PREVALENCE OF DEPRESSION IN TYPE 2 DIABETES PATIENTS IN AN URBAN AREA OF KOLAR

By

DR. ALAMELU. K, M.B.B.S.

Dissertation submitted to

Sri Devaraj Urs Academy of Higher Education and Research, Kolar, Karnataka

In partial fulfilment of the requirement for the degree of

DOCTOR OF MEDICINE

In

COMMUNITY MEDICINE

Under the guidance of

DR. MUNINARAYANA. C, M.D

DEPARTMENT OF COMMUNITY MEDICINE SRI DEVARAJ URS MEDICAL COLLEGE, TAMAKA, KOLAR-563103,

2020

SRI DEVARAJ URS ACADEMY OF HIGHER EDUCATION AND RESEARCH, KOLAR, KARNATAKA

DECLARATION BY THE CANDIDATE

I hereby declare that this dissertation titled "**Prevalence of depression in type 2 diabetes patients in an urban area of Kolar**" is a bonafide and genuine research work carried out by me under the guidance of **DR. MUNINARAYANA. C**, Professor, Department of Community Medicine, Sri Devaraj Urs Medical College, Tamaka, Kolar.

Date: **Signature of the Candidate**

Place: Kolar **Name: Dr. ALAMELU. K**

SRI DEVARAJ URS ACADEMY OF HIGHER EDUCATION AND RESEARCH, KOLAR, KARNATAKA

CERTIFICATION BY THE GUIDE

This is to certify that this dissertation titled "**Prevalence of depression in type 2 diabetes patients in an urban area of Kolar**" is a bonafide research work done by **Dr ALAMELU. K** in partial fulfillment of the requirement for the degree of **MD** in **Community medicine**.

Date:

Place: Kolar

Signature of the Guide

DR. MUNINARAYANA. C, M.D

Professor

Department of Community Medicine

Sri Devaraj Urs Medical College,

Tamaka, Kolar – 563103.

SRI DEVARAJ URS ACADEMY OF HIGHER EDUCATION AND RESEARCH, KOLAR, KARNATAKA

CERTIFICATION BY THE CO-GUIDE

This is to certify that this dissertation titled "**Prevalence of depression in type 2 diabetes patients in an urban area of Kolar**" is a bonafide research work done by **Dr ALAMELU. K** in partial fulfillment of the requirement for the degree of **MD** in **Community medicine**.

Date: **Signature of the Co-Guide**

Place: Kolar

Dr. MOHAN REDDY. M

Professor

Department of Psychiatry

Sri Devaraj Urs Medical College,

Tamaka, Kolar – 563103.

SRI DEVARAJ URS ACADEMY OF HIGHER EDUCATION AND RESEARCH, KOLAR, KARNATAKA

ENDORSEMENT BY THE HOD,

PRINCIPAL/HEAD OF THE INSTITUTION

This is to certify that this dissertation titled "**Prevalence of depression in type 2 diabetes patients in an urban area of Kolar**" is a bonafide research work done by **Dr. ALAMELU. K,** under the guidance of **DR. MUNINARAYANA.C**, Professor, Department of Community Medicine, Sri Devaraj Urs Medical College, Kolar.

Seal and signature of HOD	**Seal and signature of the Principal**
Dr. PRASANNA KAMATH. BT	**Dr. SREERAMULU. PN**
Professor and HOD,	**Principal**
Department of Community Medicine,	**Sri Devaraj Urs Medical College,**
Sri Devaraj Urs Medical College,	**Tamaka, Kolar**
Tamaka, Kolar	
Date:	**Date:**

SRI DEVARAJ URS ACADEMY OF HIGHER EDUCATION AND RESEARCH, KOLAR, KARNATAKA

ETHICS COMMITTEE CERTIFICATE

This is to certify that the ethical committee of Sri Devaraj Urs Medical College, Tamaka, Kolar has unanimously approved **Dr ALAMELU. K**, postgraduate student in the department of Community Medicine at Sri Devaraj Urs Medical College, Tamaka, Kolar to take up the dissertation work titled "**Prevalence of depression in type 2 diabetes patients in an urban area of Kolar**" to be submitted to the Sri Devaraj Urs Academy of Higher Education and Research, Tamaka, Kolar.

Signature of the Member **Secretary Signature of the Principal**

Ethical committee
Sri Devaraj Urs Medical College,
Tamaka, Kolar

Dr. SREERAMULU. PN
Principal
Sri Devaraj Urs Medical College,
Tamaka, Kolar

Date:

Place: Kolar

Date:

Place: Kolar

COPYRIGHT

DECLARATION BY THE CANDIDATE

I hereby declare that SRI DEVARAJ URS ACADEMY OF HIGHER EDUCATION & RESEARCH, KOLAR, Karnataka shall have the rights to preserve, use and disseminate this dissertation in print or electronic format for academic / research purpose.

Date: **Signature of the Candidate**

Place: Kolar **Name: Dr. ALAMELU. K**

PLAGIARISM REPORT

Sri Devaraj Urs Academy of Higher Education and Research

Certificate of Plagiarism Check for Dissertation

Author Name	Dr. ALAMELU.K
Course of Study	M.D., COMMUNITY MEDICINE
Name of Major Supervisor	Dr. MUNINARAYANA. C
Department	COMMUNITY MEDICINE
Acceptable Maximum Limit	10%
Submitted By	librarian@sduu.ac.in
Paper Title	PREVALENCE OF DEPRESSION IN TYPE 2 DIABETES PATIENTS IN AN URBAN AREA OF KOLAR
Similarity	10%
Paper ID	190593
Submission Date	2020-12-02 12:32:43

Signature of Student

Signature of Major Advisor

Professor
Dept. of Community Medicine
SDUMC, Kolar-563103

Head of the Department

Professor & HoD
Dept. of Community Medicine
SDUMC, Kolar-563103

University Librarian

Library and Information Centre
Sri Devaraj Urs Medical College

Director Of Post Graduate Studies

Director
P.G. STUDIES
Sri Devaraj Urs Medical College

* This report has been generated by DrillBit Anti-Plagiarism Software

ACKNOWLEDGEMENT

My life's guide, my provider, my friend and my all, GOD ALMIGHTY: because I owe it all to you. Many Thanks!

This work would not have been possible without the guidance and support of my guide and mentor Dr. Muninarayanana. C, professor, department of community medicine, Sri Devaraj Urs Medical College, Kolar. I am greatly indebted to him for his constant guidance throughout my M.D. course.

I owe my profound gratitude to my co-guide Dr. Mohan Reddy, professor, department of Psychiatry, Sri Devaraj Urs Medical College, Kolar for his guidance and support in completing this dissertation.

I express my heartfelt gratitude to Dr. Prasanna Kamath. BT, Dr. Ananta Bhattacharyya, Mr. Ravishankar. S and Dr. Naresh Kumar for their constant concern and advice in every step of this dissertation. I thank, Dr. Mahendra, Dr. Sunil, Dr. Waseem Anjum, Dr. Varsha R Mokhasi, Dr. Vishwas, Dr. Pradeep, Dr. Harshitha, Dr. Nagaraj and Dr. Krishna Murthy, for their continual support in completing this work.

I thank my fellow mates Dr.Swathi. HJ, Ms Ramya. N - JRF, Dr.Bhoomika. V, Dr.Sushma. A, Dr. Abhishek. SV, Dr. Anandu. SK, Dr. Ramees M Sali, Dr. Sindhu. S, and Dr. Vivek Jayan for their kind co-operation and help. I also extend thanks to Clerks, Sisters, Lab technicians and supporting staff for their kindness. Above all, I thank my parents, my children, family members, my friends, and my well-wishers for bearing me throughout.

I thank all the study participants without whom this would not have been possible.

Date: **Signature**

Place: Kolar **Dr Alamelu K**

LIST OF ABBREVIATIONS

DM – Diabetes Mellitus

WHO – World Health Organization

HbA1c – Glycated hemoglobin

T2DM – Type 2 Diabetes Mellitus

BDI – Beck Depression Inventory

BCD – Brief Case find for Depression

PHQ-9 – Patient Health Questionnaire-9

HADS – Hospital Anxiety and Depression Scale

MADRS – Montgomery Asberg Depression Rating Scale

HAM-D - Hamilton scale for Depression

CES-D – Centre for Epidemiological studies – Depression scale

GAD-7 – Geriatric Anxiety Depression-7

SMSG – Self Monitoring of Blood Glucose.

SDSCA – Self-care assessed with Diabetes Self-Care Activities

HANDS – Harvard Department of Psychiatry/National Depression Screening Day Scale

MDD – Major Depressive Disorder

ODD – Other Depressive Disorder

ECA – Epidemiologic Catchment Area

ACCORD – Action to Control Cardiovascular Risk in Diabetes

NCD – Non-Communicable Disease

BMI – Body Mass Index

WHR – Waist Hip Ratio

SDUMC – Sri Devaraj Urs Medical College

UHTC – Urban Health Training Centre

PR – Prevalence Ratio

CI – Confidence Interval

ABSTRACT

BACKGROUND AND OBJECTIVE

Diabetes, which is a chronic ailment, affects almost all organs of the human body. India has the second largest number of diabetic populations in the world, there are about 73 million people with diabetes. Depression is a major public health problem and a common mental illness WHO has identified strong association between depression and chronic illness and in specific to Diabetes. Depression is commonly seen in people with diabetes, and usually worst outcome of diabetes is seen if it's co-existing with depression. The coexistence of Diabetes and depression is significantly associated with increased risk of morbidity and mortality. The available data regarding the prevalence of depression in type 2 diabetes mellitus (T2DM) patients in the community in India are limited. So, this study was undertaken with the following objectives:

Among the Type 2 Diabetes mellitus individuals residing in the urban field practice area of Sri Devaraj Urs Medical College, Kolar

1. To estimate the prevalence of Depression.
2. To study the various socio-demographic and disease related factors associated with Depression.

METHODS

This community based cross-sectional survey was carried out in Urban field practice area of department of Community Medicine, SDUMC, Kolar, during the period of

January 2020 to June 2020. Sample size 310, calculated with prevalence of 41%, absolute precision of 6% and non-compliance 20%, eligibility screening was conducted by visiting all 1083 houses in Gandhinagar, Kolar. Known people with T2DM were enlisted, there were 311 households with T2DM patients, so universal sampling was followed and all 311 were included in the study. A pretested semi structured interview questionnaire was used to collect the information. PHQ-9 questionnaire was administered to know the depression status. Clinical examination, anthropometric measurements and capillary blood sugar testing were conducted on the study participants. Data collected was entered in Epidata and analysis was made using SPSS version 22. and STATA version 12.

RESULT

Out of 311 T2DM patients male and female participants were almost equal, in which males were 51.8%, with majority of them 46.3% were 60 years and above, nearly three fourth of them 72.3% were married, half of them 53.7% belonged to upper middle class according to Modified BG Prasad classification. Around 97.4% of the diabetic patients were on regular treatment and 89.4% of them were on oral medication, 45.0% participants gave history of presence of co-morbid conditions and more than half of the study participants 59.5% were known cases with complications of T2DM. 25.7% of the participants had mild depression, 14.8% had moderate depression, 3.2% had moderately severe depression and 0.3% had severe depression. In adjusted PR marital status, treatment modality and complications of

diabetes had association with depression, which was found to be statistically significant, p value ≤ 0.05.

CONCLUSION

Among the study participants 44.1% of the patients with T2DM had Depression. T2DM patients living in loneliness (unmarried, widow/widower and separated), who had complications of diabetes and who were on insulin were found to have association with depression.

RECOMMENDATIONS

As PHQ-9 is simple and easy tool, it can be administered by nursing staff or Medical officer to screen for depression in diabetes at primary care level. Identifying depression and treating them will improve the quality of life of diabetes patients and will reduce the overall treatment costs.

KEYWORDS

Depression, T2DM patients, Depression in Diabetes, PHQ-9

TABLE OF CONTENTS

SL.NO.	CONTENTS	PAGE NO.
1	INTRODUCTION	1-4
2	OBJECTIVES OF STUDY	5-6
3	REVIEW OF LITERATURE	8-48
4	MATERIALS AND METHODS	50-59
5	RESULTS	61-89
6	DISCUSSION	91-105
7	SUMMARY	106-108
8	CONCLUSION	109-110
9	RECOMMENDATION	111
10	REFERENCES	113-124
11	ANNEXURE	126-145

LIST OF TABLES

No	TITLE OF THE TABLE	PAGE No.
1	Prevalence of Depression in T2DM Globally	19
2	Prevalence of Depression in T2DM in Indian Studies	22
3	Joint National Committee 8 classification of hypertension	54
4	WHO Body Mass Index classification	55
5	WHO classification of waist-circumference	56
6	WHO classification of waist-hip ratio	56
7	Classification of random blood sugar levels	57
8	Distribution of study participants according to Gender	61
9	Distribution of study participants according to Age	61
10	Distribution of study participants according to Marital status	62
11	Distribution of study participants according to Occupation	62
12	Distribution of study participants according to Education	63
13	Distribution of study participants according to Modified BG Prasad classification of Socio-Economic Status	64
14	Distribution of study participants according to alcohol consumption	65

15	Distribution of study participants according to history of type 2 diabetes in the family	66
16	Distribution of women study participants according to history of consumption of OCP	66
17	Distribution of study participants according to Adequate Physical activity (150 mins/wk)	67
18	Distribution of study participants according to Good dietary practice	67
19	Nutritional status of the studied T2DM patients at Gandhi Nagar	68
20	Anthropometric characteristics of study participants with T2DM at Gandhi Nagar	68
21	RBS level of the studied T2DM patients at Gandhi Nagar	69
22	Treatment modality of study participants with Type 2 Diabetes Mellitus in urban field practice area of Kolar	69
23	Treat compliance of study participants with Type 2 Diabetes Mellitus in urban field practice area of Kolar	70
24	Other modes of treatment followed by study participants with Type 2 Diabetes Mellitus in urban field practice area of Kolar	70
25	Co - morbities of T2DM in study participants in urban field practice area of Kolar	72
26	Distribution of study participants based on Patient health questionnaire 9 screening tool for Depression	72

27	Proportion of levels of depression scoring according to PHQ – 9 in patients with Type 2 Diabetes mellitus in urban field practice area of SDUMC, Kolar	75
28	Distribution of depression in T2DM patients according to Marital status	78
29	Distribution of depression in T2DM patients according to Mode of treatment	81
30	Socio-demographic factors associated with Depression among T2DM patients in urban field practice area of Kolar	82
31	Habits related factors associated with Depression among T2DM patients in urban field practice area of Kolar	84
32	Disease related factors associated with Depression among T2DM patients in urban field practice area of Kolar	86
33	Socio-demographic and disease related factors associated with Depression among T2DM patients in urban field practice area of Kolar	88

LIST OF FIGURES

No.	TTITLE OF FIGURES	PAGE No.
1	Pathophysiology of Type 2 diabetes	9
2	Psychological factors and reactions with negative outcomes in patients with diabetes	12
3	Summary of shared pathogenic mechanisms in the depression–diabetes association covered at the International Conference on Depression and Diabetes	17
4	Map of Karnataka showing Kolar district	50
5	Distribution of study participants according to Percentage of usage of tobacco	65
6	Complications of T2DM in study participants in urban field practice area of Kolar	71
7	Proportion of levels of depression according to PHQ - 9 in patients with Type 2 Diabetes mellitus in urban field practice area of SDUMC, Kolar	76
8	Distribution of depression in T2DM patients, according to Age	77
9	Distribution of depression in T2DM patients, according to Gender	77
10	Distribution of depression in T2DM patients, according to Education	78
11	Distribution of depression in T2DM patients, according to Occupation	79
12	Distribution of depression in T2DM patients, according to H/o of T2DM Complication	80
13	Distribution of depression in T2DM patients, according to Duration of T2DM	80

LIST OF ANNEXURES

SL NO.	TITLE OF ANNEXURES	PAGE No.
1	ELIGIBILITY SCREENING PROFORMA	126
2	PROFORMA FOR DATA ACQUISITION	127
3	PATIENT HEALTH QUESTIONNAIRE -9	130
4	INFORMATION SHEET	131
5	INFORMATION SHEET – KANNADA	133
6	INFORMED CONSENT FORM	134
7	INFORMED CONSENT FORM – KANNADA	135
8	OPERATIONAL DEFINITIONS OF VARIABLES UNDER STUDY	136
9	MAP SHOWING KARNATAKA STATE AND KOLAR DISTRICT IN KARNATAKA	139
10	INSTITUTIONAL ETHICS COMMITTEE CERTIFICATE	140
11	DATA ACQUISITION IMAGES	141
12	GANTT CHART	142
13	MASTER CHART	143-145

INTRODUCTION

1. INTRODUCTION

Diabetes mellitus (DM) is a chronic endocrine disease caused due to either failure of pancreas to produce insulin (type 1) or inability of body to utilize the produced insulin (type 2).[1] The World Health Organization (WHO) projected that 300 million people will suffer from diabetes by 2025.[2] India has the second largest number of diabetic populations in the world making it a capital for Diabetes.[2] In India there are about 73 million people with diabetes and another 37 million with pre-diabetes and approximately 47% of the cases with diabetes are undiagnosed. International Federation of Diabetes says that the prevalence of DM has already reached its epidemic level globally.[3] The increase in prevalence has been attributed mainly to the rapid urbanization, sedentary life style, smoking, obesity and economic development.[4][5] Indians have the phenotype characterized by low body mass index, high upper body adiposity, high level of Insulin resistance which increases their susceptibility for Diabetes.[2] DM is not only a public health threat as a disease by itself but also worrisome because of the concomitant comorbid conditions which are usually seen in the patients with diabetes.[1]

Diabetes, which is a chronic ailment affects almost all organs of the human body.[2] Depression is one among the most common chronic mental illnesses globally and in India.[6] WHO has identified strong association between depression and chronic illness and in specific to Diabetes.[7] Series of epidemiological studies demonstrated that depression is more likely to occur in people with diabetes regardless of whether the individuals are aware of their diabetes status.[8] The depression in diabetic patients is a chronic and severe

condition. Occurrence of depression is two to three times higher in patients with diabetes mellitus. Depression is not just a single episode; in about 60-65% of patients with diabetes they get more than one episode of depression. The prevalence rates of depression are higher in patients with type 1 diabetes compared with type 2 diabetes.[9]

Comorbid diabetes with depression is an utmost clinical challenge as the outcomes of both conditions are worsened by the other.[10] Chronic hyperglycemia seen in diabetes, causes significant changes in their mood & cognitive state which is associated with depression. Diabetes with HbA1c in non-diabetic range exhibit lesser symptoms of depression than with diabetes with high HbA1c level.[5] The prevalence of depression is higher in diabetes patients who have long-term complications.[11] Complications of Diabetes such as retinopathy, neuropathy and nephropathy can worsen the severity of depression.[12] Depression is identified as a high risk factor for all-cause of mortality in diabetes patients with complication.[13] The health care cost increases by 86% for patients with Diabetes and depression than with patient with diabetes alone.[14]

Treatment for depression with Cognitive behaviour therapy and medication aids in enhancing glycemic control and also treats depression in diabetes patients. Depression tends to recurrence after remission in up to 80 % of treated patients with diabetes in a five-year period.[15]

Patient with diabetes and depression show poor self-management, unhealthy food habits, weight gain and poor adherence to treatment when compared with patient with diabetes alone.[16] There is a bidirectional association between

diabetes and depression, a complex relation that might share biological mechanisms.[9] Depression may cause poor diabetic outcome and in same way diabetes and its complication may cause poor outcome of depression. [17][18]

Co-existence of diabetes and depression reduce the quality of life of an individual, so both the disease conditions has to be identified in an individual and treated simultaneously, in order to reduce depression and for better control of diabetes.[9]

OBJECTIVES OF STUDY

2. OBJECTIVES OF STUDY

The study conducted among the Type 2 Diabetes mellitus individuals residing in the urban field practice area of Sri Devaraj Urs Medical College,

1) To estimate the prevalence of Depression.

2) To study the various socio-demographic and disease related factors associated with Depression.

REVIEW OF LITERATURE

3. REVIEW OF LITERATURE

3.1. DIABETES

3.1.1. HISTORY OF DIABETES

Diabetes mellitus was first mentioned in Ebers Papyrus, which gives remedies for excessive urination; Hippocrates encouraged the notion of preventive medicine. He emphasized the effect of diet, exercise, and lifestyle on health. Galen mentioned the illness as “diarrhoea of urine” and “the thirsty disease.” Hindu physicians Charaka, Susruta, and Vaghbata described polyuria and glycosuria. They observed the attraction of ants and flies towards urine of those diseased. It was Thomas Willis and Matthew Dobson who established the diagnosis of diabetes by demonstrating the presence of sugar in urine and blood. In University of Toronto in Macleod’s lab Banting in togetherness with Best and Collip discovered Insulin for which in 1923 Macleod and Banting were awarded Nobel Prize.[19]

3.1.2. PATHOPHYSIOLOGY OF TYPE 2 DIABETES

The pathophysiology of type 2 diabetes mellitus, it affects multiple organs and systems. Pancreatic alpha and beta cells, liver, adipose tissue, skeletal muscle, kidney, gastrointestinal system and central nervous systems contribute in the development and progression of the disease in human beings.[20]

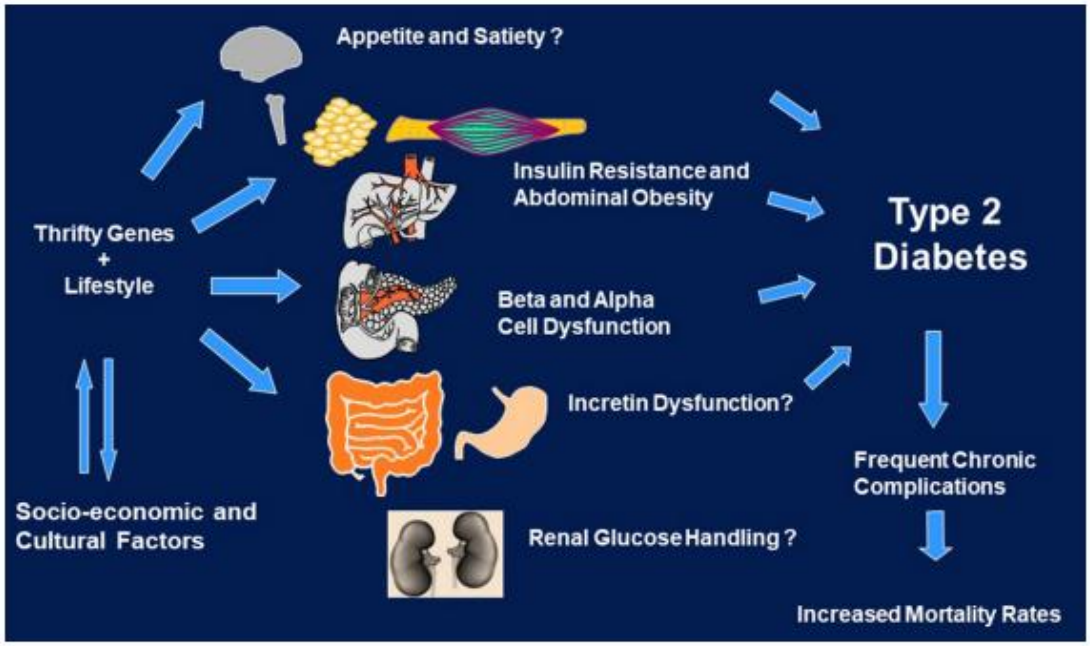


Figure 1 Pathophysiology of Type 2 diabetes

3.1.3. EPIDEMIOLOGY OF DIABETES

In the world, approximately 463 million adults are living with diabetes, according to the latest 2019 data from the International Diabetes Federation.[21] The prevalence is increasing rapidly, the numbers are expected to almost double by 2030. [3][21] Type 2 diabetes makes up about 85-90% of all cases.[22] The WHO found, diabetes has caused about 1.5 million deaths in the year 2012, making it 8th leading cause of mortality.[23] However another 2.2 million deaths worldwide were attributable to high blood glucose and the increased risks of associated complications and co-morbidities (e.g. heart disease, stroke, kidney failure) which often result in premature death and are often listed as the underlying cause on the death certificates rather than diabetes.[23] Diabetes is present all over the world, but is more usual (especially T2DM) in the better developed countries. However increase in prevalence is occurring in under developed countries especially in Asia and Africa.[23][24] The

increase of incidence in developing countries follows the trend of urbanization and lifestyle changes, including increasing sedentary lifestyles and the global nutrition transition, marked by increased intake of foods that are high energy-dense but of poor nutrients.

India has large number of diabetics than other countries of the world, according to the International Diabetes Foundation.[25][26] Currently more than 62 million Indians were affected with diabetes, that is more than 7.2% of adult population. Average age of onset is 42.5 years.[25] Nearly 1 million Indians die due to diabetes every year.[25]

India is expected to be home to 109 million individuals with diabetes by 2035, according to Indian heart Association. Study done by American Diabetes Association.[27] High incidence is due to a combination of genetic susceptibility, adoption of high-calorie diet, low physical activity by Indian middle class.[28]

In Karnataka, prevalence of self-reported Diabetes in urban area was found to be 6.1% and newly diagnosed Diabetes was 5%, whereas in rural self-reported Diabetes was 2.5% and newly diagnosed Diabetes was 3%.[29]

In Kolar rural, a study by Muninarayana et. al found the prevalence of hyperglycemia to be 10% by screening the participants capillary blood sugar level. Among the interviewed population half of them had some awareness about diabetes and its symptoms. But three forth (75%) of them were not aware of the long term effects of diabetes complication and diabetic care.[30]

3.1.4. ECONOMIC BURDEN OF DIABETES

Study by Charles et al on economic burden of diabetes in India, found that 62% of the total direct cost were drug costs INR 3,076, 61% of the total indirect cost INR 1,263, while the remainder INR 823 (39%), was due to income loss of the job.[31]

Study done in Mangalore, Karnataka found that total expenditure on diabetes is 912 INR for each visit, the direct cost on healthcare for diabetic individuals was 553 INR, and indirect expenditure was 359 INR. The average time lost on each visit- 2.6 hours which included travel time, waiting period and consultation.[32]

Average percentage of direct and indirect cost of income was 3.6% and 1.4%. The treatment cost for those in Socio-economic class I was 1.3%, in class II it was 1.7%, in class III was 3.7% and among class IV was 23.7% of the annual income.[33]

3.2. PSYCHOLOGICAL REACTION IN PATIENTS WITH DIABETES

Diabetes is a metabolic disorder that will influence physical, social and mental including psychological well-being of people. In addition to this psychosocial problems that are common in diabetes patients often lead to serious negative impact on patient's well-being and social life, if left un-addressed. The patient's perception about the seriousness of diabetes will affect the way they cope with the disease.[34] Several psychological factors contribute to affect the emotional and psychological well‐being of a person with diabetes. These include degree to which an individual accepts his/her diagnosis, how the individual adjusts to the demands of self‐care routine, and finally how he/she copes with progression of the condition, which potentially includes the development of diabetes‐related

complications. Depression is the most seen psychiatric disorder in people with diabetes, with an estimated 41% of patients suffer from poor psychological well‐being and elevated rates of depression and anxiety disorders. People with type 2 diabetes have 24% of higher risk of developing depression and therefore the co-morbid conditions of depression and diabetes needs a careful attention. [34]

Anxiety is another common psychological disorder in patients with diabetes.[34]Evidence from a systematic review reported higher prevalence of anxiety in diabetes patients with 14% of patients suffering from generalized anxiety disorder, 27% with sub‐syndromal anxiety disorder, and 40% with elevated anxiety symptoms than those without diabetes.

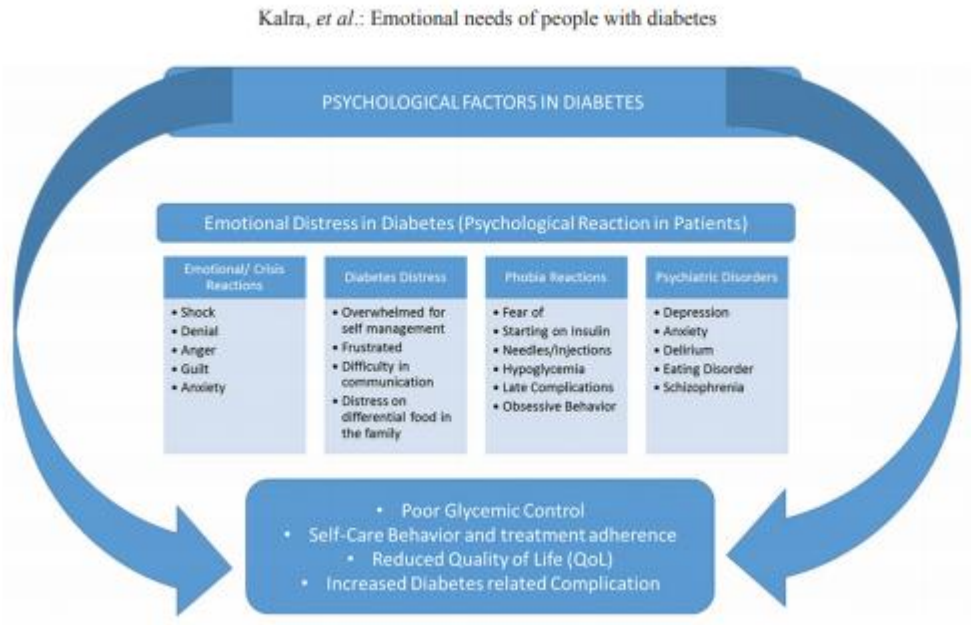


Figure 2 Psychological factors and reactions with negative outcomes in patients with diabetes

3.2.1. DEPRESSION

Depression is one of the major public health problem and a common mental illness characterized by persistent sadness, loss of interest in activities which usually people enjoy doing, decrease in quality of life including higher health care utilization and costs and disability.[7] All through the world, more than 264 million people of all ages suffer from depression. Depression is one of the major causes of disability throughout the world and considering the global burden of the disease, it is one of the leading contributors. Depression can lead to suicide,[35] Close to 800 000 people die due to suicide every year. Suicide is the second leading cause of death in 15-29-year-olds.[36] The women are affected more commonly by depression than men. For moderate and severe depression there are effective psychological and pharmacological treatments available.[35]

Depression is a mood disorder that causes persistent feeling of sadness and loss of interest among people. To diagnose major depression, patient must have anhedonia or depressed mood and at least 5 of the 9 symptoms nearly every day for minimum of 2 weeks:

- Depressed mood
- Marked diminished interest/pleasure
- Sleep disturbance
- Appetite disturbance
- Fatigue/loss or energy
- Diminished concentration or indecisiveness

• Feelings of worthlessness or guilt

• Psychomotor retardation or agitation

• Recurrent thoughts of suicide or death

They also experience functional impairment related to these depressive symptoms. Decrease in self-efficacy, motivation, and ability to participate in self-care all this characteristics indicate underlying depressive symptoms.

Even though depression can be treated successfully, many older adults suffer from chronic and recurrent depression. The symptoms of late-life depression are frequently attributed to normal aging, grief, physical illness or dementia. providers and patients often miss out on important opportunities to start treatment for a treatable health issue.[37]

Prospective study on courses of major depression says approximately 85% of individuals who recover from depression experience recurrence within 15 years, meta-analyses of chronic depression in community sample and primary care attributes that about one of the three depressed older adults experience chronic and persistent depression.[37]

Moreover, these patients with depression are at high risk for subsequent development of major depression and may also develop suicidal ideation.[37]

3.3.1. HISTORY OF DEPRESSION IN DIABETES:

Association between mental illness and diabetes has been identified since many years. In 17th century, Thomas Willis, a famous anatomist and founding member of the Royal Society, reported how '*diabetes is a consequence of prolonged sorrow*'. Later, in 1879, Henry Maudsley constructed the link by stating: '*Diabetes is a disease which often shows itself in families in which insanity prevails. Whether one disease predisposes in any way to the other or not, or whether they are independent outcomes of a common neurosis, they are certainly found to run side by side, or alternately with one another more often than can be accounted for by accidental coincidence or sequence.*' There were also overlaps in the treatment of diabetes and psychiatric illnesses. Before the discovery of insulin and antipsychotics, both conditions were together treated with Heroin; there is a case report by Monsieur Lepine in 1898 describes how heroin was given to a man with diabetes.[38]

3.3.2. DEPRESSION IN DIABETES

Depression is twice more common in type 2 diabetes than the general population and it is associated with adverse health outcomes.[39] Diabetes and depression are one of the most important public health problems in both advanced and emergent nations.[40]

Depressed patients with DM are at greater risk for a chronic course of depression or less complete recovery, Chronicity in turn, makes it more difficult for older adults and their family caregivers to optimally self-manage DM.[37]

In the older adults with DM, depressive symptoms may be overlooked because they are assumed to be due to concurrent DM and other medical illnesses. Many of the symptoms of depression such as lower energy, fatigue, loss of appetite, and sleep disturbance are also associated with DM. Thus differentiating stress related to DM self-management and depression can be challenging. [37]

Meta-analysis of 11 studies including nearly 50,000 people with type 2 diabetes but without depression at baseline has indicated that the incidence of depression is also 24 % higher in people with diabetes.[41]

Relapse rate for diagnosed major depressive disorder of 79 % over a 5-year period , These data are in contrast to general population studies that suggest a depressive episode usually lasts 8–12 weeks indicating that in people with diabetes depressive episodes are more long lasting and more likely recurrent.[40] A meta-analysis of 9 cohort studies found that adults with depression had a 37 % increased risk of developing type 2 diabetes.[41]

3.3.3. PATHOPHYSIOLOGY OF DEPRESSION IN DIABETES

The relationship between diabetes and depression, shared biological and behavioral mechanisms, such as hypothalamic-pituitary-adrenal axis activation, inflammation, autonomic dysfunction, inactive lifestyle, sleep disturbance, poor dietary habits, and environmental and cultural risk factors, are important for understanding the link between depression and diabetes.[10]

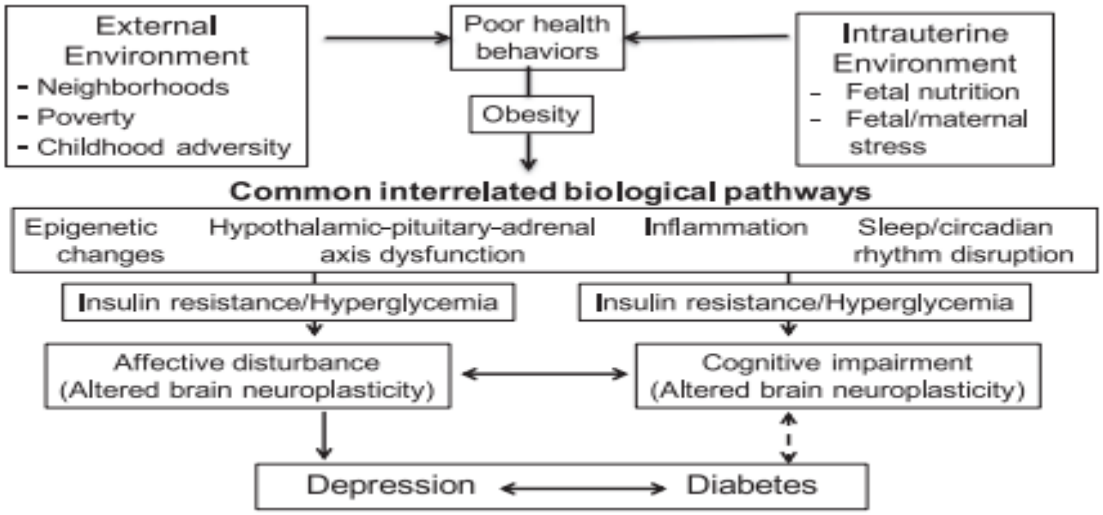


Figure 3 Summary of shared pathogenic mechanisms in the depression–diabetes association covered at the International Conference on Depression and Diabetes.[39]

a. HYPERGLYCEMIA AND DEPRESSION

Hyperglycaemia can be used a regulator for mood states. The factors like fluctuations in plasma glucose as well as prolonged hyperglycaemia, as reflected in high HbA1c levels, may be involved in the development of depression in type 2 diabetes. The brain is vulnerable to fluctuations in plasma glucose levels because neurons do not possess an active glucose transporter. That will result in high plasma glucose levels will have a direct effect on intraneuronal glucose levels. On a cellular level, these high intracellular glucose levels can activate the polyol pathway, which can induce oxidative stress and the formation of advanced glycation end products (AGEs), and both may lead to neuronal damage, which may lead to depression. In addition, increasing evidence suggests that

hyperglycaemia leads to increased levels of cortisol, which is known to be involved in the development of depression.[39]

b. DIABETES, DEPRESSION, AND MICROVASCULAR DYSFUNCTION:

The vascular depression hypothesis says that vascular damage in frontal and subcortical regions of the brain, which are involved in mood regulation, may result in depression in later life. The vascular depression hypothesis is relevant in type 2 diabetes because diabetes is having a strong link to cerebrovascular damage. the pathways of microvascular dysfunction and arterial stiffening, are considered crucial pathways early in the development of cerebrovascular damage and are known to be strongly related to diabetes as well, thus linking diabetes and depression.[39]

c. LOW-GRADE INFLAMMATION, DIABETES, AND DEPRESSION:

Low-grade inflammation is considered a key mediator of many chronic conditions. Type 2 diabetes is well known to be accompanied by systemic low-grade inflammation, which is considered an important mechanism in the development of its cardiovascular complications. Although there is less extensive evidence for depression, low-grade inflammation is indeed associated with depression, thus may represent a common biological pathway in the development of both type 2 diabetes and depression.[39]

d. DEPRESSION AND DIABETES IS BIDIRECTIONAL:

Diabetes and depression, both have an association with HPA axis dysfunction, which manifests as subclinical hypercortisolism, blunted diurnal cortisol rhythm,

or hypocortisolism with impaired glucocorticoid sensitivity, and increased inflammation.[42]

Depression is associated with the diurnal cortisol curve, including a blunted cortisol awakening response and flattening of the diurnal cortisol curve. Flattening of the diurnal cortisol curve is also associated with insulin resistance and type 2 diabetes mellitus.[42]

3.3.4. EPIDEMOLOGY OF DEPRESSION IN DIABETES

a. PREVALENCE OF DEPRESSION

In the various studies conducted on the prevalence of depression among T2DM patients, the prevalence of depression was found to vary between 11% and 83.8%. with majority of the studies having prevalence of depression more than 40%. The observed variation of high range of prevalence of depression could be due to selection bias as most of the studies were done in hospital settings which attracts participants with active symptoms who are more likely to attend to health care centres.

PREVALENCE OF DEPRESSION IN T2DM PATIENTS GLOBALLY

TABLE 1: PREVALENCE OF DEPRESSION IN T2DM PATIENTS GLOBALLY

First Author	Year	Study site	Study tool	Study setting	Prevalence (%)
Park CY[43]	2015	South Korea	BDI	Community based	28.8%
Nanayakkara[44]	2018	Australia	BCD	Hospital based	29%

Akpalu J[45]	2018	Ghana	PHQ9	Hospital based	31.30%
Pahari DP[46]	2018	Nepal	BDI	Hospital based	34.0%
Arshad AR[47]	2016	Pakistan	PHQ9	Hospital based	38.35%
Giorgis TW[48]	2016	Ethiopia	PHQ9	Hospital based	40.40%
Chew BH[49]	2016	Malaysia	PHQ9	Hospital based	41.70%
Shasha Y[50]	2016	China	PHQ9	Community Based	44.30%
AlBekairy A[51]	2017	Saudi Arabia	HADS	Hospital based	53.80%
Kamrul AB[52]	2019	Banglades h	PHQ9	Hospital based	60.3%
Mukeshimana M[53]	2019	Rwanda	PHQ9	Hospital based	83.80%

This table shows the variation in prevalence of depression among T2DM patients across different parts of the world, which ranges from 28.8% to 83.8% in the various epidemiological studies carried out, where most of the studies were hospital based studies which was published between the year 2015 to 2019, in these studies screening for depression was done by using various screening questionnaire[43,44,53,45–52]

In a study by Park et al in South Korea using Beck Depression Inventory (BDI) scale, prevalence of depression in diabetes was found to be 28.8%.[43] Similarly in a study done in Australia prevalence of depression in diabetes was found to be 29% using The Brief Case find for Depression (BCD).[44] where as in a study by

Abdul et al in Pakisthan using PHQ-9, Prevalence of depression in diabetes was found to be 38.35%.[47] and the study by Shasha et.al in China, depression was found to be 44.3%.[50] At the same time there were studies showing depression at a higher range; in which more than 50% of diabetes were depressed. To mention a few, a study done in Saudi Arabia using Hospital Anxiety and Depression Scale (HADS) found depression to be 53.8%.[51] and a study by Kamrul et al in Bangladesh shows depression to be 60.3%.[52] Prevalence of depression in diabetes in Rwanda using PHQ-9 was found to be 83.8%.[53] this shows a wide range of prevalence of depression among diabetes patients around the globe.

In these studies we observe different types of depression screening tools being used to mention it, In Nepal and South Korea Beck Depression Inventory (BDI) scale has been used, in Australia we see Brief Case find for Depression (BCD) scale been used , in the study done in Saudi Arabia; Hospital Anxiety and Depression Scale (HADS) was used and in most the studies we find Patient Health Questionnaire-9 being used to mention few Malaysia, Rwanda, China, Ethiopia, Pakisthan; this showsPHQ-9 is more commonly used in Asian and African region. At the same time in S.Korea and Nepal which is again Asian countries where we see BDI scale being used. [43,44,53,45–52]

Most of these studies were done in hospitals and only very few studies were done in the community to tell it, it was in South Korea and in China. [43,44,53,45–52]

b. PREVALENCE OF DEPRESSION IN T2DM PATIENTS IN INDIAN STUDIES:

TABLE 2: PREVALENCE OF DEPRESSION IN T2DM PATIENTS IN INDIAN STUDIES

First Author	Year	Study site	Study tool	Study setting	Prevalence (%)
Ravishankar, SN[54]	2014	Bangalore	MADRS	Hospital based	11.6%
Ali N[55]	2013	Delhi	MINI	Hospital based	27%
Neeraj K[56]	2020	Himachal Pradesh	HAM-D	Hospital based	32.7%
Samreen S[57]	2014	New Delhi	PHQ9	Hospital based	35.8%
Aminu AS[1]	2017	Manipal	PHQ9	Community based	37.5%
Amir M[58]	2016	Uttar Pradesh	HAM-D	Hospital based	38.8%
Raval A[59]	2010	Chandigarh	PHQ9	Hospital based	41.0%
Rupesh C[60]	2017	Punjab	HAM-D	Hospital based	42.0%
Hritu S[61]	2014	Madhya Pradesh	CES-D	Hospital based	42.2%
Joseph N[62]	2013	Mangalore	PHQ9	Hospital based	44.2%
Suravi P[63]	2020	Odisha	PHQ9	Hospital based	50.3%
Akhilesh J[64]	2015	Rajasthan	PHQ9	Factory	53.0%
Khullar S[65]	2016	Punjab	PHQ9	Hospital based	57.3%
Madhur V[66]	2019	Punjab	GAD7	Hospital based	58.1%
Prerna B[67]	2017	New Delhi	PHQ9	Hospital based	63.0%
Thour A[68]	2015	Chandigarh	PHQ9	Hospital based	71%

[43,44,53,45–52][1,54,63–68,55–62]

Here is a table showing the variation in prevalence of depression among T2DM patients across different parts of India, which ranges from 11.6% to 71.0%, these

epidemiological studies carried out in India, was published between the year 2010 to 2020, we found most of the studies were hospital based studies, in these studies screening for depression was done by using various screening questionnaires. [1,54,63–68,55–62]

In a study done in Bangalore by Ravishankar et. al, prevalence of depression in diabetes was found to be 11.6%. whereas in a study by Ali et.al done in Delhi, prevalence of depression in diabetes was found to be 27%. In the studies done in Himachal Pradesh, Manipal, New Delhi and Uttar Pradesh prevalence of depression ranges between 30 to 40 percent. Here we find most of the studies have prevalence of depression more than 40% and can be as high as to 71%. In out of 16 studies which was reviewed for literature search in 6 studies it was found that more than 50% of diabetes patients were depressed. [1,54,63–68,55–62]

In these studies it was noticed different types of depression screening tools being used to assess the depression among T2DM patients they are, Montgomery Asberg Depression Rating Scale (MADRS) used in a study done in Bangalore, Mini International Neuropsychiatric Interview (MINI) scale being used by Ali et. al in a study done in Delhi, Hamilton scale for Depression (HAM-D) was used in couple of studies done in Punjab and Himachal Pradesh and Centre for Epidemiological studies – Depression scale (CES-D) scale was used in a study done in Madhya Pradesh and also Geriatric Anxiety Depression-7 (GAD-7)scale been used in study at Punjab. Patient Health Questionnaire-9(PHQ-9) scale was used in most of the studies done in India, that is in 10 out of 16 studies reviewed we noticed

PHQ-9 scale being used to primarily diagnose depression in Diabetes patients. [1,54,63–68,55–62]

Most of these studies were done in hospitals and it was found among the reviewed studies only couple of studies were done in the community to mention it, study done in Manipal by Aminu et al. it was done in urban and rural area of Manipal and the other study was done in Rajasthan among factory workers. [1,54,63–68,55–62]

c. GENDER

In various studies on prevalence of depression in T2DM patients, some studies noted that proportion of male were higher than female[46][43] [62][65] and in some studies proportion of female were higher than male. [59][1]

Study done in Mangalore by Joseph et al. reported that 51.7% of the study participants were male. [62] Similarly, a study conducted in Punjab by Khullar et al. reported that 50.95% of the study participants were male. [65] 50.2% of the participants were male in the study in Nepal by Pahari et al.[46] In the study in Korea by park et al. 58.5% of them were male.[43]

In the study in Manipal by Aminu et al. reported that 54% of the study participants were female.[1] Study by Raval et al. in Chandigarh, it was found that 51% of the participants were female in the participants with depression in diabetes. [59]

In the various studies on prevalence of depression in T2DM patients, it was observed that in majority of the studies depression was more in female compared to male, it was noted that out of the reviewed articles only in one article male gender had more depression in T2DM patients than in females.

Study conducted in Punjab by Khullar found 65% of female participants had depression, which was similar to study by Amir in Aligarh where 58% of females had depression, study by Neeraj in Himachal too found 57.6% of female T2DM patients were depressed, also in the study by Joseph in Mangalore found 53.1% of females had depression and in the community based study by Aminu in Manipal too observed 68.9% female participants with T2DM was depressed.

Whereas in the study done in Odisha by Suravi found depression was more in male T2DM patients than females, where 56% of male participants had depression.

It was also found in the studies done in Ghana, China, Punjab, Mangalore and Bangalore showing significant association between depression and female gender among T2DM patients. [45][49][53][61] whereas in the study in Odisha showed association between male gender and depression in T2DM patients which was found to be statistically significant p value ≤ 0.05.

d. AGE

In almost all studies done on prevalence of depression in T2DM patients it was found that higher proportion of diabetic patients were of old age more so, 60 years and above. But the proportion of participants with depression was found

to vary across age, in some studies middle age people were found to be more depressed compared to young and old age, in certain studies elderly were found to be more depressed than young and middle aged T2DM patients.

In the study by Joseph et al. in Mangalore it was found that 26.8% were 60 years and above.[62] In community-based study done in Manipal by Aminu et al. it was found that 37% of the study participants were more than 66 years of age.[1] In the study done by Park et al. in Korea it was found that 32.5% were 60 years and above.[43] In a hospital-based study done in Nepal by Pahari et al. it was found that 33.5% of the study participants were 60 years and above.[46]

In the study by Neeraj in Himachal Pradesh depression was found to be more among elderly, 63.6% who were aged $\geq$50 years were depressed than who were less than 50 years, in the study by Joseph in Mangalore 59.7% of the elderly who were aged > 60 years were depressed than who were aged $\leq$ 60 years, similarly in the study by Aminu in Manipal, it was found that there is 1.5 fold increase in odds of depression among participants aged $\geq$65 years than who were <65 years of age.

Whereas in the study by Suravi in Odisha it was found 52.6% of participants aged 45-59 years were more depressed compared to who were aged $\geq$ 60 years. Similarly in the study by Pahari in Nepal it was found 79.3% of T2DM patients aged 45-59 years were more depressed compared to who were $\geq$ 60 years of age.

Depression was found to be significantly associated with elderly and it was seen in the studies done in Ethiopia, in Chandigarh by Amit, by Aminu in Manipal and in the study done in Mangalore by Joseph. [47] [58] [62]

e. MARITAL STATUS

It was observed in almost all studies done on prevalence of depression among T2DM patients, married people were in high proportion than unmarried, widow, separated and divorced people.

It was noticed in some studies depression was found to be more among unmarried, widow, separated and divorced people than among married people, in certain other studies depression was found to be more among married than among unmarried, widow, separated and divorce.

In the study in Mangalore by Joseph et al. shows 93.5% of them were married.[62] In Manipal by Aminu et al. shows 69.5% of them were married. [1] Similarly in the study done in Nepal by Pahari et al. shows 89.1% of them were married, [46] and also in a study in Korea by Park et al. showed 89.9% of them were married.[43]

In the study conducted in Aligarh by Amir, depression was found to high, 40% among married participants. Similarly in the study by Suravi in Odisha 66.2% of the married participants were in depression and the similar was also observed in the study at Mangalore by Joseph where 46.5 % of the married were depressed.

On the other side in the study by Aminu, 45.9% of who were unmarried, widow, separated and divorce were more depressed, similar findings was observed in the study by Pahari in Nepal where 55% of the participants who were unmarried, widow, separated and divorce were more depressed.

In the studies done in Ghana, Malaysia and Nepal it was found that there is a strong association between depression and in patients living alone (unmarried, widow, separated and divorced). [44] [48]

f. OCCUPATIONAL STATUS

It was observed most of the study participants were unemployed which includes home maker and retired people in the studies done on prevalence of depression among T2DM patients.

In most of the studies it was observed that study participants who were unemployed are more depressed compared to those who were employed.

In the study done in Manipal by Aminu et al. it was found that 69% of them were unemployed[1] whereas in the hospital-based study done in Mangalore by Joseph et al. it was found that 29.1% of the study participants were unemployed.[62]

In a study done in Korea by Park et al. 49.3% of them were found to be unemployed.[43] Similarly in a study done in Nepal by Pahari et al. it was found that 59.6% were unemployed which includes home maker and retired people.[46]

In the study by Joseph in Mangalore 62.5% of the unemployed were found to be depressed, similarly in the study by Aminu in Manipal 56.1% of the unemployed were depressed. Whereas in the study by Pahari at Nepal 55% of the Agriculturist were found to be depressed.

In the study done in Mangalore by Joseph et al strong association was found between depression and un employed T2DM patients. [62]

g. EDUCATIONAL STATUS

In the studies done on prevalence of depression in T2DM patients it was found educational status varied across studies and also depression was found to vary across educational status.

In the study done in Manipal by Aminu et al. illiterates were found to be 11%.[1] Whereas in a study done in Nepal by Pahari et al. illiterates were 21.2%.[46]

In the study done in Korea by Park et al. it was found that 40.7% of the study participants in the community had education less than or equal to 9 years.[43] Whereas in a study done by Joseph et al. 53.5% of the participants have attended high school.[62]

In the study by Amir at Aligarh, depression was found to be high among graduates , 48.4% of the graduates were depressed, whereas in the study by Suravi at Odisha 57.4% of the participants who have had primary schooling were found to be depressed, similarly in the study by Pahari at Nepal 47.1% who have had primary schooling were found to be depressed. On the other hand in the study by Joseph in Mangalore 61.5% of the illiterates were found to be depressed similarly in the study by Aminu in Manipal 54.5% of the illiterates were found to be depressed.

In the study done in Ghana basic school level was associated with a decreased odds of depression.[45]

h. SOCIO ECONOMIC STATUS

It was found in the studies done on prevalence of depression in T2DM patients, socio-economic status varied across studies.

In many of the studies depression was found to high among participants belonging to lower socio economic class and in some studies depression was found to be more among participants belonging to middle socio economic class.

In the published studies SES has been categorized into upper, middle, and lower class. In a study done in Nepal by Pahari et al. it was found that 55.2% of them belong to upper class.[46] Whereas in a study done by Aminu et at. 61.5% of them belong to middle class,[1] and the study by Joseph et al. showed 74.3% of the participants belong to middle class.[62]

In the study by Aminu in Manipal, 47.4 % of study participants belonging to lower socio economic class were depressed, similarly in the study by Joseph at Mangalore 68.9% of study participants belonging to lower socio economic class were depressed and also in the study by Pahari at Nepal 53.8% of study participants belonging to lower socio economic class were depressed. Whereas in the study conducted by Amir at Aligarh 87.1% of the participants belonging to middle socio economic class were depressed.

Liaoning Province which is situated in Northeast China, among rural residents with diabetes , high family income seem to protect against depression in China.[50] In the studies done in Mangalore by Joseph et al, and in Akash Hospital, Bangalore reported that low socioeconomic status is strongly associated with depression. [62] [54]

i. TOBACCO AND ALCOHOL CONSUMPTION

It was found in the studies done on prevalence of depression in T2DM patients, tobacco and alcohol consumption among study participants varied across studies. Depression among participants consuming tobacco and alcohol also differs across studies.

In study done in Korea by Park et al. it was found that 51.2% of them were alcohol drinkers and 20.1% of them were smokers, whereas in the study done in Punjab by Khullar et al. it was found that 78.34% of them were alcohol drinkers and 38.71% were smokers. [43][65]

Intake of alcohol, smoking were associated with increased odds of depression, among diabetes patients in Ghana.[45] whereas in the studies done in Korea and Punjab on intake of alcohol and smoking were not found associated with depression.

j. PHYSICAL ACTIVITY

In the studies done on prevalence of depression in T2DM patients it was found adequacy physical activity varied among studies and also depression among participant's physical activity differs across studies.

In a study done by Pahari et al. in Nepal it was found that 45.3% of the study participants had adequate physical activity, similarly in a study done by Park et al. in Korea it was found that 56.4% of them had adequate physical activity. [46][43]

It was noted in the study by Pahari in Nepal 40.8% of participants who do not have adequate physical activity were found to be depressed.

In the study done in Punjab by Khullar found sedentary life style increase depression by 3.4 fold than who do not have sedentary lifestyle. Similarly in the study done in Mangalore by Joseph et al, reported that obesity and depression are strongly associated among diabetic patients .[62]

k. BLOOD SUGAR LEVEL

In the studies done on prevalence of depression in T2DM patients it was found that one third of the study participants had poor control of blood sugar levels across studies.

In the study done by Park et al. uncontrolled blood sugar levels were found in 35.7% of the study participants, similarly it was noticed 36.34% of the study participants had uncontrolled blood sugar levels in the study by Pahari et al.[46][43]

In the study by Neeraj in Himachal Pradesh it was observed 66% of the participants who had poor control of blood sugar levels were depressed, similarly in the studies by Joseph in Mangalore 48.4% of the participants who had poor control of blood sugar levels were depressed, by Pahari in Nepal 44.6% of the participants who had poor control of blood sugar levels were depressed and in Korea by Park 36% of the participants who had poor control of blood sugar levels were depressed.

l. COMPLICATIONS OF T2DM

It was found in the studies done on prevalence of depression in T2DM patients, Complications of T2DM among study participants varied across studies.

In the study done by Raval et al. neuropathy was found in 65% of the study participants. Whereas in the study by Joseph et al. in Mangalore it was found that 23.5% of the study participants had neuropathy. [59][62]

In the study done by Joseph et al. it was found that 36.5% of them had retinopathy and it was similar to the study done by Raval et al. in Punjab in which 39% of the study participants had retinopathy. [59][62]

In the study by Neeraj it was found 60.6% of the participants with complication of T2DM were found to be depressed, similarly 57.4% of the participants with complication of T2DM were found to be depressed in the study by Suravi in Odisha and in the study by Joseph in Mangalore it was observed 63.6% of the participants with nephropathy were depressed and 68.9% of the participants with diabetic foot were found to be depressed.

Statistically significant association was seen between depression and complications of diabetes in the studies done in Chandigarh by Amit and in the study by Joseph in Mangalore. [58] [62]

m. CO-MORBIDITIES

In the studies done on prevalence of depression in T2DM patients, co-morbidities among study participants varied across studies.

In the study done in Korea by Park et at. It was found that 47% of them had hypertension. Similarly, in the study done in Joseph et al. it was found that 52.6% of them had hypertension. [43][62]

In the study done by Thour et al. in Punjab hypertension was found in 60.3% of the study participants. Whereas in the study done in Nepal by Pahari et al. it was found that 80.7% of them had comorbid conditions.[46][68]

In the study by Joseph in Mangalore it was found 62.8% of the participants with hypertension were depressed and 58.1% of the participants with coronary artery disease were depressed. It was noted 39% of the participants with co-morbidities were depressed

Co-morbidities was found to have strong association with depression among T2DM patients in the studies done in China , Nepal and in Mangalore.[50][62]

3.4. RISK FACTORS FOR CAUSATION OF DEPRESSION IN DIABETES

Evidence suggested diabetes and depression could mutually deteriorate with each condition acting as a risk factor in the development of the other.[40] Depression causes a worse diabetes control, lower adoption to treatment, and increased economic burden of health care costs, besides depressive symptoms which would seriously affect the quality of life of T2DM.[69]

This meta-analysis of 14 observational studies containing 82,239,298 participants that are trying to highlight several important determinants in correlation with co-morbid depression in T2DM. Being female, having diabetic complications, insulin use with a low educational level may lead to an co-morbid depression with T2DM,[37]

Risk factors associated with the presence of depression in patients with diabetes include female sex, younger age, not having a spouse, poor social support, lower education, low socioeconomic status, poor glycemic control, presence of diabetic complications, presence of medical comorbidity, physical impairment and previous history of depression, for developing depression after age 65 are similar to those in younger individuals and include being female, unmarried, low

socioeconomic status, having chronic physical illness, social isolation, a history of depression, and a family history.[69] The risk of major depression increases up to three-fold if a first-degree relative has the illness. Additional risk factors that are particularly important in older adults include loss and grief, social isolation or limited social support, high degrees of family conflict, and care taking responsibilities. Other risk factors that increase the likelihood of depression in the medically ill elderly include presence of cognitive impairment, age greater than 75, active alcohol abuse, and lower educational attainment.[37] low birth weight, adverse events in childhood, lifestyle, and obesity, and there is good evidence that complications of diabetes significantly increase the risk of depression[4.] The presence of comorbid depression was significantly higher in diabetic women (28%) than in diabetic men (18%), in clinical (32%) than in community (20%) samples, in uncontrolled (30%) than in controlled (21%) studies, and when assessed by self-report questionnaires (31%) than by standardized diagnostic interviews (11%).[40]

3.5. PROTECTIVE FACTORS FOR REDUCTION OF DEPRESSION IN DIABETES

Being productive and mobile could be the effective factors for co-morbid depression with T2DM.[69] Social support may have positive effects on psychological wellbeing independent of whether or not individuals are exposed to stress, also promote wellbeing through modulation of neuroendocrine response to stress. Social activities, such as volunteering suggested to have positive effect on depression outcomes, Studies have also suggested that religion and spirituality may play an important part in many older adults, lives and social connectedness and support are an important part of organized religion. It is also

possible that the positive effect of religion on mental health is mediated by the social connectedness and the social support derived from taking part in religious activities.[37] Treatment of depression through pharmacotherapy and/or cognitive behavioural therapy has resulted in improved glycaemic control in some, but not all.[40]

3.6. THE IMPACT OF DEPRESSION IN DIABETES

The presence of depression in DM has been associated with significant negative impact in self-care, glycemic control, health outcomes and quality of life.[69]

In adults, there is only a weak relationship between depression and glycemic control. But in contrast, there is a stronger association between comorbid depressive symptoms and a range of diabetes complications, Increased health care costs , worsened functional disability , and early mortality are seen in adults with comorbid diabetes and depression.[10]

a. SELF-CARE

The high burden of poor glycemic control and early onset of complications with associated economic costs indicates a high prevalence of poor self-management practices.[4]

According to a meta-analysis of 43 studies by Gonzalez et al, depression was significantly negatively associated with adherence to DM treatment regimen, regarding almost all self-care aspects evaluated [diet, medication, exercise, self-monitoring of blood glucose (SMBG), medical appointments attendance and composite self-care measures] except for diabetic foot care.

Gonzalez et al followed-up 128 patients with DM for 9 months. They concluded that, after adjusting for baseline self-care – assessed with Diabetes Self-Care Activities (SDSCA) questionnaire -, patients with higher depressive symptoms – assessed with Harvard Department of Psychiatry/National Depression Screening Day Scale (HANDS) - showed lower adherence to general diet recommendations (beta=-0.17, p=0.007) and specific dietary behaviors such as fruits and vegetables consumption (beta=-0.18, p=0.004) and spacing of carbohydrates (beta=-0.23, p=0.001), less exercise and poorer foot care at follow-up and medication non adherence.

Katon et al in a prospective study among 4117 patients with diabetes, found that major depression using PHQ-9 questionnaire, was associated with an increased likelihood of poor adherence to medication concerning control of DM (OR=1.98; CI:1.31-29.8; p<0.01).[69]

To improve self-care practices, effort must be focused on enhancing self-efficacy levels, while not forgetting to deal with depression and diabetes distress, especially among those with poorer levels of self-efficacy.[70]

b. GLYCEMIC CONTROL

Depression has generally been regarded to be associated with poor glycemic control in diabetes, studies revealed significantly higher mean HBA1c in the group of depressed vs non-depressed patients with T2DM, depressive symptoms severity was independently associated with HBA1c, in T2DM patients. Some prospective studies reported that mean HBA1c difference over time was higher

in depressed patients, depression predicted poor glycemic control (defined as HBA1c≥7,0%).[69]

Another important issue stressed upon is that a significant part of what has been previously conceptualized as 'depression', might well reflect general emotional distress, or diabetes-related distress, rather than clinical depression, especially when self-report questionnaires are applied for depression assessment. Diabetes-related distress and depression though overlapping represent different constructs, with probably different impact on glycemic control and responsiveness to different treatment strategies.[69]

Antidepressant effects on glycemic control have also been reported to depend upon the type of antidepressant, so in order to investigate the association between depression and glycemic control, antidepressant medication is a factor that should be controlled for.[69]

Mechanisms involved in the association between depression and glycemic control, adherence to self-care is regarded as a potential mediator though it cannot fully account for it. On the other hand depression might also have a direct negative effect on glycemic control, probably via psychoneuroimmunological and psychoneuroendocrinological pathways.[69]

3.7. LIFETIME DURATION OF DEPRESSION IN PATIENTS WITH T2DM

In a study done in USA on lifetime duration of depression in patients with type 2 diabetes (T2DM) is associated with long-term complications, disability, and early mortality. Lifetime and point prevalence rates of Major Depressive Disorder (MDD) and other depressive disorders (ODD) in the general population are well

characterized by several prospective trials that includes the Epidemiologic Catchment Area (ECA) program and the National Institute of Mental Health Collaborative Program on the Psychobiology of Depression trial. In these trials, the lifetime prevalence of MDD was found to range from 10 to 25% in women and 5 to 12% in men, and the point prevalence varied from 5 to 9% for women and 2 to 3% for men.[5] Additionally, one study found that 85% of participants who recovered from MDD experienced at least one recurrent episode.[5] Fifty-eight percent of individuals who remained well for at least 5 years following their baseline episode experienced a subsequent episode.[5] The episodes characterized as mild to severe had an average time duration of 13.8 to 16.6 weeks, and "very severe" episodes had a mean time duration of 23.1 weeks. The **overall mean duration was 16 weeks**. whereas in patients with type2 DM it was found that average number of MDD episodes was 1.8 with a **mean duration of 23.4 months** (SD 31.9; range 0.5–231.3). Over the duration of entire lifetime, mean exposure to MDD was 43.1 months (SD 46.5; range 0.5–231.3). Kaplan-Meier survival curve indicated that median episode duration will decrease with subsequent episodes (14 months, first episode; 9 months, second episode; $P < 0.002$). In patients with multiple depressive episodes, recovery time was shorter with each subsequent episode ($P = 0.002$).[71]

3.8. TREATMENT FOR DEPRESSIVE DISORDER IN DIABETES

Treatment of Depression in Diabetes includes,

a. Diagnosis of depression- well validated depression screening questionnaires for people with diabetes that includes the Beck Depression Inventory , the Patient Health Questionnaire (PHQ), the Centre for Epidemiologic Studies

Depression Scale , and the Hospital Anxiety and Depression Scale (HADS) can be used. The most widely used and validated questionnaire in people with type 2 diabetes is the PHQ-9.[41]

b. Treatment- both psychological therapies and antidepressant medication should be determined on an individual basis. As poor metabolic control, low rates of blood glucose self-monitoring, and diabetes complications all predict inadequate response to depression treatment.[41]

i. Psychological Interventions- psychotherapy protocols have used cognitive behavioural therapy delivered individually by mental health providers or trained nurse case managers but other common psychological interventions used in people with diabetes include problem solving, interpersonal therapy, motivational interviewing, counselling, and psychodynamic therapy.[41]

ii. Antidepressants-There are mixed effects on glycemic control ranging from hyperglycemic effects with tricyclic antidepressant medications to euglycemic or slightly hypoglycemic effects with selective serotonin reuptake inhibitors and serotonin–nor-adrenaline reuptake inhibitors. Sertraline may have specific advantages for glycemic control.[41]

Alonso et al, showed that in the highly developed countries of Europe, most of those (92%) with diabetes receive regular treatment, but as much as half of those with mental disorders do not receive appropriate care. 51% of people in US who had diabetes along with depression were recognized as having depression and offered treatment. However, not all those who were given a

diagnosis of depression received treatment recommended by the relevant guidelines for their condition.[10]

In the review it has been observed that psychotherapeutic interventions (a few were combined with diabetes education) had a moderate-to-large effect on depressive symptoms and a moderate-to-large effect on glycemic control. Psychopharmacological treatment with selective serotonin reuptake inhibitor (SSRI) medications also had a moderate-to-large effect on depressive disorders with lesser effects on glycemic control, better results can be achieved by collaborative care, combining screening for depression, and a team approach to care in population-based health services.[37]

Models of Care-Multidisciplinary team approaches to the identification and treatment of depression.[41]

Collaborative care model has documented the effectiveness of treating comorbid depression and DM. Its components include patient education, the presence of allied health professionals in the primary care system (to track the effects of treatment, side effects, and adherence to treatment and to provide support for needed changes in behavior), and caseload supervision by a psychiatrist using stepped-care principles, ie, adjusting the intensity of care to the development of the clinical picture. [41]

Along with pharmacological management, depression care manager (usually a nurse or clinical social worker) supports medication management through patient education, close and proactive follow-up, and brief, evidence-based psychosocial treatments such as behavioral activation or problem solving

treatment in primary care. The care manager may also facilitate referrals to additional services as needed. A psychiatric consultant regularly (usually weekly) reviews all patients under the care manager. [41]

INDEPENDENT care is a multi-component care model that combines collaborative care with decision support technology to provide population health management for patients with co-morbid diabetes and depression is a multi-component care model that combines collaborative care with decision support technology to provide population health management for patients with co-morbid diabetes and depression, is based on the four core principles of collaborative care: person-centered team care; population-based care; evidence-based care, and measurement-based treatment to target—tailored to the Indian cultural context.[72]

Components are 1) notification of their depressive symptoms to their usual diabetes care provider; 2) self-care support, proactive follow-up, and outcome monitoring by the care coordinator; 3) evidence-based care prompts to promote responsive pharmacotherapy modifications for diabetes and depression management and/or evidence-based behavioral interventions for depression, delivered by the care coordinator; and 4) bimonthly case review meetings by the care team to review the progress of all participants (at the individual, care coordinator caseload, and clinic levels), and to adjust treatment for participants who are not improving with respect to depression and cardiometabolic risk factors. [72]

3.9. TREATMENT ADHERENCE

The World Health Organization (WHO) defines adherence as "the extent to which an indivuduals's behaviour – taking medication, following a diet, and/or executing lifestyle changes – corresponds with agreed conditions from a health care provider".[73] Adherence along with a lower intensity of problems was observed in patients with a higher level of perception of self-influence on the course of the disease. Glycemic control influenced by adherence is based on many components, including patient coping strategies. Previous work has proven that positive coping styles (more approach oriented and those focused on dealing with the stressor itself) are associated with better glycemic control. Severity of difficulties in adherence to the recommendations during treatment with insulin analogues was negatively correlated with the degree of the perception of self-influence on the course of the diabetes. Adherence with a lower intensity of problems was observed in patients with a higher level of perception of self-influence on the course of the disease.[73]

Switching from human insulin to a biphasic insulin analog posed no difficulties in adherence for more than half of the patients (56.6%).[12] Whereas major and very significant problems with adherence to modified therapy were reported by 1.3% and 0.1% of patients.[73]

3.10. CONSEQUENCES OF COMORBIDITY OF DEPRESSION AND DIABETES

In a study done in Singapore it was found that DM was reported by 25.5% of the population. The prevalence of depression was found to be significantly higher in those people diagnosed with DM than those without DM (6% vs 3%). Comorbid DM and depression were more close to Indian and Malay ethnicity. Comorbid

depression and DM affects disability, cognition and healthcare utilisation by them.[74]

The prevalence of depressive disorders in diabetics is in the general range of 10% to 15%, which is approximately twice as high as the prevalence of depression in non-diabetics. Comorbidity significantly worsens the prognosis of both diseases and increases their mortality[4]. With diabetes and mental illness affecting approximately 8.3 % and 10 % of the total world's population, respectively, a degree of comorbidity between diabetes and depression is to be expected.[10]

The combined outcome of depression and of diabetes is worse. The presence of depression is linked to higher rates of complications in diabetes, to more disability, and to loss of years of life. As with other mental disorders, the pattern of causes of death does not have any significant difference from the patterns seen in the population without a depressive disorder. In children and adolescents, the presence of depression affects glycemic control.[8]

An important study conducted on 30,022 adults in the USA showed that the risk of functional disability in people with diabetes was 2.42 times higher than in people who are not prone to diabetes; that in people with depression alone, it was 3 times higher than in people without depression; and that the risk for those who had depression and diabetes, the risk was 7.15 times higher than in people who did not have depression or diabetes. Cost of treatment of diabetes when depression is present is 4.5 times higher than the treatment of diabetes alone.[10]

The presence of depression in people along with diabetes may lead to poorer self-care (non-adherence to diet, including lacking in physical exercise, irregular intake of medications for any purpose) and to behaviour that may increase the risk of cardiovascular illness and microvascular and macrovascular complications.[10]

Comorbid depression adversely affects diabetes outcomes and decreases quality of life.[10] The Studies of relationship between depression and glycemic control in adults have resulted in discrepant findings with a few showing that depression is associated with a small deterioration in glycated hemoglobin whereas others did not shown any effect. In adolescents and children, there is a more clear relationship between depressive symptoms and poorer glycemic control.[10]

Depression, even if mild, is also associated with premature mortality through a range of physical conditions. The excess mortality is not wholly explained by an increase in known risk factors because in the Action to Control Cardiovascular Risk in Diabetes (ACCORD) trial, clinically significant depressive scores were an independent risk factor for all-cause mortality after adjustment for blood pressure, glycated hemoglobin, lipids, body mass index, aspirin use, tobacco, alcohol, living alone, and educational level.[10]

Similar increases in cost of treatment have been found in other studies in the USA. The presence of depression in people with diabetes also leads to poorer self-care (non-adherence to diet, including lacking in physical exercise, irregular intake of medications for any purpose) and to behavior that may increase the risk of cardiovascular illness and microvascular and macrovascular complications. Depression has a synergistic effect in patients with diabetes,

increasing the risk for complications of both micro- and macro-vascular nature, increased hyperglycemia, predicting greater mortality.[9]

3.11. CHALLENGES OF DEPRESSION IN DIABETES

Depression, one of the major health problems in the world is gradually climbing up the list of the global burden of disease to the second place. Depression has incremental effect on the disability caused by the non-communicable disease (NCD) itself. With diabetes resultant disability being more than the summative disability, it has the most incapacitating impact. Coexistence of depression with diabetes results in poor glycaemic control and more complications due to poor self-care and lack of adherence to treatment. Depression reduce the effect of diagnosis and management of diabetes due to delayed help-seeking and excessive concern about side-effects of medication. People with diabetes are two times more likely to be depressed as compared to the general population. Compared to the west, onefourth to one-third higher proportion of people with diabetes have depression in low- and middle-income countries. India is home to second largest population with diabetes in the world with about a third having comorbid depression. Low socioeconomic status, education, unemployment, female gender and high body mass index are risk factors for depression in India.[75]

Lack of readiness for PCC for diabetes self-management, Poor patient knowledge of diabetes, Sub-optimal medication adherence and clinical inertia, Lack of diabetes clinical audits and prospective registries, Lack of integration of mental health services with diabetes care, Enabling smoking and tobacco cessation are the some identified challenges.[4]

3.12. SCREENING TOOLS FOR DIAGNOSING DEPRESSION IN DIABETES

Diagnosis of Depression- depression can be diagnosed using several validated depression screening tools for patients with diabetes that includes

The Beck Depression Inventory,

The Centre for Epidemiologic Studies Depression Scale,

The Patient Health Questionnaire (PHQ) and

The Hospital Anxiety and Depression Scale (HADS).[41]

There are Several tools available for assessing the severity of depression and can be administered easily by nursing staff or Medical officer during patient's visit to primary health care facility. One of the most frequently used tool is Patient Health Questionnaire (PHQ-9) containing 9 questions, which explores systematically the 9 DSMIV symptoms of major depression, which is a most widely used and validated questionnaire to assess depression among people with type 2 diabetes mellitus.[41]

3.13. LACUNA IN KNOWLEDGE/NEED FOR THE STUDY

India is the second largest in diabetic population and depression is twice more prevalent in diabetic patients than in general population and life time with depression in diabetic is 5 times more than in general population.[26][29][71] It is thus clearly evident that accurate assessment of depression amongst diabetic patients is very important so as to guide appropriate treatment and to reduce morbidity and mortality. A number of studies have been done in this regard, it's found that better results can be achieved by collaborative care, combining

screening for depression, and a team approach to care in population-based health services.[41] Most of them were hospital based studies and not many studies were done in the community and data regarding prevalence depression in type 2 diabetes mellitus (T2DM) patients in community in India are limited., unless we know the burden in the community giving population based health service is difficult . Hence, there is a need to study the prevalence and associated factors of depression in T2DM patients.

MATERIALS AND METHODS

4. MATERIALS AND METHODS

4.1. STUDY SETTING:

This study was undertaken in Gandhi Nagar, in Kolar Urban, Kolar Taluk in Kolar district. Kolar district is situated in southern part of Karnataka state at a distance

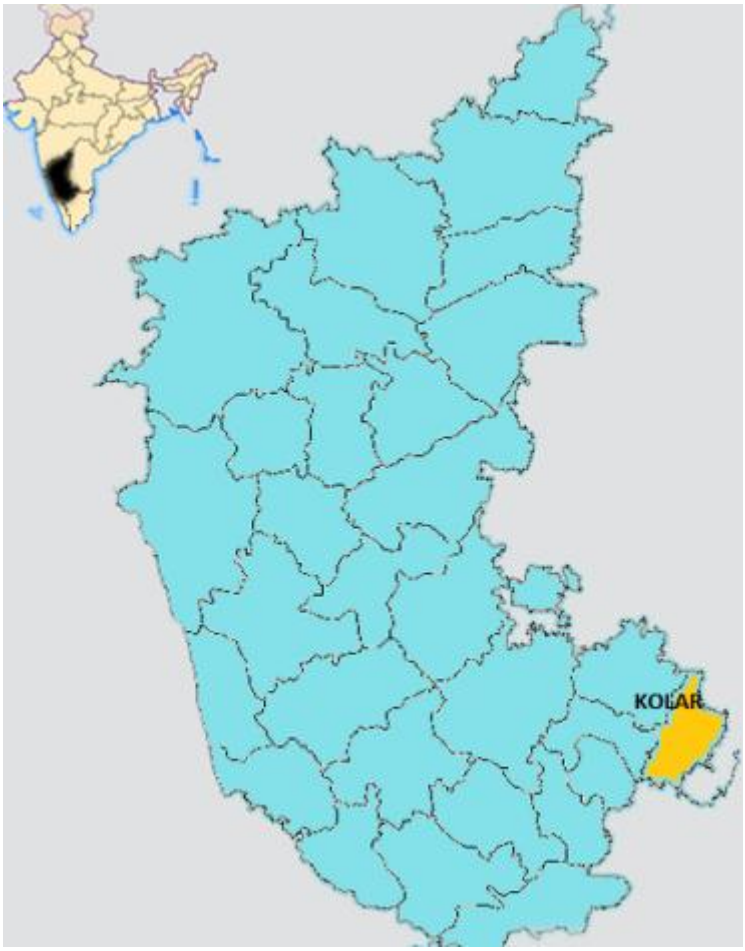


Figure 4 Map of Karnataka showing Kolar district.

of about 70kms from Bengaluru. Once famous as one of the largest gold producers in Asia, Kolar is known for silk, milk and mangoes. It occupies an area of about 4012 sq. km. and comprises a population of 15,36,401.18, consists of six taluks viz., Mulbagal, Kolar, Bangarpet, Malur, Srinivaspura and KGF.

In Kolar district the study was done in Urban field practice area of department of Community Medicine, SDUMC. Under the UHTC there are 4 field practice area,

Gandhi Nagar, Shahensha Nagar, Rehmath nagar and Darga Mohalla out of which Gandhi nagar was selected randomly, which is having 1083 households with 5496 population.

4.2. STUDY POPULATION:

Type 2 diabetes mellitus patients (self-reported - subjects who give history of type 2 diabetes diagnosed by a physician and/or if they are on treatment with anti-diabetic drugs).

4.3. INCLUSION CRITERIA:

All those consenting individuals who were a known case of type2 Diabetes mellitus patient of any duration, residing in Gandhi nagar, Kolar.

4.4. EXCLUSION CRITERIA:

1. Pregnancy during the time of survey
2. Known case of epilepsy/psychiatric disorder.

4.5. STUDY DESIGN:

Cross sectional analytical study.

4.6. STUDY DURATION:

1st January 2020 to 30th June 2020.

4.7. METHODS OF COLLECTION OF DATA INCLUDING SAMPLING PROCEDURE:

SAMPLE SIZE:

$$\text{Calculation} : \frac{Z\,\alpha^2\ (p)\ (1-p)}{d^2}$$

$$= (1.96)^2\ (0.41)\ (0.59)\ /\ (0.5)^2$$

$$s = 372$$

With a prevalence of 41% from previous study[59], keeping alpha error at 5% and an absolute precision of 5% with a two-sided confidence, the minimum sample size was calculated to be 372.

After eligibility screening it was found only 311 households had patients with T2DM in the selected UHTC area – Gandhi Nagar.

So, the sample size was recalculated with an absolute precision of 6% it was found that

$$\text{Calculation} : \frac{Z\,\alpha^2\ (p)\ (1-p)}{d^2}$$

$$= (1.96)^2\ (0.41)\ (0.59)\ /\ (0.6)^2$$

$$s = 258$$

Sample size of 258 along with non-compliance of 20%, the sample size was calculated to be 258 + 52 = 310.

Universal sampling was done and all 311 were included in the study.

4.8. BRIEF PROCEDURE:

SAMPLING:

Eligibility screening was done by visiting house to house ie. all 1083 houses in the selected area of UHTC – Gandhi nagar. People with known type 2 diabetes mellitus (self-reported - subjects give a history of type 2 diabetes diagnosed by a physician and/or if they are on treatment with anti-diabetic drugs.) was enlisted. There were 311 households with type 2 diabetes mellitus patients. From these 311 households, 311 T2DM patients were selected using universal sampling technique.

Written informed consent was requested and obtained from the participants. Pre-tested semi-structured questionnaire was used to collect the information on demographic data and disease related characteristics including the co-morbidity status. PHQ-9 questionnaire was used for assessing depression among the study participants.

4.9. STUDY TOOLS:

4.9.1. Pretested semi structured questionnaire: used to collect socio-demographic and disease information, it was administered by interview method. The questionnaire was prepared in English, validated pilot tested and was later translated to Kannada language. The variables collected by interview were basic demographic details namely age, sex, marital status, address, religion, education, occupation and socio-economic status which included total income of working members in family and number of individuals in the house. Tobacco usage and alcohol consumption habits, history of chronic diseases viz. hypertension,

cardiovascular disease, stroke, dyslipidemia, hypothyroidism and hyperthyroidism were recorded.

4.9.2. Physical examination and anthropometric measurements:

a. Blood pressure measurement: Measured using the Dr Trust - 0197, fully automatic blood pressure monitor which operates on the oscillometric principle. Blood pressure reading was taken in the right upper arm of T2DM patients, relaxed and comfortably seated on a chair with the arm cuff at the same level as the heart. Two such readings were taken 5 minutes apart and the average of these two readings was considered.[76]68,69 Eighth Joint national committee (JNC 8) classification was used to classify hypertension in the study subjects.

Table 3: Joint National Committee 8 classification of hypertension[77]

Classification	Systolic BP (mmHg)	Diastolic BP (mm Hg)
Normal	<120	<80
Pre-Hypertension	120-139	80-89
Stage 1 Hypertension	140-159	90-99
Stage 2 Hypertension	≥160	≥100

b. Height: Height was measured using a stadiometer fixed to the wall. The subject was made to stand straight on the flat floor, barefoot, with heels, buttocks, shoulders and back of the head touching the upright such that the lower border of the orbit was in the same horizontal plane as the external auditory meatus (Frankfurt plane). The headpiece of the stadiometer was gently lowered, crushing the hair and making contact with the top of the head. The reading was recorded to the nearest 0.5 centimetre.[78]

c. Weight: Weight was measured using digital weighing scale. The subject was made to stand barefoot on the center of the weighing scale, kept on the flat platform, with minimal clothing without touching anything else. The reading was noted and was recorded to the nearest kilogram. The instrument was calibrated daily with a known 5kg weight before being used. [78]

d. Body Mass Index (BMI): Calculated by dividing the weight of the subject in kilograms by the square of the subject's height in metre. The following BMI classification was used. [79]

Table 4: WHO Body Mass Index classification[79]

Classification	BMI
Underweight	<18.5
Normal weight	18.5 - 24.9
Overweight	25 - 29.9
Obese	>30

e. Waist circumference: It was measured with a non-stretchable measuring tape made of fibre at the approximate midpoint between the lower margin of the last palpable rib and the top of the iliac crest. It was recorded to the nearest centimetre.[80][81]

Table 5: WHO classification of waist-circumference[81]

Sex	Waist-circumference	
	Normal	At risk
Male	≤ 90 cm	> 90 cm
Female	≤ 80 cm	> 80 cm

f. Hip circumference: It was measured at the widest portion of the buttocks with the subject standing straight. For the measurement of both waist and hip circumference, the subject was made to stand straight with the feet close together, arms by the side of body, weight evenly distributed across the feet and wearing minimum clothing. Measurements were taken with a non-stretchable tape snug around the body at a level parallel to the floor at the end of normal expiration. [80][81]

g. Waist Hip Ratio (WHR): Computed by dividing waist circumference by hip circumference of individual. WHR of ≥0.90 for men and ≥0.85 for women indicates abdominal obesity and is considered as substantially increased risk of metabolic complications.

Table 6: WHO classification of waist-hip ratio[81]

Sex	Waist-Hip ratio	
	Normal	At risk
Male	< 0.90	≥ 0.90
Female	< 0.85	≥ 0.85

4.9.3. Investigations: Random capillary blood sugar testing was done.

Random capillary blood sugar is the most convenient way of measuring blood glucose levels. It was done by pricking the index finger or middle finger of the left hand by using a lancet, drop of blood oozes out, then the blood drop was wiped on to the test strip, and the levels of glucose was recorded in the glucometer. This blood glucose level helps in assessing how well the disease is being managed.

Table 7: Classification of random blood sugar levels[82]

Classification	Random blood sugar levels (mg/dl)
Normal	<140
Impaired	140 – 199
T2DM	200 & above

4.9.4. Patient Health Questionnaire 9 – (PHQ9)

Patient health questionnaire 9 (PHQ-9) was used to assess the depression among Diabetic patients. From the various studies it was found that PHQ-9 seems to be a better and valid tool for screening depression in diabetes subjects.[83]

Depression severity is categorized as

- 0-4 None
- 5-9 Mild
- 10-14 Moderate
- 15-19 Moderately severe

- 20-27 Severe.[84]

The score of more than 10 will be considered as Major Depressive Disorder[85].

The Patient Health Questionnaire (PHQ) is an instrument for making criteria-based diagnoses of depressive and other mental disorders commonly encountered in primary care. The PHQ-9 component of the longer Patient Health Questionnaire offer psychologists concise, self-administered tools for assessing depression. They had to incorporate DSM-IV depression criteria with other leading major depressive symptoms into a brief self-report instruments that are more commonly used for screening and diagnosis, as well as selecting and monitoring treatment.[52]

The diagnostic validity of the 9-item PHQ-9 was established in studies that had 8 primary care and 7 obstetrical clinics. PHQ-9 scores greater than 10 had a sensitivity of 88% and a specificity of 88% for Major Depressive Disorder (MDD). Reliability and validity components of the tool have indicated that it has sound psychometric properties. Internal consistency of the scale PHQ-9 has been shown to be high in some cases.[84]

4.10. STATISTICAL ANALYSIS:

Data collected was coded and entered into Epidata. Analysis of that was done using SPSS version 22. and STATA version 12. The summarized data is presented as frequencies and proportions. The association between the study outcomes and its risk factors is analyzed using Chi square test. The risk analysis for the study outcomes is done using logistic regression analysis and expressed as Prevalence Ratio with 95% confidence intervals. p value of ≤0.05 is considered as statistically significant.

4.11. ETHICAL CONSIDERATIONS:

The study is approved by the institutional ethical review committee of Sri Devaraj Urs Academy of Higher Education and Research, Kolar. Prior informed written consent was obtained from the participants of the study

RESULTS

5. RESULTS

Table 8: Distribution of study participants according to Gender (n=311)

Gender	Frequency	Percentage %
Male	161	51.8
Female	150	48.2
Total	**311**	**100**

The table shows the distribution of gender among the study participants in which proportions of male and female were almost equal. 51.8% of them were male and 48.2% of them were female.

Table 9: Distribution of study participants according to Age (n=311)

Age (in years)	Frequency	Percentage %
30 – 44	40	12.9
45 – 59	127	40.8
60 and above	144	46.3
Total	**311**	**100**

The table showing distribution of study participants according to age, among the study participants majority of them were 60 years and above that is 46.3%, followed by 40.8% of them were between the age of 45 to 59 years and least in the age group of 30 to 44 years that is 12.9%.

Table 10: Distribution of study participants according to Marital status (n=311)

Marital Status	Frequency	Percentage %
Married	225	72.3
Un married	1	0.3
Widow / Widower	82	26.4
Separated / Divorce	3	1.0
Total	**311**	**100**

This table shows the marital status of study subjects. Most of the study participants were married (72.3%), approximately one fourth of them were widow or widower (26.4 %), followed by 1% were separated and 0.3% were unmarried.

Table 11: Distribution of study participants according to Occupation (n=311)

Occupation	Frequency	Percentage %
Professional	3	1.0
Semi-Professional	17	5.5
Clerical	13	4.2
Skilled	33	10.6
Semi-skilled	56	18.0
Un-skilled	37	11.9
Home maker	68	21.9
Un employed	84	27.0
Total	**311**	**100**

Among T2DM patients residing in Gandhi Nagar, at the time of interview the participants were almost equally distributed between employed and unemployed category. Among those who were unemployed (48.9%), 27% of them were unemployed or did not have any kind of salaried employment and 21.9% of the study subjects were home makers. Among those who were employed (51.1%), 18% had semi-skilled job, 11.9 % of the study subjects were un-skilled, 10.6 % were skilled, 5.5% were semi-professionals, 4.2% had a clerical job and 1% were professionals.

Table 12: Distribution of study participants according to Education (n=311)

Education	Frequency	Percentage %
Illiterate	71	22.8
Primary	69	22.2
Secondary	115	37.0
Higher secondary	8	2.6
Bachelor degree	42	13.5
Professional/Master	6	1.9
Total	**311**	**100**

In this table the education profile of the study subjects was detailed after the interview and most of the study subjects were literate (77.2%). Among those literate participants, 22.2% of them had primary schooling, 37% went till secondary school, 2.6% were in the higher secondary category, 13.5% were

graduates holding bachelor's degree and 1.9% had a professional/master's degree and almost one fifth of the total study participants remaining (22.8%) were illiterate.

Table 13: Distribution of study participants according to Modified BG Prasad classification of Socio-Economic Status (n=311)

Socio economic status	Frequency	Percentage %
Upper class	67	21.5
Upper middle class	167	53.7
Middle class	60	19.3
Lower middle class	11	3.5
Lower class	6	2.0
Total	**311**	**100**

This table shows the distribution of study participants according to socio economic status based on Modified BG Prasad Classification. Majority of the study subjects belonged to upper middle class 53.7% , almost one fourth of the study subjects 21.5% belonged to upper class, followed by 19.3% belonged to middle class, 3.5% to lower middle class and 1.9% to lower class respectively.

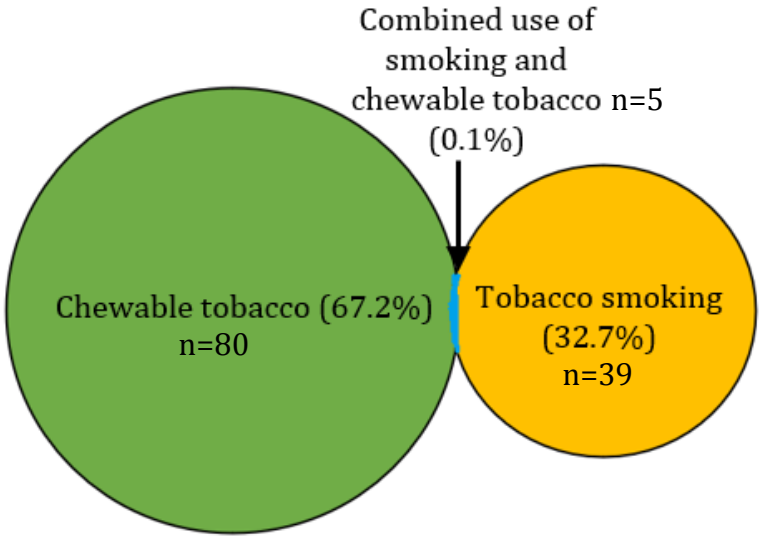


Figure 5: Distribution of study participants according to Percentage of usage of tobacco,

(Total response=124)

This table shows the distribution of study participants who were consuming tobacco. Among the tobacco products users, chewable tobacco was most consumed 67.2%, followed by 32.7% of the study participants were users of smoking tobacco and only 5 (0.1%) were Combined users of smoking and chewable tobacco.

Table 14: Distribution of study participants according to alcohol consumption, (n=311)

Characteristics	Frequency	Percentage %
Alcohol drinking	73	23.5
Not drinking Alcohol	238	76.5
Total	**311**	**100**

This table shows the distribution of study participants according to alcohol consumption. Majority of the study subjects (76.5%) were not drinking alcohol and close to one fourth of the study participants (23.5%) were alcohol drinkers.

Table 15: Distribution of study participants according to history of type 2 diabetes in the family, (n=311)

Characteristics	Frequency	Percentage %
Family history of T2DM present	171	55
Family history of T2DM absent	140	45
Total	**311**	**100**

This table brings out the percentage of study subjects distributed based on the history of type 2 diabetes in the family. More than half of the study subjects 55% gave history of presence for one or more family members having T2DM in the family who were related by blood (father, mother and siblings) whereas 45% of them gave no history of T2DM among family members.

Table 16: Distribution of women study participants according to history of consumption of OCP, (n=150)

Characteristics	Frequency	Percentage %
No History of Consumption of OCP	134	89.3
History of Consumption of OCP	16	10.7
Total	**150**	**100**

This table shows the distribution of female study participants according to history of consumption of OCP at the time of interview**.** Majority of women

89.3% gave no history of consumption of OCP and the remaining 10.7% of female participants gave history of consumption of OCP in their lifetime.

Table 17: Distribution of study participants according to Adequate Physical activity (150 mins/wk), (n = 311)

Characteristics		Frequency	Percentage %
Physical activity (minimum of 150 mins/wk)	**Present**	187	60.1
	Absent	124	39.9
Total		**311**	**100**

This table shows the distribution of study participants according to Physical activity (minimum of 150mins/wk). More than half of the study subjects 60.1% had adequate physical activity and two fifth 39.9% of the study subjects did not have adequate physical activity during the time of interview.

Table 18: Distribution of study participants according to Good dietary practice, (n = 311)

Characteristics		Frequency	Percentage %
Good dietary practice (consumption of fruits and vegetables 5 times a day and 7 days a week)	**Present**	4	1.3
	Absent	307	98.7
Total		**311**	**100**

This table describes the distribution of study participants according to Good dietary practice (consumption of fruits and vegetables 5 times a day for 7 days a

week). Almost all the study participants 98.7% of them had poor dietary practice, very meagre of only 1.3% of them have good dietary practice.

Table 19: Nutritional status of the studied T2DM patients at Gandhi Nagar, (n = 311).

Body mass index	Frequency	Percentage %
Normal weight (18.5 – 24.9)	158	50.8
Overweight (25-29.9)	129	41.5
Obese (≥30)	24	7.7
Total	**311**	**100**

This table shows the nutritional status of the studied T2DM patients at Gandhi Nagar. Among them, majority 50.8% had Normal weight, followed by 41.5% were Overweight and least of 7.7% of the study participants were Obese.

Table 20: Anthropometric characteristics of study participants with T2DM at Gandhi Nagar, (n = 311).

Characteristics	At Risk	Frequency	Percentage %
Waist hip ratio	Male (≥ 0.90)	108	34.7
	Female (≥ 0.85)	137	44.1
Waist circumference	Male (≥ 90 cms)	96	30.9
	Female (≥ 80cms)	91	29.3

This table shows the distribution of the study participants by their anthropometric characteristics. Out of 161 men who were examined, 34.7% had at risk level of Waist hip ratio and 30.9% had at risk level of waist circumference. Whereas among female participants (n=150), 44.1% had at risk level of Waist hip ratio and 29.3% had at risk level of waist circumference.

Table 21: Random Blood Sugar level of the studied T2DB patients at Gandhi Nagar, (n = 311).

Random Blood Sugar level	Frequency	Percentage (%)
Normal (<140 mg/dL)	75	23.9
Impaired (140-199 mg/dL)	152	49.0
Increased (≥200mg/dL)	84	27.1
Total	**311**	**100**

This table shows the capillary random blood sugar level of the study participants measured at the time of interview. Almost half of the participants 49% with T2DM had impaired level of random blood sugar, followed by more than one fourth 27.1% of study subjects had elevated levels of random blood sugar and the remaining 23.9% had normal levels of random blood sugar.

Table 22: Treatment modality of study participants with Type 2 Diabetes Mellitus in urban field practice area of Kolar. (n = 311)

Treatment modality	Frequency	Percentage %
No treatment	8	2.6
Oral	278	89.4
Insulin	2	0.6
Both (oral & insulin)	23	7.4
Total	**311**	**100**

Table above depicts the treatment modality of study participants with Type 2 Diabetes Mellitus in urban field practice area of Kolar. Among the studied, majority 89.4% of them were on oral treatment. In the remaining one tenth of

the study participants, 2.6% had undergone NO treatment, 0.6% of them were taking insulin and 7.4% of them were on both Oral hypoglycemics and Insulin.

Table 23: Treatment compliance of study participants with Type 2 Diabetes Mellitus in urban field practice area of Kolar (n = 311)

Treatment compliance	Frequency	Percentage %
Not taking medication	4	1.3
Regular	303	97.4
Irregular	4	1.3
Total	**311**	**100**

Table given above describes the treatment compliance of study subjects, Majority of the study subjects 97.4% were taking treatment regularly and 1.3% were on irregular treatment and another 1.3% were not taking any treatment.

Table 24: Other modes of treatment followed by study participants with Type 2 Diabetes Mellitus in urban field practice area of Kolar (n = 311)

Other modes of treatment	Frequency	Percentage %
None	301	96.8
Ayurveda	3	1
Yoga & Naturopathy	3	1
Homeopathy	4	1.2
Total	**311**	**100**

The table above shows the other modes of treatment followed by study participants with T2DM. Most of the study participants 96.8% were not using any other modes of treatment. Among the remaining least (3.2%), 1.2% of them

were taking Homeopathy , 1% of the study subjects were taking Ayurveda and another 1% of the study participants were taking Yoga & Naturopathy treatment.

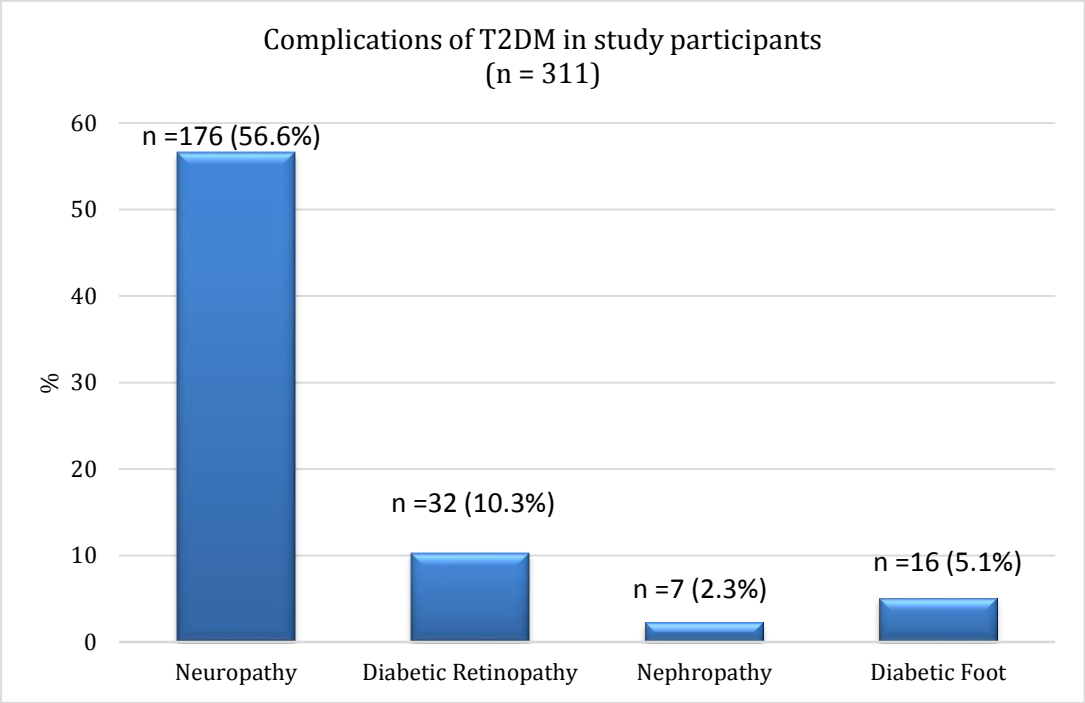


Figure 6: Complications of T2DM in study participants in urban field practice area of Kolar, (n = 311).

This figure describes the Complications of T2DM among study participants. More than half the study subjects (56.6%) had Neuropathy, one tenth of the study participants 10.3% had Diabetic Retinopathy, 5.1% of them had Diabetic foot and 2.3% of them had Nephropathy respectively.

Table 25: Co - morbidities of T2DM in study participants in urban field practice area of Kolar, (n = 311).

Co - morbidities	Frequency	Percentage %
Hypertension	106	34.1
Cardiovascular diseases	39	12.5
Stroke	3	1
Dyslipidaemia	42	13.5
Hypothyroid	9	2.9

Table depicts the Co - morbidities of T2DM in study participants in urban field practice area of Kolar. Hypertension was observed in majority 34.1% of the study subjects, 12.5% of the study participants gave Cardiovascular disease history, 1% had stroke, 13.5% had Dyslipidaemia and 2.9% had Hypothyroid.

Table 26: Distribution of study participants based on Patient health questionnaire 9 screening tool for Depression (n=311)

Characteristics	Not at all n (%)	Several days n (%)	More than half the days n (%)	Nearly every day n (%)
Little interest or pleasure in doing things	165(53.1%)	105(33.8%)	38(12.2%)	3(0.9%)
Feeling down, depressed, or hopeless	79(25.4%)	142(45.7%)	78(25.1%)	12(3.9%)
Trouble falling or staying asleep, or sleeping too much	194(62.4%)	71(22.8%)	32(10.3%)	14(4.5%)
Feeling tired or having little energy	102(32.8%)	146(46.9%)	59(19%)	4(1.3%)
Poor appetite or overeating	261(83.9%)	27(8.7%)	19(6.1%)	4(1.3%)

Feeling bad about yourself — or that you are a failure or have let yourself or your family down	184(59.2%)	98(31.5%)	26(8.4%)	3(1.0%)
Trouble concentrating on things, such as reading the newspaper or watching television	276(88.7%)	33(10.6%)	2(0.6%)	0(0%)
Moving or speaking so slowly that other people could have noticed? Or the opposite — being so fidgety or restless that you have been moving around a lot more than usual	281(90.4%)	27(8.7%)	3(1.0%)	0(0%)
Thoughts that you would be better off dead or of hurting yourself in some way	179(57.6%)	72(23.2%)	45(14.5%)	15(4.8%)

This table shows the results of PHQ9 which has been administered to the patients residing in urban field practice area of Kolar. It has been found that, in last 15 days, how far they were bothered about these symptoms.

Little interest or pleasure in doing things: majority 53.1% of them were not at all been bothered with these symptoms in any of the days. 33.8% had the said symptoms several days, 12.2% had the symptoms more than half day, 1% of them nearly had it every day.

Feeling down, depressed, or hopeless: 25.4% of them were not at all been bothered with these symptoms in any of the days. 45.7% had the said symptoms

several days, 25.1% had the symptoms more than half day, 3.9% of them nearly had it every day.

Trouble falling or staying asleep or sleeping too much: 62.4% of them were not at all been bothered with these symptoms in any of the days. 22.8% had the said symptoms several days, 10.3% had the symptoms more than half day, 4.5% of them nearly had it every day.

Feeling tired or having little energy: 32.8% of them were not at all been bothered with these symptoms in any of the days. 46.9% had the said symptoms several days, 19% had the symptoms more than half day, 1.3% of them nearly had it every day.

Poor appetite or overeating: 83.9% of them were not at all been bothered with these symptoms in any of the days. 8.7% had the said symptoms several days, 6.1% had the symptoms more than half day, 1.3% of them nearly had it every day.

Feeling bad about yourself — or that you are a failure or have let yourself or your family down: 59.2% of them were not at all been bothered with these symptoms in any of the days. 31.5% had the said symptoms several days, 8.4% had the symptoms more than half day, 1% of them nearly had it every day.

Trouble concentrating on things, such as reading the newspaper or watching television: 88.7% of them were not at all been bothered with these symptoms in any of the days. 10.6% had the said symptoms several days, 0.6% had the symptoms more than half day, none of them had it every day.

Moving or speaking so slowly that other people could have noticed? Or the opposite — being so fidgety or restless that you have been moving around a lot more than usual: 90.4% of them were not at all been bothered with these symptoms in any of the days. 8.7% had the said symptoms several days, 1% had the symptoms more than half day, none of them had it every day.

Thoughts that you would be better off dead or of hurting yourself in some way: 57.6% of them were not at all been bothered with these symptoms in any of the days. 23.2% had the said symptoms several days, 14.5% had the symptoms more than half day, 4.8% of them nearly had it every day.

Table 27: Proportion of levels of depression scoring according to PHQ – 9 in patients with Type 2 Diabetes mellitus in urban field practice area of SDUMC, Kolar. (n = 311)

Depression grading	Score	Frequency	Percentage (%)
No / Minimal depression	0 – 4	174	55.9
Mild depression	5 – 9	80	25.7
Moderate depression	10 – 14	46	14.8
Moderately Severe depression	15 – 19	10	3.2
Severe depression	20 & above	1	0.3
Total		**311**	**100**

Here is the table showing levels of depression according to PHQ-9 administered to 311 participants with T2DM residing in urban field practice area of SDUMC Kolar. More than half the study subjects 55.9% got a score of 0 – 4, followed by one forth 25.7% of the study participants has scored between 5 – 9, 14.8% of

them had a score between 10 – 14 and 3.2% had a score between 15 – 19, Only one 0.3% of the study subject came into the category of severe depression getting a score of 20 and above.

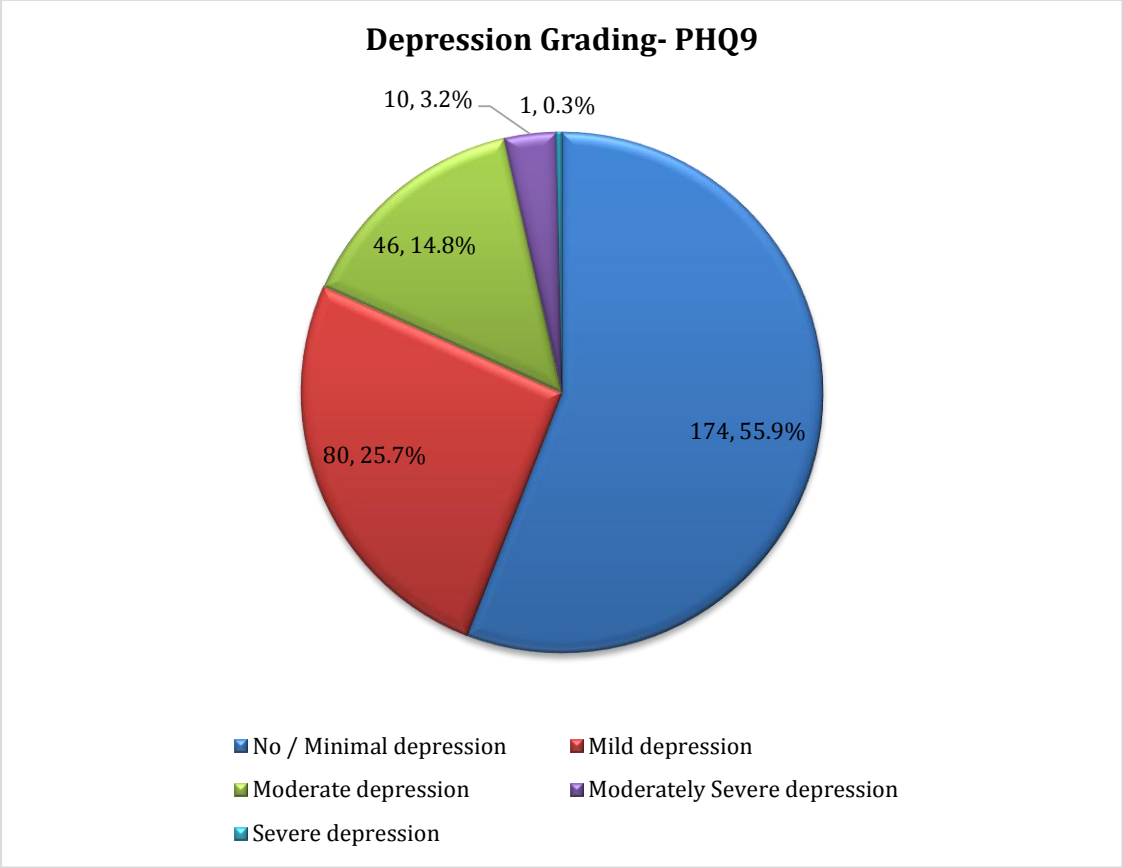
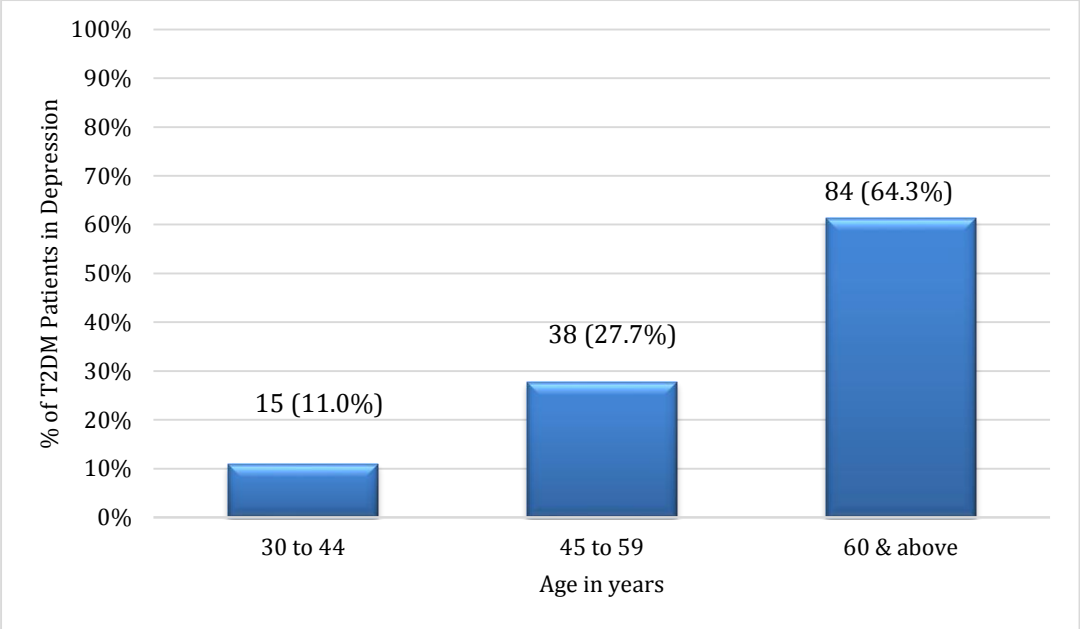


Figure 7: Proportion of levels of depression according to PHQ - 9 in patients with Type 2 Diabetes mellitus in urban field practice area of SDUMC, Kolar. (n = 311)

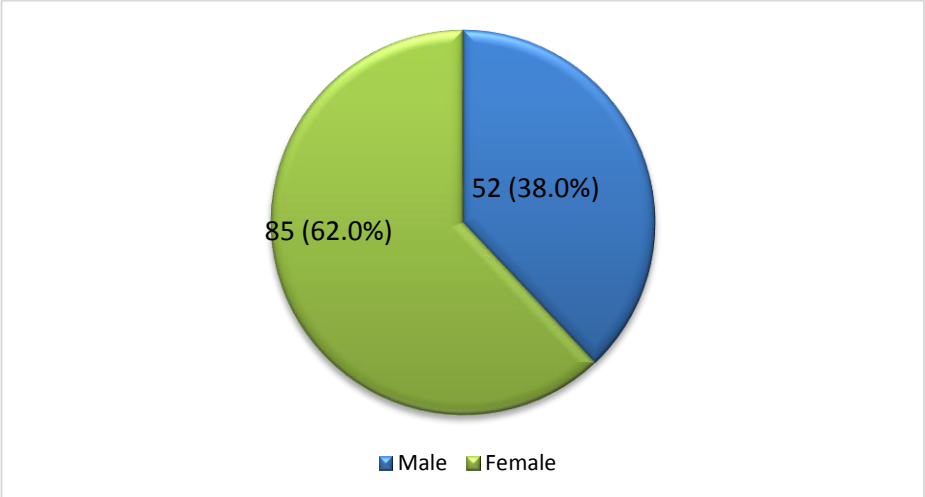
The pie chart showing levels of depression according to PHQ-9 administered to 311 participants with T2DM residing in urban field practice area of SDUMC Kolar. It was found that more than half 55.9% of them had no depression, one fourth of the participants 25.7% of them had mild depression, followed by 14.8% of them had moderate depression, 3.2% of them had moderately severe depression and 0.3% had severe depression.

Figure 8: Distribution of depression in T2DM patients, according to Age, (n = 137)



The figure above depicts the distribution of depression in T2DM patients according to age. It is evident that majority of the T2DM patients with depression were in the age group of 60 years and above 64.3%. The remaining study subjects 27.7% and 11.0% were in the age groups of 45 to 59 years and 30 to 44 years respectively.

Figure 9: Distribution of depression in T2DM patients according to Gender, (n = 137)



This figure describes the distribution of depression in T2DM patients according to Gender. Majority 62% of the female patients with T2DM were found to be depressed whereas among males only 38% were found to be depressed.

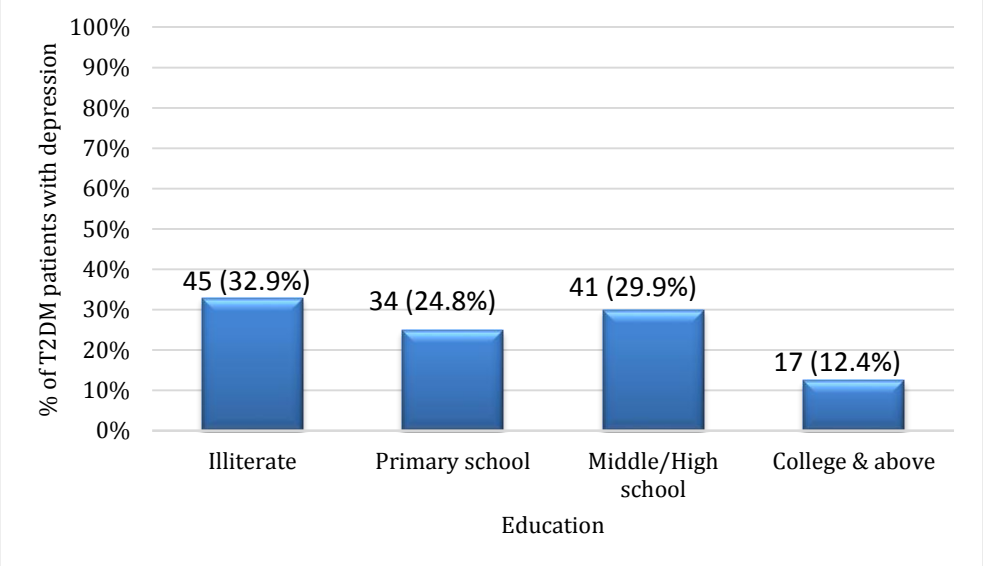
Table 28 Distribution of depression in T2DM patients according to Marital status, (n = 137)

	Depressed (n = 137)	**Non-Depressed (n = 174)**	**Total**
Married	69 (30.7%)	156(69.3%)	225
Others*	68 (79.1%)	18 (20.9%)	86
Total	**137**	**174**	**311**

*Others – unmarried, widow/widower, separated, divorce

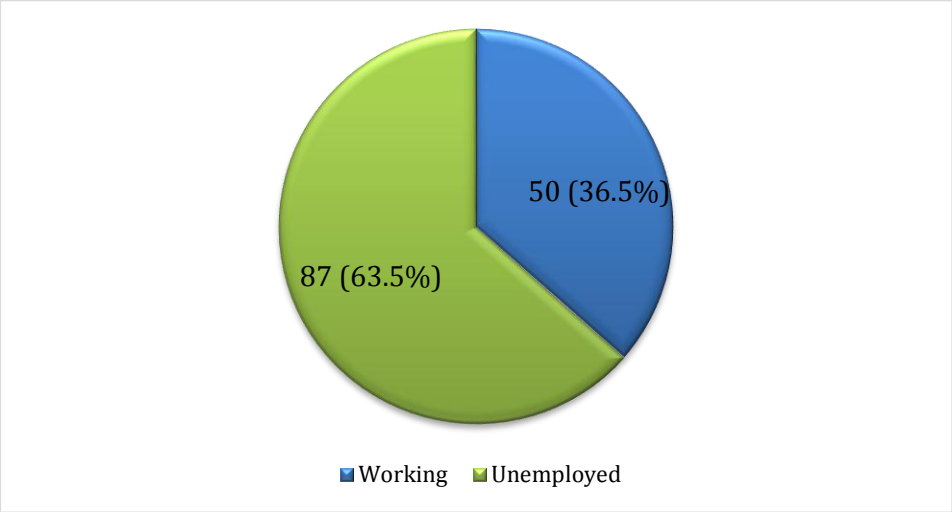
The table above describes the depression status of T2DM patients according to Marital status, among those who were unmarried, widow/widower, separated, and divorced depression was more than half the times higher 79.1% compared to married participants 30.7%.

Figure 10 Distribution of depression in T2DM patients according to Education, (n = 137)



The above figure gives the distribution of depression in T2DM patients according to education. Most number of T2DM patients with depression were literates (67.1%). Among those, 24.8% completed primary school, 29.9% went till middle/high school and 12.4% had an education of college and above. The remaining 32.9% were illiterate.

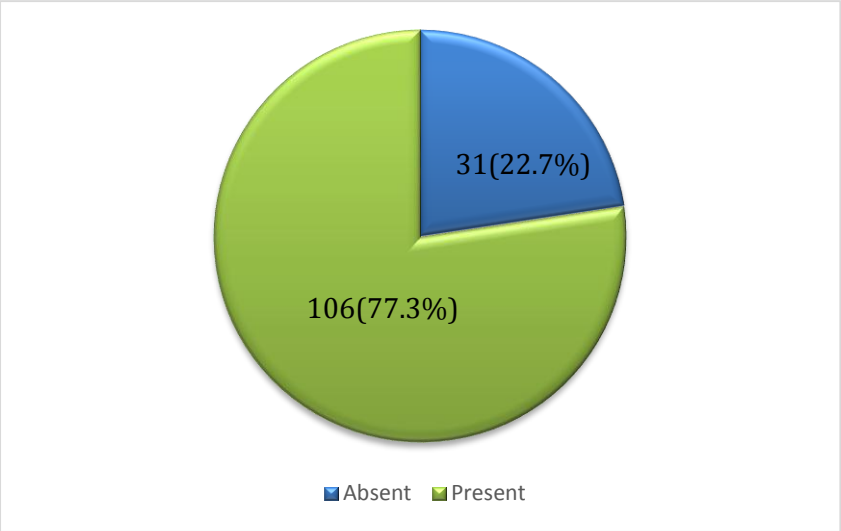
Figure 11: Distribution of depression in T2DM patients according to Occupation, (n = 137)



This figure shows the distribution of depression in T2DM patients according to occupation. Majority of depressed among study participant were unemployed 63.5% compared to those who were employed 36.5%.

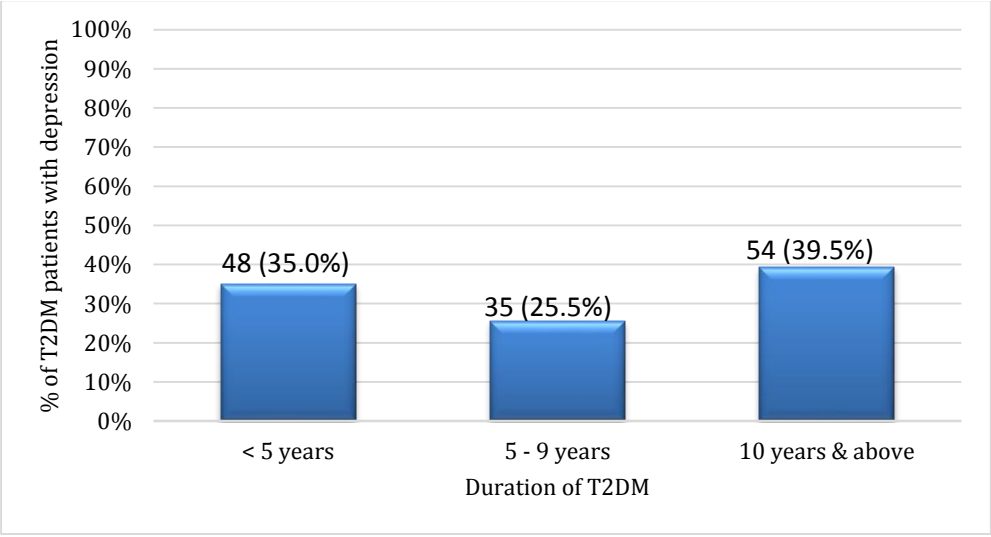
.

Figure 12: Distribution of depression in T2DM patients according to H/o T2DM complication, (n = 137)



The pie diagram shows the distribution of depression among T2DM patients according to H/o T2DM complication. Three forth of T2DM patients 77.3% with H/o T2DM complications had depression and the 22.7% of participants who had no H/o T2DM complications had depression.

Figure 13 Distribution of depression in T2DM patients according to Duration of T2DM, (n = 137)



This figure shows the distribution of depression in T2DM patients according to Duration of T2DM in years. Depression was more among the participants 39.5% who had T2DM for a period of 10 years and above, 35.0% who were depressed had T2DM for < 5 years and One fourth of the depressed 25.5% were study participants who had T2DM for 5-9 years.

Table 29: Distribution of depression in T2DM patients according to Mode of treatment, (n = 137)

	Non-Depressed	**Depressed**	**Total**
Oral	170(59.4%)	116 (40.6%)	286
Insulin	4 (16.0%)	21(84.0%)	25
Total	**174**	**137**	**311**

This figure shows the distribution of depression in T2DM patients according to mode of treatment. Most of the T2DM patients who were on Insulin were more depressed 84.0% when compared to those on Oral hypoglycemic drugs where depression is seen in 40.6%.

Table 30: Socio-demographic factors associated with Depression among T2DM patients in urban field practice area of Kolar (n = 311).

Characteristics		Depression absent n = 174 n (%)	Depression present n = 137 n (%)	Unadjusted PR(95% CI)	p value
Age (in years)	30 – 44	25 (62.5%)	15 (37.5%)		
	45 – 59	89 (70.1%)	38 (29.9%)	0.8 (0.5 - 1.3)	0.4
	60 & above	60 (41.7%)	84 (58.3%)	1.6 (1.0 - 2.4)	**0.04**
Gender	Male	109(67.7%)	52 (32.3%)		
	Female	65 (43.3%)	85 (56.7%)	1.8 (1.3 - 2.3)	**0.001**
Marital status	Married	156(69.3%)	69 (30.7%)		
	Others *	18 (20.9%)	68 (79.1%)	2.6 (2.1 - 3.2)	**0.001**
Education	Illiterate	26 (36.6%)	45 (63.4%)	2.1 (1.4 - 3.2)	**0.001**
	Primary school	35 (50.7%)	34 (49.3%)	1.6 (1.0 - 2.6)	**0.04**
	Middle/High school	74 (64.3%)	41 (35.7%)	1.2 (0.7 - 1.9)	0.5
	College & above	39 (69.6%)	17 (30.4%)		
Occupation	Working	109 (68.6%)	50 (31.4%)		
	Unemployed	65 (42.8%)	87 (57.2%)	1.8 (1.4 - 2.4)	**0.001**
Socio economic status	Upper class	132 (56.4%)	102 (43.6%)		
	Middle class	33 (55.0%)	27 (45.30%)	1.0 (0.8 - 1.4)	0.8
	Lower class	9 (52.9%)	8 (47.1%)	1.1 (0.6 - 1.8)	0.8

*Other: Unmarried, widow, separated

P $\leq$ 0.05 was considered statistically significant. PR = Prevalence ratio. CI = Confidence interval

This table shows the association of socio demographic factors of studied T2DM participants with their depression status. In univariate analysis, it was found that prevalence of depression was highest among those aged 60 years and above (PR=1.6, 95%CI 1.0 - 2.4) followed by people aged between 45 - 59 years (PR=0.8, 95%CI 0.5-1.3) when compared to the study subjects in the age category 30 – 44. The female study subjects (PR=1.8,95% CI 1.3-2.3) presented with higher prevalence of depression almost 1.8 times greater when compared to males. For marital status, participants who were unmarried, widow/widower, separated and divorced had higher prevalence of depression (PR=2.6, 95% CI 2.1-3.2) when compared to those who were married. For education, participants who were illiterate had higher prevalence of depression (PR=2.1, 95% CI 1.4 – 3.2), followed by people who had only primary education (PR=1.6, 95% CI 1.0 – 2.6) and then people who went till middle/higher secondary (PR=1.2, 95% CI 0.7 – 1.9) when compared to the study subjects who went to college. For occupation, the study participants who were unemployed (PR=1.8, 95% CI 1.4 – 2.4) had 1.8 times higher prevalence of depression when compared to those who were working. Study participants belonging to middle and lower socioeconomic class had almost similar prevalence of depression (PR=1.0, 95% CI 0.8-1.4; PR=1.1, 95% CI 0.6-1.8) when compared to individuals coming from upper socioeconomic class.

It was found that study participants who were aged 60 years and above, female gender, who were unmarried, widow/widower, separated and divorce and who were illiterate, had primary schooling, unemployed had association with depression which was found to be statistically significant with p value ≤ 0.05.

Table 31: Habits related factors associated with Depression among T2DM patients in urban field practice area of Kolar (n = 311).

Characteristics		Depression absent n = 174 n (%)	Depression present n = 137 n (%)	Unadjusted PR (95%CI)	p value
Tobacco consumption	Absent	142 (61.5%)	89 (38.5%)		
	Present	32 (40.0%)	48 (60.0%)	1.4 (1.1 - 1.8)	**0.009**
Alcohol consumption	Absent	125 (52.5%)	113 (47.5%)		
	Present	49 (67.1%)	24 (32.9%)	1.4 (1.0 - 2.1)	**0.042**
Physical activity	Adequate	113(60.4%)	74 (39.6%)		
	Not adequate	61(49.2%)	63 (50.8%)	1.3 (1.0-1.6)	**0.048**
BMI*	Normal	74 (46.8%)	84 (53.2%)		
	Over weight	86 (66.7%)	43 (33.3%)	0.6 (0.5 - 0.8)	**0.001**
	Obese	14 (58.3%)	10 (41.7%)	0.8 (0.5 - 1.2)	0.335
WHR*	Normal	37 (56.1%)	29 (43.9%)		
	At risk	137 (55.9%)	108 (44.1%)	1.0 (0.7 - 1.4)	0.984

*BMI-Body mass index WHR-Waist hip ratio

P $\leq$ 0.05 was considered significant. PR = Prevalence ratio, CI = Confidence interval

This table shows the association of habit related factors of studied T2DM participants with their depression status.

In univariate analysis, it was found that prevalence of depression was highest among those who use tobacco (PR=1.4, 95% CI 1.1 - 1.8) when compared to the study subjects who do not use tobacco. The alcohol users (PR=1.4, 95% CI 1.0 -

2.1) presented with higher prevalence of depression almost 1.4 times greater when compared to those who do not use alcohol. For physical activity, participants who had inadequate physical activity had higher prevalence of depression (PR=1.3, 95% CI 1.0- 1.6) when compared to the study subjects who had adequate physical activity. For BMI, the study participants who were over-weight (PR=0.6, 95% CI 0.5 - 0.8) had lesser prevalence of depression when compared to those who were of normal weight. Study participants who had waist hip ratio at risk level, had no significance with prevalence of depression (PR=1.0, 95% CI 0.7 - 1.4) when compared to individuals who had normal waist hip ratio.

It was found that study participants who consume tobacco, alcohol, who did not have adequate physical activity and who were overweight had association with depression which was found to be statistically significant with p value $\leq$ 0.05.

Table 32: Disease related factors associated with Depression among T2DM patients in urban field practice area of Kolar (n = 311).

Characteristics		Depression absent n = 174 n (%)	Depression present n = 137 n (%)	Unadjusted PR(95%CI)	p value
H/o T2DM complication	Absent	95(75.4%)	31(24.6%)		
	Present	79(42.7%)	106(57.3%)	2.3 (1.7 - 3.2)	**0.001**
H/o Comorbidities	Absent	97 (56.7%)	74 (43.3%)		
	Present	77 (55.0%)	63 (45.0%)	1.0 (0.8 - 1.3)	0.76
RBS level*	Normal	141(59.0%)	98(41.0%)		
	Increased	33(45.8%)	39(54.2%)	1.3 (1.0 - 1.7)	**0.037**
Duration of T2DM	< 5 years	96 (66.7%)	48 (33.3%)		
	5 - 9 years	48 (57.8%)	35 (42.2%)	1.3 (0.9 - 1.8)	0.178
	10 years & above	30 (35.7%)	54 (64.3%)	1.9 (1.5 - 2.6)	**0.001**
Mode of treatment	Oral	170(59.4%)	116 (40.6%)		
	Insulin	4 (16.0%)	21(84.0%)	2.1 (1.7 - 2.6)	**0.001**

*RBS: Random Blood Sugar

P ≤ 0.05 was considered significant. PR = Prevalence ratio, CI = Confidence interval

This table shows the association of disease related factors of studied T2DM participants with their depression status.

In univariate analysis, it was found that prevalence of depression was highest among those who had complications of T2DM (PR=2.3, 95% CI 1.7 - 3.2) when compared to the study subjects in those who do not have complications of T2DM. Patients with co-morbidities (PR=1.0, 95% CI 0.8 - 1.3) had no significant association with prevalence of depression when compared to those who do not have co-morbidities. For RBS level, participants who had increased levels of blood sugar values had higher prevalence of depression (PR=1.3, 95% CI 1.0 - 1.7) when compared to the study subjects who had normal levels of blood sugar values. Prevalence of depression was highest among those who had diabetes for a period of 10 years and above (PR=1.3, 95%CI 0.9 - 1.8) followed by people who had diabetes for a period of 5 to 9 years (PR=1.9, 95%CI 1.5 - 2.6) when compared to the study subjects who had diabetes for a period of < 5 years. Mode of treatment, the study participants who were on Insulin (PR=2.1, 95% CI 1.7 - 2.6) had higher prevalence of depression when compared to those who were on Oral hypoglycemic drugs.

It was found that study participants who had history of T2DM complication, who had increased levels of blood sugar, who had T2DM for 10 years and above and who were on insulin therapy had association with depression which was found to be statistically significant with p value $\leq$ 0.05.

Table 33: Socio-demographic and disease related factors associated with Depression among T2DM patients in urban field practice area of Kolar.

Characteristics		Unadjusted PR (95%CI)	Adjusted PR (95%CI)	p value
Age (in years)	30 – 44			
	45 – 59	0.8 (0.5 - 1.3)	0.7 (0. - 1.3)	0.229
	60 & above	1.6 (1.0 - 2.4)	0.8 (0.4 - 1.6)	0.622
Gender	Male			
	Female	1.8 (1.3 - 2.3)	1.2 (0.8 - 2.0)	0.381
Marital status	Married			
	Others *	2.6 (2.1 - 3.2)	2.2 (1.5 - 3.3)	**0.001**
Education	Illiterate	2.1 (1.4 - 3.2)	1.1 (0.6 - 2.3)	0.69
	Primary school	1.6 (1.0 - 2.6)	1.2 (0.6 - 2.3)	0.578
	Middle/High school	1.2 (0.7 - 1.9)	1.2 (0.6 - 2.1)	0.608
	College & above			
Occupation	Working			
	Unemployed	1.8 (1.4 - 2.4)	1.2 (0.8 - 1.9)	0.307
Tobacco consumption	Absent			
	Present	1.4 (1.1 - 1.8)	1.2 (0.9 - 1.8)	0.237
Alcohol consumption	Absent			
	Present	1.4 (1.0 - 2.1)	1.2 (0.7 - 2.1)	0.563
Physical activity	Adequate			
	Not adequate	1.3 (1.0- 1.6)	1.0 (0.7 - 1.4)	0.957
H/o T2DM complication	Absent			
	Present	2.3 (1.7 - 3.2)	1.6 (1.0 - 2.5)	**0.038**
RBS level	Normal			
	Increased	1.3 (1.0 - 1.7)	1.2 (0.8 - 1.7)	0.41

Duration of T2DM	< 5 years			
	5 - 9 years	1.3 (0.9 - 1.8)	1.0 (0.6 - 1.6)	0.914
	10 years & above	1.9 (1.5 - 2.6)	1.1 (0.7 - 1.8)	0.598
Mode of treatment	Oral			
	Insulin	2.1 (1.7 - 2.6)	1.8 (1.1 - 3.1)	**0.025**

*Other: Unmarried, widow, separated

P ≤ 0.05 was considered significant. PR = Prevalence ratio, CI = Confidence interval

This is the table from multivariate logistic regression whichever turned out to be significant in the univariate logistic regression where combined and analysed. It was found that in adjusted PR, marital status - people living in loneliness (unmarried, widow/widower ,divorce and separated), participants who had complications of diabetes and who were on insulin among the people in these categories depression was found to be statistically significant with p value ≤ 0.05.

DISCUSSION

6. DISCUSSION

The study was done to assess the prevalence of depression among T2DM patients residing in urban community of Kolar and to find the various associated factors with depression.

In the present study it was found that among the study participants male and female were of almost equal proportion. Male were higher 51.8%. 46.3% of the study participants were 60 years and above and 72.3% of them were married. 51.1% of the study participants were employed. 37% of the study participants have attended middle/high school. 22.8% of them were illiterate. 53.7% of the study participants belong to upper middle class. Nearly 1/4th of the study participants were consuming tobacco and alcohol. Family history of type 2 diabetes was reported by more than half of the study participants. 3/5th of the study participants has had adequate physical activity. Only 1.3% of them had good dietary practice. 5.1% of the female participants gave history of consumption of OCP. Nearly half of the study participants were overweight and obese. Nearly 3/4th of the study participants had abnormal waist hip ratio. 23.2% of them had uncontrolled T2DM (more than 200 mg/dl). 97.4% of them were taking treatment regularly out of which 89.4% of them were on oral hypo glycemic drugs.

Among the study participants 34% were hypertensive patients. While 30% of them had high blood pressure levels on examination. More than half of them gave history of complications of T2DM. Prevalence of depression was 44.1% using PHQ9 questionnaire.

Depression was significantly more common among women than men, who were 60 years and above, who were living in loneness, who were illiterate and who had primary schooling and who were unemployed.

Depression were also significant in people who were consuming tobacco and alcohol and also significant in participants who were not having adequate physical activity. Similarly, depression was significant among patients living with complications of T2DM, who were living with uncontrolled diabetes and for participants whose duration of diabetes were 10 years and above and also among patients who were on insulin.

In multivariate logistic regression, depression was found to be significant among people living in loneness, who had complications of T2DM and who were on insulin.

6.1. SOCIO DEMOGRAPHIC CHARACTERISTICS:

6.1.1. GENDER

In our study it was noticed that males were in higher proportion 51.8% than females which was similar to the studies done in Mangalore by Joseph et al. reported that 51.7% of the study participants were male. [61] Similarly, in Punjab by Khullar et al. reported that 50.95% of the study participants were male. [64] 50.2% of the participants were male in the study in Nepal by Pahari et al.[45] and also in Korea by park et al. 58.5% of them were male.[42]

Whereas in the study in Manipal by Aminu et al. reported that 54% of the study participants were female.[1] and study by Raval et al. in Chandigarh, found 51% of the participants were female. [58]

Even though males were more in our study, it was observed depression is more among female participants with T2DM (56.7%) than among males (32.3%) which was similar to the studies conducted in Punjab by Khullar found 65% of female participants had depression, study by Amir in Aligarh observed 58% of females had depression, study by Neeraj in Himachal too found 57.6% of female T2DM patients were depressed, also in the study by Joseph in Mangalore found 53.1% of females had depression and in the community based study by Aminu in Manipal too observed 68.9% female participants with T2DM was depressed.

Whereas in the study done in Odisha by Suravi found depression was more in male T2DM patients than females, where 56% of male participants had depression.

6.1.2. Age: In the present study 46.3% were 60 years and above whereas in the study done by Joseph et al. in Mangalore it was found that 26.8% were above 60 years which is less than that of the study done by us. In the study done by Park et al. in Korea it was found that 32.5% were 60 years and above.[42] In a hospital-based study done in Nepal by Pahari et al. it was found that 33.5% of the study participants were 60 years and above.[45] Our study is a community-based study whereas other studies were hospital-based study. In community based study done in Manipal by Aminu et al. it was found that 37% of the study participants were more than 66 years of age which is less to that of our study result but the cut off age was more than 65 years whereas in our study it is 60 years and above. So, that could be the reason for more number participants above 60 years of age and also as the age advances people are more prone for diabetes.[62][1]

In our study majority of the T2DM patients with depression were in the age group of 60 years and above (64.31%). Which is similar to the studies by Joseph in Mangalore 59.7% of the elderly who were aged > 60 years were depressed, by Aminu in Manipal, it was found that there is 1.5 fold increase in odds of depression among participants aged ≥65 years than who were <65 years of age.[58][61]Whereas in the study by Suravi in Odisha it was found 52.6% of participants aged 45-59 years were more depressed compared to who were aged ≥ 60 years. Similarly in the study by Pahari in Nepal it was found 79.3% of T2DM patients aged 45-59 years were more depressed compared to who were ≥ 60 years of age. This may be because middle aged are working class people, more of work related stress could be a reason for their depression.

6.1.3. Marital status: In our study 72.3% of the study participants were married. It is also similar to the studies conducted in Manipal by Aminu et al. which shows 69.5% of them were married, in Mangalore by Joseph et al. shows 93.5% of them were married, in Nepal by Pahari et al. shows 89.1% of them were married, and also in Korea by Park et al. showed 89.9% of them were married.[1][61][45][42]

It was noticed in some studies depression was found to be more among unmarried, widow, separated and divorced people than among married people, in certain other studies depression was found to be more among married than among unmarried, widow, separated and divorce.

In the present study, it was noticed that depression was more than half the times higher (79.1%) among those who were unmarried, widow/widower, separated, divorced than married participants (30.7%). Similarly in the studies by Aminu,

45.9% of who were unmarried, widow, separated and divorce were more depressed, similar findings was observed in the study by Pahari in Nepal where 55% of the participants who were unmarried, widow, separated and divorce were more depressed.

whereas in the studies conducted in Aligarh by Amir, depression was found to be high, 40% among married participants, by Suravi in Odisha- 66.2% of the married participants were in depression and also observed at Mangalore by Joseph where 46.5 % of the married were depressed. It could be because these studies were hospital based studies, when a married person with lots of commitment happened to spend their money because of sickness and also not able to work effectively because of the disease condition might make the married more depressed than others.

6.1.4. Occupational status: In our study 48.9% were unemployed which includes retire people and home maker. In the study done in Manipal by Aminu et al. it was found that 69% of them were unemployed which includes home maker and retired people which is higher than that of what we see in our study. In the hospital-based study done in Mangalore by Joseph et al. it was found that 29.1% of the study participants were unemployed. In a study done in Korea by Park et al. 44.3% of them were found to be unemployed which is close to our study results. [43][62][1] .

In most of the studies it was observed that study participants who were unemployed are more depressed compared to those who were employed.

In our study most number of T2DM patients with depression were unemployed (63.5%) similarly in the studies by Joseph in Mangalore 62.5% of the unemployed were depressed, by Aminu in Manipal 56.1% of the unemployed were depressed, Whereas in the study by Pahari at Nepal 55% of the Agriculturist were found to be depressed. In our study agriculturists were recorded as semi-skilled workers and did not look for depression perse.

6.1.5. Educational status: In the present study it was found 22.8% of the participants were illiterate whereas in the study done in Manipal by Aminu et al. illiterates were found to be 11%. In a study done in Nepal by Pahari et al. illiterates were 21.2% which is similar to that of our result.[46][1]

In the present study it was observed depression is more among illiterates 32.8%, which is similar to the studies by Joseph in Mangalore 61.5% of the illiterates were depressed and also by Aminu in Manipal 54.5% of the illiterates were depressed. Whereas in the study Amir at Aligarh, depression was high among graduates (48.4%) by Suravi at Odisha 57.4% of the participants who have had primary schooling were depressed, and also by Pahari at Nepal 47.1% found who had primary schooling were depressed.

6.1.6. Socio economic status: In our study 53.7% participants belongs to upper middle class. In a study done in Nepal by Pahari et al. it was found that 55.2% of them belong to upper class. In a study done by Aminu et at. 61.5% of them belong to middle class. In the published studies SES is been categorized into upper, middle and lower class. Whereas in our study we have categorized 5 classed that might be the reason for the difference found.[46][1]

In our study it was found upper class people were more depressed (56.4%), whereas in the study by Aminu in Manipal, 47.4 % belonging to lower socio economic class were depressed, similarly by Joseph at Mangalore 68.9% belonging to lower socio economic class were depressed and also by Pahari at Nepal 53.8% found lower socio economic class were depressed. Whereas in the study conducted by Amir at Aligarh 87.1% of the participants belonging to middle socio economic class were depressed. The reason could be because we categorized upper middle class into upper class.

6.2. TOBACCO AND ALCOHOL CONSUMPTION AMONG STUDY PARTICIPANTS:

In the present study 38.3% of them use tobacco and 23.5% of them were alcohol drinkers. In study done in Korea by Park et al. it was found that 51.2% of them were alcohol drinkers and 20.1% of them were smokers. In a study done in Punjab by Khullar et al. it was found that 78.34% of them were alcohol drinkers and 38.71% were smokers. Tobacco usage is similar in our study and study at Punjab but in our study we have included both tobacco smoking and chewable tobacco whereas in the study by other they have included only tobacco smoking. Higher rates of drinking were observed in the studies done by others.[43][65]

In our study it was noted that among those who consume tobacco depression was seen in 60% than those who don't use tobacco and among those who consume alcohol depression was seen in 32.9% which is less than those who don't use alcohol.

In our study intake of alcohol, smoking were associated with increased prevalence of depression in unadjusted analysis among diabetes patients later on adjusted analysis it did not turn out to be significant like in studies done in Punjab and Korea. Whereas intake of alcohol, smoking were associated with increased odds of depression, among diabetes patients in Ghana.[44]

6.3. PHYSICAL ACTIVITY:

In our study 60.1% of the study participants had adequate physical activity that is minimum of 150 minutes per week. In a study done by Pahari et al. in Nepal it was found that 45.3% of the study participants had adequate physical activity. In a study done by Park et al. in Korea it was found that 56.4% had adequate physical activity. Little higher rates of physical activities were identified in our study as compared to studies done by others.[46][43]

In our study it was found, among those who do not have adequate physical activity 50.8% were depressed when compared with those who have adequate physical activity 39.6% were depressed. It was noted in the study by Pahari in Nepal 40.8% of participants who do not have adequate physical activity were found to be depressed. In our study it's slightly higher, may be because that is a hospital based study.

In our study we found inadequate physical activity and overweight were associated with increased prevalence of depression in unadjusted analysis among diabetes patients, later on adjusted analysis it did not turn out to be significant. Whereas in the study done in Punjab by Khullar found sedentary life style increase depression by 3.4 fold than who do not have sedentary lifestyle.

Similarly in the study done in Mangalore by Joseph et al, reported that obesity and depression are strongly associated among diabetic patients .[61] the reason could in the study in Mangalore they have not done adjusted analysis.

6.4. RANDOM BLOOD SUGAR LEVEL:

In present study uncontrolled T2DM with GRBS level more than 200 mg/dl was found in 23.2% of the study participants as compared with that of the study done by Park et al. uncontrolled T2DM were found in 35.7% of the study participants. And it was found in the study by Pahari et al. uncontrolled T2DM were found to be 36.34% of the study participants.[46][43]

In the present study 54.2% of the participants who had increased blood sugar levels(≥ 200mg/dl) were found to be depressed similarly in the studies by Neeraj in Himachal Pradesh 66% of the participants, by Joseph in Mangalore 48.4% participants, by Pahari in Nepal 44.6% T2DM patients and in Korea by Park 36% of the participants who had poor control of blood sugar levels were found to be depressed.

6.5. COMPLICATIONS OF T2DM:

In the present study neuropathy was seen in 56.6% of the study participants whereas in the study done by Raval et al. neuropathy was found in 65% of the study participants. In a study by Joseph et al. in Mangalore it was found that 23.5% of the study participants had neuropathy. Retinopathy was seen in 10.3% of our study participants whereas in the study done by Joseph et al. it was found that 36.5% of them had retinopathy and in study done by Raval et al. in Punjab it was found that 39% of the study participants had retinopathy. The difference

observed might be because the other studies were hospital-based study, and our study is a community-based study.[59][62]

In our present study it was observed 57.3% of study participants with complications were found to be depressed whereas in those who do not have complication it was found only 24.6% were depressed. Similarly, in the studies by Neeraj 60.6% of the participants, 57.4% of the participants in the study by Suravi in Odisha with complications were found to be depressed, which is similar to our study. and by Joseph in Mangalore it was observed 63.6% of the participants with nephropathy and 68.9% of the participants with diabetic foot were found to be depressed.

6.6. COMORBIDITIES:

34.1% of the study participants had hypertension in the present study whereas in the study done in Korea by Park et at. It was found that 47% of them had hypertension. In the study done in Joseph et al. it was found that 52.6% of them had hypertension. In the study done by Thour et al. in Punjab hypertension was found in 60.3% of the study participants. In the present study 45% of the study participants had comorbid conditions. In the study done in Nepal by Pahari et al. 80.7% of them had comorbid conditions. The observed difference between our study and other study is might be due to the other studies being hospital-based study and our study is a community-based study.[46][43][62][68]

In our study it was found 45.0% of the study participants with co-morbidities were found to be depressed, whereas in the study by Joseph in Mangalore it was found 62.8% of the participants with hypertension were depressed and 58.1% of

the participants with coronary artery disease were depressed. It was noted 39% of the participants with co-morbidities were depressed.

6.7. PREVALENCE OF DEPRESSION IN T2DM PATIENTS:

In the various studies conducted on the prevalence of depression among T2DM patients, the prevalence of depression was found to vary between 11% and 83.8%. with majority of the studies having prevalence of depression more than 40%. The observed variation of high range of prevalence of depression could be due to selection bias as most of the studies were done in hospital settings which attracts participants with active symptoms who are more likely to attend to health care centres. [43,44,53,45–52][1,54,63–68,55–62]

In our studies prevalence of depression was found to be 44.1% which is similar to most of the studies where prevalence of depression was found to around 40% in the studies done in Punjab, Madhya Pradesh and Mangalore in India and in Ethiopia, Malaysia and China outside India. [43,44,53,45–52][1,54,63–68,55–62]

At the same time there were studies showing depression at a higher range; in which more than 50% of diabetes were depressed. To mention a few, a study done in Saudi Arabia found depression to be 53.8%.[51] and a study by Kamrul et al in Bangladesh shows depression to be 60.3%.[52] Prevalence of depression in diabetes in Rwanda was found to be 83.8%.[53] In, out of 16 Indian studies which was compared in 6 studies it was found that more than 50% of diabetes patients were depressed. [1,54,63–68,55–62]

In our study we have used Patient Health Questionnaire-9 like us in most of the studies we find Patient Health Questionnaire-9 being used to mention a few Malaysia, Rwanda, China, Ethiopia, Pakistan and was also used in most of the studies done in India, that is in 10 out of 16 studies this showsPHQ-9 is more commonly used in Asian and African region. At the same time in South Korea and Nepal which is again Asian countries where we see BDI scale being used. [43,44,53,45–52]

In other studies we observe different types of depression screening tools being used to mention it, In Nepal and South Korea Beck Depression Inventory (BDI) scale has been used, in Australia we see Brief Case find for Depression (BCD) scale been used, in the study done in Saudi Arabia; Hospital Anxiety and Depression Scale (HADS) was used. Montgomery Asberg Depression Rating Scale (MADRS) used in a study done in Bangalore, Mini International Neuropsychiatric Interview (MINI) scale being used by Ali et. al in a study done in Delhi, Hamilton scale for Depression (HAM-D) was used in couple of studies done in Punjab and Himachal Pradesh and Centre for Epidemiological studies – Depression scale (CES-D) scale was used in a study done in Madhya Pradesh and also Geriatric Anxiety Depression-7 (GAD-7)scale been used in study at Punjab. [43,44,53,45–52] [1,54,63–68,55–62]

Our study is a community based study similarly only very few studies were done in the community to tell it, it was in South Korea and in China. [43,44,53,45–52] study done in Manipal by Aminu et al. it was done in urban and rural area of Manipal

and the other study was done in Rajasthan among factory workers. [1,54,63–68,55–62]and most of these studies were done in hospitals.

6.8. FACTORS ASSOCIATED WITH DEPRESSION IN T2DM PATIENTS:

Depression was significantly more common among women than men. Similar findings were reported in many other studies.[43][62][1][65] A common explanation to this gender difference had been the fact that women play differing social roles as opposed to their male counterparts with attendant disadvantages including dependence and unemployment to mention few. In the current study, for instance, the majority of the women were unemployed and were homemakers. A significant association was found between depression and unemployment in this study. These findings could contribute to the relatively higher prevalence of depression among women.

In this study, being unmarried, including singlehood and widowed status, was found to be significantly associated with depression, which is similar to that of other studies.[46][43][1]

In the present study significant association was observed between educational status and depression and it is not similar to that of other studies that does not establish significant relationship between education and depression.[62][1]

There was no significant association between socioeconomic status and depression demonstrated in the present study. This disagrees with the findings from other study by Joseph et.al.[62] The reason could be difference in

socioeconomic status may not have contributed to significant differences in depression between the different social classes in this study population.

Depression was found to be significantly more frequent among unemployed participants than in employed ones. This is consistent with the findings of Joseph et al. and Aminu et al.[62][1]

Depression was found to be significantly associated with tobacco usage and alcohol usage which is similar to that of the study done in Punjab by Khullar et al.[65]

Depression was found to be significantly associated with participants not having adequate physical activities. But it is not similar with that of the study done by Pahari et al. in Nepal.[46]

Uncontrolled diabetes status was found to be significantly associated with the present study which is inconsistent with that of the study done by Pahari et al.[56] and Park et al.[43]

Complications of T2DM was found to be significantly associated with the present study which is consistent with that of the study done by Joseph et al. and Raval et al. [59][62]

Duration of T2DM 10 years and above was found to be significantly associated with the present study which is inconsistent with that of the study in done by Park et al., Pahari et al. and Raval et al. [46][43][59]

Insulin was found to be significantly associated with the present study which is consistent with that of the study done by Pahari et al. in Nepal whereas the insulin use is not significant in the study done by Raval et al. [46][59]

6.9. FACTORS ASSOCIATED WITH DEPRESSION IN T2DM PATIENTS AFTER ADJUSTMENT:

In adjusted PR complication of T2DM was significantly associated with the present study which is in coherence with that of the study done by Aminu et al.[1]

Insulin therapy was found to be significantly associated with depression in the present study which is consistent with that of the study done by Pahari et al. in Nepal.[46]

Participants whose marital status was not in the category of married (unmarried, widow and separated) was significantly associated with depression in the present study whereas it was not so in the other study done by Aminu et al.[1]

SUMMARY

7. SUMMARY

This is a community based, cross sectional study carried out in an urban area of Kolar, to estimate the prevalence of depression and socio-demographic and disease related factors associated with Depression in type 2 diabetes mellitus individuals.

Among them male and female participants were almost equal, with majority of them 46.3% were 60 years and above, nearly three forth of them 72.3% were married, half of them 53.7% belongs to upper middle class according to Modified BG Prasad classification. Around 97.4% of the diabetic patients were on regular treatment and 89.4% of them were on oral medication, 45.0% participants gave history of presence of co-morbid conditions and more than half of the study participants 59.5% were known cases with complications of T2DM.

44.1% (n=137) of the patients with T2DM had Depression, among the depressed 62% were females, 63.5% were unemployed, 72.3% had complications of T2DM and 84% of the insulin users were depressed.

T2DM patients living in loneliness (unmarried, widow/widower and separated), who had complications of diabetes and who were on insulin were found to have a statistically significant association with depression.

Depression can act as a barrier in the effective treatment of diabetes, which can in turn lead to non-adherence to treatment; in turn it can increase the complication of T2DM, again it increases financial burden and in turn increased depression, to stop this vicious cycle, patients with T2DM has to be screened for

depression, identify depression and treat them for the same, to make them have a better quality of life.

CONCLUSION & RECOMMENDATION

8.1. CONCLUSION

The study reports, the prevalence of depression among type 2 diabetes mellitus patient which was found to be 44.1%, with 25.7% of the participants had mild depression, 14.8% of them had moderate depression, 3.2% of them had moderately severe depression and 0.3% had severe depression.

Depression was found to be significantly associated with patients living in loneliness (unmarried, widow/widower, separated), patients who were on insulin and patients with complications of type 2 diabetes mellitus.

As depression could hamper patient's adherence to treatment, there is a need to diagnose early and treat them. This claims the integration of mental health into diabetes management.

8.2. RECOMMENDATION

1. Patients with diabetes are to be screened for depression, on identifying depression in T2DM patients, they are to be treated for depression.

2. As PHQ-9 is simple and easy to understand, it can be administered by nursing staff or Medical officer, so that the screening for depression in diabetes can be done at primary care level as an opportunistic screening.

3. Identifying depression early and treating them for the same will improve the quality of life of diabetes patients and also will reduce the overall treatment costs, which are generally unaffordable for most of the individuals with this disease in India.

4. In diabetic patients, the depression remains an underdiagnosed, as the diabetic specialist would be looking for common co-morbidities. To avoid it a multidisciplinary approach is needed, which would help to improve the outcomes of disease, decrease the number of DALYs and even mortality.[9]

5. Identifying diabetic patients with comorbid depression and giving them effective treatment and psychological support should be of public health and research priority.

6. Population-based interventions to reduce common etiological factors for diabetes and depression should be developed and tested in experimental studies.[10]

8.3 STRENGTHS

1. It's a community-based study, with high response rate.

2. PHQ-9 scores greater than 10 had a sensitivity of 88% and a specificity of 88%. Internal consistency of PHQ-9 was 0.81 indicating good consistency of this psychometric scale in the study population.

3. The study corroborates the factors associated with depression among patients with T2DM.

4. The findings of this study will give scope for further action to be taken for opportunistic screening for depression among T2DM patients at primary care level, by which depression can be identified and treated to improve the quality of life.

8.4 LIMITATIONS

1. As this is a cross sectional study there can be temporal association between type 2 diabetes mellitus and depression where we cannot establish which proceeded over the other cause or effect.

2. Recall bias cannot be totally eliminated as reviewing of patients documents and data was not done.

3. As this study is a cross sectional study, we could not analyze behavior over a period to time.

4. The anti-diabetic drugs used itself can cause depression, which was not noted down in detail, hypoglycaemic drugs like metformin can itself cause depression.[1]

REFERENCE

9. REFERENCES

1. Aminu AS, Chandrasekaran V, Nair S. Depression among Patients with Diabetes : A Community ‐ based Study in. 2017;37:237–44.

2. King H, Aubert RE, Herman WH. Global Burden of Diabetes, 1995–2025: Prevalence, numerical estimates, and projections. Diabetes Care 1998;21:1414-31.

3. Edition ID. International Diabetes Federation. IDF Diabetes Atlas, 9th edn. Brussels, Belgium: International Diabetes Federation, 2019.

4. Basu S, Sharma N. Diabetes self-care in primary health facilities in India-challenges and the way forward. World J Diabetes 2019;1:341.

5. Lustman PJ, Anderson RJ, Freedland KE, De Groot M, Carney RM, Clouse RE. Depression and poor glycemic control: a meta-analytic review of the literature. Diabetes Care 2000;23:934–42.

6. Poongothai S, Anjana RM, Radha S, Sundari BB, Rani CSS, Mohan V. Epidemiology of depression and its relationship to diabetes in India. J. Assoc. Physicians India2017;65:60–6.

7. Gavard JA, Lustman PJ, Clouse RE. Prevalence of depression in adults with diabetes: an epidemiological evaluation. Diabetes Care 1993;16:1167–78.

8. Sartorius N. Depression and diabetes. Dialogues Clin Neurosci 2018;20:47.

9. Bădescu S V, Tătaru C, Kobylinska L, Georgescu EL, Zahiu DM, Zăgrean AM, et al. The association between diabetes mellitus and depression. J Med Life 2016;9:23–30.

10. Holt RIG, De Groot M, Lucki I, Hunter CM, Sartorius N, Golden SH. NIDDK international conference report on diabetes and depression: current understanding and future directions. Diabetes Care 2014;37:2067–77.

11. Lin EHB, Katon W, Von Korff M, Rutter C, Simon GE, Oliver M, et al. Relationship of depression and diabetes self-care, medication adherence, and preventive care. Diabetes Care 2004;27:2154–60.

12. De Groot M, Anderson R, Freedland KE, Clouse RE, Lustman PJ. Association of depression and diabetes complications: a meta-analysis. Psychosom Med 2001;63:619–30.

13. Hofmann M, Köhler B, Leichsenring F, Kruse J. Depression as a risk factor for mortality in individuals with diabetes: a meta-analysis of prospective studies. PLoS One 2013;8:e79809.

14. Bhattacharya R, Shen C, Wachholtz AB, Dwibedi N, Sambamoorthi U. Depression treatment decreases healthcare expenditures among working age patients with comorbid conditions and type 2 diabetes mellitus along with newly-diagnosed depression. BMC Psychiatry 2016;16:247.

15. Newby J, Robins L, Wilhelm K, Smith J, Fletcher T, Gillis I, et al. Web-based cognitive behavior therapy for depression in people with diabetes mellitus: a randomized controlled trial. J Med Internet Res 2017;19:e157.

16. Katon WJ, Rutter C, Simon G, Lin EHB, Ludman E, Ciechanowski P, et al. The association of comorbid depression with mortality in patients with type 2 diabetes. Diabetes Care 2005;28:2668–72.

17. Egede LE, Zheng D, Simpson K. Comorbid depression is associated with increased health care use and expenditures in individuals with diabetes. Diabetes Care 2002;25:464–70.

18. Black SA, Markides KS, Ray LA. Depression predicts increased incidence of adverse health outcomes in older Mexican Americans with type 2 diabetes. Diabetes Care 2003;26:2822–8.

19. Sanders LJ. From Thebes to Toronto and the 21st century: an incredible journey. Diabetes Spectr 2002;15(1):56–60.

20. Caballero AE. The "A to Z" of managing type 2 diabetes in culturally diverse populations. Front Endocrinol Lausanne 2018;9:479.

21. Atlas D. International diabetes federation. IDF Diabetes Atlas, 7th edn Brussels, Belgium Int Diabetes Fed 2015;

22. HealthInfoNet AI. Chronic conditions. Diabetes 2016;

23. World Health Organization. World Health Organization Global Report on Diabetes. Geneva: World Health Organization. 2016.

24. Wild SH, Roglic G, Green A, Sicree R, King H. Global prevalence of diabetes: estimates for the year 2000 and projections for 2030: response to Rathman and Giani. Diabetes Care 2004;27:2569.

25. Gale J. India's diabetes epidemic cuts down millions who escape poverty. Bloom Retrieved 2012;8.

26. Grens K. Diabetes continuing to spike in China.[Online] April 4, 2012.[Cited: Aug 20, 2020.].

27. Wild S, Roglic G, Green A, Sicree R, King H. Global prevalence of diabetes: estimates for the year 2000 and projections for 2030. Diabetes Care 2004;27:1047–53.

28. Kleinfield NR. Modern ways open India's doors to diabetes. New York Times 2006;1:13A.

29. Anjana RM, Deepa M, Pradeepa R, Mahanta J, Narain K, Das HK, et al. Prevalence of diabetes and prediabetes in 15 states of India: results from the ICMR–INDIAB population-based cross-sectional study. lancet Diabetes Endocrinol 2017;5:585–96.

30. Muninarayana C, Balachandra G, Hiremath S, Iyengar K, Anil N. Prevalence and awareness regarding diabetes mellitus in rural Tamaka, Kolar. Int J Diabetes Dev Ctries 2010;30:18–21.

31. Yesudian CAK, Grepstad M, Visintin E, Ferrario A. The economic burden of diabetes in India: a review of the literature. Global Health 2014;10:80.

32. Javalkar SR. The economic burden of health expenditure on diabetes mellitus among urban poor: a cross sectional study. Int J Community Med Public Heal 2019;6:1162–6.

33. Chandra P, Gogate B, Gogate P, Thite N, Mutha A, Walimbe A. Economic burden of diabetes in urban Indians. Open Ophthalmol J 2014;8:91.

34. Kalra S, Jena BN, Yeravdekar R. Emotional and psychological needs of people with diabetes. Indian J Endocrinol Metab 2018;22:696.

35. Sagar R, Dandona R, Gururaj G, Dhaliwal RS, Singh A, Ferrari A, et al. The

burden of mental disorders across the states of India: the Global Burden of Disease Study 1990–2017. The Lancet Psychiatry 2020;7:148–61.

36. Cooper C. Global, regional, and national incidence, prevalence, and years lived with disability for 354 diseases and injuries for 195 countries and territories, 1990-2017: a systematic analysis for the Global Burden of Disease Study 2017. Lancet 2018;392:1789–858.

37. Park M, Reynolds CF. Depression among older adults with diabetes mellitus. Clin Geriatr Med 2015;31:117–37.

38. Holt RIG. Undoing Descartes: integrating diabetes care for those with mental illness. Pract Diabetes Int 2011;28:270–5.

39. van Sloten T, Schram M. Understanding depression in type 2 diabetes: a biological approach in observational studies. F1000Research 2018;7.

40. Simayi A, Mohemaiti P. Risk and protective factors of co-morbid depression in patients with type 2 diabetes mellitus: a meta analysis. Endocr J 2019;EJ18-0579.

41. Holt RIG. HHS Public Access. 2015;14(6).

42. Joseph JJ, Golden SH. Cortisol dysregulation: the bidirectional link between stress, depression, and type 2 diabetes mellitus. Ann N Y Acad Sci 2017;1391:20.

43. Young C, Young S, Won J, Hee M, Park J, Kim Y. Depression among Korean Adults with Type 2 Diabetes Mellitus : Ansan-Community-Based Epidemiological Study. Osong Public Heal Res Perspect 2015;6:224–32.

44. Nanayakkara N, Pease A, Ranasinha S, Wischer N, Andrikopoulos S, Speight J, et al. Depression and diabetes distress in adults with type 2 diabetes: results from the Australian National Diabetes Audit ANDA 2016. Sci Rep 2018;8:1–10.

45. Akpalu J, Yorke E, Ainuson-Quampah J, Balogun W, Yeboah K. Depression and glycaemic control among type 2 diabetes patients: a cross-sectional study in a tertiary healthcare facility in Ghana. BMC Psychiatry 2018;18:357.

46. Pahari DP, Upadhyay R, Sharma CK. Depression among diabetic patients visiting a diabetes center in Nepal. 2018;2–6.

47. Arshad AR, Alvi KY. Frequency of depression in type 2 diabetes mellitus and an analysis of predictive factors. Population Paris 2016;6:7.

48. Dar B. Prevalence of Depression and Associated Factors among Adult Diabetic Patients Attending Outpatient Department , at Felege Hiwot Referral. 2016;6:264–76.

49. Chew B-H, Vos R, Mohd-Sidik S, Rutten GEHM. Diabetes-related distress, depression and distress-depression among adults with type 2 diabetes mellitus in Malaysia. PLoS One 2016;11:e0152095.

50. Yu S, Yang H, Guo X, Zheng L, Sun Y. Prevalence of depression among rural residents with diabetes mellitus: a cross-sectional study from northeast China. Int J Environ Res Public Health 2016;13:542.

51. Albekairy A. Exploring Factors Associated with Depression and Anxiety among Hospitalized Patients with Type 2 Diabetes Mellitus. 2017;547–53.

52. Kamrul-Hasan AB, Palash-Molla M, Mainul-Ahsan M, Gaffar AJ, Asaduzzaman M, Saifuddin M, et al. Prevalence and Predictors of Depression among Patients with Type 2 Diabetes: A Multicenter Cross-sectional Study from Bangladesh. Mymensingh Med J 2019;28:23–30.

53. Mukeshimana M, Chironda G. Depression and Associated Factors Among the Patients with Type 2 Diabetes in Rwanda. Ethiop J Health Sci 2019;29.

54. Medicine AOF. A study of depression in diabetes mellitus : analysis from rural hospital , India. 2014;6:6–11.

55. Ali N, Jyotsna VP, Kumar N, Mani K. Prevalence of Depression Among Type 2 Diabetes Compared to Healthy Non Diabetic Controls. 2013;61:2012–4.

56. Kanwar N, Sharma RC, Sharma DD, Ramesh, Mokta K, Mokta JK. Prevalence of psychiatric comorbidity among patients of type 2 diabetes mellitus in a hilly state of North India. Indian J Endocrinol Metab 2019;23:602–8.

57. Siddiqui S, Jha S, Waghdhare S, Agarwal NB, Singh K. Prevalence of depression in patients with type 2 diabetes attending an outpatient clinic in India. Postgrad Med J 2014;90:552 LP – 556.

58. Mushtaque A, Gulati R, Hossain MM, Azmi SA. Prevalence of depression in patients of type 2 diabetes mellitus: A cross sectional study in a tertiary care centre. Diabetes Metab Syndr Clin Res Rev 2016;10:238–41.

59. Raval A, Dhanaraj E, Bhansali A, Grover S, Tiwari P. Prevalence & determinants of depression in type 2 diabetes patients in a tertiary care centre. 2010; 132:195–200.

60. Chaudhary R, Kumar P, Chopra A, Chabbra S, Singh P. Comparative study of psychiatric manifestations among type I and type II diabetic patients. Indian J Psychol Med 2017;39:342.

61. Singh H, Raju M, Dubey V, Kurrey R, Bansal S, Malik M. A study of sociodemographic clinical and glycemic control factors associated with co-morbid depression in type 2 diabetes mellitus. Ind Psychiatry J 2014;23:134.

62. Joseph N, Unnikrishnan B, Babu YPR, Kotian MS, Nelliyanil M. Original Article Proportion of depression and its determinants among type 2 diabetes mellitus patients in various tertiary care hospitals in Mangalore city of. 2013;17.

63. Patra S, Patro BK, Mangaraj M, Sahoo SS. Screening for depression in diabetes in an Indian primary care setting: Is depression related to perceived quality of life? Prim Care Diabetes 2020;3–7.

64. Jain A, Sharma R, Choudhary P, Yadav N, Jain G, Maanju M. Study of fatigue, depression, and associated factors in type 2 diabetes mellitus in industrial workers. Ind Psychiatry J 2015;24:179.

65. Khullar S, Dhillon H, Kaur G, Sharma R. The Prevalence and Predictors of Depression in Type 2 Diabetic Population of Punjab. Community Ment Health J 2016; 1;52:479-83.

66. Verma M, Grover S, Tripathy JP, Singh T, Nagaraja SB, Kathirvel S, et al. Co-existing non-communicable diseases and mental illnesses amongst the elderly in Punjab, India. Eur Endocrinol 2019;15:106–12.

67. Bahety P, Agarwal G, Khandelwal D, Dutta D, Kalra S, Taparia P, et al. Occurrence and predictors of depression and poor quality of life among patients with Type-2 diabetes: A Northern India perspective. Indian J Endocrinol Metab 2017;21:564.

68. Thour A, Das S, Sehrawat T, Gupta Y. Original Article Depression among patients with diabetes mellitus in North India evaluated using patient health. 2015;19:252–5.

69. Andreoulakis E, Hyphantis T, Kandylis D, Iacovides A. Depression in diabetes mellitus : a comprehensive review. 2012;205–14.

70. Devarajooh C, Chinna K. Depression , distress and self-efficacy : The impact on diabetes self-care practices. 2017;1–16.

71. Long M, Saha C. Lifetime Duration of Depressive Disorders in Patients With Type 2 Diabetes. 2016;39:2174–81.

72. Kowalski AJ, Poongothai S, Chwastiak L, Hutcheson M, Tandon N, Khadgawat R, et al. The INtegrating DEPrEssioN and Diabetes treatmENT INDEPENDENT study: Design and methods to address mental healthcare gaps in India. Contemp Clin Trials 2017;60:113–24.

73. Press D. Treatment adherence in patients with type 2 diabetes mellitus correlates with different coping styles , low perception of self-influence on

disease , and depressive symptoms. 2017;587–95.

74. Subramaniam M, Abdin E, Vaingankar JA, Picco L. Comorbid Diabetes and Depression among Older Adults – Prevalence , Correlates , Disability and Healthcare Utilisation. 2017;46:91–101.

75. Pulse and blood pressure procedures for household interviews [Internet]. Center for disease control [Cited 2017 Aug 27]. Available from https://wwwn.cdc.gov/nchs/data/nhanes3/manuals/pressure .pdf.

76. Smith L. Practice Guidelines:New AHA recommendations for blood pressure measurement. Am Fam Physician. 2005;7:1391- 139877.

77. Dennison-himmelfarb C, Handler J, Lackland DT. 2014 Evidence-Based Guideline for the Management of High Blood Pressure in Adults Report From the Panel Members Appointed to the Eighth Joint National Committee (JNC 8). 2014;1097(5):507–20.

78. The assessment of the nutritional status of the community [Internet].World health organization 1966 [Cited 2017 Aug 14].Available from http://apps.who.int/iris/handle/10665/41780. - 102 -

79. Bmi WHO, Bmi TWHO. Public health Appropriate body-mass index for Asian populations and its implications for policy and intervention strategies. 2004;363:157–63.

80. Diseases N, Health M. DISTRIBUTION : GENERAL STEPS : A framework for surveillance The WHO STEPwise approach to Surveillance of

noncommunicable diseases (STEPS). [Cited 2020 Jun 03]. Available from: http://www.who.int/chp/steps/en/

81. Consultation WHOE. Waist Circumference and Waist-Hip Ratio Report of a WHO Expert Consultation. 2008;(December):8–11.

82. American Diabetes Association Clinical Practice Recommendations.

Standards of medical in Diabetes. Diabetes care 2012;35:11-63.

83. Lamers F, Jonkers CCM, Bosma H, Penninx BWJH, Andr J, Th J, et al. Summed score of the Patient Health Questionnaire-9 was a reliable and valid method for depression screening in chronically ill elderly patients. 2008;61.

84. Kroenke K, Spitzer RL, Williams JB. The PHQ-9: validity of a brief depression severity measure. J Gen Intern Med. 2001; 16: 606-13..

85. Steenbergen-weijenburg KM Van, Vroege L De, Ploeger RR, Brals JW, Vloedbeld MG, Veneman TF, et al. Validation of the PHQ-9 as a screening instrument for depression in diabetes patients in specialized outpatient clinics. 2010;5–10.

86. Pandey VK, Aggarwal P, Kakkar R. Modified BG Prasad Socio-economic Classification , Update - 2019; Jan 1;31.

ANNEXURE

ANNEXURE I

ELIGIBILITY SCREENING PROFORMA

PREVALENCE OF DEPRESSION IN TYPE II DIABETES PATIENTS IN AN URBAN AREA OF KOLAR

1. Sl.no

2. Name

3. Age

4. Sex

5. Phone No.

6. Address

7. Socio economic class: a. Total income per month

   b. Per capita income

8. H/o diabetes (yes/no) If yes how many years

9. H/o other chronic conditions (epilepsy/psychiatric disorder).

10. Any h/o of hospital admission in last one year

ANNEXURE II

PROFORMA FOR DATA ACQUISITION

Sl. No:

Name: Age: Sex:

Mobile Number:

Marital Status: Married/Unmarried/ Widow/Separated

Religion: Hindu/Christian/Muslim

Occupation:
Professional/Semiprofessional/Clerical/skilled/semiskilled/unskilled/Homemaker/unemployed

Education:

No. of Family Members:

Total Income per Month:

Family history of diabetes:

- In Mother – Present/ Absent
- Father – Present/ Absent
- Sibling – Present/ Absent

Ill habits:

- Smoking – Yes/No
- Chewable tobacco – Yes/No
- Alcohol – Yes/No

Physical Activity: Yes/No

- Number of minutes of physical activity per day
- Number of days of physical activity per week

Female subjects:

- Age at Menopause:
- Hormone replacement therapy: Yes/No
- Consumption of OCP: Yes/No

Diet:

- How many times in a week you consume fast food:
- How many times in a week you consume fast fruits:
- How many times in a week you consume fast Vegetables:

History of diabetes

- Age at which diabetes started:
- Duration of diabetes:
- On treatment – Yes/No
- Taking treatment regularly/irregularly
- Other modalities of treatment:
  Ayurveda/Yoga/Unani/Siddha/Homeopathy

GPE GRBS (mg/dl):

- Pulse rate (beats/min):
- Systolic BP (mm Hg)
- Diastolic BP (mm Hg)
- Height (cms):
- Weight (kg):
- Hip circumference (cms):
- Waist circumference (cms):

Diabetes complication:

- Neuropathy – Yes/No
- Retinopathy – Yes/No
- Nephropathy – Yes/No
- Diabetic foot – Yes/No
- Other complications (specify) –

Comorbidities

- Hypertension – Yes/No
- Cardiovascular diseases – Yes/No
- Stroke – Yes/No
- Hypothyroid – Yes/No
- Hyperthyroid – Yes/No
- Dyslipidemia – Yes/No
- Other comorbidities (specify) –

ANNEXURE III

PATIENT HEALTH QUESTIONNAIRE -9

Over the last 2 weeks, how often have you been bothered by any of the following problems? *(Use "✓" to indicate your answer)*	**Not at all**	**Several days**	**More than half the days**	**Nearly every day**
Little interest or pleasure in doing things	0	1	2	3
Feeling down, depressed, or hopeless	0	1	2	3
Trouble falling or staying asleep, or sleeping too much	0	1	2	3
Feeling tired or having little energy	0	1	2	3
Poor appetite or overeating	0	1	2	3
Feeling bad about yourself — or that you are a failure or have let yourself or your family down	0	1	2	3
Trouble concentrating on things, such as reading the newspaper or watching television	0	1	2	3
Moving or speaking so slowly that other people could have noticed? Or the opposite — being so fidgety or restless that you have been moving around a lot more than usual	0	1	2	3
Thoughts that you would be better off dead or of hurting yourself in some way	0	1	2	3

ANNEXURE IV

INFORMATION SHEET

Title: PREVALENCE OF DEPRESSION IN TYPE II DIABETES MELLITUS PATIENTS IN AN URBAN AREA OF KOLAR

My name is Dr. Alamelu. K, Postgraduate in the department of Community Medicine, Sri Devaraj Urs Medical College, Kolar. I am carrying out a study on Depression in type 2 Diabetes. The study has been reviewed by the local ethical review board and has been started only after their formal approval.

Diabetes is a major lifestyle disorder, the prevalence of which is increasing globally. Depression is commonly seen in people with diabetes, and usually worst outcome of diabetes is seen if it's co-existing with depression. In this regard I will ask you some questions about yourself and household members about diabetes staying at your household. You need not have to answer any questions that you do not want to answer, and you may end this interview at any time you want to. However, your honest answer to these questions will help us to understand the health status of this area. We would greatly appreciate your help in responding to the questionnaire. The interview will take about half an hour.

Participation in this study doesn't involve any cost for you. This study is not only beneficial to you but also to the community at large. The results gathered from this study will be beneficial in estimating the burden of depression among diabetics

All the information collected from you will be strictly confidential and will not be disclosed to any outsider unless compelled by law. This information collected will be used only for research.

I request you to kindly give consent for the clinical examination, and provide a drop of blood from your fingertip to estimate blood sugar levels,

There is no compulsion to participate in this study. You will be no way affected if you don't wish to participate in this study. You are required to sign only if you voluntarily agree to participate in this study. Further, you are at a liberty to withdraw from the study at any time, if you wish to do so. Be assured that your

withdrawal will not affect your treatment by the concerned physician in any way. It is up to you to decide whether to participate. This document will be stored in the safe locker in the department of Community Medicine in the college and a copy is given to you for information.

For any further clarification you are free to contact the principal investigator,

Dr. Alamelu. K Mobile No: 9047833854

ANNEXURE V

INFORMATION SHEET – KANNADA

ಮಾಹಿತಿ ಪತ್ರ

ಅಧ್ಯಯನದ ವಿಷಯ: ಕೋಲಾರದ ಒಂದು ನಗರ ಪ್ರದೇಶದ ಮಧುಮೇಹ ರೋಗಿಗಳಲ್ಲಿ ಖಿನ್ನತೆಯ ಬಗ್ಗೆ ಅಧ್ಯಯನ

ನನ್ನ ಹೆಸರು ಡಾ॥ ಅಲಮೇಲು.ಕೆ. ನಾನು ಕೋಲಾರದ ಶ್ರೀ ದೇವರಾಜ್ ಅರಸ್ ವೈದ್ಯಕೀಯ ಮಹಾವಿದ್ಯಾಲಯದ ವೈದ್ಯಶಾಸ್ತ್ರ ವಿಭಾಗದ ವಿದ್ಯಾರ್ಥಿನಿ ನಾನು ಕೋಲಾರ ಒಂದು ನಗರ ಪ್ರದೇಶದ ಮಧುಮೇಹ ರೋಗಿಗಳಲ್ಲಿ ಖಿನ್ನತೆಯ ಬಗ್ಗೆ ಅಧ್ಯಯನವನ್ನು ಕೈಗೊಂಡಿದ್ದೇನೆ. ಈ ಅಧ್ಯಯನವು ಸ್ಥಳೀಯ ನೈತಿಕತೆ ಪರಿಶೀಲನ ಮಂಡಳಿಯಿಂದ ಪರಿಶೀಲನೆಗೊಳಪಟ್ಟಿದ್ದು ಅದು ಒಪಚಾರಿಕವಾಗಿ ಅನುಮೋದನ್ನು ನೀಡಿದ ನಂತರವಷ್ಟೇ ಈ ಅಧ್ಯಯನವನ್ನು ಪ್ರಾರಂಭಿಸಲಾಗಿದೆ.

ಮಧುಮೇಹವು ಜೀವನ ಶೈಲಿಯಲ್ಲಿ ಉಂಟಾಗುವ ಬದಲಾವಣೆಗಾಳಿಂದ ವ್ಯಕ್ತಿಯ ಆರೋಗ್ಯದಲ್ಲಿ ಉಂಟಾಗುವ ಒಂದು ಪ್ರಮುಖ ಏರುಪೇರು. ಇದು ಜಗತ್ತಿನಾದ್ಯಂತ ಹೆಚ್ಚು- ಹೆಚ್ಚಾಗಿ ವ್ಯಾಪಿಸುತ್ತಿದೆ. ಭಾರತವು ಮಧುಮೇಹದ ರಾಜ್ಯಧಾನಿ ಎಂದೇ ಹೆಸರಾಗಿದೆ. ಡಯಾಬಿಟೀಸ್ ರೋಗಿಗಳಲ್ಲಿ ಖಿನ್ನತೆಯ ಪ್ರಮಾಣ ಹೆಚ್ಚಿರುತ್ತದೆ ಹಾಗೂ ಖಿನ್ನತೆ ಹೊಂದಿರುವ ಮಧುಮೇಹಿಗಳಲ್ಲಿ ರೋಗದ ಪರಿಣಾಮ ಕೆಟ್ಟದಾಗಿರುತ್ತದೆ ಎಂಬುದು ಹಲವು ಅಧ್ಯಯನಗಳ ವರದಿಗಳಿಂದ ತಿಳಿದುಬರುತ್ತದೆ.ಈ ವಿಷಯವಾಗಿ ನಾನು ನಿಮ್ಮ ಮತ್ತು ನಿಮ್ಮ ಕುಟುಂಬದ ಸದಸ್ಯರ ಬಗ್ಗೆ ಕೆಲವು ಪ್ರಶ್ನೆಗಳನ್ನು ಕೇಳುತ್ತೇನೆ. ನೀವು ಎಲ್ಲಾ ಪ್ರಶ್ನೆಗಳಿಗೆ ಉತ್ತರಿಸಬೇಕಾಗಿರುವುದಿಲ್ಲ ಮತ್ತು ಈ ಸಂದರ್ಶನವನ್ನು ನಿಮ್ಮ ಆಪೇಕ್ಷೆಯಂತೆ ಯಾವಾಗ ಬೇಕಾದರೂ ಮುಕ್ತಾಯಗೊಳಿಸಬಹುದು.ಆದರೆ ನಿಮ್ಮ ಪ್ರಾಮಾಣಿಕ ಉತ್ತರಗಳಿಂದ ಈ ಪ್ರದೇಶದ ಜನರ ಆರೋಗ್ಯದ ಸ್ಥಿತಿಗತಿಗಳ ಬಗ್ಗೆ ಹೆಚ್ಚಿನ ತಿಳಿವಳಿಕೆ ಮೂಡುವುದು ಎಂಬುದನ್ನು ನಿಮಗೆ ಮನವರಿಕೆ ಮಾಡಿಕೊಡಲು ಬಯಸುತೇವೆ. ಆದುದರಿಂದ ಈ ಸಮೀಕ್ಷೆಗೆ ನೀವು ಪ್ರಾಮಾಣಿಕ ಉತ್ತರಗಳನ್ನು ನೀಡಿ ಸಹಕರಿಸಬೇಕೆಂದು ಕೋರುತ್ತೇನೆ. ಈ ಸಮೀಕ್ಷೆಗೆ ಅಧರ್ ಗಂಟೆಯಿಂದ ಒಂದು ಗಂಟೆಯ ಸಮಯ ಹಿಡಿಯಬಹುದು.ಈ ಅಧ್ಯಯನದಲ್ಲಿ ಭಾಗವಹಿಸುವುದಕ್ಕೆ ನಿಮಗೆ ಯಾವುದೇ ಖರ್ಚು ತಗಲುವುದಿಲ್ಲ. ಈ ಅಧ್ಯಯನವು ನಿಮಗೆ ಮಾತ್ರವಲ್ಲದೆ ಇಡೀ ಸಮುದಾಯಾಕ್ಕೆ ಪ್ರಯೋಜನಕಾರಿಯಾಗಿದೆ. ಈ ಅಧ್ಯಯನದ ಫಲಿತಾಂಶವಾಗಿ ದೊರೆಯುವ ಮಾಹಿತಿಯು ಈ ಪ್ರದೇಶದ ಜನರಲ್ಲಿ ಖಿನ್ನತೆಯ ಹೊರೆಯನ್ನು ಅಂದಾಜು ಮಾಡಲು ಪ್ರಯೋಜನಕ್ಕೆ ಬರುತ್ತದೆ.

ನಿಮ್ಮಿಂದ ಸಂಗ್ರಹಿಸಿದ ಮಾಹಿತಿಯನ್ನು ಗೌಪ್ಯವಾಗಿ ಇಡಲಾಗುವುದು. ಕಾನೂನು ಕಡ್ಡಾಯಪಡಿಸಿದ ಹೊರತು ಈ ಮಾಹಿತಿಯನ್ನು ಯಾರೊಂದಿಗೂ ಹಂಚಿಕೊಳ್ಳುವುದಿಲ್ಲ.ಈ ಮಾಹಿತಿಯನ್ನು ಸಂಶೋಧನೆಗೆ ಮಾತ್ರ ಬಳಸಿಕೊಳ್ಳಲಾಗುವುದು. ಆದುದರಿಂದ ಮಧುಮೇಹ ಖಾಯಿಲೆಯನ್ನು ಪತ್ತೆಹಚ್ಚಲು ಒಂದೆರಡು ತೊಟ್ಟು ರಕ್ತದ ಮಾದರಿಯನ್ನು ನಿಮ್ಮ ಬೆರಳತುದಿಯಿಂದ ಪರೀಕ್ಷೆಗಾಗಿ ನೀಡಲು ಮತ್ತು ವೈದ್ಯಕೀಯ ಪ್ರಯೋಗ ಪರೀಕ್ಷೆಗೆ ಒಳಪಡಲು ಸಮ್ಮತಿಯನ್ನು ನೀಡಬೇಕೆಂದು ಕೋರುತ್ತೇನೆ.

ಈ ಅಧ್ಯಯನದಲ್ಲಿ ಭಾಗವಹಿಸಬೇಕೆಂದು ಕಡ್ಡಾಯವೇನೂ ಇಲ್ಲ. ನೀವು ಈ ಅಧ್ಯಯನದಲ್ಲಿ ಪಾಲ್ಗೊಳ್ಳಲು ಇಷ್ಟಪಡದಿದ್ದರೆ ಅದರಿಂದ ನಿಮಗೆ ಯಾವುದೇ ಬಾಧಕವಿರುವುದಿಲ್ಲ. ನೀವು ಸ್ವಯಂ ಪ್ರೇರಣೆಯಿಂದ ಈ ಅಧ್ಯಯನದಲ್ಲಿ ಭಾಗವಹಿಸಲು ಇಚ್ಛಿಸಿದರೆ ಮಾತ್ರ ಒಪ್ಪಿಗೆ ಪತ್ರಕ್ಕೆ ಸಹಿಮಾಡಬಹುದು. ಅಲ್ಲದೆ ಯಾವುದೇ ಸಂದರ್ಭದಲ್ಲಿ, ನೀವು ಇಚ್ಛೆಪಟ್ಟರೆ, ಈ ಅಧ್ಯಯನದಿಂದ ಹಿಂದೆ ಸರಿಯಬಹುದು. ನೀವು ಹೀಗೆ ಅಧ್ಯಯನದಿಂದ ಹಿಂದೆ ಸರಿದರೆ ನಿಮಗೆ ನೀಡುತ್ತಿರುವ ವೈದ್ಯೋಪಚಾರಕ್ಕೆ ಯಾವುದೇ ಧಕ್ಕೆ ಬರುವುದಿಲ್ಲವೆಂಬ ಖಾತರಿಯನ್ನು ಈ ಮೂಲಕ ನಿಮಗೆ ನೀಡಲಾಗುತ್ತದೆ.ಇದರಲ್ಲಿ ಪಾಲ್ಗೊಳ್ಳುವ ನಿರ್ಧಾರ ಕೈಗೊಳ್ಳುವುದು ನಿಮ್ಮ ವಿವೇಚನೆಗೆ ಬಿಟ್ಟಿದ್ದು. ನಿಮ್ಮ ವೈಯ್ಯಕ್ತಿಕ ವಿವರಗಳನ್ನು ಒಳಗೊಂಡ ದಾಖಲೆಯನ್ನು ಕಾಲೇಜಿನ ವೈದ್ಯಶಾಸ್ತ್ರ ವಿಭಾಗದಲ್ಲಿ ಭದ್ರತಾ ಕಪಾಟಿನಲ್ಲಿ ಇಡಲಾಗುವುದು. ಅದರ ಒಂದು ಪ್ರತಿಯನ್ನು ನಿಮ್ಮ ಮಾಹಿತಿಗಾಗಿ ನೀಡಲಾಗುವುದು. ಯಾವುದೇ ಹೆಚ್ಚಿನ ಸ್ಪಷ್ಟೀಕರಣಕ್ಕಾಗಿ ಈ ಕೆಳಕಾಣಿಸಿದ ಪ್ರಧಾನ ಪರೀಕ್ಷೆಕರನ್ನು ಸಂಪರ್ಕಿಸಬಹುದು.

ಡಾ॥ ಅಲಮೇಲು.ಕೆ. - ಮೊಬೈಲ್ ನಂ. **9047833854**

ANNEXURE VI

INFORMED CONSENT FORM

Sl. no:

TITLE OF THE STUDY: PREVALENCE OF DEPRESSION IN TYPE II DIABETES MELLITUS PATIENTS IN AN URBAN AREA OF KOLAR

I, the undersigned, agree to participate in this study and to undergo clinical examination, disclosure of my personal information and blood sample to estimate blood sugar, as outlined in this consent form.

I have been read out/ explained in my local language i.e. in _____ and understand the purpose of this study and the confidential nature of the information that will be collected and disclosed during the study. I have had the opportunity to ask questions regarding the various aspects of this study and my questions have been answered to my full satisfaction. The information collected will be used only for research.

I understand that I remain free to withdraw from this study at any time. Participation in this study is under my sole discretion and does not involve any cost to me.

Subject's name and signature /thumb impression

Name and signature of Principal Investigator: Dr.Alamelu.K

Contact No: 9047833854 Date:

ANNEXURE VII

INFORMED CONSENT FORM – KANNADA

ಸಮ್ಮತಿ ಪತ್ರ:

ಅಧ್ಯಯನದ ವಿಷಯ: ಕೋಲಾರದ ಒಂದು ನಗರ ಪ್ರದೇಶದ ಮಧುಮೇಹ ರೋಗಿಗಳಲ್ಲಿ ಖಿನ್ನತೆಯ ಬಗ್ಗೆ ಅಧ್ಯಯನ

ಈ ಕೆಳಗೆ ಸಹಿ ಮಾಡಿರುವ ---------- ಆದ ನಾನು ಈ ಅಧ್ಯಯನದಲ್ಲಿ ಪಾಲ್ಗೊಳ್ಳುವ ಸಲುವಾಗಿ ವೈದ್ಯಕೀಯ ಪರೀಕ್ಷೆಗೆ ಒಳಪಡಲು ನನ್ನ ವೈಯ್ಯಕ್ತಿಕ ವಿವರಗಳನ್ನು ಮತ್ತು ರಕ್ತದಲ್ಲಿ ಸಕ್ಕರೆಯ ಪ್ರಮಾಣವನ್ನು ಅಳೆಯಲು ರಕ್ತದ ಮಾದರಿಯನ್ನು ನೀಡಲು ಸಮ್ಮತಿಸಿರುತ್ತೇನೆ.

ಈ ಅಧ್ಯಯನದ ಉದ್ದೇಶ, ಅಧ್ಯಯನದ ಸಂದರ್ಭದಲ್ಲಿ ನೀಡುವ ಮತ್ತು ಸಂಗ್ರಹಿಸುವ ಮಾಹಿತಿಯ ಗೌಪ್ಯತೆಯ ಬಗ್ಗೆ ನನಗೆ ನನ್ನ ಸ್ಥಳೀಯ ಭಾಷೆಯಲ್ಲಿ ಓದಿ ಹೇಳಲಾಗಿದೆ/ವಿವರಿಸಲಾಗಿದೆ ಮತ್ತು ನಾನು ಇದನ್ನು ಅರ್ಥ ಮಾಡಿಕೊಂಡಿರುತ್ತೇನೆ. ಈ ಅಧ್ಯಯನದ ವಿವಿಧ ಅಂಶಗಳ ಬಗ್ಗೆ ಪ್ರಶ್ನೆಗಳನ್ನು ಕೇಳುವ ಅವಕಾಶವನ್ನು ನನಗೆ ನೀಡಲಾಗಿದೆ ಮತ್ತು ನನ್ನ ಪ್ರಶ್ನೆಗಳಿಗೆ ತೃಪ್ತಿಕರವಾದ ಉತ್ತರಗಳು ದೊರೆತಿರುತ್ತವೆ. ಈ ಅಧ್ಯಯನದ ಮೂಲಕ ಸಂಗ್ರಹಿಸಿರುವ ಮಾಹಿತಿಯನ್ನು ಸಂಶೋಧನೆಯ ಉದ್ದೇಶಕ್ಕೆ ಮಾತ್ರ ಬಳಸತಕ್ಕದ್ದು.

ಈ ಅಧ್ಯಯನದಿಂದ ಯಾವುದೇ ಸಂದರ್ಭದಲ್ಲಿ ಹಿಂದೆ ಸರಿಯುವ ಸ್ವಾತಂತ್ರ್ಯ ನನಗಿದೆ ಎಂಬುದನ್ನು. ಈ ಅಧ್ಯಯನದಲ್ಲಿ ಪಾಲ್ಗೊಳ್ಳುವುದರಿಂದ ನನಗೆ ಯಾವುದೇ ಹೆಚ್ಚುವರಿ ವೆಚ್ಚ ತಗಲುವುದಿಲ್ಲವೆಂಬುದನ್ನು ತಿಳಿದಿರುತ್ತೇನೆ.

ಪರೀಕ್ಷಾರ್ಥಿಯ ಹೆಸರು ಮತ್ತು ಸಹಿ/ಹೆಬ್ಬೆಟ್ಟಿನ ಗುರುತು

ಸಾಕ್ಷಿಗಳ ಹೆಸರು ಮತ್ತು ಸಹಿ

೧. ದಿನಾಂಕ:

೨. ದಿನಾಂಕ:

ಸಂದರ್ಶಕರ ಹೆಸರು ಮತ್ತು ಸಹಿ

ದಿನಾಂಕ:

ಪ್ರಧಾನ ಪರೀಕ್ಷಕರ ಹೆಸರು ಮತ್ತು ಸಹಿ

ದಿನಾಂಕ:

ದೂರವಾಣಿ ಸಂಪರ್ಕ: 9047833854

ANNEXURE VIII

OPERATIONAL DEFINITIONS OF VARIABLES UNDER STUDY

Age: The completed age of T2DM patients in years at the time of interview was considered.

1. **Employment status**:

Employed (workers) - Persons who are engaged in any economic activity or who, despite their attachment to economic activity, have abstained from work for reasons of illness, injury or other physical disability bad weather, festivals, social or religious functions or other contingencies necessitating temporary absence from work constitute workers. Unpaid helpers who assist in the operation of an economic activity in the household farm or non-farm activities are also considered as workers.

Unemployed - Persons, who owing to lack of work, had not worked but either sought work through employment exchanges, intermediaries, friends or relatives or by making applications to prospective employers or expressed their willingness or availability for work under the prevailing condition of work and remuneration are considered as those who are 'seeking or available for work' (or unemployed).

2. **Education**: Highest completed formal education was considered.
3. **Occupation**: Engagement in a particular income earning activity for a major part of the day was categorized as main occupation.

Classification of individuals according to their occupation.[79]

Professional	Doctor, Engineer, Principal, Lawyer, Military officer, Senior executive, Business Proprietor, Writer, Scientist, Large employer, Director, University Professor, Police officer, Others (Horserider)
Semi Professional	Teacher, Pharmacist, Social worker, Owner of small business and manager, Farmer, others (Computer programmer, constructor, Govt employee, Nurse)
Skilled worker	Artisans, clerk, Supervisor, Carpenter,Tailor, Mechanic, Electrician, Railway guard, Painter, Modelor, Smiths, Baker, Driver, Shop assistant, Petty trader, constable,soldier, potter, barber, linesman, others (tinkering, welder, gardner,cook, mason, postman, plumber)
Semi-skilled	Factoryoperator, Agricultural labour, shoemaker, security guard, shop helper
Unskilled	Labourer, Domestic servants, peon, sweeper, washerman, others.

Socio-economic status: The modified BG Prasad socioeconomic scale was used to classify socioeconomic status of study participants.

Modified BG Prasad socioeconomic status classification, 2019.[86]

Socioeconomic class		Per capita Income
Class I	Upper	Rs. 7008 & above
Class II	Upper middle	Rs. 3504 – Rs. 7007
Class III	Middle	Rs. 2102– Rs. 3503
Class IV	Lower Middle	Rs. 1051 – Rs. 2101
Class V	Lower	≤ Rs. 1050

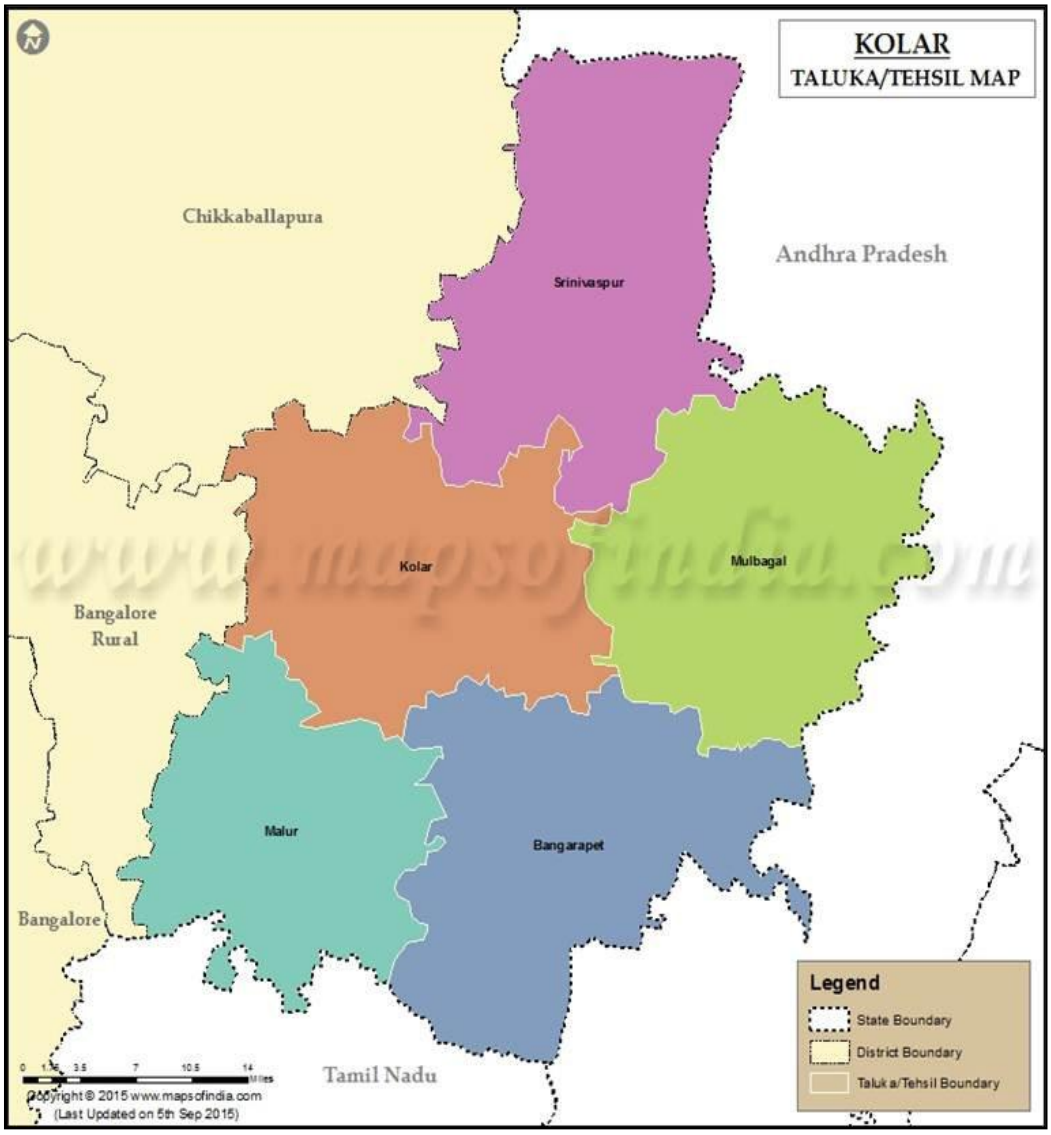
BG Prasad's classification was based on per capita monthly income. It was introduced with the base of Consumer Price Index (CPI) of 1960 as 100. Which was modified in the year 1982 and 2001, by adding linking factors.

New income value = multiplication factor × old income value × 4.63 × 4.93.

Multiplication factor = Current index value/ Base index value
linking factors were 4.93 and 4.63. [86]

ANNEXURE IX

MAP SHOWING KARNATAKA STATE AND KOLAR DISTRICT IN KARNATAKA



ANNEXURE X

INSTITUTIONAL ETHICS COMMITTEE CERTIFICATE

SRI DEVARAJ URS ACADEMY OF HIGHER EDUCATION & RESEARCH

SRI DEVARAJ URS MEDICAL COLLEGE

Tamaka, Kolar

INSTITUTIONAL ETHICS COMMITTEE

Members

1. **Sri K. Prahallad Rao, Editor, Kolar Patrike, Kolar. (Chairman)**
2. **Dr. Jagadamba.A** Assoc. Prof of Physiology, SDUMC (Member Secretary)
3. Dr. D.E.Gangadhar Rao, Prof. of Zoology, Govt. Boys College, Kolar.
4. Sri M.G.Venkata Reddy, Advocate & Notary, Kolar
5. Dr. S.R. Prasad, Prof of Microbiology, & Director, PG. Studies, SDUMC
6. Dr. Mohan Kumar.K, Prof of Surgery & Medical Superintendent, R.L. Jalappa Hospital &, R.C
7. Dr. Ranganath.B.G, Prof. & HOD of Comm. Medicine, SDUMC
8. Dr. C.S.B. Rajendra Prasad, Prof. & HOD, of Pathology, SDUMC
9. Dr. Sudha Reddy.V.R Prof of Peadiatrics, SDUMC
10. Dr. Srinivasa Reddy.P Prof. of Forensic Medicine, SDUMC
11. Dr. Sumathi.M.E Prof of Biochemistry, SDUMC
12. Dr. Bhuvana.K Prof of Pharmacology, SDUMC
13. Dr. Pavan, Asst. Prof. of Surgery, SDUMC
14. Dr.Hariprasad Asst. Prof. of Orthopedics, SDUMC
15. Sujatha M P Asst. Prof. of Anesthesia, SDUMC

No. SDUMC/KLR/IEC/ 04 /2017-18 Date: 29-11-2017

CERTIFICATE

This is to certify that the ethics committee of Sri Devaraj Urs Medical College, Kolar in its meeting conducted on **29-11-2017** has unanimously approved the synopsis for the dissertation entitled **"Prevalence of depression in type 2 diabetes patients in an urban area of Kolar"** to be submitted to Sri Devaraj Urs Academy of Higher Education and Research, Kolar, Karnataka, by **Dr.Alamelu.K,** Postgraduate student in the department of **Community Medicine** at Sri Devaraj Urs Medical College, Kolar

Member Secretary
Institutional Ethics Committee
SDUMC, Tamaka Kolar

Member Secretary
Institutional Ethics Committee
Sri Devaraj Urs Medical College
Tamaka, Kolar.

Chairman
Institutional Ethics Committee
SDUMC, Tamaka Kolar

CHAIRMAN
Institutional Ethics Committee
Sri Devaraj Urs Medical College,
Tamaka, Kolar

ANNEXURE XI

DATA ACQUISITION IMAGES

Investigator while interviewing the study participants in the community

ANNEXURE XII

GANTT CHART

SL.NO	ACTIVITY	TIME PERIOD												
		2017				2018				2020				
		Aug	Sept	Nov	Dec	Jan	Feb to Mar	April to Aug	Sep to Dec	Jan to June	July to Aug	Aug to Sep	Sep to Oct	Dec
1.	Topicsearch and selection													
2.	Synopsis submission													
3.	Approval by IEC													
4.	Proforma Preparation and validation													
5.	Pilot project													
6.	Review of literature													
7.	Data collection													
8.	Data analysis													
9.	Dissertation writing													
10	Submission of dissertation													

ANNEXURE XIII- MASTER CHART

slno	age	sex	area	mobno	mars	reg	occ	edu	fammeb	inc	dmm	dmf	dms	smok	tob	alc	fastfood	fruit	veg	dmst	dmyrs	dmrx	rxreg	otherx	pr	sbp	dbp	ht	wt	hc	wc	rbs	dyslip	othcm	plsr	hoples	sleep	tired	apptit	badfeel	concen	slow	hurt
1	95	2	1	1E+10	3	1	8	0	4	14000	0	0	1	0	1	0	0	1	14	94	1	1	1	0	80	128	76	146	85	117	96	112	0		1	0	0	1	0	0	0	0	0
2	60	2	1	8.97E+09	1	1	5	0	3	15000	0	0	1	0	0	0	0	1	15	56	41	1	1	0	76	132	82	152	58	90	72	140	0		1	1	0	2	0	0	0	0	0
3	48	2	1	9.74E+09	1	1	7	10	4	25000	0	0	1	0	0	0	0	3	20	47	1	1	1	0	80	130	80	149	49	96	77	128	0		1	0	3	1	0	0	1	0	0
4	43	1	1	9.69E+09	1	1	3	15	2	8000	1	1	1	0	0	0	0	1	18	41	2	1	2	0	74	130	70	161	70	98	80	130	1		1	1	2	1	1	1	0	0	0
5	64	1	1	9.9E+09	1	1	2	15	2	21000	1	0	1	2	0	2	0	7	20	36	26	3	1	1	80	140	84	170	90	104	102	190	1		3	2	3	0	3	0	1	1	1
7	65	1	1	9.98E+09	3	1	8	0	5	40000	0	0	0	0	2	0	0	0	20	60	4	1	1	0	84	132	84	166	56	89	85	194	0		1	1	3	1	2	0	0	0	0
8	60	2	1	8.97E+09	3	1	7	0	1	5000	0	0	0	0	0	0	1	4	16	56	4	1	1	0	68	128	78	164	74	100	86	136	0		2	2	3	2	3	0	0	1	2
9	65	1	1	9.9E+09	1	1	8	0	3	10000	0	0	1	0	0	0	2	1	20	49	16	3	1	0	86	142	90	168	70	100	90	210	0		1	1	2	2	1	0	1	1	2
10	40	2	1	9.04E+09	1	1	7	0	4	7000	0	0	0	0	1	0	0	2	20	38	2	1	1	0	74	120	70	156	62	96	89	110	0		1	0	3	1	3	0	1	1	0
11	52	2	1	9.9E+09	3	1	7	5	2	5000	0	0	0	0	1	0	0	0	20	42	10	1	1	0	72	110	70	149	48	92	74	113	0		1	1	2	1	0	0	0	0	0
12	65	1	1	9.69E+09	1	1	5	7	2	10000	0	0	0	0	0	0	0	10	20	55	10	3	1	0	88	132	84	172	65	98	90	212	0		1	1	3	2	2	1	0	0	1
13	56	1	1	9.88E+09	1	1	5	10	5	15000	0	0	1	0	0	0	0	10	20	32	24	1	1	0	88	132	86	177	92	111	110	201	0		0	1	0	1	0	0	0	0	0
14	60	2	1	8.86E+09	3	1	7	8	6	13000	0	0	1	0	1	0	1	1	20	45	15	1	1	0	80	110	70	146	45	92	74	182	0		1	2	3	2	0	0	0	0	2
15	65	2	1	9.14E+09	3	1	7	0	5	20000	0	0	1	0	0	0	1	1	20	57	8	1	1	0	78	120	70	146	54	97	84	147	0		1	2	0	2	0	0	0	0	2
16	48	1	1	9.45E+09	1	1	4	8	5	22000	1	1	1	0	1	0	4	3	20	47	1	1	1	0	72	124	82	169	82	104	100	117	0		1	1	0	1	1	0	0	0	1
17	52	2	1	9.59E+09	1	1	7	0	4	21000	0	0	0	0	0	0	0	5	20	48	4	3	1	0	78	110	70	151	60	97	89	119	0		0	2	3	3	2	2	2	2	3
18	75	1	1	9.14E+09	1	1	8	0	6	35000	0	0	0	0	0	0	0	7	20	66	9	3	1	0	78	148	86	177	68	94	86	167	0		0	1	3	1	0	0	0	0	2
19	47	1	1	9.97E+09	1	1	5	8	5	70000	1	1	1	0	0	0	2	7	20	46	1	1	1	0	75	127	83	173	80	96	84	197	0		1	2	2	2	2	1	0	0	1
20	76	1	1	1E+10	3	1	2	12	6	30000	0	0	0	2	0	2	0	4	20	70	6	1	1	0	54	210	93	176	73	103	96	256	0		2	2	3	2	2	0	0	0	2
21	47	2	1	1E+10	1	1	7	5	4	25000	0	0	0	0	1	0	2	5	20	44	31	1	1	0	93	129	90	152	62	101	88	314	0		0	0	0	0	0	0	0	0	0
24	38	2	1	9.74E+09	1	1	2	15	4	40000	1	0	0	0	0	0	0	10	20	32	6	1	1	0	72	117	75	151	54	99	81	179	0		0	1	0	1	0	0	0	0	0
25	51	1	1	9.54E+09	1	1	4	13	4	30000	0	0	1	2	0	0	0	7	16	49	2	1	1	0	83	126	85	167	65	91	78	113	0		0	1	0	1	0	0	0	0	0
26	56	1	1	9.74E+09	1	1	6	8	4	25000	0	0	0	0	0	1	0	10	20	54	2	1	1	0	76	124	83	162	64	98	87	127	0		0	1	0	1	0	0	0	0	0
27	71	1	1	1E+10	3	1	5	10	4	40000	0	0	1	2	0	0	0	10	20	69	2	1	1	0	76	120	84	172	65	84	70	153	0		1	1	0	1	0	0	0	0	0
28	55	1	1	1E+10	1	1	4	8	8	60000	0	0	1	0	2	0	0	7	14	52	3	1	1	0	76	128	89	153	67	99	94	120	0		0	0	0	0	0	0	0	0	0
29	42	2	1	1E+10	1	1	7	7	4	8000	0	1	1	0	0	0	0	4	16	30	12	1	1	0	84	128	84	157	62	103	87	207	0		2	2	2	2	0	2	0	0	2
30	40	2	1	9.24E+09	1	1	7	10	4	20000	1	1	1	0	0	0	0	8	20	38	2	1	1	0	80	120	70	152	60	102	87	127	0		1	1	0	1	0	0	0	0	0
33	45	1	1	1E+10	1	1	8	7	3	8000	0	0	0	0	0	1	0	0	10	35	10	1	2	0	80	132	89	169	67	84	71	194	0		3	3	0	2	2	2	1	0	3
34	42	1	1	9.01E+09	1	1	3	15	6	20000	1	1	1	1	0	1	4	10	20	34	8	1	1	0	78	127	90	164	80	127	114	217	0		2	1	0	2	0	0	0	0	1
35	60	1	1	1E+10	3	1	5	7	3	20000	0	0	0	0	0	0	0	4	14	55	5	1	1	0	77	117	83	174	78	97	85	137	0		0	1	0	1	0	0	0	0	2
36	58	1	1	9.95E+09	1	1	8	7	7	17000	0	0	0	0	0	0	0	1	18	56	2	1	1	0	84	126	84	162	78	102	113	189	0		2	2	0	2	0	0	0	0	2
37	56	2	1	9.04E+09	1	1	7	7	3	40000	0	0	1	0	2	0	0	10	20	53	3	1	1	0	74	138	90	154	66	114	97	187	0		2	1	0	2	0	0	0	0	1
38	44	2	1	1E+10	1	1	7	15	3	50000	1	1	1	0	0	0	0	15	20	28	16	1	1	0	80	120	80	152	58	114	97	187	0		1	1	0	2	0	0	0	0	0
40	58	1	1	1E+10	1	1	5	12	5	21000	0	0	0	0	0	0	4	7	18	53	5	1	1	0	80	139	95	169	74	108	97	195	0		0	2	0	1	0	0	0	0	0
41	46	1	1	9.54E+09	1	1	2	17	3	50000	0	1	1	0	0	0	0	16	20	34	12	1	1	0	80	128	86	162	70	116	103	192	0		0	1	0	1	0	0	0	0	0
42	42	1	1	9.59E+09	1	1	3	15	5	40000	1	1	1	0	0	1	4	8	20	33	9	1	1	0	80	130	84	170	80	111	102	170	0		0	0	0	2	0	0	0	0	0
43	40	1	1	1E+10	1	1	4	10	4	20000	0	0	0	0	0	1	4	7	15	37	3	1	1	0	79	127	85	168	78	102	94	103	0		1	1	0	1	0	0	0	0	0
44	48	2	1	9.69E+09	1	1	7	4	2	15000	0	0	0	0	1	0	0	15	20	43	5	1	1	5	72	110	70	152	54	92	74	207	0		1	1	0	2	0	1	0	0	1
45	55	2	1	1E+10	1	1	7	10	6	60000	0	0	1	0	0	0	1	14	20	52	1	1	1	0	90	110	70	161	74	115	105	132	0		1	0	0	1	0	0	0	0	0
46	45	1	1	9.97E+09	1	1	5	8	4	15000	1	0	0	1	0	1	3	1	18	42	3	1	1	0	80	122	78	162	64	104	93	182	0		0	1	0	1	0	0	0	0	0
47	70	1	1	9.54E+09	3	1	8	13	5	30000	0	0	1	0	0	0	0	5	20	68	2	1	1	0	80	120	80	168	78	111	99	112	0		1	1	1	1	1	0	0	0	1
48	51	2	1	1E+10	1	1	5	10	4	22000	0	0	0	0	0	0	0	7	18	49	2	1	1	0	74	120	80	164	70	97	83	110	0		0	1	0	1	0	0	0	0	0
49	63	2	1	9.04E+09	1	1	7	0	2	2000	0	0	0	0	2	0	0	4	18	47	16	1	1	0	80	120	70	148	52	90	78	211	0		2	2	2	2	0	0	0	0	2
52	55	2	1	8.89E+09	1	1	7	0	2	6000	0	0	0	0	0	0	0	4	18	50	5	1	1	0	72	117	77	149	50	92	76	187	0		1	1	0	1	0	0	0	0	1
53	55	2	1	1E+10	3	1	8	2	5	8000	0	0	1	0	2	0	0	1	18	49	6	1	1	0	70	110	70	146	48	94	78	164	0		2	2	2	2	0	0	0	0	2
54	51	2	1	8.9E+09	3	1	6	3	1	5000	0	0	1	0	0	0	0	10	20	49	2	1	1	0	72	110	70	151	50	85	73	109	0		1	1	1	1	0	0	0	0	3
55	56	2	1	1E+10	3	1	8	4	5	20000	0	0	1	0	0	0	0	7	20	48	8	1	1	0	75	116	83	153	60	102	87	193	0		0	2	0	1	0	0	0	0	3
56	60	2	1	9.74E+09	3	1	7	5	4	40000	0	0	0	0	0	0	0	10	18	60	1	1	1	0	72	110	72	156	58	89	74	121	0		0	1	0	0	0	0	0	0	2
57	65	2	1	9.98E+09	3	1	7	4	2	7000	0	0	1	0	0	0	0	4	15	50	15	1	1	0	76	127	87	147	46	85	72	115	0		1	2	0	1	0	0	0	0	2

58	78	2	1	1E+10	3	1	8	0	5	16000	0	0	1	0	0	0	0	7	14	58	20	1	1	0	72	113	75	151	60	104	91	197	0		2	2	2	2	0	1	0	0	3
59	65	2	1	1E+10	3	1	8	0	6	30000	0	0	1	0	0	0	0	7	14	57	8	1	1	0	70	113	71	145	47	84	70	231	0		1	2	1	1	0	1	0	0	2
60	69	2	1	1E+10	3	1	8	0	5	21000	0	0	1	0	2	0	0	7	14	58	11	1	1	0	68	117	91	148	50	86	72	137	0		1	2	2	1	0	1	0	0	3
61	60	1	1	9.84E+09	1	1	3	12	3	50000	0	0	0	0	0	2	0	16	20	58	2	1	1	0	76	124	82	170	72	95	81	121	0		0	1	0	1	2	0	0	0	1
62	40	2	1	7.02E+09	1	1	7	7	4	18000	0	1	0	0	0	0	0	8	20	39	1	1	1	0	72	120	70	154	56	94	76	173	0		1	2	0	1	0	0	0	0	1
63	60	2	1	1E+10	3	1	6	0	1	4000	0	0	0	0	0	0	0	7	14	58	2	1	1	0	78	123	81	146	44	81	70	118	0		2	3	3	2	0	0	0	0	2
64	42	1	1	7.8E+09	1	1	5	9	4	15000	1	0	0	0	0	0	0	5	18	40	2	1	1	1	77	123	87	165	57	88	76	192	0		2	2	1	2	0	1	0	0	0
65	50	1	1	9.73E+09	1	1	2	15	5	50000	1	0	1	0	0	0	0	7	20	49	1	1	1	0	70	125	81	172	76	95	83	112	0		0	1	0	1	0	0	0	0	0
66	55	2	1	1E+10	1	1	6	0	4	22000	0	1	1	0	2	0	0	7	14	45	10	1	1	0	71	113	77	148	50	87	72	97	0		0	2	0	2	0	0	0	0	1
67	45	1	1	9.85E+09	1	1	4	10	4	15000	0	0	0	2	0	2	0	2	16	41	4	1	1	0	88	120	84	167	65	84	70	147	0		0	1	0	1	0	0	0	0	0
68	57	2	1	9.01E+09	3	1	7	2	5	14000	0	0	1	0	1	0	0	1	20	54	3	1	1	0	76	110	70	146	50	97	82	186	0		2	2	2	2	0	0	0	0	1
69	40	2	1	1E+10	1	1	7	5	3	40000	0	1	0	0	1	0	2	6	20	39	1	1	1	5	76	110	70	156	64	102	92	112	0		2	1	0	1	0	0	0	0	0
70	80	1	1	9.74E+09	1	1	8	4	2	2000	0	0	0	2	2	2	0	1	14	60	20	3	1	0	89	130	86	167	105	145	134	225	1	copd	0	2	0	0	0	1	0	0	1
71	59	2	1	8.95E+09	1	1	7	15	6	40000	1	1	1	0	0	0	0	10	20	46	13	1	1	1	74	123	75	143	64	111	102	227	1	glaucoma	1	1	2	1	0	1	0	0	1
73	67	2	1	9.48E+09	3	2	7	10	1	20000	1	0	1	0	0	0	0	4	18	49	18	1	1	0	86	126	76	150	50	97	82	245	0		0	1	2	0	0	0	0	0	0
74	60	1	1	7.64E+09	3	1	6	8	3	20000	0	0	0	2	0	2	0	4	16	56	4	1	1	0	80	159	97	165	90	138	124	176	0		1	1	0	1	0	0	0	0	1
75	45	2	1	8.18E+09	1	1	4	8	6	30000	0	0	0	0	0	0	0	4	16	41	4	1	1	5	76	112	84	156	71	110	102	130	0		1	1	0	2	0	1	0	0	0
77	75	1	1	9.38E+09	3	1	6	4	3	12000	0	0	1	2	0	2	0	0	10	75	1	1	1	0	84	157	96	169	67	90	74	179	0	ckd	1	2	0	2	0	0	0	0	3
78	60	2	1	7.98E+09	1	1	8	3	5	8000	0	0	1	0	0	0	0	0	18	50	10	0	0	2	80	140	90	146	54	96	80	170	0		0	0	0	1	0	0	0	0	0
79	45	1	1	1E+10	1	1	6	4	3	12000	0	0	0	0	1	1	0	0	10	39	6	0	0	0	80	124	86	156	49	87	70	213	0		2	2	0	2	2	2	2	2	3
80	48	1	1	9.45E+09	1	1	5	7	4	8000	0	0	0	0	1	0	0	4	20	45	3	1	1	0	80	122	84	163	65	107	93	197	0		1	1	0	1	0	0	0	0	0
81	55	2	1	8.55E+09	3	1	6	4	5	18000	0	0	1	0	0	0	0	7	16	49	6	1	1	0	70	112	69	147	50	88	72	132	0		0	1	0	1	0	0	0	0	1
82	47	1	1	7.32E+09	1	1	5	6	6	12000	0	0	1	0	0	0	0	4	16	45	2	1	1	0	80	136	91	164	70	108	94	164	0		0	0	0	1	0	0	0	0	0
83	50	1	1	1E+10	1	1	5	7	6	20000	0	0	1	0	0	0	0	7	20	47	13	3	1	0	78	128	84	169	78	110	98	187	0		0	0	0	1	0	0	0	0	0
84	62	2	1	1E+10	3	1	8	2	5	12000	0	0	1	0	2	0	0	2	16	47	15	1	1	5	74	116	74	153	52	89	76	129	0		2	1	2	1	0	0	0	0	1
85	60	2	1	7.01E+09	3	1	6	2	1	6000	0	0	0	0	0	0	0	3	14	58	2	1	1	0	68	117	77	143	45	85	70	194	0		0	1	0	1	0	0	0	0	0
86	50	2	1	9.9E+09	1	1	7	2	5	20000	1	0	0	0	0	0	1	14	20	35	15	1	1	0	78	136	84	164	81	115	99	253	0		0	1	0	1	1	0	0	0	0
87	42	1	1	8.12E+09	1	1	5	10	4	12000	1	0	0	0	0	0	0	7	21	34	8	1	1	0	80	120	80	164	64	94	92	180	0		0	0	0	0	0	0	0	0	0
88	51	2	1	7.33E+09	1	1	7	0	2	12000	0	0	1	0	1	0	0	7	18	50	1	1	1	0	70	110	70	149	52	94	78	123	0		0	1	0	1	0	0	0	0	0
90	49	1	1	8.49E+09	1	1	5	10	4	14000	1	0	1	0	0	0	0	4	18	47	2	1	1	0	80	130	80	167	72	92	84	147	0		0	0	0	0	0	0	0	0	0
91	70	1	1	9.45E+09	1	1	8	12	2	30000	1	1	1	1	0	1	1	7	18	50	20	1	1	0	80	152	94	167	70	94	82	180	0		1	1	1	1	0	0	0	0	1
92	48	2	1	8.9E+09	1	1	7	0	6	20000	1	1	1	0	1	0	0	4	18	42	6	1	1	0	80	120	70	151	62	102	85	190	0		1	2	0	1	0	0	0	0	1
93	52	2	1	7.64E+09	3	1	6	4	1	7000	0	0	0	0	1	0	1	4	15	45	7	1	1	0	82	124	78	156	60	96	80	183	0		1	2	2	1	0	1	1	0	2
94	52	2	1	9.66E+09	3	1	6	0	2	20000	0	0	0	0	0	0	0	3	15	51	1	1	1	0	70	110	70	158	52	75	93	172	0		1	2	1	1	0	1	0	0	1
95	50	2	1	9.35E+09	1	2	7	10	6	24000	0	0	0	0	0	0	0	7	21	49	1	1	1	0	88	154	97	152	55	94	78	204	0		0	1	0	1	0	0	0	0	0
96	58	1	1	9.9E+09	1	1	4	8	3	15000	0	0	0	0	0	1	1	4	18	55	3	1	1	0	86	130	80	156	78	102	97	163	0		0	1	0	1	0	0	0	0	0
97	62	1	1	9.74E+09	1	1	5	7	2	20000	1	0	1	1	0	1	0	4	15	53	9	3	1	0	88	156	98	167	72	96	92	172	0		1	2	0	1	1	0	0	0	1
98	66	1	1	9.85E+09	1	1	5	5	2	12000	0	0	1	0	0	0	0	3	18	59	7	1	1	0	78	138	84	154	49	88	70	140	0		1	1	0	1	0	0	0	0	0
99	67	1	1	8.75E+09	3	1	8	2	5	12000	0	0	1	0	0	0	0	0	15	52	15	1	1	0	88	146	94	169	62	90	71	197	0		2	2	1	2	1	1	0	0	2
100	53	2	1	9.95E+09	1	1	7	7	3	20000	0	1	0	0	1	0	0	7	18	52	1	1	1	0	80	120	70	155	54	96	78	157	0		1	1	0	1	0	1	0	0	1
101	67	1	1	9.88E+09	1	1	5	7	4	12000	0	0	1	0	0	1	0	4	18	65	2	1	1	0	70	120	80	164	60	92	76	137	0		0	0	0	0	0	0	0	0	0
102	82	2	1	9.74E+09	3	1	8	0	7	25000	0	0	1	0	2	0	0	2	15	70	12	1	1	0	78	110	70	153	49	89	71	193	0		2	3	2	2	2	1	1	0	2
103	48	2	1	8.1E+09	1	1	7	7	3	20000	0	1	1	0	0	0	0	5	18	38	10	1	1	0	74	120	70	154	54	73	94	176	0		2	2	1	2	1	1	0	0	1
104	70	1	1	9.61E+09	3	1	6	4	1	5000	0	0	1	0	0	0	0	2	14	64	6	1	1	0	90	120	80	166	59	89	71	219	0		1	2	1	1	0	1	0	0	1
105	72	1	1	9.59E+09	3	1	6	4	1	3000	0	0	0	0	0	0	0	0	14	69	3	1	1	0	86	130	80	164	58	92	74	187	0		2	2	1	2	2	1	0	0	2
106	52	1	1	9.85E+09	1	1	2	15	5	60000	0	0	1	0	0	1	0	7	18	51	1	1	1	0	78	140	90	166	68	84	76	114	0		0	1	0	0	0	0	0	0	0
108	58	1	1	9.59E+09	5	1	4	13	1	40000	1	1	1	1	0	1	5	7	15	47	11	1	1	0	80	158	95	169	86	110	105	132	0		0	1	1	0	0	0	0	0	0
109	50	1	1	9.38E+09	1	1	5	10	3	28000	1	0	1	0	1	1	1	7	21	41	9	1	1	0	80	154	92	162	67	97	89	139	1		0	1	0	1	0	0	0	0	0
110	80	2	1	9.98E+09	1	1	8	0	3	10000	0	0	1	0	2	0	0	1	15	77	3	1	1	0	72	120	80	148	52	96	82	147	0		1	2	2	2	1	1	0	0	2
112	68	1	1	6.3E+09	1	1	5	4	4	15000	0	0	0	0	0	1	0	4	15	57	11	1	1	0	88	120	80	164	62	87	71	147	0		0	1	0	0	0	0	0	0	0

113	42	1	1	9.98E+09	1	1	1	16	5	40000	0	1	0	0	0	1	1	7	21	38	4	1	1	0	80	140	90	167	78	101	97	178	1		1	1	0	1	0	1	0	0	0
114	74	1	1	9.01E+09	3	1	8	4	3	12000	0	0	0	0	0	0	0	2	18	65	9	1	1	0	80	142	92	159	56	92	77	240	0		2	2	2	2	2	2	1	1	3
115	54	1	1	9.74E+09	1	1	8	5	5	25000	0	0	1	0	0	2	1	4	15	47	7	1	1	0	74	130	80	164	65	94	77	149	1		1	2	1	2	1	2	1	0	1
116	45	1	1	9.69E+09	1	1	5	8	3	15000	0	0	1	0	0	0	0	7	20	44	1	1	1	0	80	130	80	174	72	97	84	180	0		0	0	0	0	0	0	0	0	0
117	53	1	1	9.04E+09	1	1	4	11	5	15000	1	0	0	0	0	0	0	4	20	49	4	1	1	0	80	130	80	161	70	98	80	105	0		0	0	0	0	0	0	0	0	0
118	46	1	1	9.73E+09	5	1	3	10	1	10000	0	0	0	0	1	1	4	5	20	42	4	1	1	0	70	126	82	167	68	104	98	110	1		0	1	0	1	0	1	0	0	1
119	68	2	1	7.84E+09	3	1	2	15	1	18000	0	1	1	0	0	0	2	14	20	40	28	1	1	2	80	128	76	148	80	117	99	212	1		2	3	1	2	0	1	0	0	3
120	70	1	1	9.63E+09	1	1	8	10	5	50000	1	0	1	0	2	2	0	7	21	58	12	1	1	0	80	130	80	170	67	85	71	140	0		0	1	1	1	0	1	0	0	1
121	59	1	1	7.34E+09	1	1	4	8	3	15000	0	0	0	0	0	1	2	5	15	54	5	1	1	0	74	128	86	164	60	86	73	138	0		0	1	0	0	0	0	0	0	0
122	80	1	1	9.98E+09	1	1	8	10	2	30000	0	0	1	0	0	0	0	7	21	58	22	3	1	0	86	146	84	172	70	90	74	140	0		0	1	1	1	0	1	0	0	1
123	43	1	1	7.79E+09	1	1	5	8	6	20000	0	1	1	1	0	1	2	1	15	38	5	1	1	0	84	130	82	171	78	100	95	210	0		0	1	0	0	0	0	0	0	0
124	48	2	1	9.9E+09	1	1	7	15	4	50000	1	1	1	0	0	0	1	7	18	47	1	1	1	0	70	110	70	159	57	98	78	114	0		0	1	0	0	0	0	0	0	0
125	60	2	1	7.41E+09	1	1	2	10	4	30000	0	1	1	0	0	0	0	7	20	55	5	1	1	0	76	118	76	153	64	107	92	130	1		0	1	0	1	0	0	0	0	0
126	70	2	1	9.01E+09	1	1	6	0	1	4000	1	0	1	0	1	0	0	4	20	66	4	1	1	0	80	180	80	149	49	96	77	200	0		1	2	1	1	0	1	0	0	1
127	60	2	1	1E+10	3	1	6	6	1	5000	0	0	1	0	1	0	0	7	15	58	2	1	1	0	80	110	70	152	56	97	78	179	0		0	1	1	1	0	1	0	0	1
128	47	2	1	9.85E+09	3	1	6	5	2	15000	0	0	0	0	1	0	1	3	18	45	1	1	1	0	68	128	82	160	70	101	87	186	0		0	1	1	1	0	1	0	0	1
129	60	2	1	9.59E+09	3	1	6	0	5	10000	0	0	1	0	2	0	0	0	14	56	4	1	1	0	78	120	70	146	52	99	84	174	0		1	2	1	2	1	1	1	0	2
130	45	1	1	9.54E+09	2	1	4	10	2	15000	1	1	1	0	0	1	4	7	15	39	6	1	2	0	84	128	86	162	78	114	109	249	0		1	2	2	2	1	2	1	0	2
131	78	2	1	1E+10	3	1	7	0	1	1000	0	0	0	0	0	0	0	0	10	68	10	1	1	0	62	108	72	161	55	89	70	109	0		2	3	3	2	3	3	1	1	3
132	45	2	1	9.74E+09	3	1	6	7	4	40000	1	0	0	0	0	0	0	4	14	44	1	1	1	0	68	126	80	159	60	92	76	137	0		0	1	0	1	0	0	0	0	0
133	60	2	1	9.9E+09	3	1	6	0	1	6000	0	0	0	0	0	0	0	1	14	57	3	1	1	0	66	132	82	156	62	99	84	116	0		1	2	2	1	1	1	0	0	1
134	65	2	1	9.34E+09	3	1	8	5	5	18000	1	0	0	0	0	0	0	4	14	52	13	1	1	0	70	142	90	155	64	104	89	173	0		1	1	0	1	0	0	0	0	1
135	50	1	1	9.85E+09	1	1	3	15	4	24000	1	0	1	0	0	1	0	7	21	46	4	1	1	0	70	120	80	164	67	86	72	110	0		0	1	0	0	0	0	0	0	0
136	75	2	1	9.48E+09	3	1	7	0	2	12000	0	1	0	0	0	0	0	2	14	63	12	1	1	0	82	140	90	149	56	99	87	156	0		2	2	2	2	1	1	0	0	2
137	65	1	1	9.21E+09	1	1	5	7	5	45000	1	0	1	0	0	0	0	7	18	63	2	1	1	0	68	120	80	159	62	98	94	148	0		0	1	0	0	0	0	0	0	0
138	55	2	1	9.9E+09	1	1	7	8	2	12000	0	0	0	0	1	0	0	7	18	52	3	1	1	0	80	120	80	150	64	108	97	109	0		0	1	0	1	0	0	1	0	0
139	68	2	1	9.92E+09	1	1	7	7	4	50000	1	0	0	0	0	0	0	7	21	54	14	1	1	0	72	110	70	151	51	76	98	117	0		1	1	1	1	0	0	0	0	1
140	40	1	1	9.48E+09	1	1	2	17	3	46000	1	1	0	0	0	1	1	7	18	37	3	1	1	0	80	120	80	169	72	90	78	130	0		0	1	0	0	0	0	0	0	0
141	50	1	1	8.05E+09	1	1	4	8	4	15000	1	1	0	1	1	1	0	3	15	49	1	1	1	0	78	130	82	164	86	113	107	149	0		0	2	1	1	1	1	0	0	0
142	65	2	1	6.59E+09	1	1	8	0	15	95000	0	0	1	0	0	0	0	7	21	62	3	1	1	0	70	110	70	156	52	96	78	174	0		1	1	1	1	0	0	0	0	0
143	80	1	1	9.62E+09	3	1	8	10	15	95000	0	0	1	0	2	0	0	7	21	70	10	1	1	0	80	146	88	167	84	118	110	259	0		2	3	2	2	2	2	1	1	2
144	60	1	1	9.04E+09	1	1	5	7	8	35000	1	0	1	0	0	1	0	4	18	54	6	1	1	0	80	148	96	157	71	104	99	173	0		0	1	1	1	0	0	0	0	0
145	60	1	1	9.74E+09	1	1	5	5	4	28000	0	0	0	0	0	1	0	3	15	57	3	1	1	0	80	120	80	158	46	88	70	109	0		0	1	0	0	0	0	0	0	0
146	70	1	1	9.84E+09	1	1	8	10	10	70000	1	0	1	0	0	0	0	7	18	58	12	1	1	0	88	142	94	164	88	108	102	194	0		2	2	2	2	1	1	1	1	2
147	60	2	1	9.84E+09	1	1	8	4	10	70000	0	0	0	0	0	0	0	7	18	58	2	1	1	0	74	110	70	148	58	113	97	214	0		2	2	2	2	1	1	1	1	2
148	65	2	1	9.61E+09	3	1	6	0	6	30000	0	0	0	0	1	0	0	4	18	62	3	1	1	2	78	110	70	151	59	99	85	217	0		1	2	1	2	2	1	0	0	1
149	85	2	1	1E+10	3	1	8	0	2	6000	0	0	0	0	0	0	0	1	14	60	25	1	1	0	84	132	84	164	67	99	81	176	0		1	2	2	2	2	1	0	0	2
150	65	2	1	7.37E+09	3	1	5	4	2	6000	1	0	0	0	0	0	0	2	15	58	7	1	1	0	80	120	70	161	57	89	72	163	0		1	2	2	1	1	1	1	0	1
151	70	2	1	7.39E+09	3	1	8	0	3	40000	0	0	0	0	1	0	0	7	18	62	18	1	1	0	64	110	70	160	58	98	80	247	0		1	2	1	1	1	1	0	0	1
152	47	1	1	9.9E+09	1	1	5	15	4	16000	1	0	1	0	0	0	0	1	21	41	6	1	1	0	91	120	80	173	75	102	96	160	0		0	0	0	0	0	0	0	0	0
154	68	1	1	9.14E+09	1	1	3	15	6	45000	0	1	1	0	0	2	0	1	21	53	15	1	1	0	90	128	82	168	70	102	92	174	1		0	1	0	0	0	0	0	0	0
155	54	2	1	9.66E+09	1	1	7	7	6	30000	0	0	0	0	0	0	0	1	18	51	3	1	1	0	80	120	70	152	50	96	78	147	0		0	1	0	0	0	1	0	0	0
156	38	1	1	7.02E+09	1	1	2	15	4	20000	0	1	0	0	0	0	0	2	14	26	12	1	1	0	74	130	74	155	69	94	92	217	1		0	1	0	0	0	0	0	0	0
157	54	1	1	8.62E+09	5	1	4	10	2	18000	0	0	1	0	0	1	0	4	21	40	14	1	1	0	90	130	84	167	89	106	102	180	1		0	1	0	0	0	0	0	0	0
158	55	2	1	8.45E+09	1	1	8	0	13	90000	0	0	0	0	2	0	0	7	21	54	1	1	1	0	78	110	70	150	50	96	79	190	0		1	1	0	1	0	1	0	0	0
159	60	1	1	9.73E+09	1	1	5	15	4	20000	1	0	1	0	0	0	1	7	14	59	1	1	1	0	70	150	90	168	70	98	95	159	1		0	0	0	0	0	0	0	0	0
160	80	1	1	9.74E+09	3	1	8	14	4	16000	0	0	0	0	0	0	0	0	18	75	5	1	1	0	74	120	80	166	74	97	92	178	1		1	1	1	1	0	1	0	0	1
161	48	1	1	7.26E+09	1	1	4	12	4	20000	0	1	0	1	0	1	2	2	21	44	4	1	1	0	80	148	88	159	65	99	94	180	0		0	1	0	0	0	0	0	0	0
162	38	2	1	7.26E+09	1	1	4	7	4	22000	0	0	0	0	1	0	2	2	21	34	4	1	1	0	80	120	70	154	60	109	93	250	0		0	1	0	1	0	1	0	0	0
163	72	2	1	8.07E+09	3	1	8	7	8	40000	1	0	0	0	0	0	0	2	21	68	4	1	1	0	70	144	92	156	52	94	76	130	1		0	1	0	1	0	1	0	0	1