.*,2015).

Suriyatamilan *et al.*, (2022) collected *Ganoderma* sp. and treated with different solvents extracted in the vacuum evaporator, Soxhalet appliance and analyzed, its bioactive compound and antioxidant and anticancer activity in HepG2 hepatocyte cell line. Methanol extracts of crude *Ganoderma lucidum* showed inhibitory activity against test organisms such as *Candida albicans*, *Enterococcus faecalis*, *Pseudomonas aeruginosa*, and *Staphylococcus aureus*. Ethanol extract of  $\text{AgNO}_3$  treated *Reishi* mushroom showed good inhibitory zone against ENT-infected microbial species but crude extract showed little zone inhibition.

The *Ganoderma lucidum* was also cultivated in several media using four different concentrations but the best Mycelial growth was observed on potato dextrose medium at pH 5 and 25 ° C, followed by malt growth. Extract, Kirk's medium and molasses and

**MATERIALS**  
**AND**  
**METHODS**



### 3. Material and Methods

#### 3.1. Survey and Collection of *Ganoderma* Species

In the present investigation, *Ganoderma lucidium* was collected from different site of Rani Durgavati University, Jabalpur premises in the month of January-February 2022. Healthy and mature fungi were carefully collected for sampling. The samples were brought to the laboratory in sterile polythene bags for further process. The site of collection of *Ganoderama lucidium* as given in table 3.1.

**Table: 3.1 Collection site of *Ganoderma lucidium***

| S.No. | Common name     | Scientific name           | Collection Site                      |
|-------|-----------------|---------------------------|--------------------------------------|
| 1     | Reishi mushroom | <i>Ganoderma lucidium</i> | DIC, RDVV, Jabalpur                  |
| 2     |                 |                           | Vigyan Bhawan Area, , RDVV, Jabalpur |

#### 3.2 Purification of *Ganoderma lucidium*:

After the collection of *Ganoderma lucidium* from the nature further grow in *in vitro* condition in the laboratory. For this, the mushroom samples were clean with tap water properly for removal of dust and debris from the outer parts of the sample. The sample were again washed with sterilized distilled water and kept on the Whatman filter paper for the proper removal of water from the sample. After the cleaning of *Ganoderma lucidium* small parts of it were placed on the PDA plates supplemented with antibiotics. The Petri plates were incubated at 26-27°C for 3-5 days in fungal bacterial incubator. The Petri plates were monitored every day to check the growth of fungal mushroom colonies from the segments. Isolation of pure fungal strains from the master plate were obtained by transferring the hyphal tips to new PDA plate and incubated at 26-27°C.

#### 3.3 Preparation of media

For isolation of Reishi mushroom Potato Dextrose Agar Medium (PDA) was used. For preparation of PDA 200 / gm peeled potatoes were boiled in distilled water for 30 min. After boiling the potato extract was filtered through Muslin cloth, and then make-up a volume of 1000 mL, by adding sterilized distilled water. Thereafter, 20 / gm dextrose and 20/gm Agar-Agar was added in the potato extract and homogenized by gentle heat. Now, the medium was autoclaved at 15 Psi for 20 min or at 121°C. The preparation of media as given in table no. 3.2

**RESULT**  
**AND**  
**DISCUSSION**



## 4. Result and Discussion

### 4.1 Survey and Collection

In the present investigation, *Ganoderma lucidum* was collected from different site of Rani Durgavati University, Jabalpur premises in the month of January-February 2022. Healthy and mature fungi were carefully collected for sampling as shown in table no.4.1 and plate no.4.1.

**Table: 4.1 Collection site of *Ganoderma lucidum***

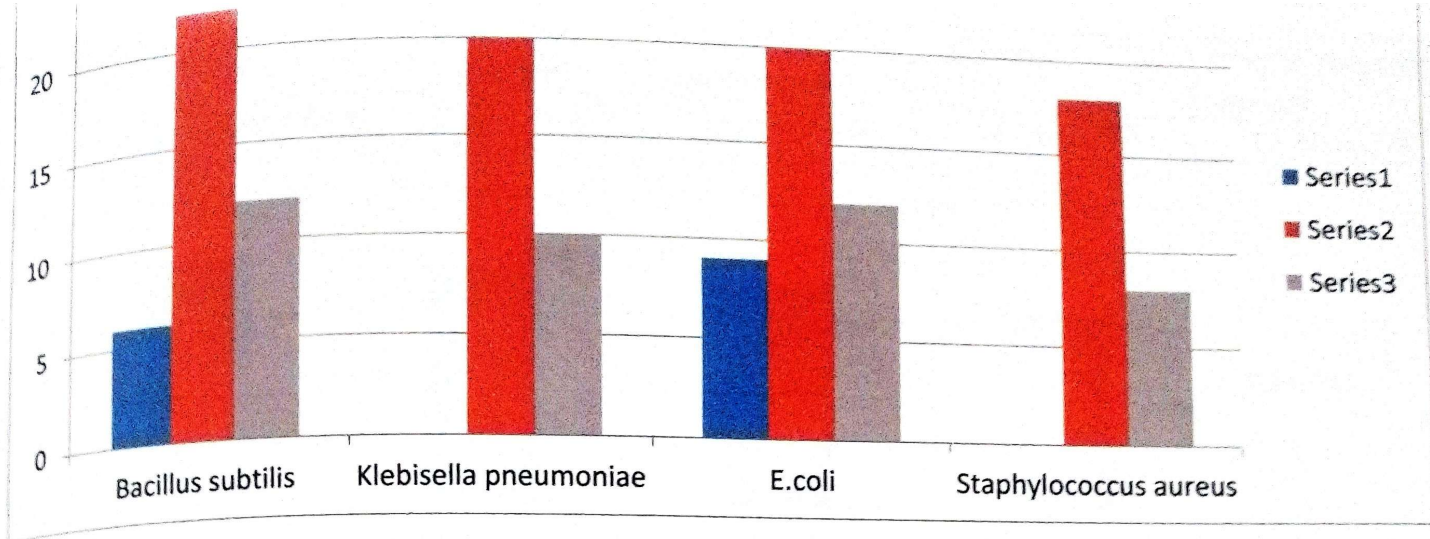
| S.No. | Common name     | Scientific name          | Collection Site                    |
|-------|-----------------|--------------------------|------------------------------------|
| 1     | Reishi mushroom | <i>Ganoderma lucidum</i> | DIC, RDVV, Jabalpur                |
| 2     |                 |                          | Vigyan Bhawan Area, RDVV, Jabalpur |

Rajput *et al.* (2016) also collected the different type of fungal mushroom including Reishi mushroom from the different sites of Maharashtra, India and characterized on the basis of their cultural characteristics, colour and morphology of fruiting bodies and spores. Similarly, Alheeti *et al.*, (2020), first record of the isolation, identification and fruiting body production of the Reishi mushroom (*Ganoderma lucidum* (W. Curt.: Fr.) P. Karst) from the Iraqi environment.

### 4.2 Morphological Identification of *Ganoderma lucidum*

For morphological identification slide culture technique was used to observe the morphological characteristics of the fungal strain. After 7 days of incubation at  $26 \pm 1^\circ\text{C}$ , the colonies on growth media were observed under light microscope (Metzer) and on the basis of morphology the mushroom was observed as substipitate to sessile, dimidiate, fibrous to spongy. *Pileus flabelliform*, surface glabrous, smooth, slightly dented and corrugated, bright to dull, with semi-concentric furrows, more conspicuous to the margin, cuticle light orange, reddish-golden, deep orange, light brown, reddish-brown, dark brown and almost black in some zones, with deep yellow, furrows due to cuticle detaching, covered by a brown basidiospores layer; margin sterile, obtuse, smooth, with groove zones, pale yellow, with yellowish-orange zones, greyish yellow after contact. The fungi were not fully homogenous, with a deep yellow band under the cuticle, light orange to brown toward the tubes, concentrically zonate, with two resinous bands, the upper thickened, both intermittent, – context length, interrupted near the margin. Tubes were long, brown, orange white towards the pores surface, unstratified. Pores 3-5 per mm, 133-171  $\mu\text{m}$  diam, pale yellow, greyish-yellow after contact, angular to rounded, with irregular edge. Stipe was, lateral, smooth, shiny to dull, flattened too cylindrical, solid, fibrous to spongy, concentrically zonate. Basidiospores are ellipsoids to oblong, apex truncate, with apical germ pore, exosporium with sub free to partially anastomosed inter walled pillars, reddish-brown as





**Fig:4.1 Antibacterial activity of *Ganoderma lucidum***

Vazirian et al., (2014) observed the antimicrobial activity of the secondary metabolites of *G. lucidum* against Gram-positive bacteria and yeast, with minimum inhibitory concentration values of 6.25 mg/mL. Further the antimicrobial bioactive compound was purified and elucidated as ergosta-7,22-dien-3 $\beta$ -yl acetate, ergosta-5,7,22-trien-3 $\beta$ -yl acetate (isopyrocalciferol acetate), ergosta-7,22-dien-3-one, ergosta-7,22-dien-3 $\beta$ -ol, and ergosta-5,7,22-trien-3 $\beta$ -ol (ergostrol).

In another research work, antimicrobial activity of various solvent extracts (40Pg/ml) of *Ganoderma lucidum* was tested against six species of bacteria: *Escherichia coli* (MTCC-443), *Staphylococcus aureus* (MTCC-737), *Klebsiella pneumoniae* (MTCC2405), *Bacillus subtilis* (MTCC-1789) *Salmonella typhi* (MTCC-531) and *Pseudomonas aeruginosa* (MTCC-779). Acetone extract exhibited maximum antibacterial activity ( $31.60 \pm 0.10$ ), while the most susceptible bacterium observed was *Klebsiella pneumonia* (Sandhu et al.,2010).

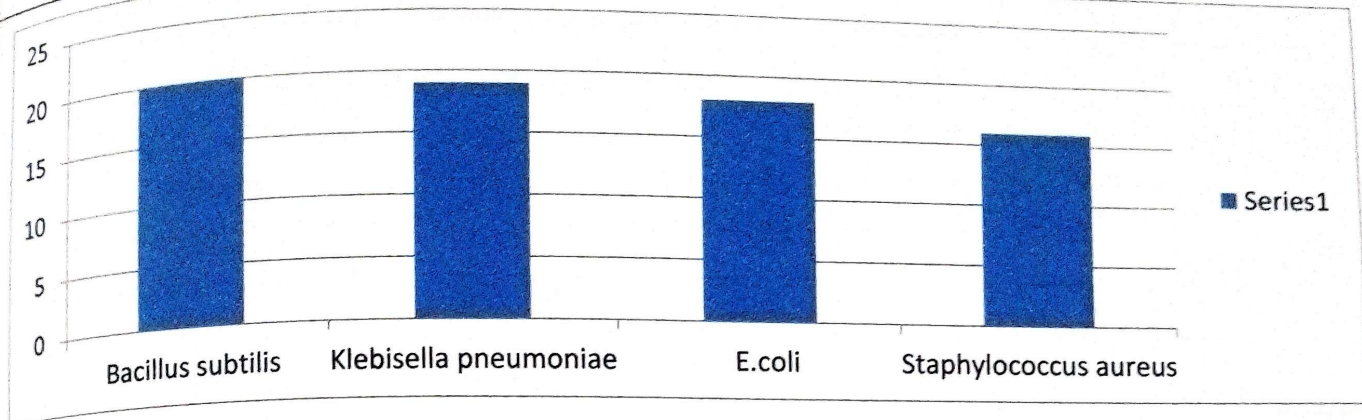
#### 4.4 Solvent–Solvent Extraction of Bioactive Compounds

The extraction process is an important step in the investigation of biologically active compounds. When extracting compounds from fungi, the type of solvent used, the extraction process employed and age or type of cultivation of living tissue all can have a marked effect on the type of compound that can be extracted.

In the present study, metabolites of *G.lucidum* was extracted with a number of organic solvent like hexane, methanol, chloroform, butanol, ethyl acetate, carbon tetra chloride, benzene etc. phase (1:1v/v) and concentrated. After evaporation of solvent, the metabolites were mixed with sterilized distilled water and tested their antibacterial activity by Agar well diffusion method. It was observed that fraction of Hexane extract has shown maximum antibacterial activity against *B. subtilis* ( $20.15 \pm 0.70$  mm), *E. coli* ( $18.20 \pm 0.80$  mm), *S. aureus* ( $16.80 \pm 0.58$  mm) and *K. pneumoniae* ( $16.80 \pm 0.58$  mm) as given in Table no. 4.4 Fig. 4.2 & plate no. 4.5



| S.No. | Isolate                   | <i>Bacillus subtilis</i> | <i>Klebisella pneumoniae</i> | <i>E.coli</i> | <i>Staphylococcus aureus</i> |
|-------|---------------------------|--------------------------|------------------------------|---------------|------------------------------|
| 1     | <i>Ganoderma lucidium</i> | 20.15±0.70               | 19.50±0.00                   | 18.20±0.80    | 16.80±0.58                   |



**Fig:4.2 Antibacterial activity of *Ganoderma lucidium***

Similar result was found by Desale *et al.* (2013) who observed the antibacterial activity of the crude extract of *G.lucidium* extracted with hexane, ethyl acetate and methanol were tested for their antimicrobial potential. The ethyl acetate displayed significant antibacterial activity against

*B. subtilis*, *K. pneumoniae*, *E. coli*, *S. typhimurium*, *B. cereus* and *S. aureus*.

Chaudhary *et al.* (2015) also tested antimicrobial activity of methanol extract of secondary metabolite of mushroom strain in a concentration of 100 mg/mL, 200 mg/mL, 300 mg/mL, 400 mg/mL and 500 mg/mL. The methanolic extract was found to show antimicrobial activity even at concentration of 500 mg/mL for *K. pneumoniae* (28±0.00 mm), *S. aureus* (27.33±1.24 mm), *E. coli* (19.33±0.47 mm), *Candida albicans* (10.33±0.57 mm) and *Trichophyton mentagrophyte* (25.66±0.47 mm).

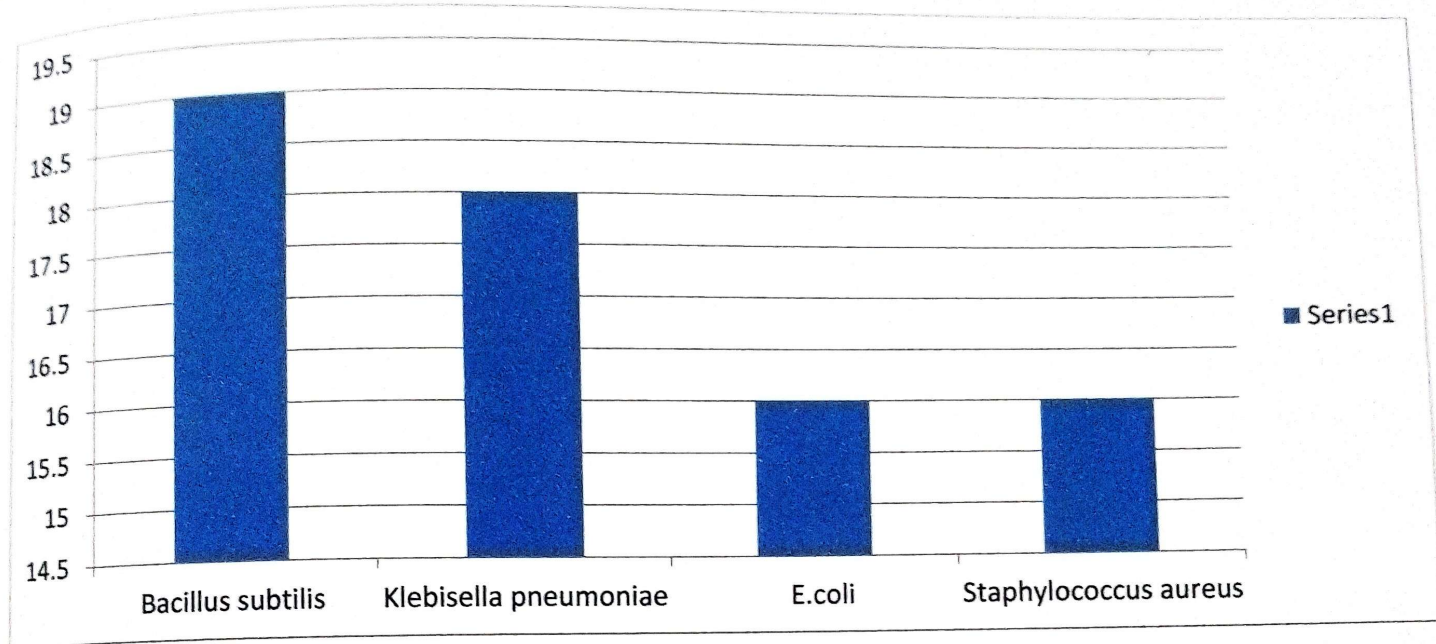
#### 4.5 Thin Layer Chromatography

For further purification of antibacterial bioactive compound isolated from the mushroom the thin layer chromatography was done. The solvent-solvent extract that showed the maximum antibacterial activity was run on silica gel G plate in solvent mixture of n-Hexane: ethyl acetate: acetone (4:3:3) that gave a single big spot on silica gel G plate observed after placed in the iodine chamber with a Rf value of 0.60, as shown in Fig.4. The spots were scooped from the silica gel plates and mixed with sterilized distilled water and centrifuged in the micro centrifuge at a rate of 10000 rpm for 10 min for separation of silica gel particles from the compounds. After the centrifugation, the upper layer was separated out into clean sterilized vials and tested for their antibacterial activity. The maximum antibacterial activity was observed against the *B. subtilis* (19.55±0.45 mm), *E. coli* (16.00±0.25 mm), *S. aureus* (16.80±0.58 mm) and *K. pneumoniae* (18.50±0.580 mm) as given in Table no. 4.4 Fig. 4.3



**Table:4.4 Antibacterial activity of TLC spot of *Ganoderma lucidium***

| S.No. | Isolate                   | <i>Bacillus subtilis</i> | <i>Klebisella pneumoniae</i> | <i>E. coli</i> | <i>Staphylococcus aureus</i> |
|-------|---------------------------|--------------------------|------------------------------|----------------|------------------------------|
| 1     | <i>Ganoderma lucidium</i> | 19.55±0.45               | 18.50±0.00                   | 16.00±0.25     | 16.80±0.58                   |



**Fig:4.3 Antibacterial activity of TLC spot of *Ganoderma lucidium***

In another study, Yin *et al.* (2018) extracted the antibacterial secondary metabolite of the fungal mushroom with ethyl acetate which demonstrated promising antibacterial activity against different Gram-positive bacteria in Disc diffusion assay. The extract was then subjected to thin layer chromatography (TLC) using dichloromethane: methanol (9:1) as a mobile solvent system and eleven spots with diverse polarities were obtained. The TLC chromatogram with bioactive spot was localized with bio autography assay and the result showed that the yellow spot with Rf value of 0.523 exhibited promising antibacterial activity against the four Gram-positive bacteria. In one of the research work an automatic triple development HPTLC fingerprint analysis was carried out for detecting the distribution consistency of the triterpenoic acids in various Lingzhi samples. The chromatographic conditions were optimized as follows: stationary phase, precoated HPTLC silica gel 60 plate; mobile phase, toluene-ethyl acetate-methanol-formic acid (15 + 15 + 1 + 0.1); and triple-development using automatic multiple development equipment. The chromatograms showed good resolution, and the color images provided more specific HPTLC fingerprints than have been previously published. It was observed that the abundance of triterpenoic acids and consistent fingerprint pattern in Red Lingzhi (fruiting body of *G. lucidium*) outweighs the other species of Lingzhi (Zhen *et al.*, 2010).



## 5. SUMMARY

In the present study, *Ganoderma* sp. were collected from the different site of RDVV, Jabalpur. The morphological identification of the mushroom was done by slide culture technique. After 7 days of incubation at  $26\pm 1^{\circ}\text{C}$ , the colonies on growth media were observed under light microscope (Metzer) and on the basis of morphology the mushroom was observed as substipitate to sessile, dimidiate, fibrous to spongy. *Pileus flabelliform*, surface glabrous, smooth, slightly dented and corrugated, bright to dull, with semi-concentric furrows. The antibacterial activities of CFCF (Cell-free culture filtrate) of the endophytic fungi were observed for 07, 14 and 21 days by using agar well diffusion method. The fungal mushroom was screened out for antibacterial activity against 4 pathogenic bacteria. During the screening of fungal mushroom, culture free cell filtrates (CFCF) of 7<sup>th</sup>, 14<sup>th</sup> and 21<sup>st</sup> days were examined for their antibacterial activity as depicted in Table 4.2. and plate no.4.3 Based on the result fungal mushroom, gave best zone of inhibition against *B. subtilis* ( $22.15\pm 0.70$  mm), *E. coli* ( $20.50\pm 0.25$  mm), *S. aureus* ( $18.80\pm 0.58$  mm) and *K. pneumoniae* ( $20.50\pm 0.58$  mm)

In the present study, metabolites of *G.lucidium* was extracted with a number of organic solvent like hexane, methanol, chloroform, butanol, ethyl acetate, carbon tetra chloride, benzene etc phase (1:1v/v) and concentrated for the partial purification of antibacterial bioactive compounds. It was observed that fraction of Hexane extract have shown maximum antibacterial activity against *B. subtilis* ( $20.15\pm 0.70$  mm), *E. coli* ( $18.20\pm 0.80$  mm), *S. aureus* ( $16.80\pm 0.58$  mm) and *K. pneumoniae* ( $16.80\pm 0.58$  mm). The solvent-solvent extract that showed the maximum antibacterial activity was run on silica gel G plate in solvent mixture of n-Hexane : ethyl acetate : acetone (4:3:3) that gave a single big spot on silica gel G plate observed after placed in the iodine chamber with a Rf value of 0.60, that was further observed for antibacterial activity against the test bacterial strain. After the observation of antibacterial activity of the bioactive compounds and partial purification of the secondary metabolite of *Ganoderma lucidium* which has further sent to the ITC, Chandigarh for chemical characterization of the bioactive compound through Gas-Chromatography and Mass spectroscopy analysis. Hence the bioactive compound produced by the *G.lucidium* will play an important role in the development of future antibacterial drugs and also has other potential for pharmaceutical industries.



## Future Prospects

*Ganoderma* sp., under the extensive in vivo and pharmacological research, can be used in various microorganisms and parasitic diseases. Therefore, future work should be focused on in vivo and pharmacological assays of known compounds, especially *Ganoderma lucidum* that have antimicrobial and anti-parasitic properties. A better understanding of the antimicrobial and anti-parasitic compounds from *Ganoderma* sp. is crucial for identifying the potential side effects and trace out the new host target and molecular mechanisms, which will provide evidence to further clinical applications of these compounds.

Challenges including genetic analysis, biosynthetic metabolism, separation, isolation and identification may be encountered. In addition, due to the rapid emergence of drug resistance in microorganisms and parasites, fewer options have been left for the treatment of diseases caused by microorganism and parasites. To fight back this problem, further research should be focused on this field for all the identified compounds and the unidentified compounds, which are on the way to be identified.

Our work revealed numerous extracts of *Ganoderma* sp. exhibit the inhibition to microorganisms including parasites, indicating that *Ganoderma* sp. in particular still seem to possess opportunities for new drug lead compounds. Therefore, further studies need to be carried out in order to explore this concealed area.

No doubt, it is evident that *Ganoderma* sp. is going to serve as one of the potential sources of novel antibiotics and anti-parasitic drugs in the near future. To reach the apex and specificity of effective antimicrobial and anti-parasite activity, cooperative investigations need to be carried out in the areas of genomic, bioinformatics, chemistry and pharmacology. Moreover, strategies to evoke the sleeping gene clusters linked for the production of bioactive compounds and its regulation need to be adopted.



PLATE: 4.1. Survey and Collection of *Ganoderma lucidium*





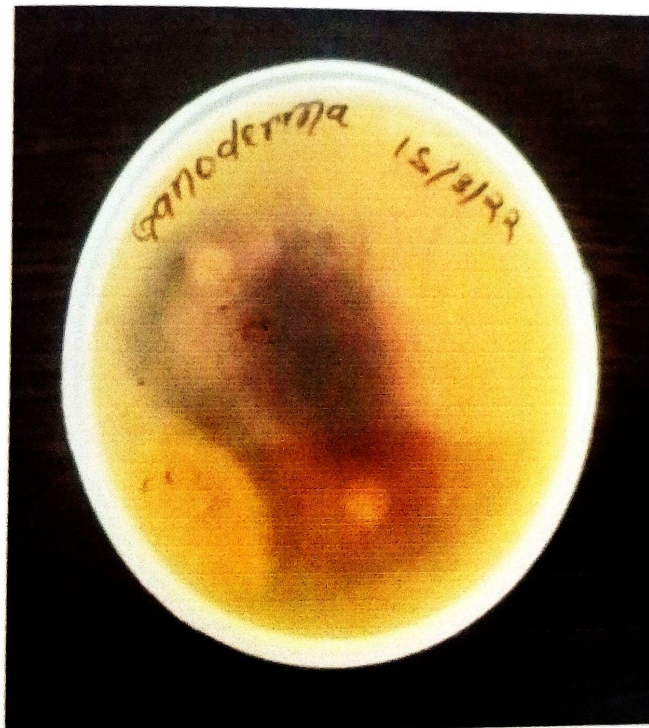
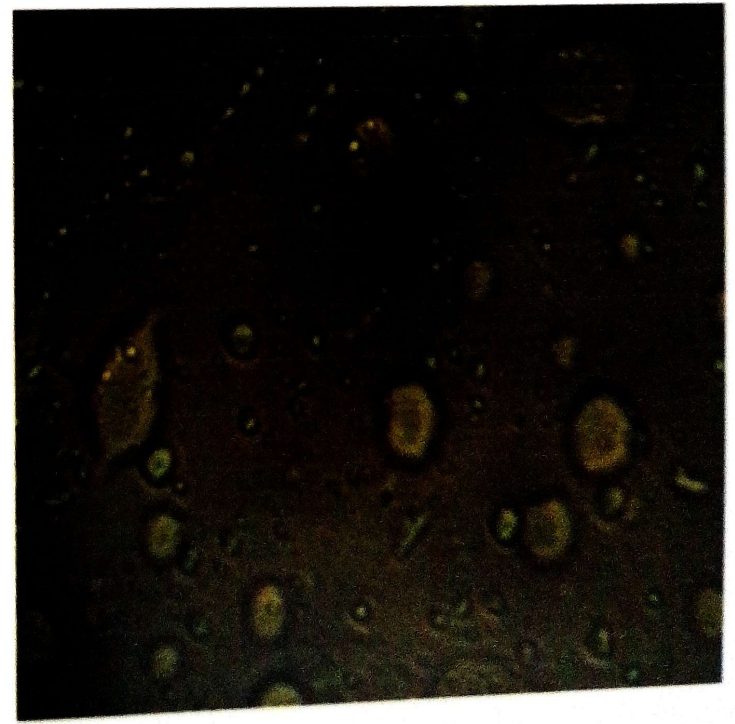
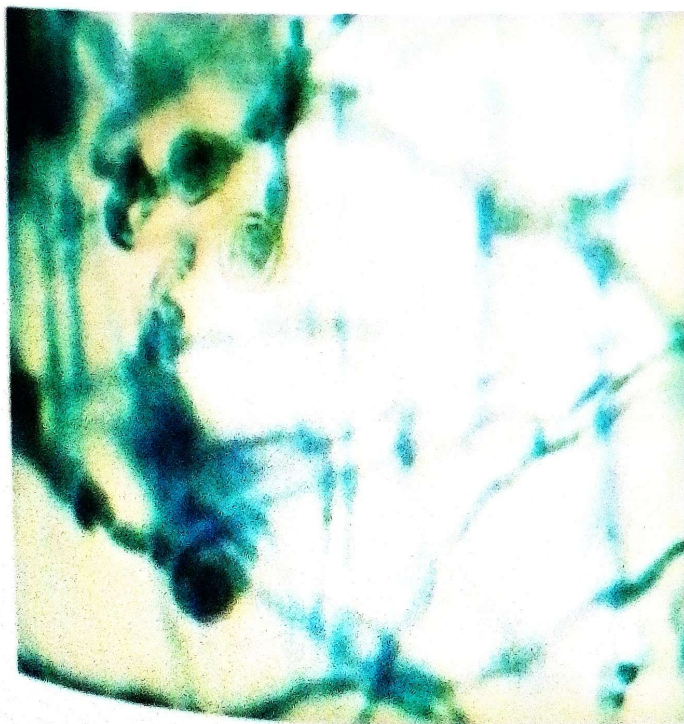
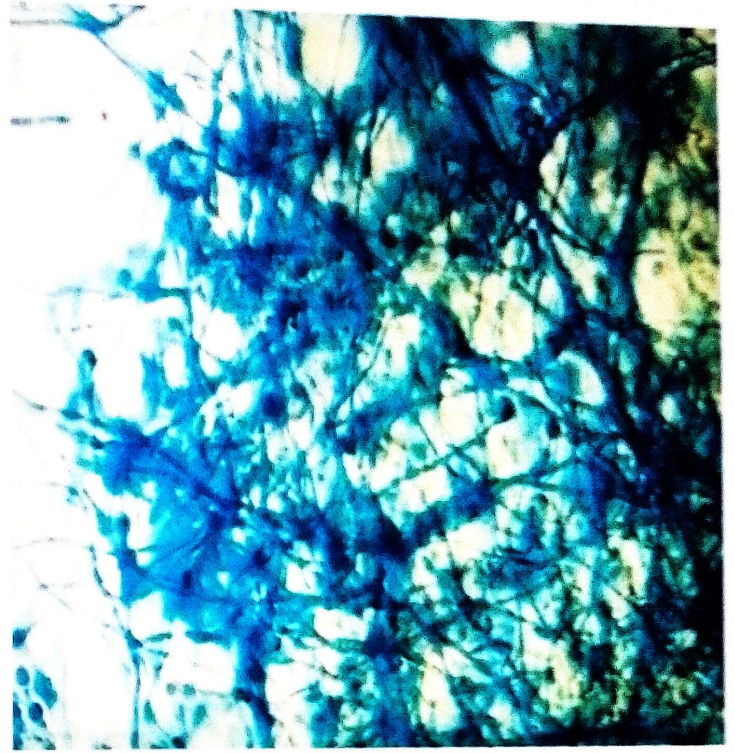




PLATE: 4.3 Morphological identification of *Ganoderma lucidum*





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**ST. ALOYSIUS COLLEGE JABALPUR**



(AUTONOMOUS)  
REACCREDITED 'A' GRADE BY NAAC (CGPA3.8/4.00)  
COLLEGE WITH POTENTIAL FOR EXCELLENCE BY UGC  
JABALPUR (M.P.)

**SESSION : 2021-2022**

**DEPARTMENT OF ZOOLOGY**

*Project Report*

*On*

**LIFE STYLE DISEASES-**

**INSOMNIA**

*Submitted to*  
**Dept. of Zoology**

*Submitted by*  
**Upadhi Tekam**  
M. Sc. II Semester



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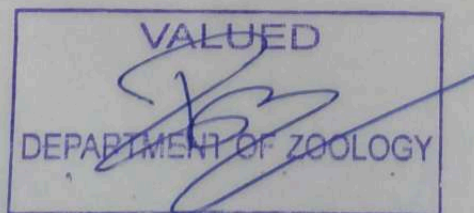
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## **LIFE STYLE DISEASES- INSOMNIA**



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## ACKNOWLEDGEMENTS

*I would like to extend my sincere gratitude towards principal Dr. Fr. G. Vazhian Arasu and Head, Department of Zoology Dr. Priyanka Sinha, St. Aloysius College (Autonomous) Jabalpur for providing laboratory facilities, extending necessary help and kind support to Carry out this project work.*

*I am enormously indebted to all my classmate for extending their cooperation and help during the collection of leaf and insect.*

*Last but not the least I express my gratitude towards my parents and my family for their unconditional love and support during the completion of the project.*

**Upadhi Tekam**

**M. Sc. II Semester**

## DECLARATION

I, *Upadhi Tekam* of class M.Sc. II semester Zoology, St. Aloysius College Jabalpur, M.P. that I have has made project report on **Life Style Diseases-Insomnia**, at Jabalpur, 2021-22 and prepared this report original by me.

*Upadhi*  
Signature



## INTRODUCTION

**Lifestyle diseases** can be defined as diseases linked with one's lifestyle. These diseases are **non-communicable diseases**. They are caused by lack of physical activity, **unhealthy eating**, **alcohol**, **substance use disorders** and **smoking tobacco**, which can lead to **heart disease**, **stroke**, **insomnia**, **anxiety**, **obesity**, **type II diabetes** and **Lung cancer**. Lifestyle disease may soon have an impact on the workforce and the cost of health care. Treating these non-communicable diseases can be expensive to treat. It can be critical for the patients health to receive primary prevention and identify early symptoms of these non-communicable disease. These lifestyle disease are expected to increase throughout the years if people do not improve their lifestyle choices.

## INSOMNIA

Insomnia, the inability to sleep adequately. Causes may include poor sleeping conditions, circulatory or brain disorders, a respiratory disorder known as apnea, stress, or other physical or mental disorders. Insomnia is not harmful if it is only occasional; the body is readily restored by a few hours of extra sleep. If, however, it is regular or frequent, insomnia may have harmful effects on other systems and functions of the body. Between 10% and 30% of adults have chronic insomnia, and many more deal with it from time to time. Here's a look at some of the latest research on this condition, its causes, and treatments that may help.

### ► INSOMNIA STATISTICS

#### Global sleep deprivation

According to recent studies, 20% of people around the world are sleep deprived.



Source: India Today

THE GOOD BODY

## TYPES OF INSOMNIA

Not all cases of insomnia are identical. People can be affected by insomnia in different ways, and distinguishing between forms of the condition can be useful for both health professionals and people with insomnia.

There are two main types of insomnia:

### Short-Term Insomnia

Also known as acute insomnia or adjustment insomnia, this is a brief episode of difficulty sleeping. Short-term insomnia is often caused by a stressful life event, such as the loss of a loved one, a disconcerting medical diagnosis, a pandemic, rebounding from cessation of a drug or marijuana, or a major job or relationship change.

Acute insomnia lasts for less than three months, and symptoms may fade on their own as time passes and a person copes with the stressful incident that gave rise to their sleeping problems. However, short-term insomnia can be persistent and become chronic insomnia.

Short-term insomnia can affect both children and adults. It is more common in women than in men, and it can arise during pregnancy as well as menopause.

### Chronic Insomnia

Chronic insomnia is a long-term pattern of difficulty sleeping. Insomnia is considered chronic if a person has trouble falling asleep or staying asleep at least three nights per week for three months or longer.

Some people with chronic insomnia have a long history of difficulty sleeping. Inability to get the sleep they need may be persistent or go away and recur with months-long episodes at a time. Chronic insomnia has many potential causes. Like acute insomnia, it can be tied to stressful situations, but it may also be related to irregular sleep schedules, poor sleep hygiene, persistent nightmares, mental health



disorders, underlying physical or neurological problems, medications, a bed partner, and certain other sleep disorders.

Like short-term insomnia, chronic insomnia occurs in people of all ages and has a higher prevalence in women. While the sleep disorder of insomnia is principally classified as either short-term or chronic, there are other terms that may be used to describe insomnia. These terms may be used informally or as a way for researchers to better categorize and analyze the different ways that insomnia can be experienced.

### Sleep Onset Insomnia

Sleep onset insomnia describes difficulty falling asleep at the beginning of the night, or in the case of shift workers, whenever they attempt to initiate sleep. It is associated with the idea of tossing and turning without actually being able to get to sleep. Most people with sleep onset problems can't fall asleep even after spending 20-30 minutes in bed. The inability to fall asleep means that a person with insomnia of this nature has reduced total sleep time and can feel the effects of that lack of sleep the next day.

### Sleep Maintenance Insomnia

Sleep maintenance insomnia describes an inability to stay asleep through the night. Most often, this means waking up at least once during the night and struggling to get back to sleep for at least 20-30 minutes. The fragmented sleep associated with poor sleep maintenance means a decrease in both sleep quantity and quality, creating higher chances of daytime sleepiness or sluggishness.

### Early Morning Awakening Insomnia

Early morning awakening insomnia involves waking up well before a person wants or plans to in the morning. Some experts view this as a component of sleep maintenance while others consider it separately. Inability to get their desired amount of sleep can impair a person's physical and mental function the next day.

### Mixed Insomnia

Though not a formal term, the descriptor mixed insomnia may be applied to people who have a combination of problems related to sleep onset, sleep maintenance, and early morning awakenings. In general, the broader term insomnia can be thought of as describing mixed insomnia because it is common for people to have overlapping sleeping problems. In addition, people with insomnia often find that their symptoms can shift over time, making it hard to classify insomnia strictly among the subtypes of onset, maintenance, and early morning awakenings.

### Comorbid Insomnia

In the past, sleeping problems were sometimes labeled as comorbid insomnia or secondary insomnia. This meant that insomnia was believed to arise as a result of another condition such as anxiety, depression, sleep apnea, gastroesophageal reflux disease (GERD), or physical pain.

Contemporary research has generated a deeper understanding of insomnia that recognizes that sleeping problems often have a bidirectional relationship with other health issues. For example, while anxiety may contribute to insomnia, insomnia may trigger or exacerbate anxiety as well. Furthermore, insomnia triggered by another condition does not always go away even after that underlying issue is resolved.

Because of the complexity of these relationships, it becomes difficult to classify insomnia as strictly comorbid or secondary. Similarly, the presence of multiple contributing factors makes identifying a single cause of insomnia challenging for many patients.

For these reasons, insomnia classification systems used in sleep medicine have moved away from this terminology and toward a broader understanding of insomnia.



## Causes of insomnia

Insomnia can result from a range of physical and psychological factors. Often, the cause is a temporary problem, such as short-term stress. In some other instances, insomnia stems from an underlying medical condition.

Genetics- Scientists are looking at whether the likelihood of having insomnia is something you're born with. They've identified specific areas in our genes that appear to play a role in insomnia symptoms.

Common causes include:

- having jet lag, switching shifts at work, or dealing with any other changes to the body's internal clock
- the room being too hot, cold, or noisy, or the bed being uncomfortable
- caring for someone in the house, if it disrupts sleep
- getting too little physical exercise
- having night terrors or bad dreams

using recreational drugs, such as cocaine or ecstasy  
In some people, stress or a mental health issue is responsible for insomnia. A person may be experiencing:

- depression
- anxiety
- bipolar disorder
- schizophrenia

Some other health conditions that can limit sleep include:

- restless legs syndrome
- an overactive thyroid
- sleep apnea
- gastrointestinal reflux disease, commonly called GERD
- chronic obstructive pulmonary disease, known as COPD
- chronic pain

Often, symptoms of another health issue or natural transition cause difficulty sleeping. During menopause, for example, hormonal changes can lead to night sweats, which can interrupt sleep. In people with Alzheimer's disease, changes in the brain disrupt or change sleeping patterns. Also, some people have a rare genetic disorder called fatal familial insomnia, which prevents sleep and can be life threatening.

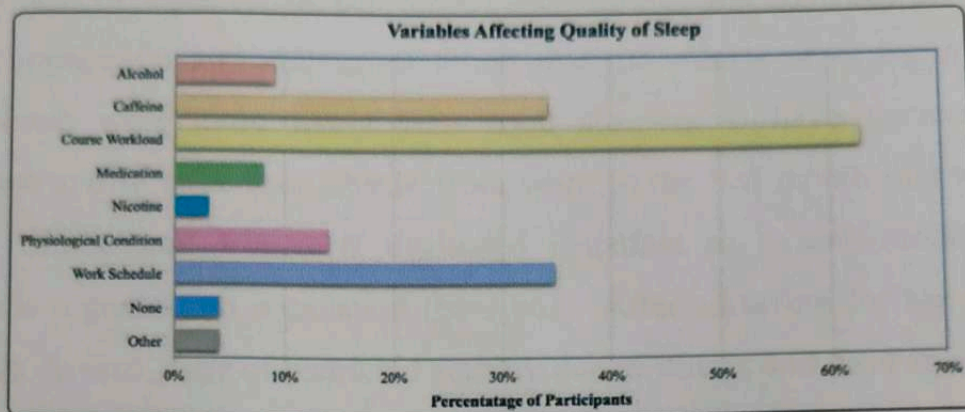


Figure 2. Variables Affecting Quality of Sleep

## CONSEQUENCES OF INSOMNIA

Due to its chronicity, insomnia is associated with substantial impairments in an individual's quality of life. In several studies, insomniacs reported decreased quality of life on virtually all dimensions of the 36-item Short Form Health Survey of the Medical Outcomes Study (SF-36), which assesses 8 domains: (1) physical functioning; (2) role limitation due to physical health problems (role physical); (3) bodily pain; (4) general health perceptions; (5) vitality; (6) social functioning; (7) role limitations due to emotional health problems (role emotional); and (8) mental health. One study compared SF-36 results in groups of mild and severe insomnia patients with groups of patients diagnosed with depression or congestive heart failure (CHF). Severe insomnia patients had numerically greater loss of function than patients with CHF in reported pain, emotional effects, and mental health effects. Additionally, insomnia patients also reported more physical problems than patients with depression.



Research has shown that among the daytime consequences of insomnia, the increased occurrence of accidents poses the greatest health risk. Insomniacs are 2.5 to 4.5 times more likely than controls to have an accident. In a sample of 8,625 community respondents in France, Léger et al. reported that 8% of insomniacs and 1% of non-insomniacs had an industrial accident in the past 12 months. Work productivity is also compromised among insomniacs due to work-related problems (ie, higher rates of absenteeism, decreased concentration, and difficulty performing duties). Kuppermann and colleagues found that individuals reporting a current sleep problem were more likely than good sleepers to have decreased job performance and to have been absent from work in the last month due to health problems. Simon and VonKorff evaluated insomnia in a staff-model health maintenance organization population (N=1,962). After adjusting for age, gender, and chronic disease, days of restricted activity due to illness and days spent in bed were about twice as common among insomniacs compared with non-insomniacs. Additionally, mean total health care expenditures were 60% higher in the insomnia group relative to the controls.

Population- and clinic-based studies have demonstrated a high rate of psychiatric comorbidities in patients with chronic insomnia. In fact, insomnia is more frequently associated with psychiatric disorders than any other medical illness. For example, in the Epidemiologic Catchment Area study, 40% of insomniacs had a comorbid psychiatric disorder compared with 16.4% of those with no sleep complaints. Additionally, depression and anxiety are the most common comorbid psychiatric disorders in insomniacs. It has traditionally been assumed that insomnia is secondary to the psychiatric disorder; however, given the chronicity of insomnia, it is possible that in some, if not most, cases the insomnia precedes the psychiatric disorder. In fact, it is possible that insomnia represents a significant risk for the development of a subsequent psychiatric disorder. In a large-scale European population-based study (N=14,915), it was found that insomnia more often preceded rather than followed incident cases of a mood disorder. This effect is even more pronounced for relapses of the mood disorder, where in 56.2% of cases, insomnia symptoms preceded symptoms of a mood disorder relapse. In



contrast, in chronic insomnia patients with a comorbid anxiety disorder, the first occurrence of anxiety or a relapse preceded insomnia in most instances.

To further understand the relation of sleep and psychiatric disorders, several longitudinal studies have examined the evolution of psychiatric disorders among insomnia patients. These studies used follow-up periods ranging from 1 to 40 years, with the majority using a 1- to 3-year follow-up period. In all of these studies, insomnia has been found to confer a substantial risk for the development of a depressive disorder. Typically, the relative risk was approximately 5 (range 2–40), and in all cases it was statistically significant. While some studies also reported an increased risk for anxiety or drug abuse, neither of these was consistently found. Finally, longitudinal studies in subjects with affective disorders show that depressed patients who experience improvements in sleep will also experience a more rapid antidepressant response; while those patients whose insomnia persists will have a short time to relapse. What is clearly needed are clinical trials to assess the impact of insomnia therapy on incidence of depression as well as the time to relapse in depressed patients who are in remission.

The question then arises as to whether insomnia causes depression, vice versa, or both. The close association of insomnia with depression is likely related to common underlying pathophysiological mechanisms for sleep and mood regulation that make the individual vulnerable to both conditions. Data have shown that both the diagnosis of insomnia and the severity of the sleep disturbance are related to overactivation of the hypothalamic-pituitary-adrenal (HPA) axis and the hypersecretion of cortisol. Recent evidence suggests that there may be some neuroendocrine and clinical similarities between insomnia and depression. Corticotropin-releasing factor (CRF) dysregulation has been implicated in the pathogenesis of psychiatric disorders such as depression as well as in the mediation of hyperarousal seen in primary insomnia. This abnormality might represent the common risk factor, and therefore, it is quite possible that both disorders would respond to the same therapeutic intervention (eg, corticotropin-releasing hormone antagonists).



## Insomnia Medications

A new type of drug is giving doctors another option when it comes to prescription medication to treat insomnia. Orexin receptor antagonists. Some of the latest sleep medications are known as orexin inhibitors. They block the action of a brain chemical that keeps you alert, called orexin. Two of these drugs include:

Lemborexant (Dayvigo)

Suvorexant (Belsomra)

Scientists are studying two other similar drugs in clinical trials.

All sleeping pills come with risks and side effects. With some, you can develop a tolerance, which means it stops working effectively at the recommended dosage, or even feel like you can't fall asleep without them. Some can cause you to walk, eat, or even drive in your sleep. Most can leave you feeling groggy the next day. Doctors usually only prescribe them for the short-term, and you have to stop using them gradually.

Melatonin. Your body makes this hormone as the sun goes down, telling you it's time to get sleepy. A prescription form of melatonin helps you fall asleep by acting like melatonin in your brain. Melatonin supplements are often sold as a treatment for insomnia.

## How To Diagnose Insomnia

The requirements for an insomnia diagnosis are continually evolving as researchers learn more about this sleep disorder. According to current criteria, patients must report at least one of the following problems in order to receive an insomnia diagnosis.

- Difficulty falling asleep
- Difficulty remaining asleep during the night
- Repeated instances of waking up earlier than desired
- Feelings of resistance about going to sleep at a reasonable hour
- Difficulty sleeping without help from a parent or caregiver

Additionally, patients must experience one or more of the following daytime impairments after a night of insomnia-affected sleep:

- Feelings of fatigue or malaise
- Difficulty concentrating, paying attention, recalling, or remembering
- Impaired performance in social, family, academic, or occupational settings
- Excessive daytime sleepiness
- Hyperactivity, impulsivity, aggression, and other behavioral problems
- Decreased energy, motivation, or initiative
- Higher risk of errors or accidents
- Concerns or dissatisfaction regarding sleep

These nighttime and daytime symptoms must occur despite adequate opportunity for sleep and a bedroom environment that is conducive to sleep. If symptoms occur at least three times per week for at least three months, the patient will be diagnosed with chronic insomnia. If these benchmarks have not been reached, then the condition is known as short-term or acute insomnia. A third condition known as other insomnia may be diagnosed if the patient does not meet the criteria for short-term insomnia but nonetheless exhibits insomnia symptoms.

The cause of a person's insomnia symptoms is also crucial to their diagnosis. Primary insomnia occurs independently, while secondary insomnia is usually attributed to an underlying medical or psychological condition that causes sleep loss. Primary and secondary insomnia share the same symptoms. However, treatment for secondary insomnia will typically also address the patient's underlying condition.

#### Prevention

Prevention and treatment of insomnia may require a combination of cognitive behavioral therapy, and lifestyle changes. Among lifestyle practices, going to sleep and waking up at the same time each day can create a steady pattern which may help to prevent insomnia. Avoidance of vigorous exercise and caffeinated drinks a



few hours before going to sleep is recommended, while exercise earlier in the day may be beneficial. Other practices to improve sleep hygiene may include:

- Avoiding or limiting naps
- Treating pain at bedtime
- Avoiding large meals, beverages, alcohol, and nicotine before bedtime
- Finding soothing ways to relax into sleep, including use of white noise
- Making the bedroom suitable for sleep by keeping it dark, cool, and free of devices, such as clocks, cell phones, or televisions
- Maintain regular exercise
- Try relaxing activities before sleeping

### Background

A survey of 1.1 million residents in the United States found that those that reported sleeping about 7 hours per night had the lowest rates of mortality, whereas those that slept for fewer than 6 hours or more than 8 hours had higher mortality rates. Getting 8.5 or more hours of sleep per night was associated with a 15% higher mortality rate. Severe insomnia – sleeping less than 3.5 hours in women and 4.5 hours in men – is associated with a 15% increase in mortality.

With this technique, it is difficult to distinguish lack of sleep caused by a disorder which is also a cause of premature death, versus a disorder which causes a lack of sleep, and the lack of sleep causing premature death. Most of the increase in mortality from severe insomnia was discounted after controlling for associated disorders. After controlling for sleep duration and insomnia, use of sleeping pills was also found to be associated with an increased mortality rate.

The lowest mortality was seen in individuals who slept between six and a half and seven and a half hours per night. Even sleeping only 4.5 hours per night is associated with very little increase in mortality. Thus, mild to moderate insomnia for most people is associated with increased longevity and severe insomnia is associated only with a very small effect on mortality. It is unclear why sleeping longer than 7.5 hours is associated with excess mortality.

While insomnia is typically transient, some cases are persistent and can last for years. 'Insomnia disorder' should be diagnosed using diagnostic criteria from the American Psychiatric Association's Diagnostic and Statistical Manual (DSM) and/or the International Classification of Sleep Disorders (ICSD). Both have been recently updated. The fifth edition of the DSM (DSM-5) is geared towards primary care and general mental health providers. Criteria for insomnia disorder require that sleep symptoms cause clinically significant distress or impairment(s) in functioning (social, occupational, educational, academic, behavioral, or other) and occur despite adequate opportunity for sleep on at least 3 nights per week for at least 3 months. Diagnosis also requires that symptoms not be primarily linked to other sleep disorders or occur exclusively during the course of another sleep-wake disorder (narcolepsy, breathing-related sleep disorder, circadian rhythm disorder); not be attributable to the physiological effects of a substance; and not be explained by coexisting mental disorders or medical conditions. Dysfunction associated with insomnia disorder includes fatigue, poor cognitive function, mood disturbance, and distress or interference with personal functioning. Both criteria recognize sleep-related complaint(s) despite adequate opportunity for sleep combined with distress or dysfunction created by the sleep difficulty in their current and previous versions. Until recently, diagnostic criteria classified insomnia as primary or comorbid, depending on the absence or presence of other conditions.

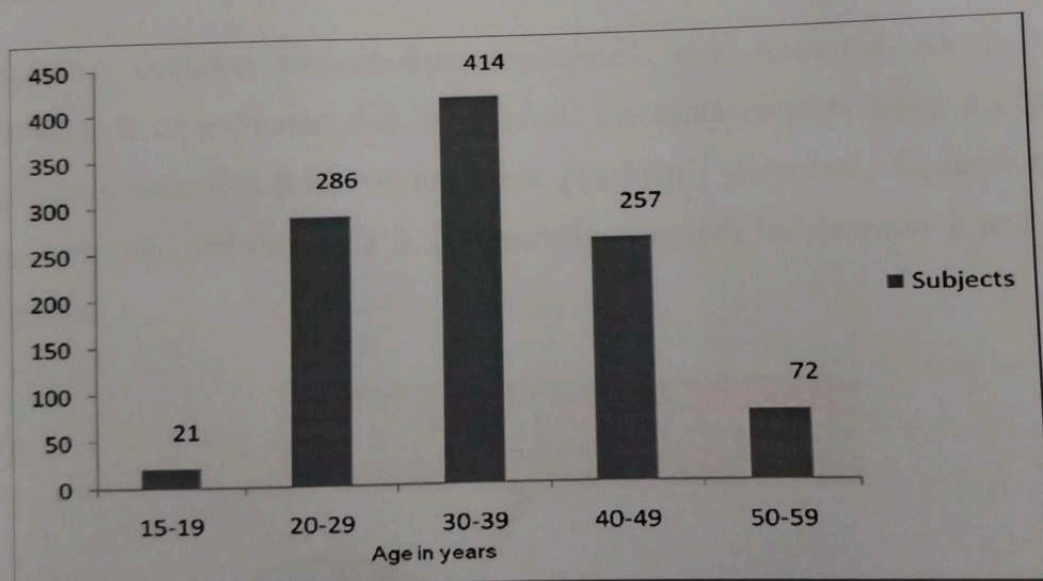
### **PREVALENCE OF INSOMNIA**

Estimates of the prevalence of insomnia depend on the criteria used to define insomnia and more importantly the population studied. A general consensus has developed from population-based studies that approximately 30% of a variety of adult samples drawn from different countries report one or more of the symptoms of insomnia: difficulty initiating sleep, difficulty maintaining sleep, waking up too early, and in some cases, nonrestorative or poor quality of sleep. Conclusions from the NIH State-of-the-Science Conference held in June 2005 indicate that the addition of a diagnostic requirement that includes perceived daytime impairment or distress as a function of the insomnia symptoms results in approximately 10%



prevalence of insomnia. Finally, the application of more stringent diagnostic criteria, such as the Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition (DSM-IV), which includes the additional requirements that insomnia symptoms persist for at least 1 month and do not exclusively occur in the presence of another sleep disorder, mental disorder, or the direct physiological effects of a substance or medical condition, yields current prevalence estimates of approximately 6%.<sup>9</sup>

Several well-identified risk factors for insomnia were reported by the State-of-the-Science Conference in June 2005. Age and gender are the most clearly identified demographic risk factors, with an increased prevalence in women and older adults. While the cause of this increased risk in the elderly is not well defined, it may be due to the partial decline in functionality of sleep control systems that may contribute to insomnia in this older population.

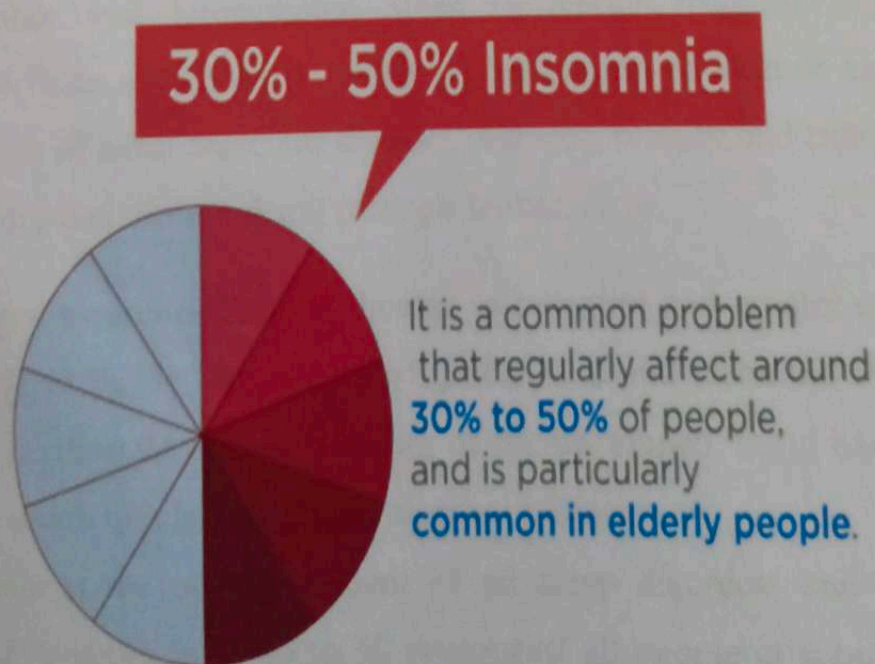


Importantly, the presence of comorbid medical conditions is also a significant contributor to the increased prevalence of insomnia in the elderly. Additionally, in women, insomnia is more prevalent with both the onset of menses and menopause. Comorbid medical disorders, psychiatric disorders, and working night or rotating shifts all represent significant risks for insomnia. It is important to recognize that these factors do not independently cause insomnia, but rather they are precipitants of insomnia in individuals predisposed to this disorder. In fact, chronic illnesses

are a significant risk for insomnia. It is estimated that the majority of people with insomnia (approximately 75%–90%) have an increased risk for comorbid medical disorders, such as conditions causing hypoxemia and dyspnea, gastroesophageal reflux disease, pain conditions, and neurodegenerative diseases. Importantly, a variety of primary sleep disorders as well as circadian rhythm disorders are frequently comorbid with and often lead to insomnia.

Among the primary sleep disorders, restless legs syndrome (RLS), periodic limb movement disorders (PLMD), and sleep-related breathing disorders (snoring, dyspnea, sleep apnea) often present with an insomnia symptom. This is especially true among the elderly. Among younger individuals, difficulty falling asleep is often associated with a phase delay syndrome. However, in the elderly, phase advance syndrome results in reports of difficulty initiating sleep, maintaining sleep, and experiencing early morning awakenings.

The most common comorbidities associated with insomnia are psychiatric disorders. It is estimated that 40% of all insomnia patients have a coexisting psychiatric condition.<sup>8,15</sup> Among these psychiatric disorders, depression is the most common, and insomnia is a diagnostic symptom for depressive and anxiety disorders.







### Insomnia Facts

Insomnia or poor sleep health is not regarded as a public health crisis but many experts believe that it should be treated as one. The burden of insomnia has been grossly underestimated because the focus of attention is restricted towards few other conditions that contribute to non-communicable diseases. While diets and obesity have a huge role to play, the importance of sleep to general health and wellbeing cannot be underestimated. Sleep deprivation, insomnia and other sleep disorders contribute significantly to the global burden of disease as they greatly increase the risk of cardiovascular disease, diabetes, obesity and cancer, as well as the risk of injury and violent death through human error.

- Increased awareness on the disease is essential and greater efforts need to be made to tackle the paucity of global data and insomnia statistics. What was once thought of as a problem of the developed world has now become just as much of a burden in developing countries.
- Insomnia is the most prevalent of all sleep disorders and is believed to affect anywhere from 30 to 50 percent of all people at some point in their lifetime.

- Long-term sleep deprivation can cause severe health problems and compromise your quality of life. It is estimated that chronic insomnia affects as much as ten percent of these individuals.
- Insomnia affects one out of four people and it isn't gender or age specific. Insomnia in children may be uncommon but it is certainly not unheard of. With increased examination and performance stress these figures are only rising. The condition is increasingly prevalent as you age with 40 to 60 percent of all individuals above the age of 60 suffering from insomnia.

### *Insomnia in Children*

- Insomnia is twice as likely to affect women as compared to men. Chronic insomnia greatly increases the risk of various non-communicable diseases. There were 57 million deaths in 2008, with 58% of these being attributed to chronic (non-communicable) diseases. These numbers could be significantly reduced if sleep disorders were addressed.
- Studies have shown that the risk of strokes, hypertension, arteriosclerosis, obesity, diabetes and depression are much higher in patients suffering from insomnia.
- Substance abuse like smoking, alcoholism and drugs are more likely to develop in individuals suffering from insomnia.
- Fatigue and drowsiness cause around 100,000 traffic accidents a year, claiming as many as 1,500 lives and leaving over 70,000 injured. Now take into account that these figures are limited to the United States which accounts for just 5 percent of global population.
- Researchers have found that insomnia isn't just a problem in humans but can affect our pets as well and pests too! Fruit flies were the test subjects in the study and they were found to display symptoms very similar to those seen in humans such as impaired balance and weight gain.
- Most of us tend to think that following a regular routine on weekdays will suffice to keep us healthy. Unfortunately, those wild weekends and late night parties also take their toll. Studies suggest that people with different



sleep schedules on weekdays and weekends are more likely to suffer from sleep deprivation and obesity.

There is no miracle cure or medication for insomnia that can solve the problem. Sleeping pills do not cure insomnia and can even contribute to the development of chronic insomnia. Cognitive behavioral therapy is the only strategy with a proven track record.

### *Sleeping Pills*

Fatal familial insomnia should not be confused with acute or chronic insomnia. It's a much more serious condition that is caused as a result of a genetic disease. This disease prevents the victim from falling asleep and the duration of sleeplessness keeps increasing until the lack of sleep turns fatal. Thankfully, this is not a common condition.

### OBJECTIVE -

To perform a survey on awareness of lifestyle disease (insomnia) among the local people of a particular area (Jabalpur):

Requirements - questionnaire paper, pen, cardboard, etc .

Methodology -Survey methodology as a scientific field seeks to identify principles about the sample design, data collection instruments, statistical adjustment of data, and data processing, and final data analysis that can create systematic and random survey errors.

There are many methods to conduct a survey ,here I have used the questionnaire method for collecting data .

Analysis and interpretation of data-The method used for surveying is questionnaire,17 questions are included in this questionnaire.the survey was conducted on 100 people of a local area in Jabalpur .

Observation :

The responses (majority) to questions are written below:

| S.no | Response question(majority )                 | to | No. of other responses | No. of responses(majority) |
|------|--|----|------------------------|----------------------------|
| 1.   | Normal healthy meals                         |    | 55                     | 45                         |
| 2.   | yes  |    | 42                     | 58                         |
| 3.   | Good   |    | 60                     | 30                         |
| 4.   | yes  |    | 50                     | 50                         |
| 5.   | 6-7 hours                                    |    | 64                     | 36                         |
| 6.   | Regular sleep                                |    | 46                     | 54                         |
| 7.   | After 10pm                                   |    | 24                     | 76                         |
| 8.   | Rarely                                       |    | 42                     | 58                         |
| 9.   | Yes  |    | 30                     | 60                         |
| 10.  | yes  |    | 26                     | 64                         |
| 11.  | sometimes                                    |    | 46                     | 54                         |
| 12.  | Rarely                                       |    | 48                     | 52                         |
| 13.  | Sometimes                                    |    | 60                     | 30                         |
| 14.  | Yes  |    | 36                     | 64                         |
| 15.  | Prefer going to calm or peaceful environment |    | 46                     | 54                         |
| 16.  | No   |    | 30                     | 70                         |
| 17.  | Yes  |    | 28                     | 72                         |



# ST ALOYSIUS COLLEGE JABALPUR

## SURVEY ON LIFESTYLE DISEASE - INSOMNIA

Age- <20  >40  <50  <40

Gender-

Q.1 What is your daily lifestyle is :

normal healthy meals

irregular eating habits

healthy diet and regular exercising

Q.2 Are you aware of the problems that could arise due unhealthy lifestyle?

Yes

No

Q.3 In general ,how is your current health :

Excellent

Very good

Good

Poor

Q.4 Do you know about any sleeping disorders like insomnia ?

Yes

No

Q.5 How many hours do you sleep?

6-7

7-9

5-6

8-10

Q.6 How would you describe your sleeping pattern:

Irregular sleep pattern

regular sleep pattern

Q.7 What time do you go to bed at night?

Before 10 pm

After 10 pm

Q.8 Do you have trouble sleeping once in bed ?

Never

Rarely

Always

Q.9 Have you noticed any change in your sleeping pattern?

Yes

No

Q.10 If yes do you feel refreshed upon waking up in the morning?

Yes

No

Q.11 Do you have trouble concentrating on something?

Yes

No

Sometimes

Q.12 Do you often feel tired and unable to do everyday chores?

Yes

NO

Rarely

Q.13 Do you feel sleepy during day time?

Yes

No

Sometimes

Q.14 Have you been in a stressful situation lately?

Yes

No

Q.15 How did deal with a stress?

I talk to family or friends

I prefer going to a calm or peaceful environment

I like to travel

the option is not available

Q.16 Do you take any medicine, which type (optional)?

Yes  ←

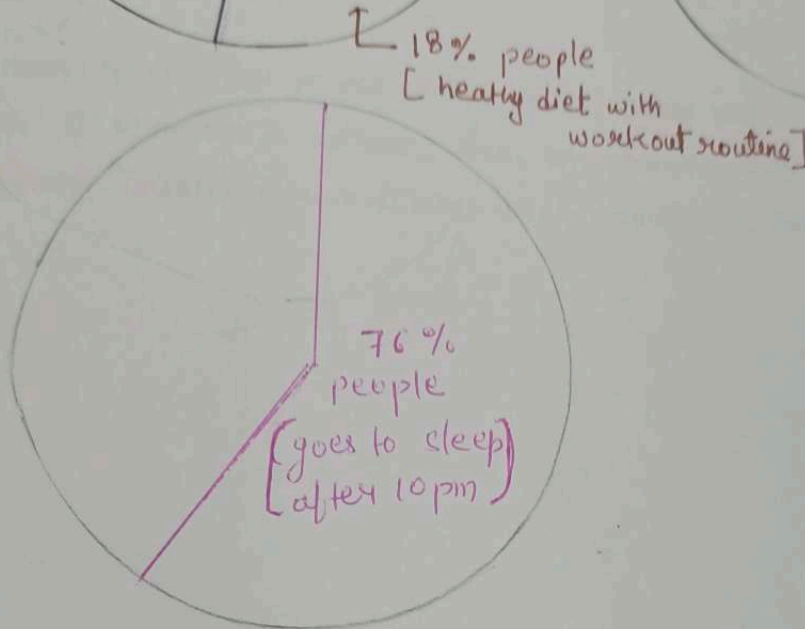
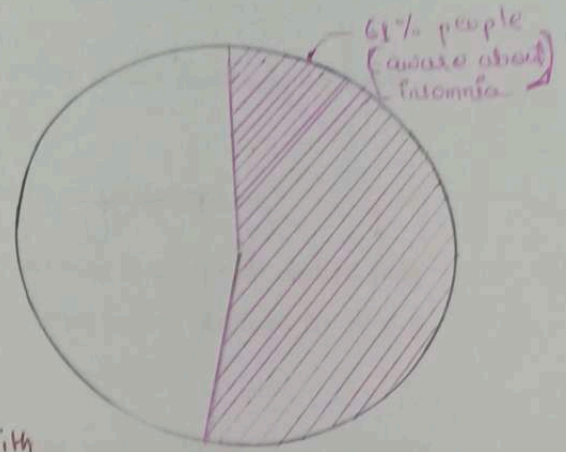
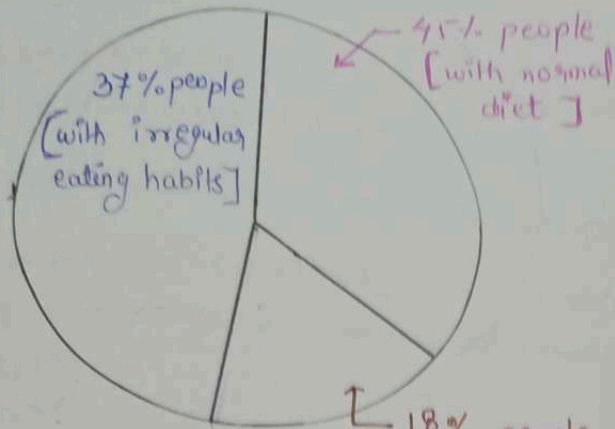
No

Q.16 So do you think change in sleeping patterns can cause serious problems?

Yes

No





Result – On the basis of the survey conducted following results are obtained:

1. Majority (45%) of people have a normal diet and 18% people have a healthy diet and workout routine .
2. Majority (61% )of people are aware about insomnia .
3. 76% people sleep after 10 pm which suggests that they have higher chances of becoming insomniac.
4. The above table shows that 58% people sometimes find it hard to sleep .
5. 54% people sometimes have trouble concentrating.
6. The above observation shows that 64% people have been in stressful situation ,which in longterm results in sleeping disorders .
7. 54% people found it hard to concentrate or focus on something (work) .

**Conclusion**-In conclusion majority of people are aware about insomnia or have suffered from any type of insomnia.

It was observed that lifestyle choices does affect health of an individual.

**Recommendation** – For a healthy life and a healthy society it is recommended that people of the country are educated and aware to make better choices to live a healthy life .

It is recommended that people should be self-aware and indulge in a healthy lifestyle .if someone is suffering from any disease, they should consult a professional . Lifestyle diseases if taken lightly could lead to dangerous disorders .



## REFERENCE

(<https://www.nhlbi.nih.gov/health-topics/insomnia>)

<https://www.nhlbi.nih.gov/health-topics/sleep-studies>

<https://www.webmd.com/sleep-disorders/insomnia-latest-research>

**Elucidation of Oligomeric characteristics of MarR family protein  
of *Mycobacterium tuberculosis***

**A Dissertation submitted to St. Aloysius College in partial fulfilment of the  
requirement for the award of the degree of**

**Master of Science**

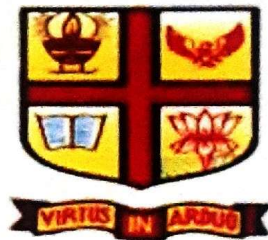
**In**

**Biotechnology**

**By**

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**CSIR-IMTECH  
2022**



## DECLARATION

I Jyotsana Patel, student of St. Aloysius College, Jabalpur (M.P.), have completed the project titled “**Elucidation of oligomeric characteristics of MarR family protein of *Mycobacterium tuberculosis***” for the award of Degree of Master of Science in Biotechnology for academic session 2021-2022. The information given in this project is true to the best of my knowledge.



**Jyotsana Patel**



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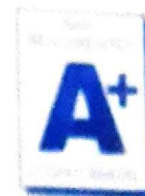
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## CERTIFICATE

This is to certify that the work entitled, "**Elucidation of oligomeric characteristics of MarR family protein of *Mycobacterium tuberculosis***" in CSIR-IMTECH, Chandigarh submitted by Ms. JYOTSANA PATEL partial fulfilment for the award of degree of Master of Science in Biotechnology, St. Aloysius College, Jabalpur Madhya Pradesh has been carried out under the supervision of Dr. Charu Sharma, Senior Principal Scientist of CSIR-IMTECH, Chandigarh.

Dr. L.K. Pandey

Professor and Head of the Department

Department of Biotechnology

Dated: 30/06/22





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### CERTIFICATE

This is to certify that the thesis entitled, "Elucidation of Oligomeric characteristics of MarR family protein of *Mycobacterium tuberculosis*" submitted by Ms. Jyotsana Patel (4202777) in partial fulfilment for the award of degree of **Master of Science in Biotechnology, St. Aloysius College, Jabalpur, Madhya Pradesh** has been carried out from 11.02.2022 to 21.06.2022 under my supervision at CSIR-IMTech, Chandigarh. This work is original and has not been submitted in part or full to any other university or institute for the award of this or any other degree or diploma.

*Charu Sharma*  
21.6.2022

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Senior Principal Scientist  
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## Key to Abbreviations

### Miscellaneous

|        |   |
|--------|---|
| TB     | Tuberculosis                              |
| Mtb    | <i>Mycobacterium tuberculosis</i>         |
| MDR-TB | Multiple Drug Resistant Tuberculosis      |
| XDR-TB | Extensively Drug Resistant Tuberculosis   |
| TDR-TB | Total Drug Resistant Tuberculosis         |
| MTBC   | Mtb Complex                               |
| WHO    | World Health Organization                 |
| His    | Histidine                                 |
| HIV    | Human Immunodeficiency Virus              |
| AIDS   | Acquired Immune Deficiency Syndrome       |
| TLR    | Toll Like Receptor                        |
| NTD    | N-Terminal Domain                         |
| CTD    | C-Terminal Domain                         |
| NOD    | Nucleotide-binding Oligomerization Domain |
| MR     | Mannose Receptor                          |
| NLR    | NOD Like Receptor                         |
| CLRs   | C-type Lectin Receptors                   |
| SR     | Scavenger Receptor                        |
| Sp     | Surfactant Protein                        |
| LAM    | Lipoarabinomannan                         |
| LAMP   | Loop-mediated Isothermal Amplification    |
| NAAT   | Nucleic Acid Amplification Test           |
| PCR    | Polymerase Chain Reaction                 |
| BCG    | Bacillus Calmette-Guerin                  |
| LPA    | Line Probe Assay                          |

### Weights and Measures

|               |  |
|---------------|--|
| °C            | Degree Centigrade                        |
| bp, kb        | Base pair, Kilo base                     |
| ng, µg, mg, g | Nanograms, Micrograms, Milligrams, Grams |
| µL, ml, L     | Microliter, Millilitre, Litre            |
| µM, mM, M, N  | Micromolar, Millimolar, Molar, Normal    |
| Sec, min, h   | Second, Minutes, Hour                    |
| kDa           | Kilo Dalton                              |
| OD            | Optical Density                          |
| rpm           | Revolutions per minute                   |

### Techniques

|                         |  |
|-------------------------|--|
| SDS-PAGE                | Sodium Dodecyl Sulphate-Polyacrylamide Gel Electrophoresis |
| Affinity Chromatography | Ni-NTA   |
| FPLC                    | Fast Protein Liquid Chromatography                         |

### Chemicals

|        |   |
|--------|---|
| APS    | Ammonium Persulfate                       |
| BSA    | Bovine Serum Albumin                      |
| IPTG   | Isopropyl-β-D-thiogalactopyranoside       |
| TEMED  | N, N, N, N-tetramethyl-ethane-1,2-diamine |
| Ni-NTA | Nickel-Nitriloacetic acid Agarose         |
| SDS    | Sodium Dodecyl Sulphate                   |
| β-ME   | β-Mercaptoethanol                         |
| DTT    | Dithiothreitol                            |



|                   |                                    |
|-------------------|------------------------------------|
| PBS               | Phosphate Buffered Saline          |
| PBST              | Phosphate Buffered Saline-Tween 20 |
| MgCl <sub>2</sub> | Magnesium Chloride                 |
| EDTA              | Ethylene diamine tetra acetic acid |
| EthBr             | Ethidium Bromide                   |
| Kan               | Kanamycin                          |
| Cam               | Chloramphenicol                    |
| Amp               | Ampicillin                         |
| CaCl <sub>2</sub> | Calcium Chloride                   |
| PMSF              | Phenyl methyl sulfonyl fluoride    |
| DDW               | Double Distilled Water             |

# *Introduction*



## **1. INTRODUCTION**

Tuberculosis is one of the deadliest disease caused by *Mycobacterium tuberculosis* (Mtb). Worldwide, TB is the popular most cause of death holding 13<sup>th</sup> position and reported to be second topmost infectious killer after COVID-19 (above HIV/AIDS). According to WHO, 2021 (<https://www.who.int/>) one fourth of the world's population, i.e., around 2 billion people are suffering from TB infection, while more than 10 million are in the capture of active TB disease yearly. In 2019, 1.2 million children fell ill with TB globally and 465,000 people fell ill with drug-resistant TB (<https://www.cdc.gov/>). Although the treatment with anti-microbial drugs kill majority of pathogenic bacilli within 1-2 weeks, however, it is recommended to continue multi-drug therapy for at least 6 to 7 months as per directly-observed treatment, short course (DOTS). This extended therapy minimizes the survival of intracellular pathogen within the cell and inhibits the reactivation of infection. Several studies indicated that the dormant bacteria encounter intracellular harsh microenvironments like low oxygen (Hypoxia), nutrition limitation or starvation and pH stress (Deb *et al.*, 2009; Flentie *et al.*, 2016). These amazing versatility of host-induced stresses induce the emergence of stress resistant heterogeneous pathogenic subpopulations of the bug and consequently leads to metabolic advancement and survival enhancement (Prosser *et al.*, 2017). Even in the dormant state *Mtb* can get reactivated under favourable conditions and starts replication that results in active TB (Veatch and Kaushal, 2018). These properties of *Mtb* makes it famous for understanding the underlying mechanism of its defence, so that one can come to other favourable conclusions aiding to its effective treatment.

The extraordinary adaptive capability of *Mtb* to overcome the multiple environmental stresses inside the macrophages makes it a very strong pathogen. Also, the multiple drug resistance to the already existing drug regimen is one of the biggest obstacles in the way of eradication of TB. Therefore, there is a need for new antibiotic and also for new drug targets to deal with this crisis as well as to avoid cross resistance of currently use therapies (Winglee *et al.*, 2015).

Multiple antibiotic resistance Regulator (MarR) proteins are a great attraction for drug evaluation in relevance to their critical role in antibiotic resistance, virulence, cell viability, survival and response to treatment with anti TB drugs (Zheng *et al.*, 2019). MarR system is conserved in human pathogenic bacteria and is reported in *Mtb* as well. MarR is involved in drug resistance and intracellular survival of *Mtb* (McDermott *et al.*, 1998). The proteins of MarR family respond to wide variety of stresses by modulating the expression of genes for the

survival of the pathogen. MarR homologs are also reported to have a role in regulating virulence genes of pathogenic bacteria because of their ability to respond to the sudden environmental changes.

The basic structural organization of a MarR proteins consist of a conserved winged helix–turn–helix motif (Han *et al.*, 2019). This wHTH motif binds and recognize palindromic sequences of DNA in a dimeric form (Zhen *et al.*, 2019). Mostly MarR proteins work as sensors to modulate the expression of stress responsive genes. Based on the sequence similarity, eight proteins of Mtb belong to MarR family. MarR homologs in Mtb are namely Rv0042c, Rv0880 (resistance to bedaquiline), Rv2011c, Rv1049 (MosR), Rv2327, Rv0737, Rv2887 and Rv1404 (regulate acid stress). All of these proteins are poorly studied and came into light very recently. According to the sequence analysis, no specific DNA binding motif has been found in case of Mtb and only 60–122 amino acid residues of MarR protein are critical for binding DNA sequences.

Here we have focused on one of the possible transcriptional regulators of MarR family of Mtb, i.e., **Rv0042c** which has been found to be overexpressed in granuloma site of a human lung of a MDR TB patient and thought to be involved in drug resistance (Rachman 2004, Movahedzadeh *et al.*, 2004). Rv0042c was reported to be indirectly regulated by the DNA binding domain (PhoPC) of response regulator PhoP (Wang *et al.*, 2007). In 2015, the genome wide transcription regulations for Rv0042c have been studied using Chip-Seq (Minch *et al.*, 2015). Besides, whole genome sequencing (WGS) of the linezolid-resistant mutants exhibited intergenic point mutation (G to T) in the Rv0042c-Rv0043c region (Pi *et al.*, 2019). In sum, Rv0042c protein is relatively an unstudied protein. Therefore, it was decided to elucidate the structural characteristics of Rv0042c *in vitro* in order to understand its biological behaviour *in vivo*. In this regard, the oligomeric behaviour of Rv0042c under oxidative and reductive stress conditions *in vitro* have been taken up.



*Review  
of  
Literature*

## **2. REVIEW OF LITERATURE**

### **2.1 Introduction to Tuberculosis:**

Tuberculosis (TB) is one of the deadliest, multisystemic, contagious, air-borne infectious disease which is caused due to the infection of gram positive bacterium *Mycobacterium tuberculosis* (Mtb). Worldwide TB is one of the top three infectious diseases in the world. World Health Organization (WHO) data shows that 1.5 million people died from TB in 2020 (WHO Report 2020). TB is also the 13th leading cause of death globally. As of now, it's the second main infectious cause of death, after COVID-19. TB is the most common in developing countries, but in reference to the Centre for Disease Control and Prevention (CDC Report of 2020), over 7,000 cases of TB were also registered in the United States in 2020.

In year 1689, Richard Mortan confirmed that pulmonary form of Mtb was linked with pathology in the past but due to varying symptoms, until 1820 TB was not recognized as a single disease. Finally in 1832, J. L. Schonlein was the first to assign a name 'Tuberculosis' to these conditions (Ajaz *et al.*, 2021).

### **2.2 Causative agent of Tuberculosis:**

TB caused by variety of species of Gram positive bacteria known as Mtb or tubercle bacilli. Robert Koch identified the bacillus, Mtb as the causative pathogen of tuberculosis on 24<sup>th</sup> March 1882. Later on in 1905 he was awarded the Nobel Prize in physiology and medicine for the same (Schultz *et al.*, 2011). Mycobacteria is a small non spore forming, non-capsulated, aerobic, non-motile, rod-shaped, gram positive bacillus bacteria. It is an acid-fast bacilli having lipid rich wax like cell wall and one of the most recalcitrant bacteria to treat. Most common staining technique is Ziehl Neelsen technique used for detection of acid-fast bacteria (Singhal *et al.*, 2015). Mtb takes long time (almost 24 h) for division and replication.

### **2.3 *Mycobacterium tuberculosis* complex (MTBC):**

The causative agent of TB is Mtb. The Mtb complex (MTBC) includes a nearly related species that cause tuberculosis in both animals and humans. The MTBC includes four TB causing mycobacteria: *M. bovis*, *M. africanum*, *M. canetti*, and *M. microti*. *M. africanum* which is not frequent, but in Africa it is a major cause of TB (Forrellad *et al.*, 2013). *M. bovis* was once considered as a common cause of TB. *M. canetti* infection is rare and seems limited to Horn of Africa. *M. microti* is also rare and observed only in hosts with weak immunity.



#### **2.4 *Mycobacterium tuberculosis* (Mtb):**

Mtb is a thin straight rod bacterium of size  $0.4 \times 3\mu\text{m}$  and grow either singly or in pairs or small clumps. The complex lipid of cell wall makes it difficult to be stained by common Gram's Method. Mtb efficiently retains staining dyes as this is not removed even after acidic treatment, therefore, it is classified as an acid-fast bacillus and stained by acid-fast staining using Ziehl-Neelsen technique (Pfyffer 2015).

#### **2.5 Antigenic Structure of Mtb:**

Mycobacteria has many unique immunoreactive substances, present as cell wall components. There are three types of antigens present in Mycobacteria, i.e., ones that are actively secreted outside of cell, Ones that are bound to cell wall, and ones which are present only in cytoplasm. The secreted and cell wall bound antigens are the first antigens to be encountered by immune system upon infection and are thus likely the key players for activating immune response and pathogenicity. Cell wall (insoluble) antigens are present on the cell wall and the basic structure of cell wall is typically of Gram-positive bacteria. The innermost cytoplasmic membrane is surrounded with a thick peptidoglycan layer without any outer membrane. Other components of cell are lipids, proteins and polysaccharides. The lipids constitute 60% of cell wall weight and contribute to several biological properties. Mtb has a different lipid components that helps in intracellular survival and also in establishing the infection (Kuang *et al.*, 2022). Lipids of the cell wall attributes to the acid-fastness of bacteria and immunogenicity. Coming to mycobacterial cell envelope, it consists of four main layers: (i) the peptidoglycan (murein) containing plasma membrane or inner membrane (IM). These peptidoglycans are covalently linked with the polysaccharides (arabinogalactan) whose terminal ends are esterified by mycolic acids. Peptidoglycans help in maintaining cell's shape and rigidity. (ii) The peptidoglycan–arabinogalactan complex (AGP), composed of polysaccharides existed externally to peptidoglycan layer. (iii) Outer membrane (OM) or 'mycomembrane', which is covalently linked to AGP via the mycolic acids, a principal constituent of cell wall composed of long chains of  $\alpha$ -alkyl and  $\beta$ -hydroxy fatty acids attached to the terminal arabinose units of arabinogalactan and (iv) the outermost capsule (Kalscheuer *et al.*, 2019). Alpha-glucan is the major constituent of the outermost capsule, it has comparatively lesser population of arabinomannan and mannan, proteins and lipids. The major Mtb capsular components mediate interactions with phagocytes that favour bacterial survival. Cytoplasmic Antigens (Ag)

includes Ag5, Ag6, Ag14, Ag19, Ag32, Ag38 and Ag60. All these antigen are protein in nature except Ag60 that comprises lipopolysaccharide and protein as a complex.

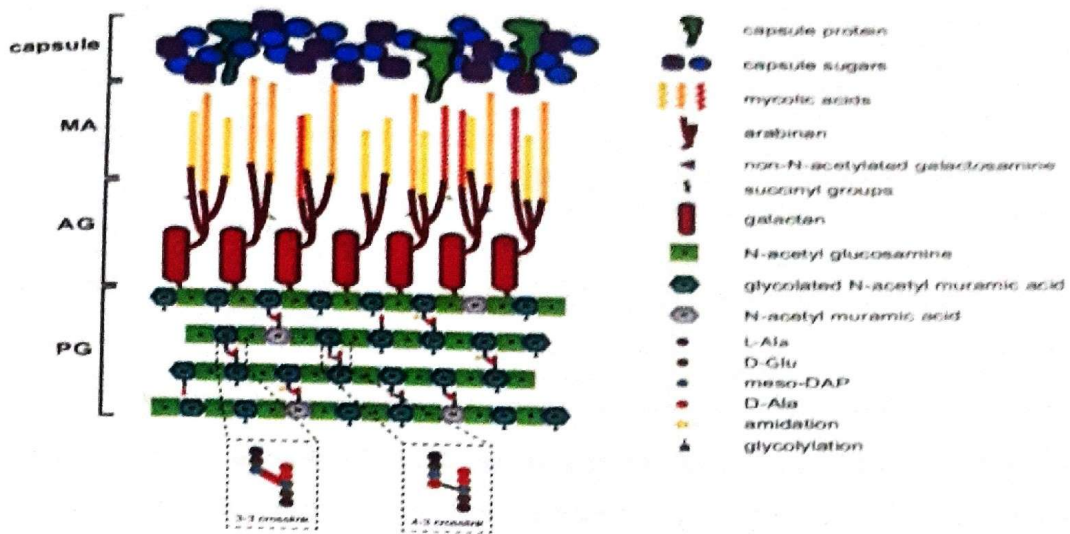
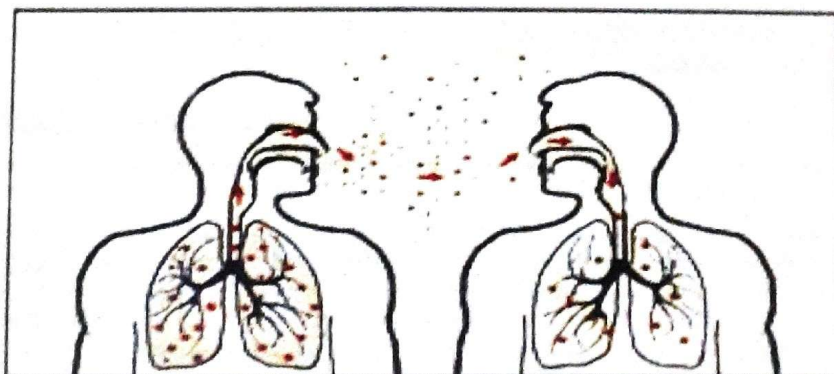


Figure RL1: Cell wall components of Mtb (<https://www.semanticscholar.org>).

## 2.6 Transmission of Tuberculosis:

TB is an airborne pathogen that easily transfer from one person to another. The source of infection is usually a patient who is already infected and has an active pulmonary TB. Coughing, speaking or sneezing of the infected patient produces tiny infectious aerosols termed as droplet nuclei of size 1 to 5 microns in diameter (Patterson *et al.*, 2019). Spread of these particles generally depends upon the surrounding environment.



Red dots are droplets containing TB bacteria that are expelled by an infected person when talking, sneezing or coughing and are inhaled by someone closely and enter their lungs.

Figure RL2: Image showing Transmission of TB pathogen from one person to another through air droplets (<https://www.slideshare.net>).



**Table RL1: Key Factors related of Transmission of Mtb**  
(<https://www.cdc.gov/tb/education>).

| Factor         | Description  |
|----------------|--|
| Susceptibility | Susceptibility (immune status) of the exposed individual   |
| Infectiousness | Infectiousness of the person with TB disease is directly related to the number of tubercle bacilli that he or she expels into the air. Persons who expel many tubercle bacilli are more infectious than patients who expel few or no bacilli |
| Environment    | Environmental factors that affect the concentration of <i>M. tuberculosis</i> organisms  |
| Exposure       | Proximity, frequency, and duration of exposure   |

The rate of infection of a healthy person is directly related to the number of tubercle bacilli that are inhaled or present in the air while contacting a diseased person. Persons with coughing and sneezing symptoms are more infectious in comparison to others (Maher *et al.*, 2009).

The initial infection is referred as primary TB and post-primary or while secondary infection is reinfection of the subsequent disease in a previously treated person, source can be exogenous or by reactivation of a primary infection. Pathological characters of both these infections are quite different as mentioned below in a table:

**Table RL2: Primary and Post-primary TB characteristics (Cambier *et al.*, 2014).**

| Characteristics       | Primary              | Post-primary  |
|-----------------------|----------------------|---------------|
| Site                  | Any part of the lung | Apical region |
| Local lesion          | Small                | Large         |
| Cavity formation      | Rare                 | Frequent      |
| Lymphatic involvement | Yes                  | Minimal       |
| Infectivity           | Uncommon             | Usual         |
| Tuberculin reactivity | Negative (initially) | Positive      |
| Local spread          | Uncommon             | Frequent      |

## 2.7 Diagnosis of TB:

For diagnosis of tuberculosis, there are many different non-molecular and molecular methods.

### 2.7.1 Non-Molecular Techniques-

**Microscopy** is commonly used and the primary TB diagnostic test. It includes the microscopic examination of sputum for acid-fast bacilli (AFB) which is less time consuming, costly, less sensitive and poorly specific especially in patients carrying HIV infection and children. **Culturing** involves Lowenstein-Jensen, Middlebrooks's 7H9 broth and Middlebrooks's 7H10 and 7H11 agar media. These media provide all the essential nutrition and environmental conditions needed by the bacteria (Foulds *et al.*, 1998). **Animal inoculation** includes the use of many animal species for TB infection in animal models such as rabbits, guinea pigs, mice and non-human primates. Each of these model has similar features of human TB, either that be clinical signs, pathology, infection burden, progression of the disease or immunology.

But these techniques delayed the process being slow, time consuming, expensive to maintain the infrastructures and well-trained workers. This delay in diagnosis is a major drawback as treatment is dependent on diagnosis and thus gets delayed. Therefore, there is an urgent need for novel quick method with accurate diagnosis.

### 2.7.2 Molecular Techniques:

As the time is advancing new diagnostic methods are coming into light. Along with the advancement of molecular techniques, different types of tests are available for example; nucleic acid amplification tests (NAATs) that includes polymerase chain reaction (PCR), real-time PCR, and loop-mediated isothermal amplification (LAMP) (Ghiasi *et al.*, 2015). The most popular test for the diagnosis of TB that is recommended by the WHO is nucleic acid amplification (NAATs).

### 2.7.3 Rapid Molecular testing of TB:

WHO currently approved different Molecular tests that are: Loop-mediated isothermal amplification test (TB-LAMP) which is commercially developed by Eiken Chemical, Tokyo, Japan; MTB Plus and MTBRIF Dx tests (Molbio Diagnostics, Goa, India) (Vijayalakshmi *et al.*, 2019); Xpert MTB/RIF and Xpert MTB/RIF Ultra assays developed by Cepheid, Sunnyvale, USA which simultaneously pinpoint tuberculosis; Truenat MTB and lateral flow urine lipoarabinomannan assay (LF-LAM) (Bjerrum *et al.*, 2019).



And initially the most recent tests commended by WHO is Truenat (MTB test) (Sharma *et al.*, 2021) or Xpert (MTB/RIF or MTB/RIF Ultra) for fast diagnosis purposes in pulmonary TB. The technique called as NAAT (Nucleic Acid Amplification Tests) are cartridge based technique which detects the presence of TB DNA with common mutations, generally associated with *rpoB* gene along with RIF resistance within 2 h.

## 2.8 Treatment of TB:

The patients infected with TB can be cured if the right medication is given at the right time. Treatment given is dependent on the age group of patients as well as different health conditions, types of TB (latent or active) and the area of infective organs (brain, lungs & kidney). TB treatment is often compounded by the issues related to drug resistance, dormancy and persistence. The extensive use of rifampicin and streptomycin was noticed in early 20<sup>th</sup> century. The first line anti-tuberculosis therapy constitute the four drugs with bactericidal and bacteriostatic activity against TB. These four drugs are Ethambutol (E), Isoniazid (H), Rifampicin (R) and Pyrazinamide (Z) (Shi *et al.*, 2007). Two of the bactericidal core drugs rapidly kill bacteria which reduces infectiousness and slowing down the disease progression. In the events of documented resistance or toxicities, these drugs should be replaced by other drugs with similar efficacies.

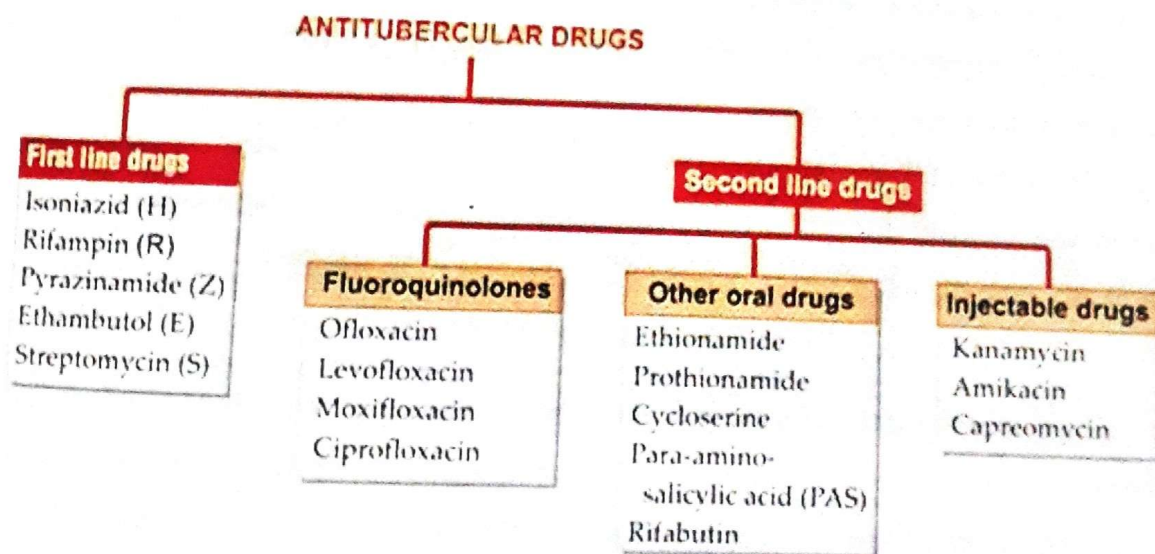


Figure RL3: Examples of Anti-TB first and second line drugs (<https://www.jaypeedigital.com>).

### 2.8.1 Treatment of Drug Susceptible TB:

Drug susceptibility of Mtb can either be determined by metabolic inhibition in a medium having anti-tuberculosis drug or by spotting growth or by detecting mutated genes at molecular level. It is also explained as the growth inhibition of pathogen due to drug activity by different means: 1) *in vitro* growth in drug-free and drug-containing media; 2) metabolic activity detection or measurement 3) mycobacteriophage lysis and 4) analyse the genetic mutations (Kim 2005). In a standard treatment for active TB, a 6 month course of combination of four anti-TB drugs is used. Isoniazid and rifampicin are of prime importance in this treatment, with ethambutol and pyrazinamide given in the first 2 months of treatment (Seid *et al.*, 2018). However, there are chances of failure of treatment if one does not stick to long duration of treatment that will adverse the condition by emerging drug resistance TB treatment.

### 2.8.2 Treatment of Drug resistance TB:

Despite the availability of effective medication drug-resistant tuberculosis (TB) has posed a great challenge to the people, communities and global TB control society. Along with affecting the patient, Drug resistant TB impose a tremendous burden on overextended public health system and attack the resources which are already limited. Drug-resistant tuberculosis (TB) has emerged as a major contributor to AMR worldwide and threatens the lives of the patients.

Drug resistance is divided into two categories. First is **Primary resistance** when the Mtb infected person has already developed a resistant to some drug. **Secondary resistance** when the drug-resistant organisms which was dormant earlier due to drug treatment emerge back during treatment. This type of resistance occur only when there is a lack of continuation to the medication procedure by the patient. Non-adherence to one drug will generate resistance. In case of adults, the main reason of drug resistant TB recurrence of TB disease, exposure to some drug resistant TB patient or emergence of a co-infection like HIV.

In this era the inception and spreading of Multidrug resistant tuberculosis (MDR-TB) is a very serious outcome of uncurbed drug resistance. WHO defines MDR strain as the strain for which rifampicin and isoniazid shows least effect. MDR-TB requires an extended and high-cost second-line treatment for at least eighteen months as compared to drug-susceptible isolates (Iseman *et al.*, 1993). There cases where first line anti-TB drug i.e. isoniazid and rifampicin is ineffective has increased. The second-line anti-tuberculosis drugs include Fluoroquinolones and Aminoglycosides (Kanamycin, Capreomycin, and Amikacin). With increased cases of



MDR-TB, *in vitro* testing determines the potency of newer agents. Another challenging condition is extensively drug resistant-tuberculosis (XDR-TB), which can be explained as resistance to first-line agents (rifampicin and isoniazid), any fluoroquinolone and other injectable second-line agents (Amikacin, Kanamycin and Capreomycin). The resistance to all the tested drugs is known as Total Drug Resistant TB (TDR-TB) (Cohen *et al.*, 2014).

### **2.8.3 Vaccine for TB:**

Defence against Tuberculosis termed as Immunotherapy, was proposed by Robert Koch in 1890. Until now, the one and only effective vaccine for tuberculosis in use is the Bacillus Calmette-Guérin (BCG) vaccine. It was used for the first time in 1921 on humans (Soysal *et al.*, 2005). The side effects of BCG vaccine is experienced by almost 3 out of every 10,000 vaccinated people. This vaccine is not given to immuno-compromised persons. Although BCG immunization come up with a fair and effective protection for small children and infants, (including defence against TB meningitis and miliary TB), its efficacy in adults is fluctuating, ranging from 0% to 80%. (Luca *et al.*, 2013). The call for advancement of TB immunotherapy increases day by day because the disease has become increasingly drug-resistant.

BCG strain was isolated by sub culturing a virulent strain of *M. bovis* for about 239 times for period of 13 years on glycerine potato medium. The strain is not virulent to humans but it's capability to induce an immune response is retained. BCG has been widely administered to >3 billion people under the WHO immunization programme (Trunz *et al.*, 2006) with an outstanding safety record (Casanova *et al.*, 1996). BCG has been found protective for extra pulmonary TB and TB meningitis. The vaccine is said to be 60% effective in dealing against common pulmonary form of TB among adolescents and adult population which forms the age group with higher risks for the development of pulmonary active TB disease (Moliva *et al.*, 2017). The efficiency of BCG vaccine dwindles with age.

The immunity provided by the BCG vaccine depends upon the immune response generated by mycobacteria at the site of infection (Dijkman *et al.*, 2019). When BCG vaccine is directly injected into the mucosa of lungs, it induces a local immune response that can fully inhibit the infection in comparison to receiving BCG via skin which is not as effective.

## **2.9 New drugs and drug regimens to treat TB:**

The new guidelines assessed by WHO in 2022 on latest drug regimens:

- 1) The strategy developed by WHO for new drugs authorization is treatment for six months with bedaquiline, pretomanid and linezolid (BPaL) followed by moxifloxacin (BPaLM) which is checked out in the clinical trial TB-PRACTECAL (Chang *et al.*, 2018). From this BPaLM is said to be used for MDR-TB patients periodically without previous exposure of above drugs (World Health Organization 2022).
- 2) The 6-month regimens based on the BPaL has also been evaluated and finally the amount of linezolid doses have been identified (World Health Organization 2022).
- 3) The other modification in all-oral short regimens (6 & 9 months) is in continuous clinical trials. The previous stresses shown by WHO in 2020 related to patients of MDR/RR-TB & pre-XDR-TB, can now be relieved very much by this programmatic data study on new regimes.

## **2.10 The End TB Strategy:**

### WHO End TB Strategy 2016 - 2035

WHO's "Global strategy and targets for tuberculosis prevention, care and control after 2015" is taken up by World Health Assembly in 2014 (<https://tbfacts.org/>). As Tuberculosis is a global epidemic, this 20 years planning and strategies were aimed to end this epidemic and called the End TB Strategy. This is defined as the occurrence rate of less than 10 people per 100,000 population per year. This incidence rate is the number of new active TB cases at a particular time in a population.

The major targets of this END TB Strategy are:

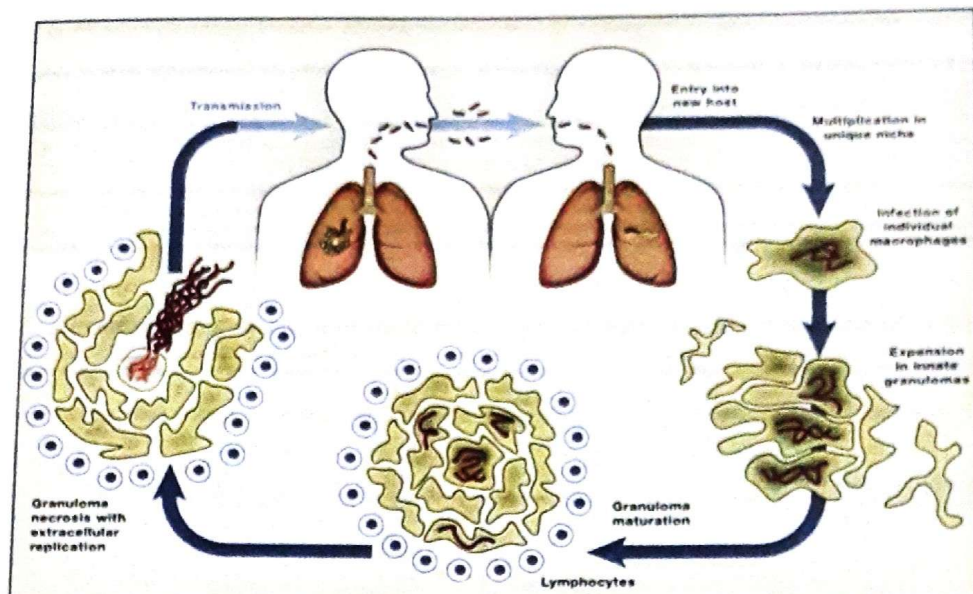
- Reducing the deaths by almost 95%, caused due to TB.
- To halt the new active TB cases by 90% between these 20 years.
- To make sure that because of this deadly disease no family feels burdened with unfortunate expenses.



## 2.11 Pathogenesis of TB:

The TB cycle starts with the dispersion of aerosols of Mtb. The risk of transmission arises when a dose of one bacilli spread throughout the air. When the bacilli enters the patient's lungs alveolar macrophages, phagocytosis starts. After this formation of granuloma started by the monocytes in response by immune system to fight off the disease. This is the hallmark feature of TB. Mtb secured prolonged survival within the alveolar macrophages. APCs (Antigen Presenting Cells), macrophages and dendritic cells involved in phagocytosis of pathogen in the lungs, fails to eradicate the infection. Among the most effective APCs dendritic cells play a crucial role during the initial stage of TB infection (Tascon *et al.*, 2000). There are different Mtb components which are recognized and internalized by various host receptors like Toll-like receptors (TLRs), nucleotide-binding oligomerization domain (NOD), NOD like receptors (NLRs) and C-type lectins receptors (CLR). Toll-like receptors are TLR1, TLR2, TLR4, TLR7, TLR8 and TLR9, Nod-like receptors are NOD1, NOD2, NLRP3 and NLRC4 whereas C-type lectin receptors include mannose receptor (MR-CD207), the dendritic cell-specific intracellular adhesion molecule grabbing non-integrin (DC-SIGN), Mincle, Dectin-1 and Dectin-2, Dectin-3, CL-LK and DCIR. However, some are potential receptors such as complement receptors, scavenger receptors (SR), surfactant protein A receptor (Sp-A) and cholesterol receptors. Sp-A is a glycoprotein located at alveolar surfaces and it helps in enhancing the binding and uptake of Mtb pathogen by upregulating MR activity. On the bacterial cell wall, interaction of MR with Mtb is halted by blockage of manosyl oligosaccharide residues (Jo *et al.*, 2008). Then inhibition of phagocytosis of Mtb started by surfactant protein-D. These host receptors identify micro bacterial cell wall mannose-capped Lipoarabinomannan (Man-LAM), etc. Phagosome

maturation and cytokine signalling is also affected by the up taking of Mtb through different receptors (Philips and Ernst 2012).



**Figure RL4: Pathogenesis pathway of *Mtb* in Humans (Cambier *et al.*, 2014).**

When Mtb and other intracellular pathogens enter into the host macrophages, phagosomes are inhibited at the early stages. The phagosome-lysosome fusion is a normal maturation cycle by which bacteria faces harsh environment like low pH, toxic peptides and reactive oxygen intermediates (ROI) and lysosomal enzymes. Major elements in antimicrobial activity are reactive nitrogen intermediates (RNIs) produced by activated mouse macrophages. Usually the successful fusion of lysosome and phagosome results in the eradication of pathogen but in case of Mtb, phagosome consisting Mtb prevents fusion with lysosome, resulting in the persistence of Mtb within the host.

## 2.12 Introduction to MarR:

Evolution has led to the emergence of super powerful sensing and survival systems in all organisms that aids to their existence. Excellent adaptive capacity to the diverse set of stresses being faced during infection results in the successful intracellular infection of Mtb. These stresses are oxidative stress agents, organic solvents, lipophilic compounds, antibiotics etc. The proteins of multiple antibiotic resistance regulator (MarR) family respond to wide variety of stresses by modulating the expression of proteins. MarR homologs are also found to be involved in the regulation of virulence genes of pathogenic bacteria because of their ability to



respond to the sudden environmental changes. The MarR family proteins have a direct link in regulation of genetic loci conferring resistance to multiple antibiotics and pathogenesis (Perera & Grove 2010; Grove 2013). During environmental stress a signal molecule comes and binds to the DNA binding site of MarR protein, disturb the binding and switch on the regulation of the respective operon, diagrammatically represented in Figure RL5.

Therefore, the critical role of MarR family transcriptional regulators in the survival of Mtb by modulating gene expression under various redox stress conditions is crucial to study.

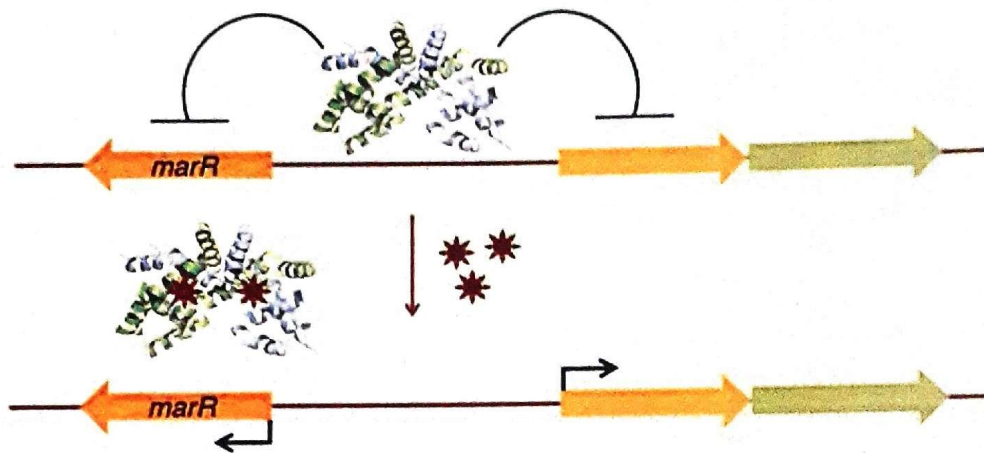
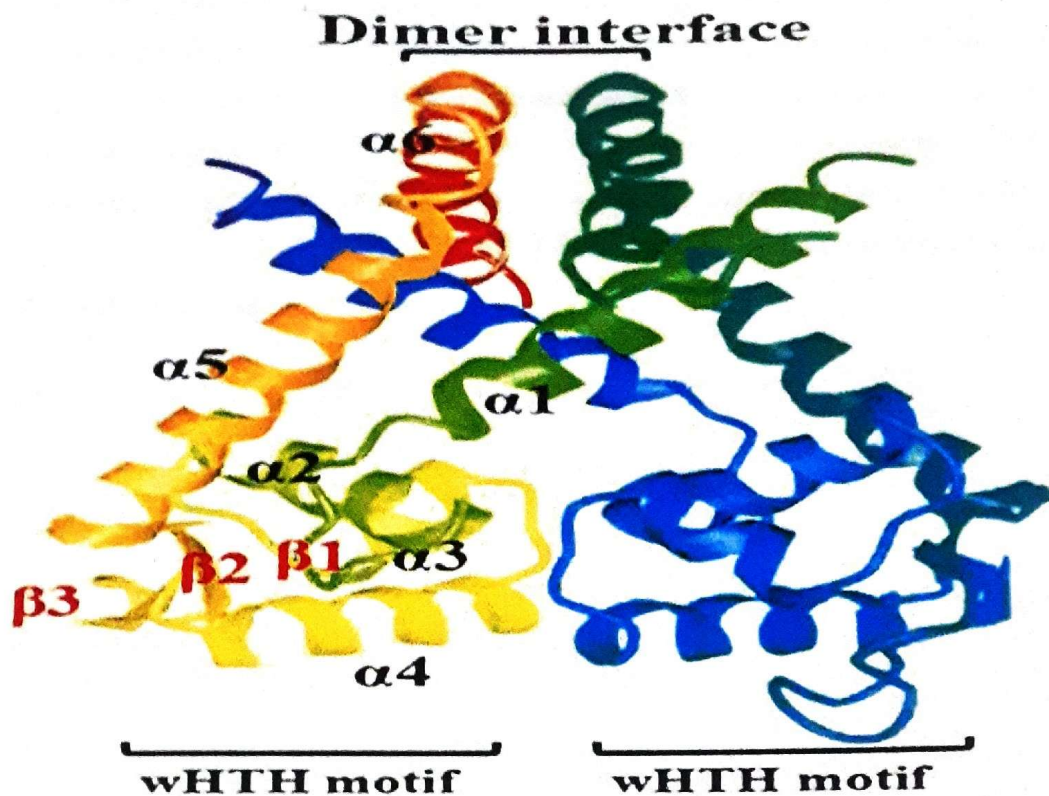


Figure RL5: A typical organization of genetic loci encoding MarR proteins (Zheng *et al.*, 2019).

### 2.12.1 MarR Family Proteins of Mtb

MarR proteins came to existence in *E. coli* K12 and described as a transcription factor that controls the expression of *marRAB* operon and provides resistance to bacteria against antibiotics, phenolic compounds, organic solvents and other type of stresses (Alekhshun and Levy 1999, 2007). MarR family factors are present extensively among other pathogenic bacteria of humans. Some of them are *Salmonella typhimurium*, *Pseudomonas aeruginosa*, *Enterobacteriaceae* and *Bacillus subtilis* (Gong *et al.*, 2019). There is a lot of information available about the physiological functions of MarR protein in bacteria other than Mycobacterium. For example: there are 8 MarR homologs found in Mtb, out of which one is shown below:



**FIGURE RL6:** Crystal structure of Rv0880 MarR family protein is resolved at 2.0Å. The subunit of the dimer consists of six  $\alpha$ -helices and three  $\beta$ -sheets. Each subunit contains winged helix–turn–helix (wHTH) motif as DNA-binding site (Gong *et al.*, 2019).

Just like these bacteria, the existence of MarR system also confirmed in *Mycobacterium* (McDermott *et al.*, 1998) and identified that it is involved in drug resistance and intracellular survival of Mtb (Xu *et al.*, 2019). There are only eight MarR homologs identified till date, namely Rv0042c, Rv0880, Rv2011c, Rv1049, Rv2327, Rv0737, Rv2887 and Rv1404. Three out of these eight proteins, Rv0880, Rv1049, Rv2887, have been characterised so far. Rv0042c one of the five uncharacterized MarR proteins.

### 2.12.2 Rv0042c

Rv0042c is a one of the functionally uncharacterised protein of MarR family in *Mycobacterium*. It is supposed to act as a transcription regulator in Mtb and found to be overexpressed in the granuloma site of human lung of a TB patient and associated with drug resistance. Rv0042c is 627bp/208 amino acids (~22.0 kDa) and is found in inner membrane in



cytosol of Mtb. Rv0042c is downregulated by a PhoPC which is a DNA binding domain of response regulator (Wang *et al.*, 2007). Rv0042c is annotated to have helix-turn-helix DNA binding domain upon comparing its amino acid sequence with MarR protein of *E. coli* (Hao *et al.*, 2014). There is a probability that Rv0042c may also play a role in binding to promoters of different genes via helix turn helix motif and regulate the expression under various stress conditions. So, there is a high probability that Rv0042c may have many functions which are connected with each other.

*Materials*

*And*

*Methods*



### **3: Materials & Methods**

#### **3.1 Chemicals and Media**

Molecular biology grade chemicals including EDTA (0.5M), SDS, Glycerol, Acrylamide, BSA, Sodium azide, Bradford reagent, APS, TEMED, PMSF, Sodium Orthovanadate, Benzamidine, Tween-20, Bromophenol Blue, Etbr,  $\beta$ ME, DTT,  $\text{CaCl}_2$  and Agarose were purchased from Sigma-Aldrich, India. LB media components (NaCl, Casein enzyme hydrolysate, Yeast extract and Bacteriological agar), Skim milk powder, Tris (2M, pH=7.4),  $\text{NaH}_2\text{PO}_4$ ,  $\text{Na}_2\text{HPO}_4$ , were purchased from HiMedia, India. For protein purification, Ni-NTA Agarose resin was procured from Qiagen. Snake skin Dialysis membrane, Coomassie Brilliant Blue R-250, Methanol, Glacial acetic acid, Isopropanol, Tris and Glycine was also obtained from ThermoScientific. Protein concentrators 10.0 MWCO were obtained from Merck. BL21RosettaLyS were obtained from Qiagen whereas pET28a plasmid expression vectors were purchased from Novagen. Nitrocellulose membrane used for western transfer was procured from GE Healthcare. Kanamycin and Chloramphenicol were purchased from Gold Bio and Sigma-Aldrich, respectively.

#### **3.2 Competent cells preparation using $\text{CaCl}_2$ method**

Primary bacteria was obtained by inoculating single colony in 10 ml culture bottle containing autoclaved LB broth followed by incubation at  $37^\circ\text{C}$ , 200 rpm for 12 h. The secondary culture was obtained by inoculating 1% primary culture in 25 ml LB broth. The secondary culture was incubated at  $37^\circ\text{C}$ , 200 rpm till 0.4  $\text{OD}_{600}$  and then the culture was incubated on ice for 10 min. After 10 min, the cells were pelleted at 4,000 rpm for 5 min at  $4^\circ\text{C}$  in swinging bucket rotor. The pellet was resuspended by adding 10 ml pre-chilled Solution-A (0.1 M  $\text{CaCl}_2$ ) and incubated on ice for 1 h followed by centrifugation of cells at 4,000 rpm for 3 min at  $4^\circ\text{C}$  in swinging bucket rotor. Supernatant was discarded and pellet was resuspended in 2 ml of pre-chilled Solution-B (0.1 M  $\text{CaCl}_2$  + 15% Glycerol). Then, 100 $\mu\text{l}$  of prepared competent cells were aliquoted in pre-chilled and labelled MCTs and stored at  $-80^\circ\text{C}$  until use.

#### **3.3 Transformation of bacterial competent cells by heat shock method**

A single aliquot of competent cells prepared as mentioned above was thawed on ice-water and then, 50 ng of plasmid DNA was added to the competent cells and incubated on ice-water for 15 min. Heat shock was given at  $42^\circ\text{C}$  for 90 sec and immediately plunged back into ice for 5 min. After 5 min, 1ml of autoclaved LB media was added to the cells and incubated at  $37^\circ\text{C}$ ,



200 rpm for 1 h. The culture was plated on LB agar petri-dishes along with specific antibiotics for selection of transformed bacteria and incubated at 37°C for 12 h.

### **3.4 Plasmid isolation by Alkaline Lysis method**

Primary culture was given in 10 ml LB culture bottle by inoculating single colony followed by incubation at 37°C, 200 rpm for 12 h. The 1.5 ml of culture was transferred in sterile MCT and centrifuged at 12,000 rpm, 1 min at 4°C or at 7,000 rpm, 5 min at 4°C. Supernatant was discarded properly and 100 µl of an ice-cold Solution I was added. The pellet was resuspended by tapping and kept on ice for 5 min followed by addition of 200 µl freshly prepared Solution II (Lysis buffer) and was mixed gently by inverting the tube 2-3 times. The tube was kept on ice for 5 min followed by addition of 150 µl of ice-cold Solution III (Neutralization buffer), mixed gently, kept on ice for 5 min and centrifuged for at 12,000 rpm for 15 min, 4°C. Supernatant was transferred into a fresh MCT and equal volume of Phenol: Chloroform was added, mixed properly and followed by centrifugation at 12,000, 2 min, 4°C. The upper aqueous layer was transferred to a previously chilled fresh tube and equal volume of ice-cold isopropanol was added. Mixed properly and kept on ice for 5 min. Centrifuged at 12,000 rpm for 10 min at room temperature and supernatant was discarded. Pellet was air-dried at 37°C for 30 min and resuspended in 50 µl of Tris-EDTA buffer (pH 8.0) followed by RNase treatment at 37°C for 10 min. Finally the concentration of DNA was determined through Nano-drop by taking absorbance at the ratio of 260/280 nm.

### **3.5 DNA purification by Gel Extraction Method**

Gel Extraction method is used to extract and purify DNA using QIAGEN Gel Extraction kit which has yellow coloured QG buffer and PE buffer (ethanol is added before use). At first, excise the DNA fragment from the agarose gel with a clean, sharp scalpel. Weigh the gel slice in MCT, before that tare the weight of an empty MCT. Add 3 volume of gel to 1 volume of gel weighed then incubate it at 60°C in a heater for 10 min until gel dissolved completely and vortexed for 2-3 times during incubation. Checked the mixture colour. Added 1 gel volume (equal to gel weight) of isopropanol to the sample and mixed. Placed a spin column in 2 ml collection tube. To bind DNA, applied the sample to spin column and centrifuge (1 min, 11,000 rpm) at RT, discarded the flow through. To wash, added 750 µl of buffer PE into spin column, centrifuge (1 min, 13,000 rpm), discarded the flow through and centrifuged an empty spin column (1 min, 13,000 rpm). Placed spin column into a clean 1.5 ml MCT then eluted DNA,



added 30  $\mu$ l EB buffer (added according to amount of sample DNA) to the centre of the spin column. Stand still for 1-5 min then centrifuge for 1 min then purified DNA was eluted into MCT. The reading of purified DNA was taken in Nano Drop.

### **3.6 Protein purification for Rv0042c and its mutants**

#### **3.6.1 Over-expression of proteins:**

Primary culture was given by inoculating a single colony of BL21Rossetta pLysS cells transformed with vector pET-28a (Rv0042c) for His-tagged Rv0042c proteins in 10 ml culture bottle followed by incubation at 37°C, 200 rpm for 12 h. From primary culture, 1 % inoculum was given for secondary culture in 600 ml LB media and incubated at 37°C, 200 rpm until OD<sub>600</sub> reached 0.4 followed by cold shock treatment for 30 min, then kept the culture in 18°C at 200 rpm in shaker for 20 min. After this take out 1.0 ml uninduced sample, then, induced with 0.5 mM IPTG and incubated at 18°C for 18 h. After 18 h of induction, cells were harvested at 6,000 rpm for 10 min at 4°C. The supernatant was discarded and the obtained pellet was resuspended in 1X PBS (pH 7.4) with the help of vortex, centrifuged at 6,000 rpm for 15 min at 4°C discarded the supernatant and proceeded with pellet for protein purification.

#### **3.6.2 Bioinformatics:**

Rv0042c sequence alignment was done with other well studied MarR family proteins to find out the present identity. Alpha fold and pyMOL software were used for structural visualization of Rv0042c.

#### **3.6.3 Purification of His tagged Rv0042c protein:**

The induced pellet was resuspended in 10 ml lysis buffer containing 0.2 M Orthovanadate (30  $\mu$ l) and 100 mM PMSF (300  $\mu$ l) protease inhibitors. Then dissolved the pellet completely and volume was made up to 30 ml, after this added 5  $\mu$ l DNase enzyme, 35  $\mu$ l  $\beta$ -ME, 30  $\mu$ l Triton-X 100 and kept it for 20 min. The resuspended pellet was then sonicated at 15 pulse "On" and 20 "Off" having amplitude 24 % till the pellet became translucent. After sonication, the lysed cells were centrifuged at 11,000 rpm for 30 min at 4°C. The supernatant was transferred to the fresh Falcon tube and loaded onto a Ni-NTA column pre-equilibrated with 10 mM Imidazole buffer. The supernatant was passed 5 times through the column. The column was washed with 30 ml of wash buffer comprising 500 mM NaCl, 20 mM Tris and 10 % glycerol and increasing concentrations of Imidazole buffers, i.e., 20 mM, 40 mM, 60 mM and 80 mM (pH 7.4). The

protein was eluted with 10 ml of 250 mM elution buffer and the elution fractions were collected. The eluted fractions containing desired protein as analysed by SDS-PAGE were pooled and dialyzed in dialysis buffer 500 mM NaCl, 10 % glycerol 20 mM Tris and 0.5 mM EDTA (pH 7.4) for overnight at 4°C on stirrer. Next day, the protein was concentrated using 10 MWCO protein concentrators. The concentrated protein was quantified using Bradford assay at 595 nm.

### **3.7 SDS PAGE**

The purified elution fractions and samples from washings along with uninduced, induced supernatant, pellet and flow through were electrophoresed on 10% SDS-PAGE after adding 4X loading dye. Prior to loading of sample onto the gel, the samples were heated in a dry bath at 100°C for 10 min and centrifuged 13,000 rpm for 1 min at RT. The samples were analysed on discontinuous vertical SDS-polyacrylamide gel with 5% (w/v) stacking gel and 10% (w/v) resolving gel using 25 mA current. Protein molecular weight markers were run concurrently on the same gel for analysis. Gels were stained with Coomassie Brilliant Blue staining solution followed by destaining.

### **3.8 Bradford Assay for quantification of protein**

Protein samples were prepared by diluting the concentrated protein samples 1:10 or 1:5 in water followed by addition 500 µl of Bradford Reagent. The sample was mixed properly. Respective blanks were prepared by replacing the protein sample with dialysis buffer. The absorbance of blue colour product was measured on a UV spectrophotometer at 595 nm. For standard curve, the standard BSA solution was prepared with concentration 0.1 µg/µl, 0.2 µg/µl, 0.3 µg/µl, 0.4 µg/µl and 0.5 µg/µl from BSA stock of concentration 2 mg/ml. To prepare the standard curve, absorbance value at 595 nm of each standard BSA solution was plotted against their concentration and a linear curve was obtained. The unknown concentration of protein was calculated by comparing their absorbance at 595nm with known BSA standards using standard curve and expressed in µg/µl.

### **3.9 Non- denaturing SDS Page**

Rv0042c and its deletion mutants were treated with β-ME and DTT followed by boiling the samples at 100°C. Other set of samples without the treatment of β-ME or DTT were not boiled.



All these samples were subject to SDS-PAGE to check the oligomerization status of the proteins. Results were confirmed by western transfer.

### **3.10 Western blotting**

The protein samples electrophoresed in SDS-PAGE gel was transferred onto a nitrocellulose membrane in a Trans-Blot apparatus. The membrane was stained with Ponceau S stain and washed with 1 % Acetic Acid until the stain was completely removed. The membrane was blocked in 5% skim milk for 40 min at RT. The blot was washed thrice with 1X PBST for 10 min each and incubated with particular dilution of primary antibody, i.e., Anti- His at 1:20,000 dilution for 2 h followed by 3 washings of 10 min each with 1X PBST and incubated at RT with enzyme-conjugated secondary antibody, i.e., Goat Anti-mouse at 1:15,000 dilution for 1.0 h. After washing thrice with 1X PBST, appropriate enzyme substrate solution was added. Membrane was exposed to the X-ray film for various time points and developed in a dark room.

### **3.11 Gel Filtration Chromatography- FPLC (Fast Protein Liquid Chromatography)**

**AKTA Purification:** This is a technique often used to analyse or purify mixtures of proteins in which the molecules are separated according to difference in sizes when pass through a column packed with the chromatographic medium (gel) formed from polymers. Pores in gel matrix are filled by liquid phase and are comparable in size to the molecules we wish to separate. Small molecules can diffuse into the gel from surrounding solution, relatively large molecules will be prevented by their size from diffusing into the gel. As large molecules are unable to diffuse and confined to outside solution, they can come down to the column very fast as an eluent. In FPLC the mobile phase is a liquid and the stationary phase is often a resin. Fast protein liquid chromatography systems generally consist of a pump, a UV detector, a conductivity meter, and a fraction collector and operate at pressures of ~3,500 psi (24 MPa). Samples can either be loaded manually by injection into a sample loop or automatically using a sample pump. Some fast protein liquid chromatography systems have multi-wavelength detectors for monitoring sample elution at several wavelengths.

# *Results*



## 4. RESULT

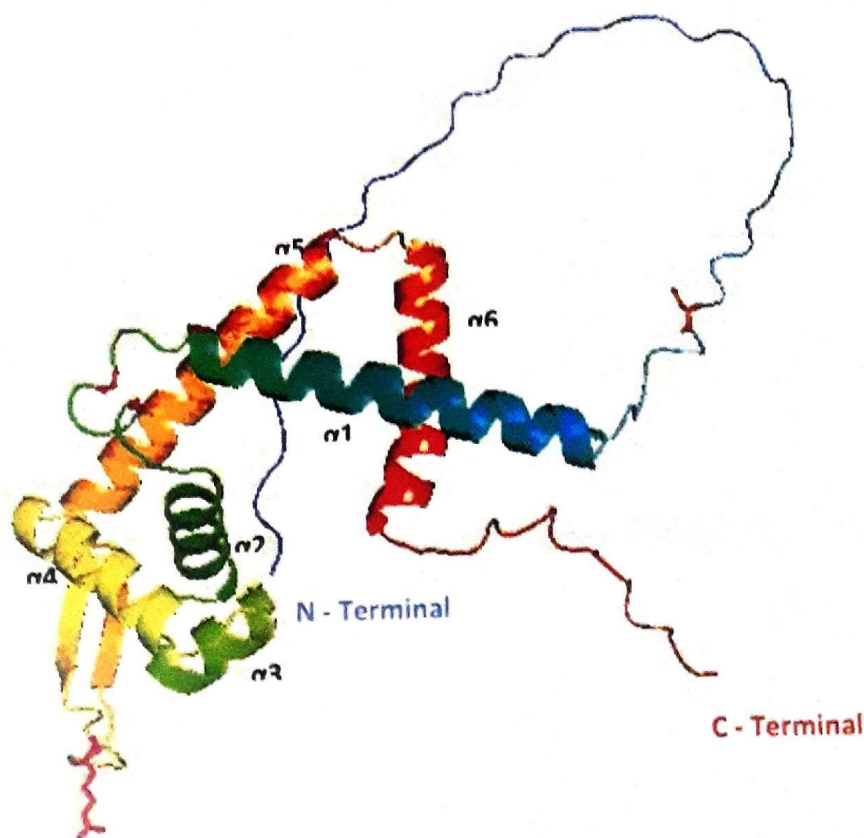
### 4.1 Introduction

Rv0042c is an important MarR family protein which is a possible transcription regulator existing in oligomers under native conditions in Mtb. Therefore, it is crucial to study the oligomeric nature of this protein. To unravel the oligomeric status, Rv0042c was cloned from genomic DNA of Mtb by the senior in the lab and its purification was standardized. Later on analysing its structure through alpha fold model, it was observed that this particular protein contains long unorganised loops at its 'N' and 'C' terminal. To study the effect of these loops on the proper folding and structural stability, 'N' and 'C' terminal deletion mutants were also generated by a senior in the lab and their oligomeric behaviour have been compared with the wild type by me.

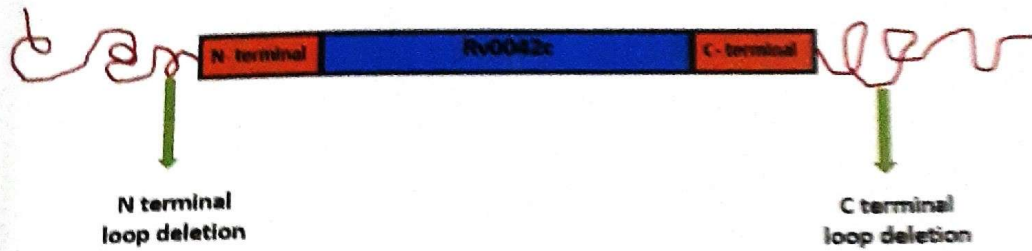
### 4.2 Analysis of predicted structure of Rv0042c on Alpha Fold

Due to unavailability of crystal structure of Rv0042c, Alpha Fold software freely available at Google was used to predict the structure (<https://alphafold.ebi.ac.uk/search/text/rv0042c>). Looping regions were identified and deleted using sequence specific primers.

A.



B.



**Figure R1:** A. Predicted Structure of Rv0042c at  $\alpha$  fold. Comprising 6  $\alpha$ -helices and 3  $\beta$ -sheets, a typical winged helix-turn-helix structure of MarR family proteins. B. Diagrammatic representation of deletion of long loops from N and C terminal domains of wildtype Rv0042c.

#### 4.3 Preparation of Rosetta pLysS competent cells and Transformation-

BL21 Rosetta pLysS competent cells were prepared using  $\text{CaCl}_2$  which aids and binding of plasmid DNA to lipopolysaccharide present in cell wall. Positively charged calcium ions attract both negatively charged DNA backbone and the negatively charged group in the LPS inner core. During transformation of these cells by heat shock method, a sudden increase in temperature created pores in the plasma membrane of bacteria which allowed plasmid DNA to enter the bacterial cell.

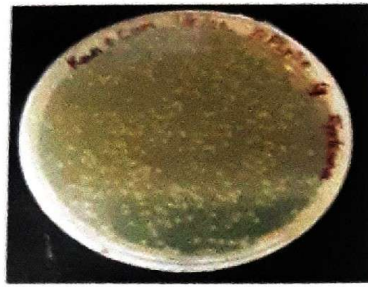


A.



B.





C.

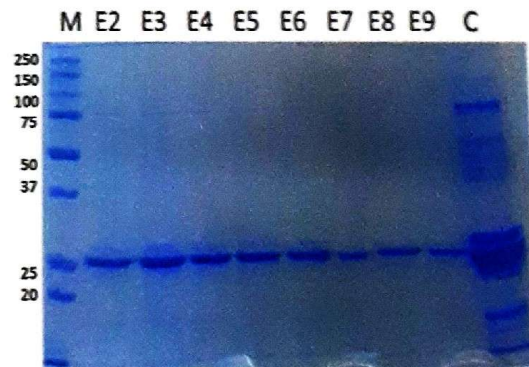
**Figure R2: Transformation of BL21Rosetta pLysS cells-** A. Competent BL21Rosetta pLysS expression cells transformed with vector pET-28c containing Rv0042c at T7 promoter. (A) Agar plate (Kan + Cam) showing single colonies for wild type transformants B. Agar plate (Kan + Cam) showing single colonies for N terminal deletion mutant. C. Agar plate (Kan + Cam) showing single colonies for C-terminal deletion mutant.

#### 4.4 Purification of Rv0042c Wild Type Protein with N-Deletion & C-Deletion Mutants

Rv0042c wildtype protein was purified using affinity chromatography. The various fractions of purification process were electrophoresed on SDS-PAGE, purified band appeared at 25 kDa (Fig. R3). The N and C terminal deletion mutants were purified by the same protocol. Both mutants were eluted around 50 kDa (Fig. R3 & R4), indicating that it is present as a dimer.



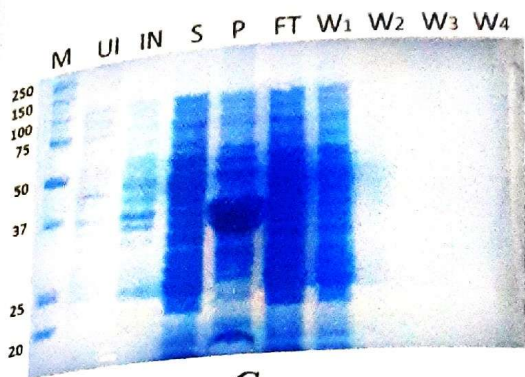
A.



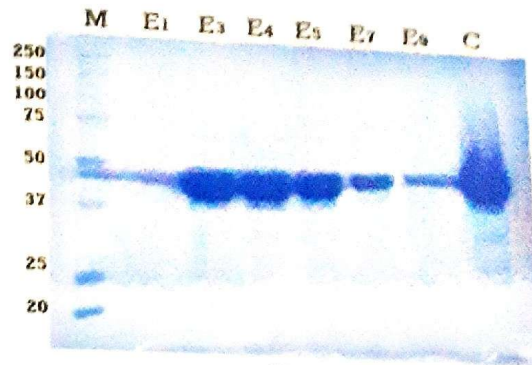
B.

**Figure R3:** Showing the purification level of wild type Rv0042c protein by using affinity chromatography. **Panel A.** Lane M = marker; UI = Uninduced sample; IN = induced samples; S = mutant; P = pellet; FT = Flow through; W1 = 20 mM washing; W2 = 40 mM washing; W3 = 60 mM washing; W4 = 80 mM washing. **Panel B** comprise the elution fractions of purified Rv0042c from E2 to E9 followed by C = concentrated protein.



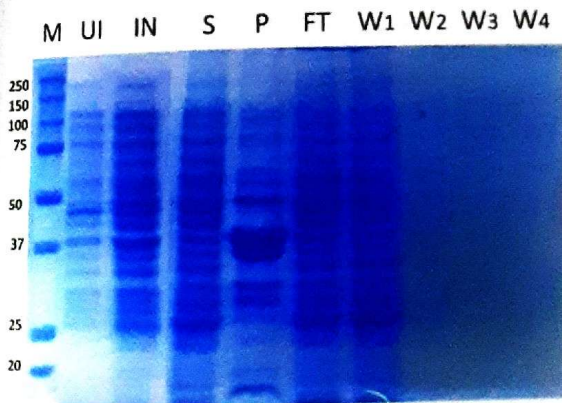


**C.**

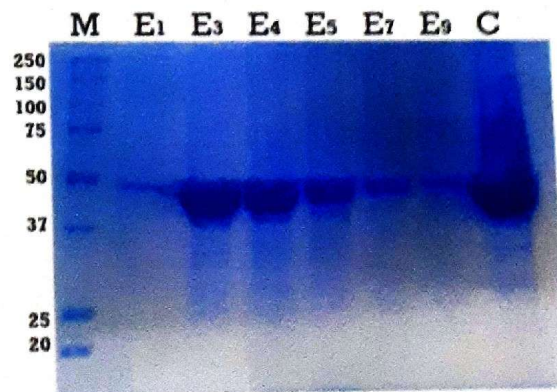


**D.**

**Figure R4:** Showing the purification of N-terminal deletion mutant of Rv0042c protein by using affinity chromatography. **Panel C.** Lane M = marker; UI = Uninduced sample; IN = induced samples; S = supernatant; P = pellet; FT = Flow through; W1 = 20 mM washing; lane W2 = 40 mM washing; W3 = 60 mM washing; W4 = 80 mM washing. **Panel D** comprise the elution fractions: E1, E3, E4, E5, E7, E9 followed by C = concentrated protein of purified N-deletion mutant of Rv0042c. protein.



**E.**



**F.**

**Figure R5:** Showing the purification of G-terminal deletion mutant of Rv0042c protein by using affinity chromatography. **Panel E.** Lane M = marker; UI = Uninduced sample; IN = induced samples; S = supernatant; P = pellet; FT = Flow through; W1 = 20 mM washing; lane W2 = 40 mM washing; W3 = 60 mM washing; W4 = 80 mM washing of C-terminal deletion mutant of Rv0042c Protein. **Panel F** comprise the elution fractions: E1, E3, E4, E5, E7, E9 followed by C = concentrated protein of purified G-deletion mutant of Rv0042c protein.



#### 4.5 Oligomerization of Rv0042c and its mutants:

Purified Rv0042c and its deletion mutants were electrophoresed under denaturing and non-denaturing conditions. One sample from each protein was treated with 10 mM  $\beta$ -Mercaptoethanol ( $\beta$ -ME) and followed by boiling at 100°C for 5 min to ensure proper denaturation of protein. The protein sample not treated with  $\beta$ -ME and no boiling was kept as control. It was observed that under non-denaturing conditions, wildtype Rv0042c exist as a dimer (50 kDa) which was reduced to monomer (25kDa) when treated with  $\beta$ -ME and upon boiling (Fig. R7. A) In case of 'N' and 'C' terminal mutants, tetrameric form was observed under non-denaturing conditions and stable dimers were found at denaturing conditions. Same results were confirmed using DTT at 10 mM as a reducing agent (Fig. R7. Panel B).

To ensure the proper reducing environment deletion mutants were also titrated against higher reducing environment so that the dimer can get reduce to monomer as in case of wildtype Rv0042c. However, no effect was observed on these stable dimers in case of 'N' and 'C' terminal deletion mutants. These result highlighted the importance of loops in folding of the protein structure.

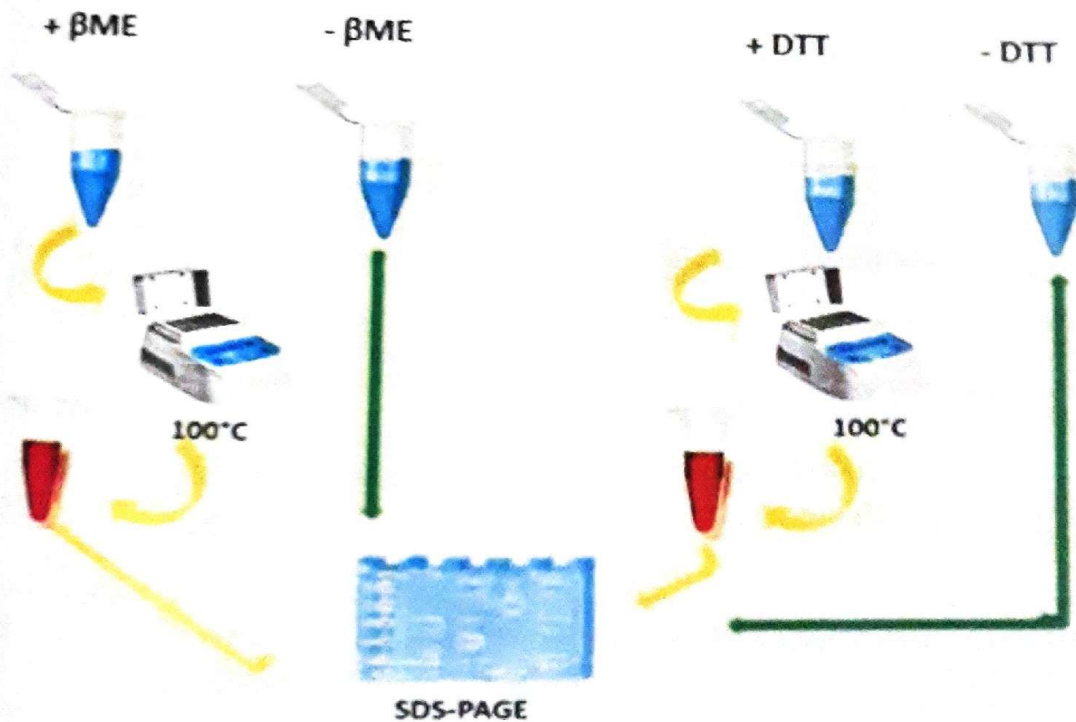
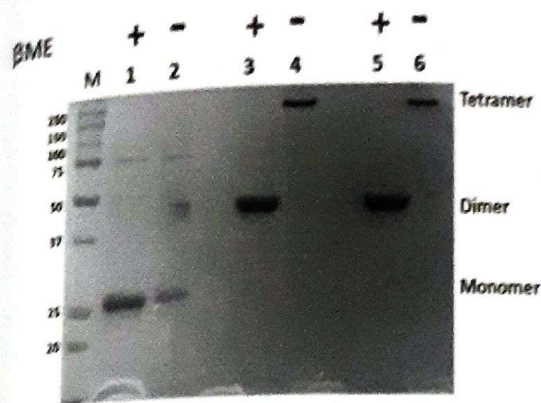
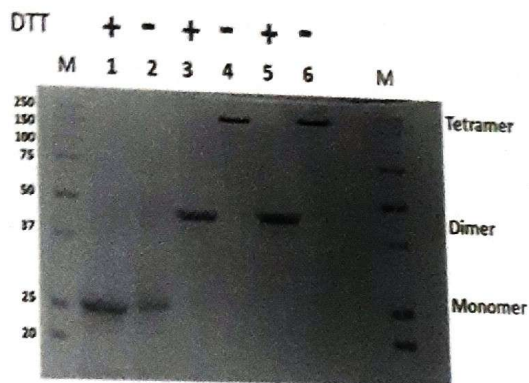


Figure R6: Flowchart of the experiment.



A.

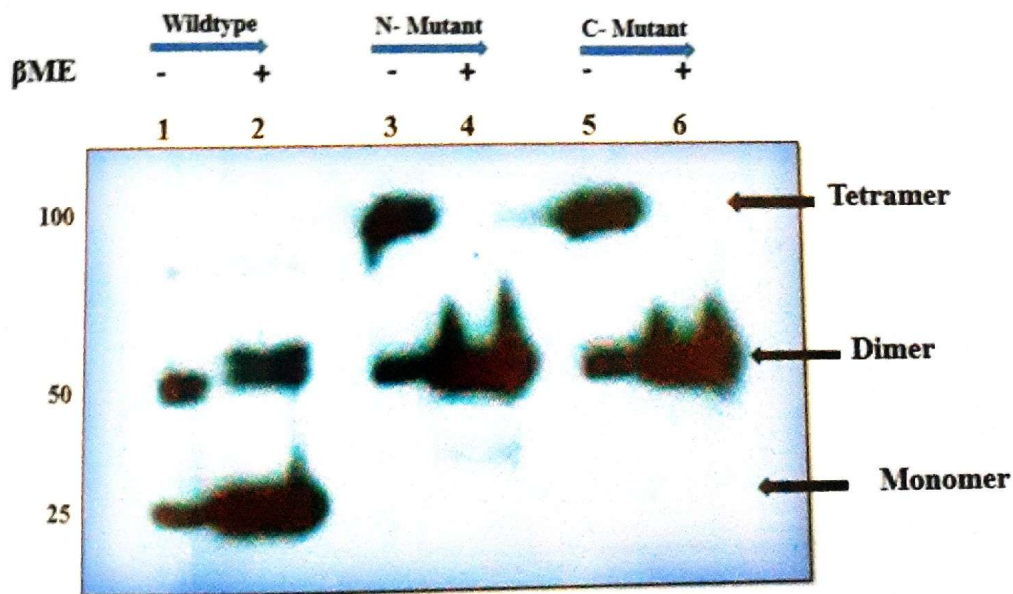


B.

**Figure R7: Shows the oligomeric forms of Rv0042c wildtype and 'N' and 'C' terminal deletion mutants.**

**A. Wildtype and mutants treatment with  $\beta$ ME as a reducing agent, lane M = Marker; 1 = + $\beta$ -ME treated and boiled wildtype Rv0042c, 2 = - $\beta$ -ME, unboiled wildtype Rv0042c; 3 & 4 shows  $\beta$ -ME treated and Non  $\beta$ -ME treated proteins for N terminal deletion mutant and 4 & 5 =  $\beta$ -ME treated and Non  $\beta$ -ME treated proteins for N terminal deletion mutant non-reduced C.**

**B. Similar treatment was given with DTT as a reducing agent: Lane 1 & 2 shows Rv0042c Treated and Non- treated samples, 3, 4, 5 & 6 shows same for 'N' and 'C' terminal deletion mutants respectively.**



C.

**Figure R8: Shows the western Blot analysis of the previous experiment. Confirmation of the oligomeric forms of Rv0042c and its deletion mutants at 'C' and 'N' terminal through western blotting with  $\alpha$ -His antibody.**

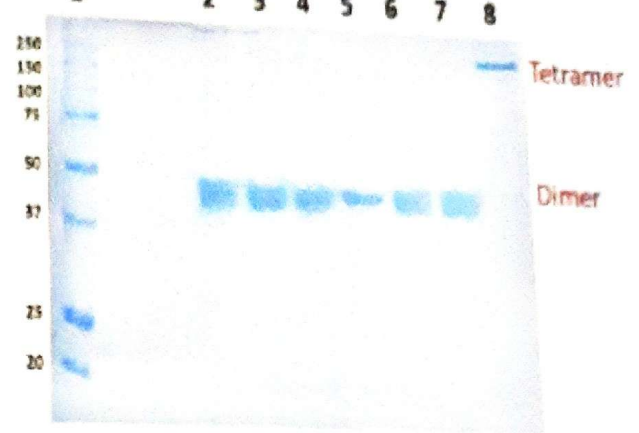


DTT (mM) 0 10 20 30 50 70 100  
1 2 3 4 5 6 7 8



D.

DTT (mM) 100 70 50 30 20 10 -DTT  
1 2 3 4 5 6 7 8



E.

**Figure R9: Shows the effect of Increasing concentration of DTT on the oligomeric behaviour of 'N' and 'C' terminal deletion mutants of Rv0042c. Panel C and D shows the effect of increasing concentration of DTT as a reducing agent from 10 mM to 100 mM in comparison to 0 mM DTT in lane 2 in case of N-terminal deletion mutant and in lane 8 in case of C-terminal deletion mutant respectively.**

# *Discussion*



## 5. Discussion

Despite the availability of highly effective drugs, world is facing the problem of treatment of TB even in 21<sup>st</sup> century. The problem of emergence of drug resistance further aggravates this crisis. MarR family protein are promising candidates for meeting out the drug resistance as they have the direct link in regulating the efflux pump and other stress responsive genes to sustain the survival of the pathogen. In case of Mtb elaborative study of this family of protein is still lacking.

Rv0042c selected in this study is indicated to be involved in drug resistance according to the literature. In the current study, it was found that like other MarR proteins wildtype Rv0042c exist as a Dimer in its native conditions. Dimers appeared to be the functional form of Rv0042c as it binds its specific DNA sequence. Under reduced conditions, it exist as monomer. The long loops of this proteins have a greater role in the stabilization and perhaps provide flexibility to the protein to adapt according to the surrounding environment. Deletion of loops from N and C terminal of wild type Rv0042c provided more rigidity to the dimers and tetramers as they are not converting to monomers even at higher concentration of reductive agents.

Rv0042c can be a global regulator of Mtb to sustain its survival under varying stress. Further, studies are needed to look into its regulation and functionality *in vivo* as it is important to reveal the intriguing interconnected regulatory networks of Mtb for better understanding of its virulence and pathogenesis.

*Conclusion*



**6. Conclusion:**

Rv0042c is an important member of MarR family of proteins. For any protein study its structural features are crucial in reference to its function. In this study, the oligomeric behavior of Rv0042c under oxidative and reductive conditions have been analyzed. Interestingly, Rv0042c forms dimers in its native form and its N and C terminal long loops are crucial for its oligomeric behavior and stability. After loop deletions, Rv0042c forms rigid dimers and tetramers even under harsh reductive conditions which indicates the involvement of loops in sensing its outside environment and change its oligomeric structure accordingly.

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# **SAMPLE PROJECT REPORTS**

**2021-22**

**FACULTY OF ARTS**

**Field Project Work Report**  
प्रोजेक्ट (परियोजना) कार्य

.....  
*Consumer Right*  
.....

(Title of Field Project Work)

For the partial fulfillment of  
B.A./ B.Sc./ B. Com./ BBA/ BCA Degree  
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सी.ए. / की डिग्री की आंशिक प्रतिपूर्ति हेतु

Session : 2021-22.....



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St. Aloysius' College (Aut)  
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# Field Project Work Report

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बी.ए./ बी.एस.सी./ बी.कॉम./ बी.बी.ए./ बी.सी.ए./ की डिग्री की आंशिक प्रतिपूर्ति

हेतु

Session : ...2021-22.....

Prince Kumar Bais

Name of student/ Students (छात्र का नाम)

B.A. 1<sup>st</sup> year

Class (कक्षा)

Roll No (अनुक्रमांक)

St. Aloysius College Jabalpur

Name of the organization, where the work was completed (संस्था का नाम जहाँ  
कार्य पूर्ण किया गया)

Dr. Vishwas Patel

Name of Supervisor (पर्यवेक्षक का नाम)



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Jabalpur M. P.

## Declaration of Student's Original Work

### विद्यार्थी की मौलिकता का घोषणा पत्र

I Price kumar Bais hereby declare that this Field Project report is based on the original work done by me, in which published and unpublished material has been used after due approval. I also declare that the submitted report has not been submitted for any other degree / course in the past / present.

मैं ..... एतद द्वारा घोषणा करती / करता हूँ कि यह परियोजना रिपोर्ट मेरे द्वारा किये गए मूल कार्य पर आधारित है, जिसमें प्रकाशित एवं अप्रकाशित सामग्री का प्रयोग विधिवत स्वीकृति के उपरान्त किया गया है। मैं यह भी घोषणा करती / करता हूँ कि प्रस्तुत रिपोर्ट किसी अन्य डिग्री / पाठ्यक्रम हेतु पूर्व / वर्तमान में प्रस्तुत नहीं किया गया है।

Name of student/ Students (छात्र / छात्रा का नाम) : Price kumar Bais.  
Class (कक्षा) : B.A 1st year  
Roll Number (अनुक्रमांक) :  
Signature with date (हस्ताक्षर दिनांक सहित) :



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this work.

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..... was a great  
chance for learning and professional development. I express my deepest  
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..... who  
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I am grateful to everyone who supported me or guided me directly or  
indirectly.

Signature

Name of the student :

.....

## INTRODUCTION

### Consumer's Rights In India

The Definition of Consumer Right is 'The Right to have information about the quality, potency, quantity, purity, price and standard of goods or services', as it may be the case, but the consumer is to be protected against any unfair practices of trade. It is very essential for the consumers to know these rights.

However there are strong and clear laws in India to defend consumer rights, the actual plight of consumers of India can be declared as completely dismal. out of the various laws that have been enforced to protect the consumer rights in India, the most important is the Consumer protection Act 1986, According to this law everybody including individuals, a firm, a hindu undivided family and a company, have the right to exercise their consumer rights for the purchase of the goods and services made by them. It is significant that, as consumer, one knows the



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Basic Rights as well as about the Courts and procedures that follow the infringement of one's Right. In General, the Consumer rights in India are listed below:

- \* The Right to be protected from all kind of hazardous Goods & Services.
- \* The Right to be fully informed about the performance and quality of all goods & services.
- \* The Right to free choice of Goods & Services.
- \* The Right to be heard in all Decision-making processes related to Consumer interests.
- \* The Right to seek Redressal, whenever consumer rights have been infringed
- \* The Right to complete consumer education.



The Consumer Protection Act, 1986 and several other laws like the weights, standard & measure act can be formulated to make sure that there is fair competition in the market & free flow of correct information from goods & services providers to the ones who consume them. In fact, the degree of consumer protection in any country is regarded as the right indicator of the progress of the country. There is high level of sophistication gained by the goods & services providers in their marketing and selling practices and different types of promotional tasks viz - Advertising resulted in an increasing requirement for more consumer awareness and protection. The government of India has realized the condition of consumers therefore the ministry of consumer affairs, food and public distribution has incorporated the department of consumer affairs as the nodal organization to protect the consumer rights. Redress the consumer grievances & promote the standards governing goods & services provided in India.



# Right To Information

The Right to Information is defined as 'the Right to be informed about the quality, quantity, potency, purity and standard & price' of goods & services, as the case may be so as to protect the consumer against unfair trade practices in the Consumer protection Act 1986. In the market place of India, consumers get information by two ways namely advertising and word of mouth however these sources are considered to be unreliable but still this word of mouth is quite common here because of this, the Indian consumers hardly have precise & complete information for addressing the true, value, safety, suitability, reliability of any product. usually the hidden costs can be found, lack of suitability, quality problems and safety hazards only after the purchase of the product. There is another right claimed by the Indian government on paper. This right must ideally make sure that all consumable products have been labelled in a standard manner containing the cost, quantity, the ingredients and instructions given to use the product safely.



## Right To Choose

The Definition of Right to Choose as per the Consumer protection Act is 'the Right to be assured, wherever possible, to have access to a variety of goods & services at Competitive prices. For Regulating the market place, There is just one factor required and i.e. Competition. The Existence of cartels, oligopolies & monopolies prove to be Counterproductive to Consumerism. The Natural Resources, Liqueur Industry, Telecommunications, Airlines etc. All are being controlled by a mafia to some or other extent. Since the Indian consumers come from a Socialist Background, the tolerating of monopolistic market is found in their Blood.

## Right To Consumer's Education

The Right of Every Indian citizen to have education on matters regarding consumer protection as well as about her/his right is regarded as the last right provided by the Consumers in the Country have informational programmes & materials which are easily



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Accessible and would enable them to make purchasing decisions which are better than before.

## ★ First Progress Report for field Project

### # Introduction and scope of the Project work -

According to the Consumer Protection Act 1986, The Consumer right is referred to as the right to be protected against marketing of goods & services which are Hazardous and food processing, this right is spread across the Domain having a serious effect on the Health of the Consumer or their well being viz. Automobiles, Housing, Domestic Appliances, travel etc. when there is violation of the right then there occur medical malpractice in the country. It is estimated every year that thousands or millions of citizens of India are killed or seriously injured by immoral practices by Doctors, Hospitals, pharmacists, and the automobile industry. still the government



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of India known for its callousness, does not succeed in Acknowledging this fact or making a feeble effort for mainting statistics of the mishaps. The government of India needs to know world class product testing facilities to test drugs, food, cars or any other consumable product that can prove to be a menace to life.

### # Scheme/structures of the Project work ~

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### # Decision of the students for project work -

Mayank divided the whole survey in different parts to make it effective

\* Study: Detailed study of current education scenario has been done for question to be asked.

\* Preparation of questions:

\* Collecting data by survey from different peoples:-  
As the data collected by myself for this purpose, it is purely reliable & trusted.



\* Analysis:- Study of collected information

\* Interpretation:- to find the results from it.

\* conclusion

# Details of the concerned work place / institution  
(where the work has been done)

1. Sadar Bazaar

2. city

3. Gorakhpur

4. Madan Mahal

5. civil line

6. Ghanta ghar

7. Railway station. ETC.



# Proposed project goals should be short and smart ~

The Right to seek redressal against unfair trade practices or restrictive trade practices or unscrupulous exploitation of consumers is referred to as the right to redressal according to the Consumer protection Act 1986.

The government of India has been bit more successful with regard to this right. The consumer courts like district consumer disputes redressal forums at district level, state consumer dispute redressal commission have been incorporated with the help of the consumer protection Act 1986.

These consumers grievances redressal agencies have fiduciary as well as geographical jurisdictions which address consumer cases

between businesses and consumer. About 20 lakhs consumer cases addresses are heard in the district consumer forum and ~~around~~ ~~on~~ ~~Ground~~ can be heard in the State.



## ## Second Progress Report of Project work-

### # Project Methodology (work-flow)

Consumers are the largest economic group in any country. They are the central point of all economic activities. The ultimate aim of production, storage and distribution is to ensure consumption of goods & services to the satisfaction of the consumers. Consumer awareness means being conscious of having knowledge about the various consumer protection laws. Redress mechanism and the Consumer buy right to informed about the quality, price to get representation if there is any grievances or suggestion, and right to seek redress against unfair trade practice or unscrupulous exploitation. The consumer protection Act was enacted in 1986 to protect the consumers from unfair trade practice.



## # Details of Information collection | Field survey:-

A Market Analysis should include local survey research to fully understand the uniqueness of your particular market and its consumers. Consumers surveys can provide you information on when, where, why, how & for what people shop. They can reveal attitudes towards your downtown and how those attitudes affect shopping habits. Surveys also invite consumers to share their perspectives regarding the current and future economic health of a downtown or business district. Readily available demographics or life styles data from secondary sources described earlier in this toolbox cannot completely describe where local people shop or what they would like to see in their downtown.

This section provides details on what kinds of survey and questions could help your analysis and provides samples of surveys instruments for your use.



## Literature Review ~

Though the first consumer movement began in England after WWII, a modern declaration about consumer's rights was first made by the former U.S. President, John F. Kennedy before the US Congress on March 15, 1962 where four basic consumer rights were recognised i.e. the right to satisfaction of basic needs, the right to safety & the right to be informed and the right to choose. This is acted as the springboard for research in this area. After that a number of research studies have been undertaken on consumer rights.







Name:- Shivam Kewat

works at Vishal Mega Mart

प्र० आप उपभोक्ता अधिकार के बारे में क्या जानते हो?

उ० उपभोक्ताओं का अधिकार होना बहुत जरूरी है क्योंकि अगर वो होगा तो आप जो सामान की खरीदारी कर रहे हो, आप इस सामान की हर एक जानकारी प्राप्त कर सकते हैं दुकानदार से।

प्र० क्या आप जानते हैं कि किस क्वालिटी का सोना खरीदना चाहिए?

उ० हाँ, जो Hallmark का लोगो होता है वह हमें संतुष्ट करता है कि हमें इसी क्वालिटी का सोना खरीदना चाहिए।

प्र० क्या आपके या आपके कंपनी के ऊपर आज तक किसी ने Case file किया है?

उ० नहीं, किसी ने नहीं किया है। हम हर एक सामान उचित दाम पर बेचते हैं ताकि ग्राहक बार-बार हमारे ही यहाँ आएँ और हम अपने ग्राहकों को पूर्ण रूप से संतुष्ट करने की कोशिश करते हैं।

प्र० क्या ग्राहक आप से सामान की जानकारी माँगा है?

उ० कोई माँगा है और कोई नहीं माँगा।



□ \_\_\_\_\_ □ \_\_\_\_\_

Date

|   |   |   |   |   |
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Name:- Bhavik Agrawal  
Men's Selection

Q. Do you examine the expiry date of products?

A- Yes.

Q. Do you know about consumer forum?

A- No.

Q. Do you sell your product at MRP?

A- Yes, and sometime below MRP to attract consumers.

Q. What ~~do~~ you would do if other shopkeeper is exploiting a consumer?

A- I can case a file at consumer forum on him.



NAME:- NIKHIL JAIN

9 to 11 Gujarat Namkeen

Q. Do you examine expiry date of a product when you buy or sell them?

A - yes.

Q. Do you sell your products at MRP?

A - yes.

Q. what will you do if any consumer ~~cases~~ files a case against you?

A - Don't know. I'll search in internet.

Q. Do you give the bill of the consumer?

A - yes, Always.

NAME:- Abhisha vince PIVAT

Student

Q. what Do you know about consumer's Rights?

A - Every consumer should know their rights to be safe <sup>from</sup> fraudulent.







Name:- Krishnapal Singh  
Student

प्र० Consumer Protection Act क्यों लागू किया गया था भारतीय संसद द्वारा?

उ० ये जो Consumer Protection Act है इसे २५ दिसंबर 1986 को लागू किया गया था। कांग्रेस की सरकार द्वारा लागू किया गया था और उस समय के प्रधानमंत्री राजीव गांधी थे। इसे स्वीकार किया गया था क्योंकि उपभोक्ताओं को गलत तरीके से सामान बेचने और सही जानकारी न देने और उपभोक्ता का interest बचाने के लिए लागू किया गया था।

प्र० क्या आप एक इलाखरा दे सकते हैं, अगर कोई चुनने का अधिकार का हनन कर रहा है तो?

उ० अगर मैं एक दुकान में गया और मुझे कोई सामान लेना है और मैं एक सामान चुन लिया पर वह दुकानदार मुझे जबरदस्ती वाप-लाए कर रहा है कि वह इसका सामान ले लो, तो यह मेरे चुनने का अधिकार का हनन कर रहा है।

प्र० National Consumer's Rights day कब मनाया जाता है?

उ० २५ दिसंबर



## # ★ Third Progress Report of Project work

### # Details of the work completed -

It's like a task for me to visit lots of places to find peoples to gather the information related consumers right. This project has made all of us a lot to learn from it. how we should conduct survey, how to interact with unknown peoples and how to express yourself. These kinds of project would help a lot in the future.

we have also faced many difficulties to complete this project.

After visiting a lot of places with my group members we started searching for those people to whom we could ask the questions, but we could only find 1-3 person at a time/place or a day.

As of now we have gone through 8-11 surveys conducted at different ~~po~~ places. The main problem was to search for the people who could answer to us. we went to many shops like Teal stall, paan shop, samosa shop where labour gathers daily when we asked some them to answer our question they refused to answer because of their unawareness about consumers rights & consumers courts.

To talk with illiterate peoples, firstly we have to convince them that we would not take your much of time.

So far we have completed most of our project work like introduction, P1, P2 etc. it would take some more days to complete this project.

This is how I complete my side of work in this project. we learned a lot of things from this project survey.



## # Analysis of Information / data ~

Looking at the growing interdependence of the economy of the world and taking into consideration of the international character of many business practices, it is nowadays important to notice that the consumer rights protection and promotion is becoming a very high necessity. Consumers, all over the world are demanding value for their precious money in the form of quality goods & better services in true sense. Modern technological developments & innovations have no doubt made a great impact on the quality, accessibility, availability and safety of goods and services; ~~the~~ but the fact of life is that the consumers are still victims of unscrupulous & exploitative practices prevailing since many years. Consumer exploitation assumes numerous forms like adulteration of food, spurious drugs, dubious hire purchase plans, high prices, poor quality, deficient services, deceptive advertisements, hazardous products, black marketing and so on & so forth.



## # Techniques of Analysis / applied Technique:

The Methodologies for data collection through surveys contains sample questionnaires for the various types of child labour survey.

The manual aims to survey those responsible for designing and conducting consumers rights surveys & Resources collective information on all aspects of issue related to Consumers.

It specifies the essential concepts and definition and provides operational guidelines or determining the scope and content of various types of consumers rights surveys for design of the questionnaire and interview instructions & for the selection of the survey respondents. The manual will help with training personnel in the conduct of ~~and~~ ~~and~~ consumers right surveys of various types.



## # Challenges In This Project ~

- First challenge for our group is to select places where we can get more people to interact with.
- Second challenge was to prepare the questionnaire. In this we faced many challenges like what kind of question we have to design, which kind of vocabulary we can use, how many question we can ask, how to arrange question in series, some language issue.
- Third challenge was, how to communicate with those peoples, how ask those question, how to talk to them, through which technique we could get more cooperation from them and many more challenges.
- And other things about them was that some of those peoples were not able to answer our questions, some people doesn't have time to answer the question & many of them have not cooperated with us.



## • Field Project Final Report •

Consumer Report Rights is a subject that has been settled in most other countries, but there are still many people who didn't know about the topic. Every one is entitled to the same rights no matter what country they live in and should be informed of their rights. One way this can be done is by spreading awareness on consumer rights through social media.

Consumer Rights are a very important topic in India. They have been granted to the people of this country under Article 300A of the Indian constitution and are meant to provide protection against exploitative trade practices. Many people in India feel that they no longer need consumer rights because they have less money and there will be less products available to them in the future as well as with more competition from outside companies.



India is a country with a population of over 1 billion people. within this large population, there are a number of people who have not yet been informed about the rights given to them by the government. These rights are mainly outlined by the consumer protection Act and allow for consumer to sue if they were wronged by a company or retailer. ~~Imagine~~

Imagine you buy a shirt, and it falls apart after one wash. This has happened to so many people in India, especially since companies are taking advantage of the market. The majority of consumers feel that their rights are not being respected and that they are not getting what they paid for, while the government is only trying to help the companies make more profit.

We conducted the survey based on a questionnaire we prepared. Some of the questionnaire and peoples remark are as follows:-



# CONSUMER

# Rights

