Master of Science in Public Health

Association of diet with depression among type-2 diabetic patients visiting tertiary care hospitals in Rawalpindi city

By

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Declaration

In submitting this dissertation, I certify that I have read and understood the rules and regulations of ASOPH and QAU regarding assessment procedures and offences and formally declare that all work contained within this document is my own apart from properly referenced quotations.

I understand that plagiarism is the use or presentation of any work by others, whether published or not, and can include the work of other candidates. I also understand that any quotation from the published or unpublished works of other persons, including other candidates, must be clearly identified as such by being placed inside quotation marks and a full reference to their source must be provided in proper form.

This dissertation is the result of an independent investigation. Where my work is indebted to others, I have made acknowledgments.

I declare that this work has not been accepted in substance for any other degree, nor is it currently being submitted in candidature for any other degree.

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Date: 15-08-2022

Dedicated to everyone who have helped and supported me, especially my family and friends!

ABSTRACT

Background:

Type-2 diabetes is a public health risk that can be negatively affected by both common depression and a poor nutrition. Type-2 diabetes has become more prevalent in Pakistan, although there is insufficient research to link food, depression, and type-2 diabetes.

Objectives:

The study aimed to find the frequency of individuals suffering from depression, the dietary patterns of type 2 diabetic patients, and the link between diet and depression in patients with type-2 diabetes visiting to tertiary care hospitals in Rawalpindi, Pakistan.

Methodology:

This cross-sectional research was conducted among 264 patients with type-2 diabetes (>20 aged) who attended OPDs of tertiary care hospitals in Rawalpindi. Participants were chosen by consecutive sampling. The frequency of depression was determined using Beck's Depression Inventory scale. Semi-quantitative FFQ was used to examine the participant's dietary patterns while the participant's demographic and socioeconomic information were also recorded. The questionnaire was also transcribed into Urdu for the respondent’s convenience. In order to investigate the link between dependent variables and socio-demographic factors, the chi-square test of correlation has been used.

Results:

The majority of the 264 respondents were females (n=186, 70%), and were aged between years of 31- 40 (n=93, 35.2%). The majority of type-2 diabetic patients reported depression (n=149, 56%). Gender, BMI, employment status, educational level, smoking status, and comorbidities

were all significantly linked to depression ($p<0.05$). Most of the participants had unhealthy diet (n=138, 53%). Diet and respondent's monthly income were significantly associated (p=0.007). This study found no statistically significant relationship between diet and depression in type-2 diabetes individuals (p value=0.473).

Conclusion:

This study found that the most of type-2 diabetes patients experienced depression and unhealthy diet patterns were more prevalent among the study population than were healthy diet patterns. There were no statistically significantly association found between diet and depression among patients with type 2 diabetes in this study.

Keywords: Association, Type-2 diabetes, BDI, depression, Healthy diet, Unhealthy diet, FFQ, Tertiary hospitals, Rawalpindi.

ACKNOWLEDGEMENTS

In the name of ALLAH, the most Merciful and Beneficent

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LIST OF ABBREVIATIONS

DM	Diabetes Mellitus
T2DM	Type-2 Diabetes Mellitus
BDI	Beck's Inventory Depression
BMI	Body Mass Index
WHO	World Health Organization
IDF	International Diabetes Federation
WDF	World Diabetes Foundation
SPSS	Statistical Package for Social Sciences
GI	Glycemic Index

CHAPTER I: INTRODUCTION

One of the most prevalent mental conditions is depression, characterized by lack of interest in one's life, followed by constant sadness, a sense of low self-worth, low energy, and poor attention, all of which interfere with daily activities. Typical mood fluctuations and emotional responses to difficulties in regular living are not the same as depression. Depression affects females more than males. Around 280 million people around the world suffer from depression (World Health Organization, 2021). With an estimated 3.8% of the population affected, 5.0% of adults and 5.7% of individuals over 60 years old, depression is a major contributor to the overall global burden of disease and a major cause of disability worldwide (Evans-Lacko, S., *et al*., 2018). Due to poverty, unemployment, homelessness, and hunger, depression is more common in Pakistan than in other countries, with prevalence rates ranging from 22% to 60%. (Aziz, A., & Khan, N., 2021).

Diabetes mellitus is described by elevated blood sugar levels driven on by abnormalities of insulin synthesis, insulin deficiency, or both. Diabetes is more commonly considered as a "bio-behavioral disorder," which means that it includes interactions between biological, psychological, and behavioral processes. Diabetes is a condition that is intimately linked to other health-related issues, especially psychological problems, which result to uncontrolled diabetes. It is a pandemic disease with a significant economic impact on both individuals and their communities. Diabetes is estimated to affect 537 million people in the world by 2021, 643 million by 2030, and 783 million by 2045. After China and India, Pakistan has the third-highest prevalence of diabetes globally. Pakistan has a diabetes prevalence rate of 26.7%. (Khan, U., Liaquat, A., & Azeem, S., 2022).

Depression worsens diabetic psychosocial effects, leading to more distress with diabetes. The actual cause of increasing prevalence levels of depression among diabetes is still being studied. In

future diabetic patients would be at risk because of depression (Rotella, F., & Mannucci, E., 2013). Patients who have hypertension and T2DM have indeed been reported to have higher than 20% prevalence of depression (Gold, S. M., *et al.,* 2020).

The interaction between DM and depression is bidirectional, and it is evident that managing these two conditions together is difficult (Sughra, U., & Imran, M, 2018). The earlier diagnosis of depressive episodes in patients with T2DM is crucial for monitoring appropriate treatment and lowering morbidity and mortality (Mueller, M., Ganesh, R., & Bonnes, S., 2020). In two-thirds of patients with diabetes, depression remains undiagnosed and untreated, which might worsen diabetes complications. Additionally, compared to the general population, diabetes patients are twice as likely to have depressed symptoms. Diabetes patients are more prone to experience anxiety and depression than non-diabetic patients (El Bilbeisi, A. H.; Srour, *et al.,* 2019). Therefore, for many diabetes patients, depression can be a major hindrance to good diabetes management.

The vast majority of Diabetes Mellitus sufferers have T2DM. The world - wide incidence of diabetes is growing due to population ageing, economic development, and increased urbanization (Basu, S., Yoffe, P., *et al*., 2013). In Pakistan, the prevalence of depression in patients with type 2 DM is 22% (Sughra, U., & Imran, M, 2018). Although the exact cause of type 2 diabetes is uncertain, there is a strong correlation between obesity, growing age, and family diabetes history. Unfortunately, in developing countries like Pakistan, the risk of depression related to T2DM is underreported.

Patients with depression and T2DM reported poor self-monitoring of blood sugar records, as well as poor obligation to lipid-lowering and antihypertensive treatment. They have an increased risk of developing lifelong diabetes complications, uncontrolled glucose, and elevated cardiovascular

risk factors (Asefa, A., *et al*., 2020). Poor diabetes management and clinical outcomes are certainly impacted on by sedentary lifestyle, smoking, and a high-fat diet (Powers, M. A., Bardsley, J., 2015).

Poor diabetes-related outcomes are triggered by depression, but depression can also be driven on by complications from diabetes. Diabetes and depression may be interrelated due to economic burdens, poor social interactions, and incapability to manage anxiety. Significant levels of patient stress are linked with the disorder, which has adverse social, economic, and mental consequences. Poor adherence to diet management may emerge from co-morbidity of diabetes with depression. The individual who is affected with depression and diabetes may suffer intense pain and have negative effects on the health.

Comorbid conditions like hypertension, kidney disease, and heart disease can result in negative health consequences on patients, causing additional challenges for diabetes treatment and self-management. Comorbidities, complications from DM, a body mass index (BMI) above 30, elevated blood hemoglobin levels (HbA1c) below 8%, cigarette smoking, insulin use, and a prolonged diabetes status are all associated with depression in people who have diabetes. Nearly 43% of diabetic patients are believed to experience psychiatric disorder (Maia *et al.,* 2012).

DM patients are less expected to practice self-care. High blood sugar levels can damage the vision, kidneys, nerves, and heart (American Diabetes Association, 2015). Patients with diabetes who develop depressive symptoms are more prone to behave in a non-cooperative manner when prescribed medical treatments, such as taking oral medications and following prescribed diets (Ali, M. K., *et al*., 2020).

T2DM is responsible to 90% of all diabetes cases worldwide and it can be managed or prevented by adopting good nutrition and healthy lifestyle. (Gregg, E. W., Li, Y., *et al.,* 2014). One lifestyle factor that may be essential in both preventing and treating these illnesses is diet. Individuals with both DM and depression are less likely to follow diet and fitness guidelines, which may reduce their quality of life and worsen their DM. Promoting self-management behaviors, such as blood sugar monitoring, taking proper medications, exercising, and maintaining a good diabetic diet, is the basis of managing type-2 diabetes.

Dietary patterns have been utilized to examine diet-disease relationships. Dietary patterns may be helpful in making dietary recommendations since they are simple to understand and implement. (Koci, N., & Mirkin, C. A., 2022). Hence, investigating the connection among diet patterns and depression may improve T2DM patients' health outcomes and reduce the rate of diabetes-related early death. However, few research have focused into the relationship between dietary patterns and depression among T2DM patients. Mostly studies has investigated the links between specific foods or food groups with depression rather than diet patterns, which is the most appropriate way to examine the effect of the entire diet on nutrition-related disease (Tomaino, L., 2021).

1.1. Rationale:

Diabetes Mellitus and depression are the two most serious public health concerns. They are a key contributor to mortality and disability worldwide. Diabetes-related complications are possibly increased by depression (Al Qusaibi, B., Mosli, H *et al*., 2022) because of their bidirectional linkage. In Pakistan, literature regarding diet and its link between depression in T2DM is limited. In this study, type-2 diabetic patients who visited tertiary care hospitals in Rawalpindi will be investigated to determine the relationship between diet and depression.

The outcome of this research will help diabetic patients in altering their dietary habits, provide healthcare professionals more information in this area to enable them to make better decisions to improve the diet quality and treatment given to diabetic patients experiencing anxiety and depression, and bring new ways to enhance public understanding of diet management for diabetes and supporting them within their homes and communities to manage stress and follow healthy lifestyle.

Objectives:

1. To find out the frequency of individuals suffering from depression
2. To determine the dietary patterns of type 2 diabetic patients.
3. To find out the association of dietary patterns with depression among type-2 diabetes patients visiting tertiary care hospitals in Rawalpindi, Pakistan.

CHAPTER II: LITERATURE REVIEW

2.1: Depression and Diabetes- An Overview:

Depression is one of the most prevalent mental illness. Due to delayed diagnosis, depression has a severe negative influence on health. Suicide is another outcome of depression. Every year, more than 700,000 individuals commit suicide (World Health Organization, 2021). A lifelong disease called diabetes is correlated with high glucose levels. The commonest kind of diabetes in adults is type-2, in which the body is unable to utilize insulin effectively. Patient motivation can be increased by actively analyzing illness and treating anxiety and despair (Perrin, N. E. D., 2017). Depression does have an impact on diabetes self-care and diabetes management, and there are challenges in clinical care management that might hinder the early diagnosis and management of psychological disorders in diabetes care (Basil, Abdul; *et al*., 2018). Individuals having T2DM experience depressive symptoms which considerably worse health-related quality of life (Ali, S., Stone, M., Skinner, *et al*., 2010).

2.2: Relationship between diabetes and depression:

Diabetes and depression have a complex relationship as people with diabetes commonly experience depressed symptoms, which may be related worsened diabetes outcomes through decrease in self-care and compliance (Gonzalez, J. S., *et al*., 2008). According to studies, there is a reciprocal association between depression and diabetes. Due to the discomfort associated with diabetes, the burden of its effects, and functional impairment, co-morbid depression may make it worse. Additionally, depression makes diabetes-related discomfort worse and both illnesses have a poor impact on glycemic management (Holt, R. I., DeVries, J. H., *et al*., 2021).

DM patients mostly experience depressive episodes. About one in five persons with type 2 diabetes suffer from depression (Merone, L., & McDermott, R., 2017). People who are depressed are more likely than those who are not to experience diabetic problems. The probability of death, inappropriate disease management, complications from diabetes, and poor quality of life all increases with depression in a patient. Early-onset depression is associated with unhealthy lifestyle choices such smoking, poor eating, being obese, and living a sedentary lifestyle, which raises the chance of developing diabetes mellitus (Hoare, E., *et al*., 2016).

2.3: Global Burden of depression and diabetes:

The major causes of disability and main contributions to the whole burden of disease are diabetes and depression (Evans-Lacko, S., *et al*., 2018). According to the World Health Organization, diabetes affects 422 million people globally, primarily in low- and middle-income countries, and it also accounts for 1.5 million deaths each year. 5.0% of adults and 5.7% of geriatrics are reported to have depression, which impacts 3.8% of the population overall. The World Diabetes Foundation reports that 280 million individuals worldwide suffer from depression, 70% of whom lived in undeveloped countries.

2.4: Impact of diet on depression and diabetes:

Primary prevention is an important factor in regard to managing diabetes and depression. Nutritional therapies play a major role in managing both DM and depression. The International Society for Nutrition Psychiatry Research claims that dietary factors can aid in the prevention and treatment of common mental illnesses (R. A. Adan, et al., 2019). Depression and diabetes mellitus are both illnesses that can be managed with good diet. Diabetes patients who consume lower fruits

and vegetables experience more mental problems (Salari-Moghaddam, A., *et al*., 2018). Type 2 diabetes is avoidable via healthy eating and lifestyle habits (Gregg, E. W., Li, Y., et al., 2014).

A well-known diet pattern, the Mediterranean diet is low in carbohydrates and has recently been linked to a variety of health advantages. These diets are linked to decreased incidence of onset diabetes and improved glycemic management in diabetic patients (Guasch-Ferré, M., & Willett, W. C., 2021).

2.5: Previous publications similar to topic:

Cross-sectional research on type-2 diabetes patients in Saudi Arabia by Al Qusaibi, B., *et al*. shown that depression can raise the risk of complications from diabetes. The prevalence of depression was seen to be 54% in diabetes patients, with inactivity and experiencing at least one diabetes-related problem being the two main risk factors (p=0.00), respectively. The frequency of depression in diabetic patients was shown to be considerably high. Women are more likely to be depressed than males (Al Qusaibi, B., Mosli, H., *et al*., 2022).

According to a cross-sectional research conducted by Kailash Nagar *et al*., in India showed that individuals with diabetes experience fear, sadness, and anxiety in contrast to having need to alter their eating habits so they can no longer eat sweets and sugary foods. Although the friends and family provided emotional support. There is evidence that diabetes patients experience mental trauma, which makes them feel more exhausted and stressed (Kailash Nagar *et al*., 2021).

Cross-sectional research done in Nairobi by Wekesah *et al*. discovered that poverty, stress, and lack of education encouraged habits such as smoking, alcohol use, lack of physical activity, and a poor diet, all of which have been linked to the onset of obesity, diabetes, and hypertension. The absence of medicine at public health facilities was seen as the second-most significant barrier to

medication adherence among older patients, just beside a lack of family support (Wekesah *et al*., 2019).

According to a cross-sectional study conducted by el Bilbeisi, A. H., *et al*., in Palestine found that 29% of patients with type 2 diabetes experienced depression according to DASS scale. 11.7%, 8.5%, 6.7%, and 2.1% of respondents, respectively, reported experiencing mild, moderate, severe, and very severe depression. Furthermore, the research aspect revealed two main dietary patterns: the Western and the grains-vegetables-and-fruits dietary patterns. Patients who followed the grains, vegetables, and fruits diet pattern had a reduced risk of experiencing depression (p value = 0.001) and a greater risk of having good health (p value = 0.004) (el Bilbeisi, A. H., *et al.,* 2019).

A qualitative meta-analysis of patient's experiences of living with diabetes and depression conducted by González-Castro, *et al*. revealed that a diabetes diagnosis is linked with a range of psychological emotions, including shock, despair, worry and fear, guilt, irritability, rage, isolation, humiliation, and feelings of dependency. An increase in depression symptoms and a decrease in the efficiency on antidepressant treatment are both caused by changes in blood sugar levels (González-Castro, T. B., *et al.,* 2019).

Cross-sectional research conducted by Sughra, U., and Imran, M., in Pakistan found that women were more at risk than men to face mental disorders, though this was not statistically significantly associated (p=0.769). Individuals reported mild mood abnormalities in 28.2%, borderline clinical disorders in 23.6%, moderate depression in 20.9%, severe depression in 9.1%, and profound depression in 1.2% of patients. In this study, 55.5% of respondents having T2DM were depressed (Sughra, U., & Imran, M, 2018).

A cross-sectional study by Umegaki *et al*. on geriatric diabetes patients revealed that high amount of carbs intake are certainly related with depression in women but not in males. This study found a link between dietary GI and depression in 30% of patients with type 2 diabetes. According to study's results, glycemic index & sugar levels were significantly higher in depressed patients than in non-depressed individuals (p value = 0.003), irrespective of the fact that both groups consumed approximately the same amount of carbohydrates (Umegaki *et al*., 2019)

According to cross-sectional research conducted by Darwish, *et al*., found that T2DM is linked to depressive symptoms, and comorbid depression in T2DM patients has been linked to even worse clinical features. Physical activity levels, self-management effectiveness, distress resulting from a diabetes diagnosis, and linked with prolonged diabetes duration may all be possible factors of the bi-directional relationship between Type 2 DM and depression. Depression in people with type 2 diabetes mellitus (T2DM) have been linked to negative clinical features (Darwish, L., *et al*., 2018).

A meta-analysis research conducted by Liu, X., Yan, *et al*. revealed that low intake of fruits and vegetables is linked with high risk of depression. In the end, this analysis comprised ten trials with 227,852 respondents for fruit intake and eight studies with 218,699 respondents for vegetable intake. The combined relative risk of depression for the highest fruit and vegetable consumption categories was 0.86 (0.81, 0.91; P <0.01) and lowest was 0.89 (0.83, 0.94; P <0.01), respectively (Liu, X., Yan, *et al*, 2016).

A cross-sectional investigation conducted in Pakistan by Azad, N., *et al*. revealed that over 50% of respondents had mental conditions. Anxiety and depression were shown to be more prevalent in patients with chronic type-2 diabetes who were female, uneducated, or housewives, however diabetes duration, medication, and management of diabetes had no impact on these conditions (Azad, N., Gondal, M., *et al*., 2014).

Cross-sectional research performed by Haghighatdoost, F., and Azadbakht, L., found a bidirectional negative connection between DM and depression. Diabetes patients are twice at risk to have depressed symptoms as people without the disease. However, depression was undiagnosed in most of diabetic patients, eventually leading to increased complications of diabetes. Dietary changes to tackle these health issues are a fundamental approach for controlling depression in diabetes people (Haghighatdoost, F., & Azadbakht, L. 2013).

A cross-sectional study conducted by Khan, T. M., *et al*., in Rawalpindi, Pakistan revealed significant differences in depression through intake levels of sweet foods, fast foods, snack foods, ready-to-eat foods, and fruits and vegetables. Depression results an increase in the intake of unhealthy food categories such sweets, fast food, snacks, and ready-to-eat meals, whereas a rise in depression causes less intake of fruits and Green leafy vegetables (Khan, T. M., Bibi, S., Rasool, *et al*., 2020).

Cross-sectional research conducted by Akbaraly, T. N*., et al.* found that two dietary patterns "Whole food" and "Processed food" had been studied on a total of 3486 individuals (26.2% women, mean age 55.6 years) . Self-reported depression was assessed five years later using the Center for Epidemiologic Studies-Depression (CES-D) scale. The results showed that consuming large amounts of processed food increased the probability of CES-D depression (OR = 1.58, 95% CI 1.11-2.23). (T. N. Akbaraly, et al., 2009)

According to cross-sectional research on 400 women who were patients at healthcare facilities conducted by Baharzadeh, E., *et al*., found that the relationship between various subgroups of fruit and vegetable intake (FV) and depression has not been studied in healthy adult populations. After controlling all influencing variables, participants in the lower quartiles of total FV consumption

were more likely to develop depression than those in the upper quartiles (p= 0.03). (Baharzadeh, E., *et al.,* 2018).

According to cross-sectional study conducted by Park, S., and Park, K., on type-2 diabetes mellitus patients in Korea revealed that individuals with lower scores on adherence to dietary guidelines had a greater likelihood of reporting depression (OR: 0.51; 95% (CI): 0.30-0.87). Respondents with poor adherence to proper meal schedules and moderate calorie intake (OR: 1.69, 95% CI: 1.15-2.50) were more likely to experience depression. However, individuals who had trouble sticking to the low sodium intake had less chance of depression (OR: 0.60, 95% CI: 0.40-0.88), and no connection was found between moderate carbohydrate intake, adequate vegetable/seaweed intake, or moderate alcohol use with depression (Park, S., & Park, K., 2021)

A cross-sectional study conducted by Al-Mssallem, M. Q., *et al*. revealed that food intake has significant consequences for individuals with type-2 diabetes. The study included 404 individuals (207 men and 197 women). Diet was recorded by using validated food questionnaire. White rice were the main source of dietary CHO, and the research found that dietary CHO intake was higher among Saudi patients with type 2 diabetes, exceeding the daily recommended amount by 67% of energy. (M. Q. Al-Mssallem *et al.,* 2020)

2.4. Conceptual Framework:

Based on the previous literature, a conceptual framework of the present study was developed that highlight the factors of the depression in T2DM patients along with some management strategies.

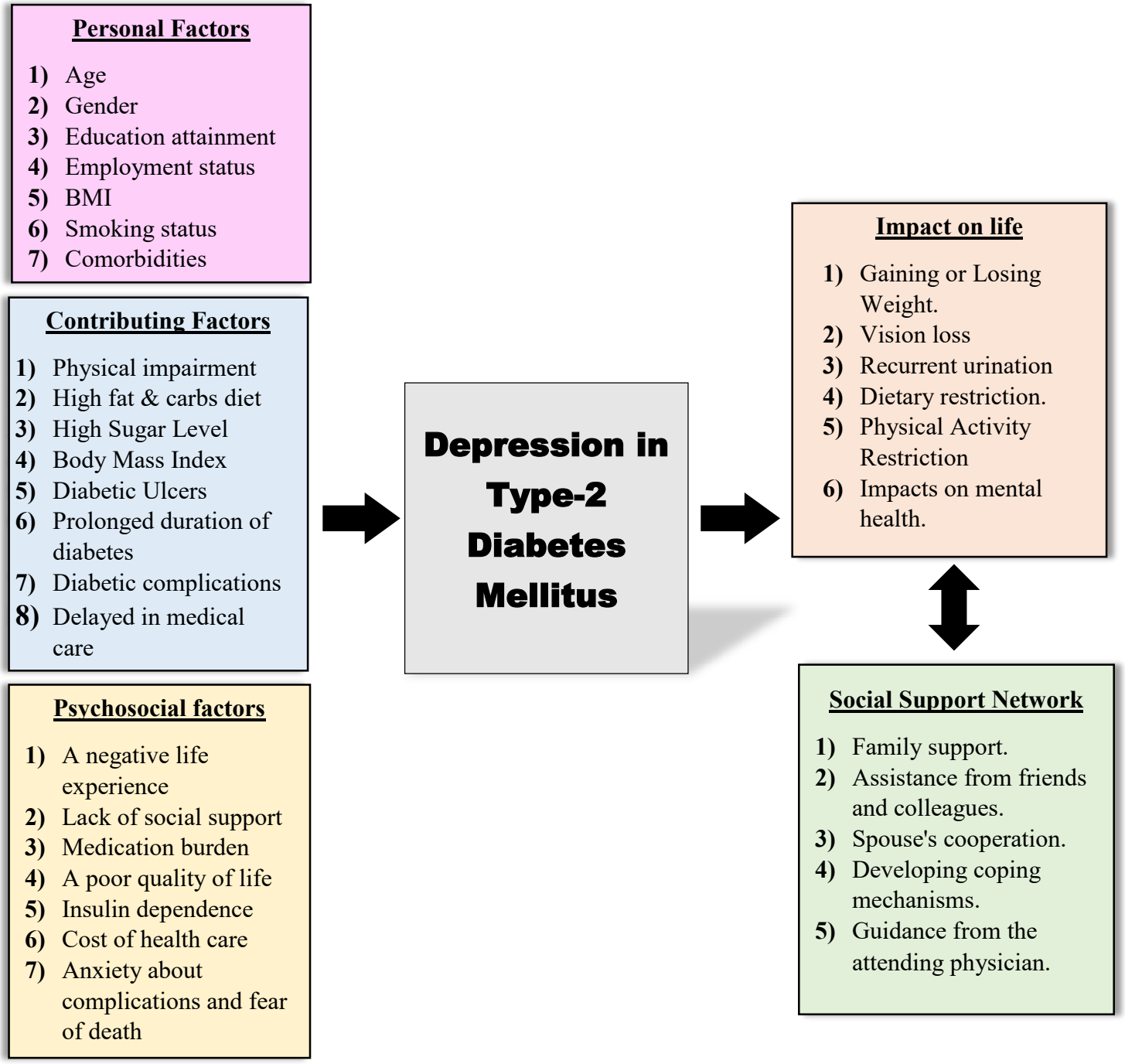


Figure 1: Conceptual Framework of Depression in type-2 diabetic patients

2.5. Operational Definitions:

2.5.1. Type-2 Diabetic patients:

The patients who have had high sugar levels for more than three years and have received a clinical diagnosis of adult-onset diabetes.

2.5.2. Depressed:

An individual is classified as depressed if the score on the Beck depression inventory scale ranges from 10 to 21.

2.5.3. Non-Depressed:

An individual is classified as non-depressed if the score on the Beck depression inventory scale ranges from 04 to 09.

2.5.4. Healthy Diet:

An individual is considered to follow a healthy diet if they consume a lot of whole grains, dairy products, vegetables, fruits, poultry, oily fish, pulses and legumes, nuts and seeds, and sugar-free tea, while consuming little to no refined grains, beverages, baked goods, fast food, dessert, candy, and sweets and their food frequency questionnaire score is in the range of 06 to 24.

2.5.5. Unhealthy Diet

An individual is considered to follow a unhealthy diet if they consume low whole grains, dairy products, vegetables, fruits, poultry, oily fish, pulses and legumes, nuts and seeds, and sugar-free tea, while consuming high refined grains, beverages, baked goods, fast food, dessert, candy, and sweets and their food frequency questionnaire score is in the range of 25 to 52.

CHAPTER III: METHODOLOGY

3.1. Research Design:

A quantitative research approach using cross-sectional study design was used for the current study.

3.2. Research Duration:

Study period for the current research was six months (March-2022 to August-2022)

3.3. Study Setting:

The study was carried out at public and private Hospitals of Rawalpindi.

3.4. Research Participants:

Study participants were type-2 diabetic patients who were visiting medicine OPDs for their checkup from their consultant. Samples were selected on the basis of inclusion and exclusion criteria.

3.4.1. Inclusion Criteria:

1. Type-2 diabetes patients above 20 years of age.
2. Both Male and Female patients were included.
3. Both literate and illiterate patients were included.

3.4.2. Exclusion Criteria:

1. Patients who didn't understand Urdu language.
2. Diabetic Patients with severe complications were excluded.
3. Patients who were not willing to participate in the study.

3.5. Sample Size Calculation:

Sample size was calculated using proportion formula for sample size calculation in OpenEpi menu, Version 3.01 software. Previous prevalence of severe preoperative anxiety was taken as 22% as reported by a study conducted at diabetic clinic of Fauji Foundation Hospital, Pakistan in 2018 (Sughra, U., & Imran, M, 2018). Calculated sample size was 264 with 95% confidence interval (C.I) and 5% margin of error.

Sample Size for Frequency in a Population

Population size(for finite population correction factor or fpc)(*N*):	1000000
Hypothesized % frequency of outcome factor in the population (*p*):	22%+/-5
Confidence limits as % of 100(absolute +/- %)(*d*):	5%
Design effect (for cluster surveys-*DEFF*):	1

Sample Size(*n*) for Various Confidence Levels

ConfidenceLevel(%)	Sample Size
95%	264

3.6. Sampling Strategy:

Desired sample was collected using non-probability consecutive sampling strategy.

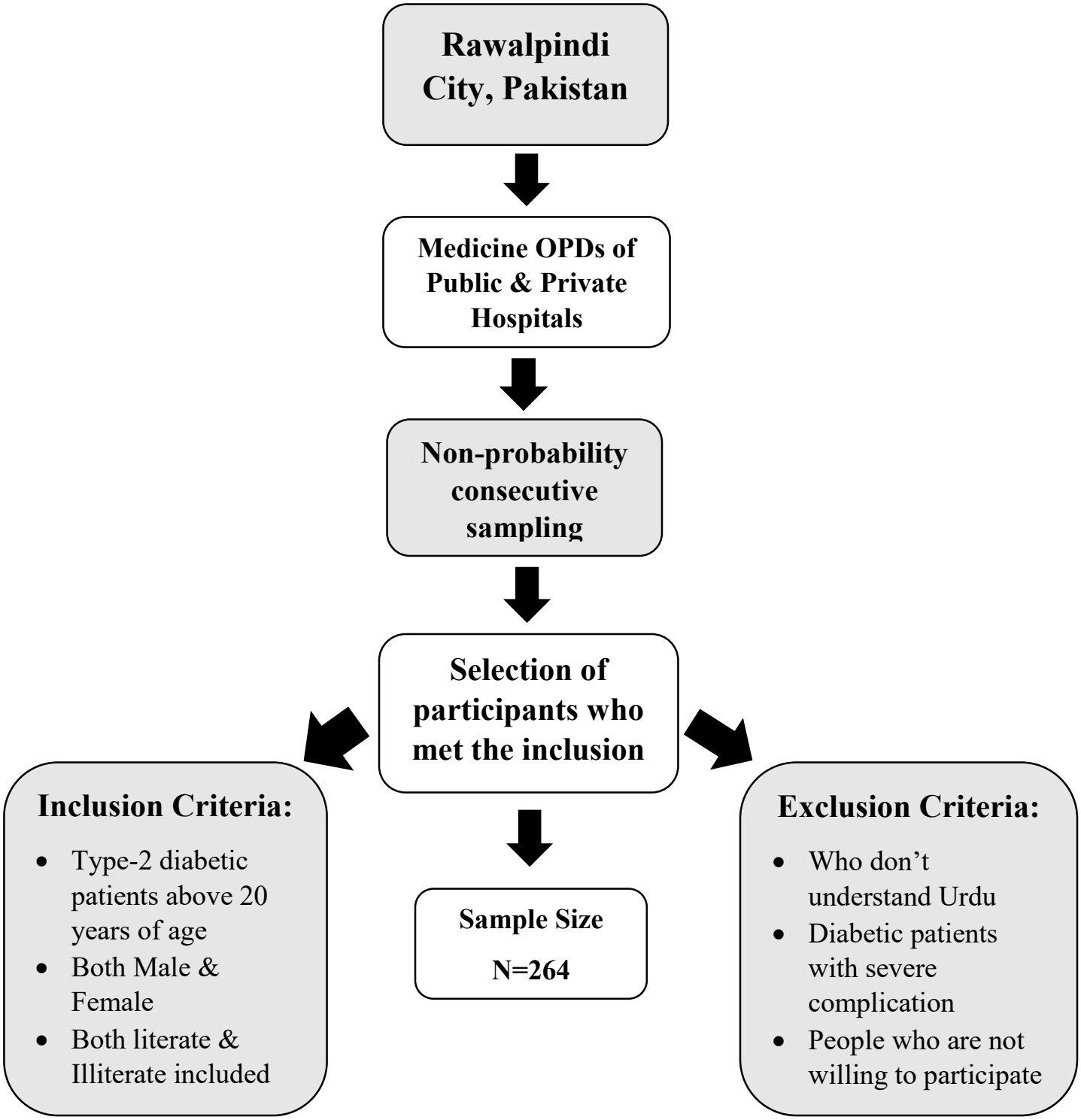


Figure 2: Non-Probability Consecutive Sampling Strategy

3.7. Data Collection Instrument:

3.7.1. Questionnaire Design:

Data was collected using an interview-based questionnaire. A Performa was developed to collect data regarding socio-demographics characters of the respondents, frequency of depression and Dietary patterns of type-2 diabetic patients. Questionnaire was also transcribed into Urdu for the better understanding of the respondents. Questionnaire was developed using one validated tool, Beck's depression inventory (BDI) Scale (Beck, *et al*., 1961) to measure depression and one adapted Semi-quantitative Food Frequency Questionnaire (FFQ) to find out the dietary patterns. Questionnaire is attached in Annexure-I.

3.7.2. Content of the Questionnaire:

The questionnaire contained three major sections:

1. **First part** included questions related to socio-demographic characters and precautions taken by respondents from past two months that comprise of a series of closed statements answerable by "yes" or "no".
2. **Second part** included BDI scale (Beck, *et al*., 1961) to check the frequency of individuals suffering from depression.
3. **Third part** included adapted semi-quantitative FFQ to find out the dietary patterns.

3.7.3. Study Variables:

3.7.3.1. Outcome Variable:

The major purpose of the questionnaire was to find the association of diet with depression among type-2 diabetic patients. The outcome variable were depression and dietary patterns of type-2

diabetic patients which were measured using a validated tool, Beck's Depression Inventory (Beck, *et al*., 1961) and adapted semi-quantitative food frequency questionnaire.

3.7.3.2. Independent Variable:

Data on independent variables was collected through a structured Performa that is constructed after international and national literature review. The Performa included socio-demographic variables such as age, gender, marital status, BMI, employment status, monthly income etc. In addition to these, it also included some variables related to the disease such as family history of diabetes, duration of diabetes etc. This section also included precautions taken by respondents from last 2 months.

3.8. Data Collection Process:

3.8.1. Pilot Testing:

Pilot testing was performed before starting the formal data collection procedure by including 10% of the actual sample size. Reliability was checked after entering data into SPSS. The value of Cronbach's Alpha for section B (Beck's Depression Inventory scale, 15 items) was 0.419 while value of Cronbach's Alpha for section C (Semi-quantitative food frequency questionnaire, 20 items) was 0.837 (Annexure-2).

3.8.2. Data Collection:

Data was collected by the researcher herself in approximately two months. All the patients in OPDs of the selected hospitals were approached. Consent was taken orally from all patients and only those patients were selected who agreed to take part in the research process and fulfill the inclusion criteria. After taking the consent, the patients were interviewed and their responses were recorded by the researcher.

3.9. Data Analysis Procedure:

Code book was developed and data was entered in Statistical Package for Social Sciences (SPSS) version 26. After careful data entry, data was checked for any error before proceeding to the further analysis. After data cleaning, data transformation was carried out for certain variables. Data analysis was done in two phases; descriptive analysis and inferential analysis.

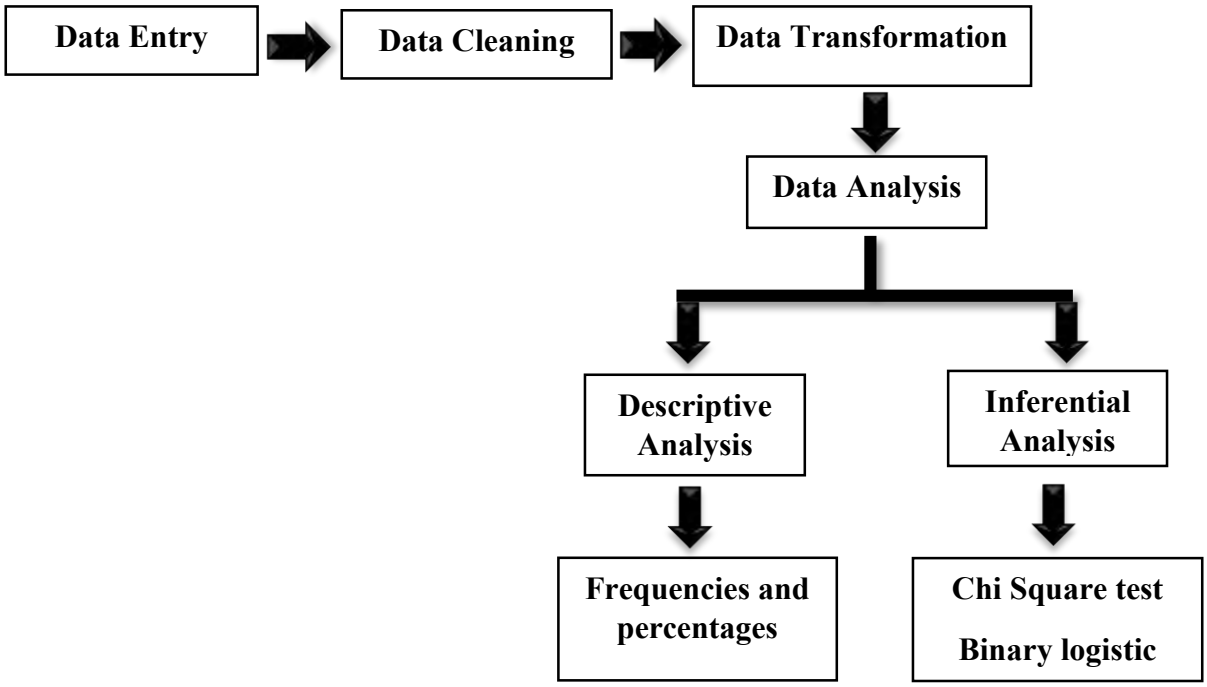


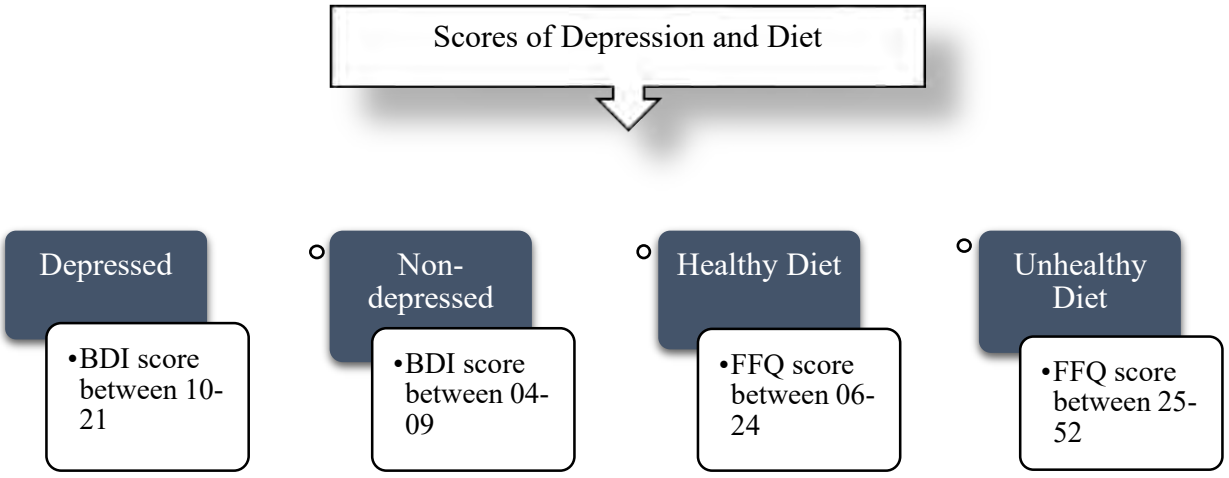
Figure 3: Data Analysis Plan

3.9.1. Descriptive Analysis:

Descriptive statistics were generated for socio-demographic characteristics and outcome variable. Data was summarized in the form of frequencies and percentages and presented in table form, Bar chart and Pie chart.

3.9.2. Inferential Analysis:

Pearson Chi Square Test of Independence was run to check the association of demographic variables with computed score for depression and dietary patterns of Type-2 diabetic patients visiting public and private hospitals of Rawalpindi city.



3.10. Ethical Considerations:

Before starting formal data collection, approval from Institutional Review Board (IRB) of Al-Shifa School of Public Health Rawalpindi, Pakistan has been taken (Annexure-4). Permission letter from the Head of Department of ASOPH was obtained regarding access to public & private hospitals. Permission was taken from the public & private hospitals of Rawalpindi city for conducting research. Patients were explained the purpose of the research and oral consent was taken from each participant (Annexure-3). Participants were assured for the confidentiality of their data. Data collected from the respondents was kept anonymous and was not shared with anyone. Data was entered in SPSS anonymously. After data entry, hard copies were kept at a safe place.

CHAPTER IV: RESULTS

In the current study, data of 264 respondents diagnosed with type-2 diabetes mellitus, who visited medicine OPDs for their checkup from consultant physician was collected. A summary of descriptive and inferential analysis is given below:

4.1: Demographic Characteristics:

A total of 264 respondents were included in this research. Majority of the respondents were females (n=186, 70.5%) and were 31-40 years of age group (n=93, 35.2%). Majority of the respondents educational attainment were intermediate (n=95, 36%), married (n=145, 54.9%), non-smokers (n=187, 70.8%), overweight according to BMI (n=121, 45.8%), had family history of diabetes (n=149, 56.4%), and had diabetes duration of more than 10 years (n=117, 44.3%). Demographic characteristics of the respondents are shown in table 1.

Table 1: Descriptive summary of Socio-demographic Variables

S. No	Variable	Frequency (n)	Percentage (%)
1.	**Age**		
	21-30 Years	70	26.5
	31-40 Years	93	35.2
	41-50 Years	65	24.6
	Above 50 Years	36	13.6
3.	**Marital Status**		
	Married	145	54.9
	Unmarried	119	45.1
4.	**BMI**		
	Underweight (<18.5)	6	2.3
	Normal Weight (10.5-24.9)	58	22.0
	Overweight (25.0 -29.9)	121	45.8
	Obese (>30.0)	79	29.9
5.	**Employment Status**		
	Employed	139	52.7
	Unemployed	125	47.3
6.	**Monthly Income**		
	<20,000	32	12.1

	20,000-30,000	123	46.6
	30,000-40,000	78	29.5
	>40,000	31	11.7
7.	**Education Attainment**		
	Illiterate	55	20.8
	Primary	50	18.9
	Intermediate	95	36
	Graduate	64	24
8.	**Smoking Status**		
	Smoker	77	29.2
	Non-smoker	187	70.8
9.	**Family history of diabetes**		
	Yes	149	56.4
	No	115	43.6
10.	**Diabetes Duration**		
	Less than 5 years	43	16.3
	Five to ten years	104	39.4
	More than 10 years	117	44.3
11.	**Comorbidities**		
	Hypertension	83	31.4
	Renal Disease	27	10.2
	Cardiovascular Disease	44	16.7
	Lung Disease	23	8.7
	None	87	33.0

Gender of the Respondents:

In this study, out of 264 respondents, female population (n=186, 70%) were higher in the study group as compared to male population (n=78, 30%).

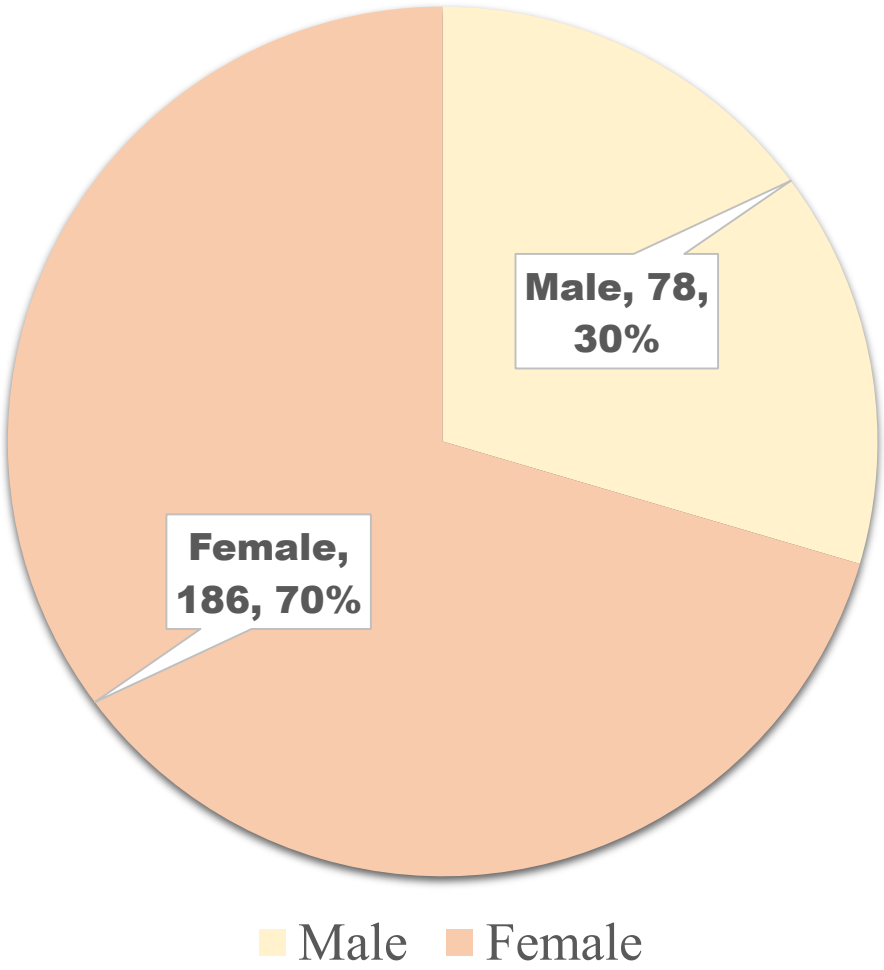


Figure 4: Gender of respondents

Precautions

Out of 264 Respondents, some patients take precautions from last two months in which the majority of the respondents had continue regular medication (n=113, 42.8%), Increase physical activity (n=107, 40.5), regular glucose monitoring (n=215, 81.4%), weight management (n=171, 64.8), adapt regulated daily meal plans (n=124, 47%).

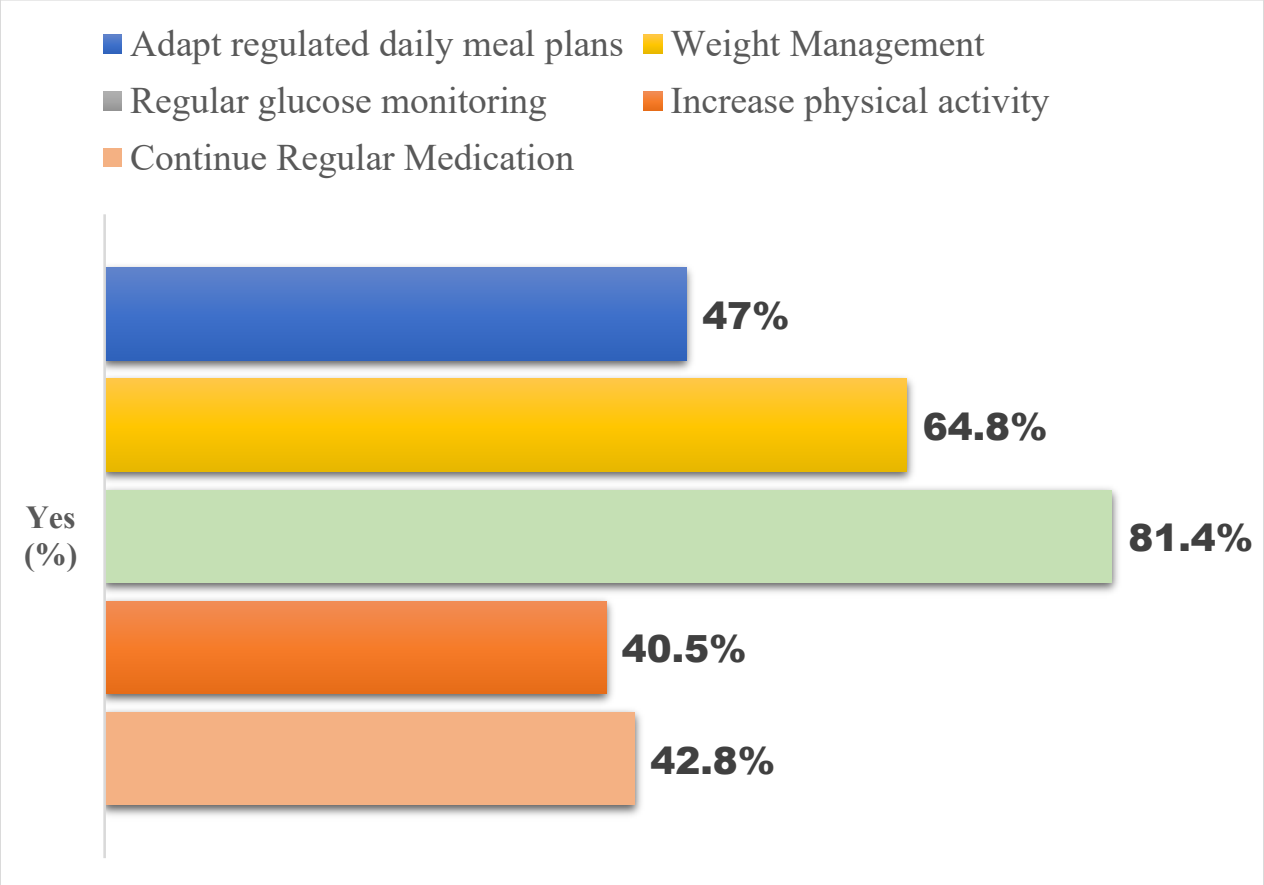


Figure 5: Precautions taken by respondents from last 2 months

4.2: Beck's Depression Inventory:

Total 264 respondents completed the questionnaire on association of diet with depression among Type-2 diabetic patients. Frequency of depression is measured by using validated Beck's Depression Inventory Scale. Questionnaire was interview based. Summary of Beck's Inventory Depression is given below.

Table 2: Descriptive summary of Depression

Sr. No	Outcome Variables	(n)	(%)
1.	**BDI-1**		
	I am no more worried about my health than usual	3	1.1
	I am worried about my physical problems like aches, pains, upset stomach, or constipation	111	42.0
	I am very worried about physical problems and it's hard to think of much else	89	33.7
	I am so worried about my physical problems that I cannot think of anything else	61	23.1
2.	**BDI-2**		
	I haven't lost much weight, if any, lately	152	57.6
	I have lost more than five pounds	77	29.2
	I have lost more than ten pounds	25	9.5
	I have lost more than fifteen pounds	10	3.8
3.	**BDI-3**		
	I don't get more tired than usual	11	4.2
	I get tired more easily than I used to	114	43.2
	I get tired from doing almost anything	108	40.9
	I am too tired to do anything	31	11.7
4.	**BDI-4**		
	I can sleep as well as usual	150	56.8
	I don't sleep as well as I used to	86	32.6

	I wake up 1-2 hours earlier than usual and find it hard to get back to sleep	10	3.8
	I wake up several hours earlier than I used to and cannot get back to sleep	18	6.8
5.	**BDI-5**		
	I do not feel sad	145	54.9
	I feel sad	98	37.1
	I am sad all the time and I can't snap out of it	16	6.1
	I am so sad and unhappy that I can't stand it	5	1.9
6.	**BDI-6**		
	I am not particularly discouraged about the future	191	72.3
	I feel discouraged about the future	61	23.1
	I feel I have nothing to look forward to	9	3.4
	I feel like future is hopeless and that things can never improve	3	1.1
7.	**BDI-7**		
	I get as much satisfaction out of things as I used to	180	68.2
	I don't enjoy things the way I used to	84	31.8
	I don't get real satisfaction out of anything anymore	0	0.0
	I am dissatisfied or bored with everything	0	0.0
8.	**BDI-8**		
	I don't feel I am being punished	241	91.3
	I feel I may be punished	23	8.7
	I expect to be punished	0	0.0
	I feel I am being punished	0	0.0
9.	**BDI-9**		
	I don't feel that I look any worse than I used to	219	83.0
	I am worried that I am looking old or unattractive	31	11.7
	I feel there are permanent changes in my appearance that make me look unattractive	4	1.5
	I believe that I look ugly	10	3.8

10.	**BDI-10**		
	I don't cry any more than usual	108	40.9
	I cry more now than I used to	115	43.6
	I cry all the time now	41	15.5
	I used to be able to cry, but now I can't cry even though I want to	0	0.0
11.	**BDI-11**		
	I have not lost interest in other people	91	34.5
	I am less interested in other people than I used to be	151	57.2
	I have lost most of my interest in other people	16	6.1
	I have lost all of my interest in other people	6	2.3
12.	**BDI-12**		
	I make decisions about as well as I ever could	238	90.2
	I put off making decisions more than I used to	15	5.7
	I have greater difficulty in making decisions more than I used to	11	4.2
	I can't make decisions at all anymore	0	0.0
13.	**BDI-13**		
	I can work about as well as before	102	38.6
	It takes an extra effort to get started at doing something	105	39.8
	I have to push myself very hard to do anything	23	8.7
	I can't do any work at all	34	12.9
14.	**BDI-14**		
	I am no more irritated by things than I ever was	61	23.1
	I am slightly more irritated now than usual	108	40.9
	I am quite annoyed or irritated a good deal of the time	62	23.5
	I feel irritated all the time	33	12.5

Appetite of the Respondents

Results from the data of 264 respondents shows that 5% of the participants have much worse appetite (n=13), 35% have no good appetite as it used to be (n=92) and 60% of the respondents appetite is no worse than usual (n=159)

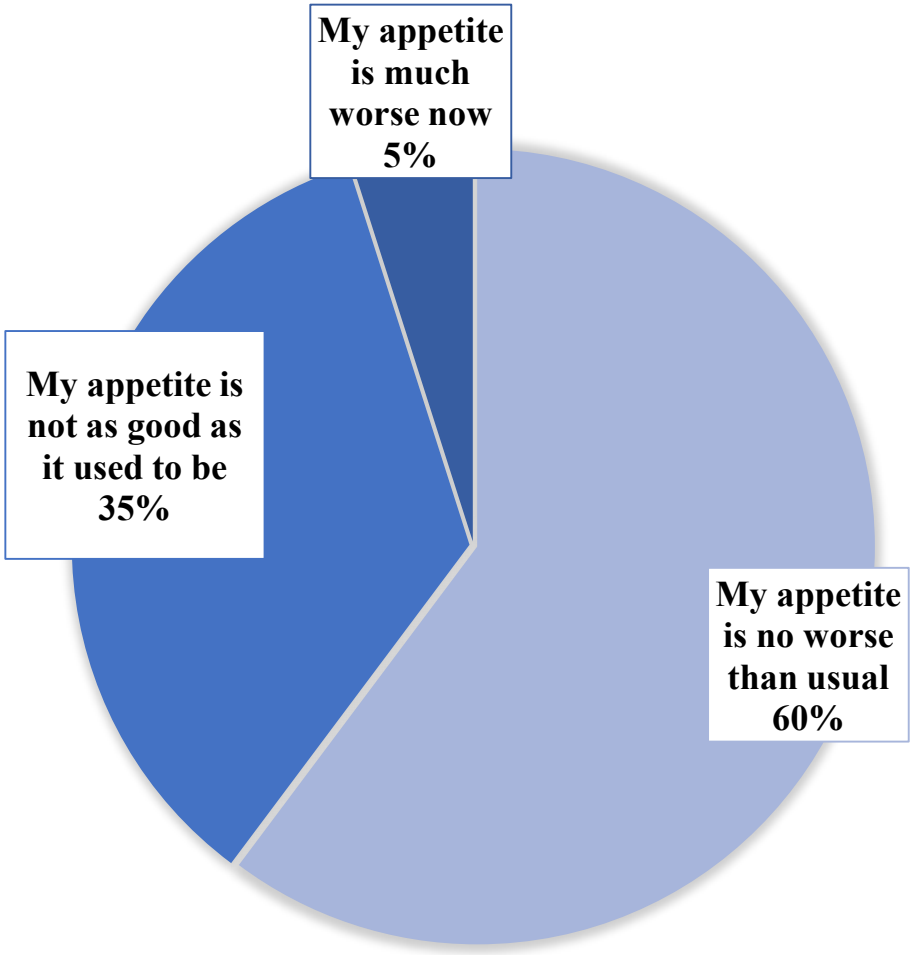


Figure 4: Appetite of the respondents

Depression

The results showed that out of 264 respondents, 56% of the respondents were depressed (n=147) and 44% of the respondents were non-depressed (n=117). Respondents who scored between 10-21 on Beck Depression Inventory scale were labelled as depressed and those who scored between 04- 09 were labelled as non-depressed.

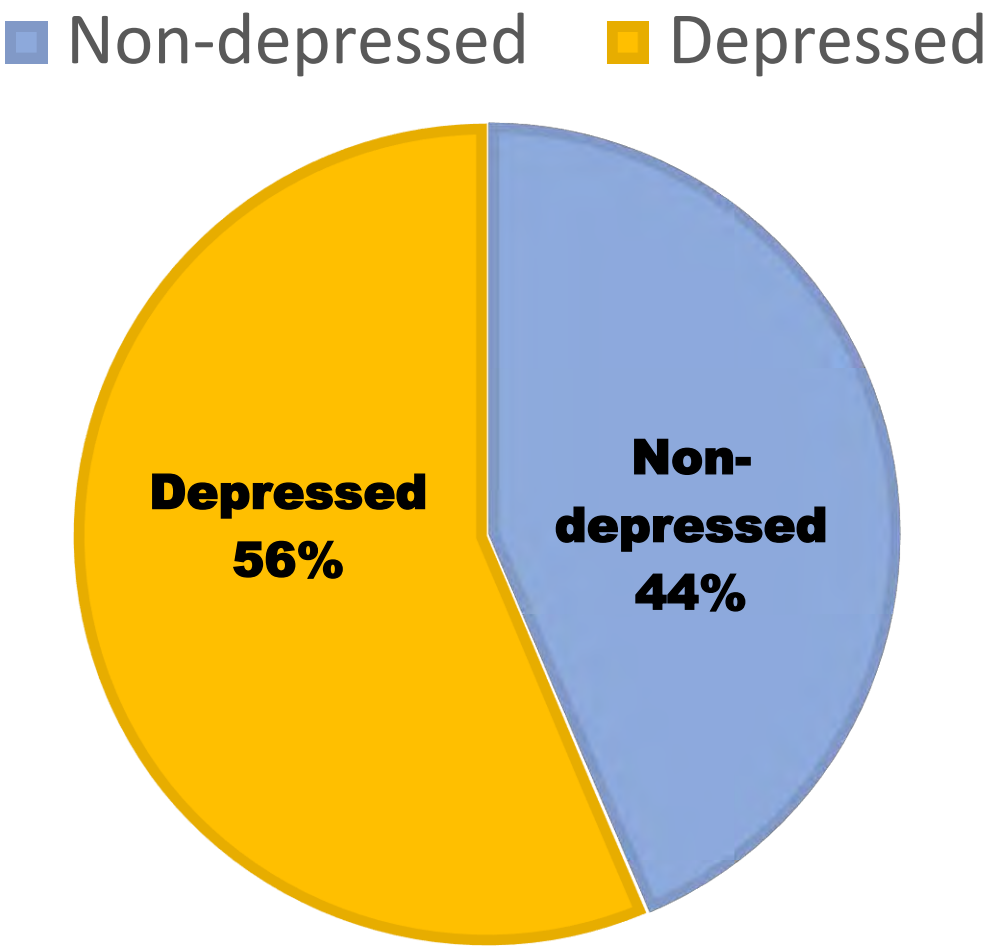


Figure 7: Mental state of Respondent

4.2.2: Dietary Patterns:

Total 264 respondents completed the questionnaire on association of diet with depression among type-2 diabetic patients. Adapted semi-quantitative Food Frequency Questionnaire (FFQ) was used to determine the dietary patterns of type-2 diabetic patients. Summary of respondent's dietary patterns is given below.

Table 3: Descriptive summary of Dietary Patterns

S. No	Dietary Patterns	(n)	(%)
1.	**Breakfast**		
	Daily	248	93.9
	2 Times a day	0	0.0
	Once a week	0	0.0
	2-4 Times a week	10	3.8
	Never	6	2.3
2.	**Lunch**		
	Daily	264	100.0
	2 Times a day	0	0.0
	Once a week	0	0.0
	2-4 Times a week	0	0.0
	Never	0	0.0
3.	**Dinner**		
	Daily	262	99.2
	2 Times a day	1	0.4
	Once a week	0	0.0
	2-4 Times a week	0	0.0
	Never	1	0.4
4.	**Snacks**		
	Daily	10	3.8
	2 Times a day	159	60.2
	Once a week	0	0.0
	2-4 Times a week	1	0.4
	Never	94	35.6
5.	**Refined Grains**		

	Daily	64	24.2
	2 Times a day	2	0.8
	Once a week	9	3.4
	2-4 Times a week	0	0.0
	Never	189	71.6
6.	**Whole Grains**		
	Daily	52	19.7
	2 Times a day	123	46.6
	Once a week	0	0.0
	2-4 Times a week	27	10.2
	Never	62	23.5
7.	**Dairy Products**		
	Daily	143	54.2
	2 Times a day	50	18.9
	Once a week	1	0.4
	2-4 Times a week	0	0.0
	Never	70	26.5
8.	**Fruits**		
	Daily	102	38.6
	2 Times a day	116	43.9
	Once a week	0	0.0
	2-4 Times a week	31	11.7
	Never	15	5.7
9.	**Vegetables**		
	Daily	107	40.5
	2 Times a day	107	40.5
	Once a week	25	9.5
	2-4 Times a week	23	8.7
	Never	2	0.8
10.	**Poultry**		
	Daily	134	50.8
	2 Times a day	107	40.5
	Once a week	23	8.7
	2-4 Times a week	0	0.0
	Never	0	0.0
11.	**Meat**		
	Daily	48	18.2
	2 Times a day	74	28.0
	Once a week	118	44.7
	2-4 Times a week	21	8.0

	Never	3	1.1
12.	**Oily Fish**		
	Daily	69	26.1
	2 Times a day	32	12.1
	Once a week	98	37.1
	2-4 Times a week	1	0.4
	Never	64	24.2
13.	**Pulses & Legumes**		
	Daily	102	38.6
	2 Times a day	97	36.7
	Once a week	26	9.8
	2-4 Times a week	37	14.0
	Never	2	0.8
14.	**Nuts & Seeds**		
	Daily	99	37.5
	2 Times a day	60	22.7
	Once a week	2	0.8
	2-4 Times a week	57	21.6
	Never	46	17.4
15.	**Beverages**		
	Daily	85	32.2
	2 Times a day	18	6.8
	Once a week	45	17.0
	2-4 Times a week	106	40.2
	Never	10	3.8
16.	**Tea without sugar**		
	Daily	97	36.7
	2 Times a day	69	26.1
	Once a week	28	10.6
	2-4 Times a week	1	0.4
	Never	69	26.1
17.	**Baked Foods**		
	Daily	97	36.7
	2 Times a day	69	26.1
	Once a week	27	10.2
	2-4 Times a week	1	0.4
	Never	70	26.5
18.	**Fast Foods**		
	Daily	97	36.7
	2 Times a day	69	26.1

	Once a week	27	10.2
	2-4 Times a week	2	0.8
	Never	69	26.1
19.	**Dessert**		
	Daily	105	39.8
	2 Times a day	7	2.7
	Once a week	48	18.2
	2-4 Times a week	14	5.3
	Never	90	34.1
20.	**Candy & Sweets**		
	Daily	105	39.8
	2 Times a day	7	2.7
	Once a week	48	18.2
	2-4 Times a week	14	5.3
	Never	90	34.1

Diet of Respondents:

Results of 264 respondents showed that unhealthy diet (n=138, 52.3%) was more common among the study group as compared to healthy diet (n= 126, 47.7%). Respondents scored between 06- 24 on Food frequency questionnaire scale were considered having healthy diet and those who scored between 25- 52 were considered having unhealthy diet.

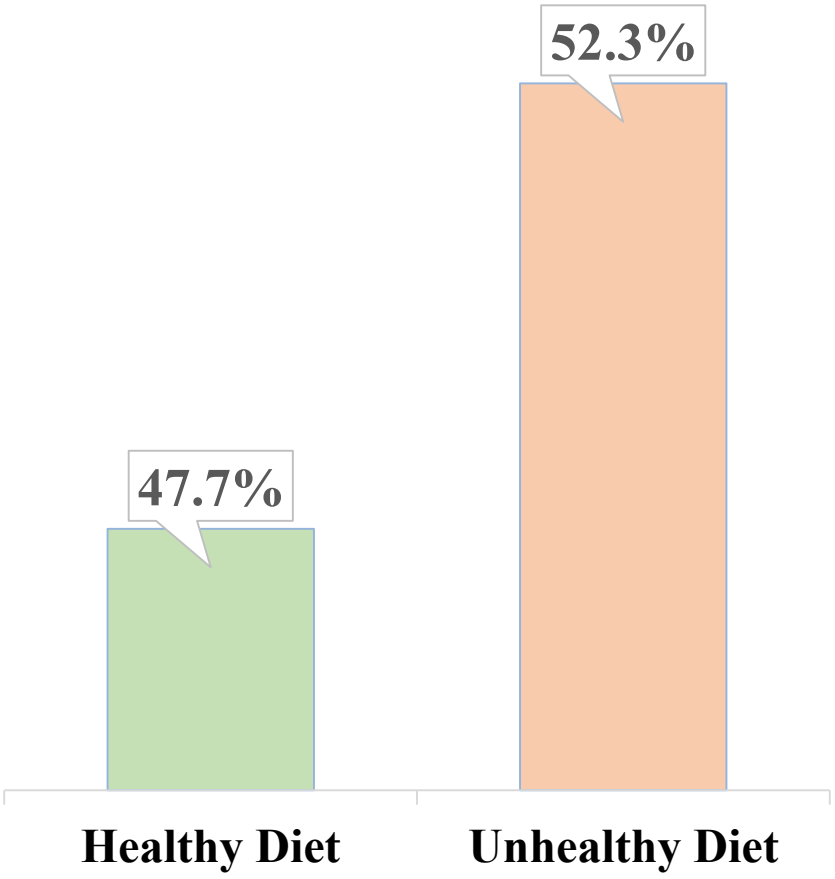


Figure 8: Diet of Respondents

4.7. Inferential Analysis:

4.7.1. Pearson Chi Square Results:

Association of Depression with demographic variables was determined using Pearson Chi Square Test of Independence after confirming the assumptions of the test. All p-values below 0.05 were considered statistically significant. A summary of association of socio-demographic characters and depression is given in table below.

Table 4: Association of Depression and Socio-demographic characteristics

S. No.	Variables	Depressed N (%)	Non-depressed N (%)	Chi Square (df)	P- value
1.	**Age**				
	21-30 Years	35 (13.3)	35 (13.3)		
	31-40 Years	37 (14)	56 (21.2)	6.741 (3)	0.081
	41-50 Years	33 (12.5)	32 (12.1)		
	Above 50 Years	10 (3.8)	26 (9.8)		
2.	**Gender**				
	Male	47 (17.8)	31 (11.7)	12.552 (1)	**0.0001**
	Female	68 (25.8)	118 (44.7)		
3.	**Marital Status**				
	Married	64 (24.2)	81 (30.7)	0.044 (1)	0.835
	Unmarried	51 (30.7)	68 (25.8)		
4.	**BMI**				
	Underweight (<18.5)	2 (0.8)	4 (1.5)		
	Normal Weight (10.5-24.9)	16 (6.1)	40 (15.2)	7.989 (3)	**0.046**
	Overweight (25.0 -29.9)	62 (23.5)	60 (22.7)		
	Obese (>30.0)	35 (13.3)	45 (17)		
5.	**Employment Status**				
	Employed	79 (29.9)	60 (22.7)	21.039 (1)	**0.0001**
	Unemployed	36 (13.6)	89 (33.7)		
6.	**Monthly Income**				
	<20,000	16 (6.1)	16 (6.1)		
	20,000-30,000	54 (20.5)	69 (26.1)	2.211 (3)	0.530
	30,000-40,000	35 (13.3)	43 (16.3)		
	>40,000	10 (3.8)	21 (8)		
7.	**Education Attainment**				

	Illiterate Primary Intermediate Graduate	14 (5.3) 20 (7.6) 56 (21.2) 25 (9.5)	41 (15.5) 30 (11.4) 39 (14.8) 39 (14.8)	17.267 (3)	**0.001**
8.	**Smoking Status** Smoker Non-smoker	 45 (17) 70 (26.5)	 32 (12.1) 117 (44.3)	9.791 (1)	**0.002**
9.	**Family history of diabetes** Yes No	 64 (24.2) 51 (19.3)	 85 (32.2) 64 (24.2)	0.051 (1)	0.821
10.	**Diabetes Duration** Less than 5 years Five to ten years More than 10 years	 20 (7.6) 46 (17.4) 49 (18.6)	 22 (8.3) 58 (22) 69 (26.1)	0.499 (2)	0.779
11.	**Comorbidities** Hypertension Renal Disease Cardiovascular Disease Lung Disease None	 32 (12.1) 15 (5.7) 13 (4.9) 13 (4.9) 42 (15.9)	 56 (21.2) 12 (4.5) 31 (11.7) 10 (3.8) 40 (15.2)	10.478 (4)	**0.033**

Results of the Chi square test showed that Gender (p value = 0.0001), BMI (p value = 0.046), Employment status (p value = 0.0001), Education attainment (p value = 0.025), Smoking status (p value = 0.002) and comorbidities (p value = 0.033) has significant association with depression in type-2 diabetic patients.

Table 5: Association of diet with Socio-demographic characteristics

S. No.	Variables	Healthy Diet N (%)	Unhealthy Diet N (%)	Chi Square (df)	P- value
1.	**Age**				
	21-30 Years	30 (11.4)	40 (15.2)		
	31-40 Years	50 (18.9)	43 (16.3)	2.280 (3)	0.516
	41-50 Years	29 (11)	36 (13.6)		
	Above 50 Years	17 (6.4)	19 (7.2)		
2.	**Gender**				
	Male	38 (14.4)	40 (15.2)	0.044 (1)	0.835
	Female	88 (33.3)	98 (37.1)		
3.	**Marital Status**				
	Married	71 (26.9)	74 (28)	0.198 (1)	0.657
	Unmarried	55 (20.8)	64 (24.2)		
4.	**BMI**				
	Underweight (<18.5)	2 (0.8)	4 (1.5)		
	Normal Weight (10.5-24.9)	29 (11)	27 (10.2)	0.919 (3)	0.821
	Overweight (25.0 -29.9)	57 (21.6)	65 (24.6)		
	Obese (>30.0)	38 (47.5)	42 (15.9)		
5.	**Employment Status**				
	Employed	67 (25.4)	72 (27.3)	0.026 (1)	0.871
	Unemployed	59 (22.3)	66 (25)		
6.	**Monthly Income**				
	<20,000	10 (3.8)	22 (8.3)		
	20,000-30,000	53 (20.1)	70 (26.5)	11.986 (3)	**0.007**
	30,000-40,000	41 (15.5)	37 (14)		
	>40,000	22 (8.3)	9 (3.4)		
7.	**Education Attainment**				
	Illiterate	28 (10.6)	27 (10.2)		
	Primary	28 (10.6)	22 (8.3)	2.817 (3)	0.421
	Intermediate	40 (15.2)	55 (20.8)		
	Graduate	30 (11.4)	34 (12.9)		
8.	**Smoking Status**				
	Smoker	38 (14.4)	39 (14.8)	0.115 (1)	0.735
	Non-smoker	88 (33.3)	99 (52.9)		
9.	**Family history of diabetes**				
	Yes	73 (27.7)	76 (28.8)	0.220 (1)	0.639
	No	53 (20.1)	62 (23.5)		
10.	**Diabetes Duration**				
	Less than 5 years	16 (6.1)	26 (9.8)		
	Five to ten years	54 (20.5)	50 (18.9)	2.299 (2)	0.317
	More than 10 years	56 (21.2)	62 (23.5)		

11.	**Comorbidities**				
	Hypertension	47 (17.8)	41 (15.5)		
	Renal Disease	15 (5.7)	12 (4.5)		
	Cardiovascular Disease	14 (5.3)	30 (11.4)	8.339 (4)	0.080
	Lung Disease	14 (5.3)	9 (3.4)		
	None	36 (13.6)	46 (17.4)		

Results of the Chi square analysis show that monthly income (p value = 0.007) has significant association with diet, rest of the socio-demographic have no statistically significant association with Dietary intake of study group (p value>0.05).

Table 6: Association of Diet with Depression

S. No.	Variables	Healthy Diet N (%)	Unhealthy Diet N (%)	Chi Square (df)	P-value
1.	**Non-Depressed**	52 (19.7)	63 (23.9)	0.514 (1)	0.473
	Depressed	74 (28)	75 (28.4)		

Results of the Chi square analysis showed that there was no statistically significantly association found between diet and depression among the study group (p value>0.05) although most of the patients experienced depression and had unhealthy diet.

CHAPTER V: DISCUSSION

In the current study, depression and dietary intake were evaluated using two tools: the validated Beck's inventory depression and the modified semi-quantitative Food frequency questionnaire. Patients visiting public and private hospitals for their checkups participated in the study. Furthermore, particular precautions taken by respondents in the previous two months were enquired about and noted. All factors were examined separately with socio-demographic variables, and their relationship to the outcome variables was established.

The study included 264 patients having type-2 diabetes mellitus. The results showed that majority of the participants suffered from depression (n= 149, 56%). Participants with a BDI score of 04-09 were classified as depression-free, whereas those with a score of 10-21 were classified as depressed. An earlier meta-analysis research by Khaledi, *et al*., which included 248 studies involving 83,020,812 diabetic patients globally, showed that 28% of type 2 diabetes patients experience depression globally (Khaledi, *et al*., 2019). Rehman *et al* study revealed that type 2 diabetes patients had prevalence rates of depression, anxiety, and stress of 47.9%, 69.6%, and 62.9%, respectively (Rehman *et al.,* 2015).

Depression was not associated with age (p= 0.081), despite the fact that 105 (40%) people above the age of 60 experienced depression. A previous study by Herrman, H., et al. found that in patients having type 2 diabetes mellitus, the threat of depression was greater in those under 65 years old compared to those between 65 and 85 years old (Herrman, H., et al., 2022). As younger people are less experienced when coping with difficult circumstances and they have more negative influences on life therefore they are more prone to develop depression. Besides, it is known that type 2 DM is a chronic condition and challenge that last for a lifetime therefore this would lead younger people to depression.

There was a statistically significant relationship between depression and gender (p=0.0001), with females having 68 (25.8%) higher mood disorders and depression than males having 47 (17.8%). Previous research by Haleem *et al*. studied Type 2 DM patients with and without Depression and found that Depression was three times more prominent in females (25.7%) than males (7.1%). (Haleem *et al*., 2017). Another research done in Pakistan revealed that 61 (55.5%) of the DM patients had comorbid depression. The prevalence of mood disorders was found to be higher in females (83.6%) than in males (16.4%) (Sughra, U., & Imran, M, 2018).

There was a statistically significant relationship between depression and gender (p=0.0001), with females having 68 (25.8%) higher mood disorders and depression than males having 47 (17.8%). Previous research by Haleem *et al*. studied Type 2 DM patients with and without Depression and found that Depression was three times more prominent in females (25.7%) than males (7.1%). (Haleem *et al*., 2017). Another previous research conducted in Pakistan revealed that 61 (55.5%) of the DM patients had comorbid depression. The prevalence of mood disorders was found to be higher in females (83.6%) than in males (16.4%) (Sughra, U., & Imran, M, 2018)

In current study depression and BDI (Body Mass Index) were shown to be statistically significantly associated (p=0.046). Among depressed respondents, 97 (36.8%) had a BMI >25 (obese), while 18 (6.9%) have a BMI <25 (Normal weight). A lower BMI is linked to fewer depressive problems in the research group. Previous research by Zahra, A., *et al*. in Pakistan revealed that obesity was linked with depression as 39.5% of the 134 individuals in the research were obese, and 47.3% of them reported having depression (Zahra, A., et al., 2022).

In this study depression was shown to be less prevalent in diabetes patients who were unemployed, 36 (13.6%) compared to employed patients, 79 (30%), and this association was statistically significant (p=0.0001). In a prior study, Tran, N. M., *et al*. discovered that in a single-variate

analysis, patients with unstable employment had a higher rate of depression than those who were unemployed (34.5% vs. 17.7%, p <0.05), likely because they were more likely to lose their jobs while they were in the hospital, making it challenging for them to find employment when they were discharged (Tran, N. M., et al., 2021). However, since it results in poor economic position and lowers self-esteem, unemployment is also a risk factor for depression, according to multiple studies; however, there was no significant relationship between depression and marital status (p= 0.835) in this study.

In current study the prevalence of depression was lower among the illiterate respondents (5.3%) than among the literate respondents (38.3%), however there was a statistically significant association between depression and educational level (p=0.001). Depression and smoking status had a statistically significant association (p=0.002). Although majority of the respondents were non-smokers 70 (26.5%) because of more female population as compared to male. Previous research done in Pakistan by Ali, S., & Kumar, P., shown that smokers had a higher risk of developing anxiety and depression than non-smokers. Nearly 50% of cigarette smokers in the study had depression (Ali, S., & Kumar, P., 2020).

In this study depression and comorbidities had a statistically significant association (p=0.033). The study found that 32 (12%) of the depressed individuals had hypertension, 15 (5.7%) had renal illness, 13 (4.9%) had cardiovascular disease, and 13 (4.9%) had lung disease. A previous study conducted in Pakistan showed that type-2 diabetes patients had a 39.84% prevalence of hypertension (Shahbaz, U., Huang, E., 2022). Another study by Asefa, A., *et al*. revealed that people with comorbidities including hypertension, kidney diseases, and heart disease might have a range of negative clinical outcomes that provide further challenges to diabetes management and life. Self-monitoring of blood glucose and adherence to lipid-lowering and antihypertensive

medications were both poor in patients with diabetes and depression (Asefa, A., *et al*., 2020). The current study also revealed that there were no significant differences in monthly income, family history of diabetes, or duration of diabetes between the depressed and non-depressive groups ($p>0.05$).

In the current study, particular precautions undertaken by individuals with type 2 diabetes over the past two months were also highlighted. Out of 264 responders, 81.4% (n=215) regularly monitor their glucose levels, 64.8% (n=171) pay attention to their weight management to manage their diabetes, 47% (n=124) adopt regulated daily meal plans that include low GI foods, 42.8% continued taking regular medications, and 40.5% (n=107) increase their physical activity.

There are few research in the literature that studied the connection between diet and depression in T2DM patients. That's because most studies have focused on dietary patterns, which is the most reasonable approach for evaluating the influence of the overall diet on nutrition-related disorders, rather than particular foods or food categories and nutrients with depression.

In current study respondents who scored between 06 and 24 on the Food Frequency Questionnaire were categorized as having a healthy diet, whereas those who scored between 25 and 52 were categorized as having an unhealthy diet. Results revealed that 138 (52%) of the individuals in the research group had an unhealthy diet. Previous study by Khan, T. M., *et al*., in Pakistan found that depression increases consumption of unhealthy diets such as sweet foods, fast food, snack foods, and ready-to-eat foods, whereas depression increases result in lower consumption of fruits and vegetables (Khan, T. M., *et al*., 2020).

In current study statistically association was found between monthly income and diet ($p= 0.007$). Previous research conducted in Chicago by French, S. A., *et al*., examined the link between

household income and diet and found that lower household income was linked to poorer diet quality. Individuals with lower income consumed less fruits and vegetables, more sugar-sweetened drinks, and generally had low diet quality than those with higher incomes (French, S. A., Tangney, C. C., et al., 2019). However, no statistically significant association was found between diet and age, gender, marital status, BMI, employment status, education level, smoking status, family history of diabetes, duration of diabetes and comorbidities ($p>0.05$).

On the other hand, the current study identified two primary eating patterns: 1) A healthy diet that included whole grains, dairy products, vegetables, fruits, poultry, oily fish, pulses and legumes, nuts and seeds, and sugar-free tea while limiting intake of refined grains, beverages, baked goods, fast food, dessert, candy, and sweets. 2) Unhealthy diet that included high consumption of refined grains, beverages, baked goods, fast food, dessert, candy, and sweets, as well as a low intake of whole grains, dairy products, vegetables, fruits, poultry, oily fish, pulses & legumes, nuts & seeds, and sugar-free tea.

Chi-square of association test was used to determine the link between depression and diet in the study group. The current study's findings revealed that there was no link between depression and diet. A previous study carried out by Nanri, A., *et al* in Japan found no evidence of a link between depression and different dietary patterns (Nanri, A., *et al*., 2010). Another previous study conducted by Park, S., & Park, K., 2021 in revealed no link between moderate carbohydrate consumption or adequate vegetable intake and depression (Park, S., & Park, K., 2021). Another previous study conducted in Pakistan found significant association between depression and sweet foods, fast foods, snack foods, ready to eat foods ($p=0.0001$). Depression leads to increase consumption frequency of unhealthy food groups including sweet foods, fast foods, snack foods,

ready to eat foods while increase in depression leads to decrease consumption frequency of fruits and vegetables (Khan, T. M., *et al*., 2020).

Another previous study done by Baharzadeh *et al*. revealed that consumption of a variety of foods, including citrus, fruits, green leafy vegetables, was independently associated with a decreased risk of depression (Baharzadeh *et al*., 2018). A previous meta-analysis studies conducted by Liu X. *et al.,* found that intakes of both fruits and vegetables were inversely linked to the risk of depression. Recent studies shown that depressed individuals consumed less fruits and vegetables and more unhealthy diets (Liu X. *et al*., 2016).

In current study low glycemic index foods were seen to have positive effect on patient's health. The glycemic index measures a food's ability to promote a rise in blood sugar levels in the body after consumption. Foods with high glycemic index place the body under more pressure to produce more insulin to prevent the blood sugar level from rising and reverting to normal. White bread, white rice, processed meals, and other refined grains and cereals have a higher glycemic index than whole grains and cereals. Good adherence to dietary guidelines was closely associated with a lower prevalence of depression among T2DM patients.

A previous study indicated that antioxidants such carotenoids, vitamin C, and vitamin E might help to avoid the symptoms of depression (Ju, S. Y., & Park, Y. K., 2019). According to another study conducted, a high consumption of B - complex vitamins, namely folic acid, is linked to a reduced risk of depression (Allen, L. H., et al., 2018). Another prior study revealed that fruits and vegetables also contain dietary fiber, which has been linked to an improvement in mood (Jang, J. T., Shuting, L., & Koller, A., 2016). Previous study found that green leafy vegetables are high in folate and magnesium, both of which help to reduce depression (Lassale, C., et al., 2019). Another prior research found that folate plays a role in the brain's metabolism of monoamines like serotonin

(Chi, S. H., et al., 2016). Another prior study discovered that lower serotonin production leads to depression (Baharzadeh, E., et al., 2018). As shown in a previous study excessive levels of calcium and glutamate in magnesium insufficiency reduce synaptic function and trigger depression (Djokic, G., Vojvodi, P., et al., 2019). Another previous study revealed that individuals with sufficient levels of magnesium were found to have reduced levels of C-reactive protein, a sign of low-grade inflammation (Lee, C., Min, S. H., & Niitsu, K., 2022). Previous studies showed that diet low in protein, saturated fat, cholesterol was associated with a higher risks of diabetes and depression (Altun, A., Brown, H., 2019).

5.1. Strengths:

- The current study used a validated and internationally accepted tool for measuring depression (Beck's Depression Inventory Scale) in type 2 diabetes patients.
- In Pakistan, literature on the effect of depressed symptoms on diabetic patients is abundant, however diet and its relationship with depression and diabetes is limited. Therefore, the purpose of this research was to examine whether diet would have any association with depression in type 2 diabetes patients.
- The current study is successful in revealing Diet habits of type-2 diabetic patients, as a representative sample.
- The current study identified major risk factors associated with depression in Diabetes patients.
- The current study included a diversified sample of patients from various social strata, education levels, and ethnic groups.

- The current findings of the study can be applied to a same patient group from other regions of Pakistan due to similar contextual characteristics.

5.2. Limitations:

Despite the sincere efforts of the researcher, few limitations were still present in the current study.

- It was a cross-sectional study and hence no causal link can be established in this study.
- As it was a time-limited research, sub-parts of the dietary patterns were not detected, resulting in finding no association between the outcome variables.
- The current study was performed in specific areas of Rawalpindi city.
- Recall bias and false reporting are possible when evaluating dietary patterns with the Food frequency questionnaire.

5.3. Conclusion:

This study found that majority of females patients aged between 31 to 40 years experienced depression. There was no statistical association found between diet and depression among type-2 diabetic patients in this study but more than half of the respondents struggled with depression and unhealthy diet patterns were more prevalent among the study population than were healthy diet patterns.

5.4. Recommendations:

- Proper patient counselling with a nutritionist is required for maintaining a balanced diet.

- Quality of food should be enhanced and less use of preserved and packed foods should be encouraged.
- Workshops and seminars on nutrition should be conducted to improve the dietary habits of public and educate them about healthy lifestyle.
- Low-fat and carbohydrate diets (low glycemic index foods) are advised for diabetes people suffering from depression.
- Conduct counselling sessions to educate people on how they can manage depression.
- Public health policies should be planned tactically to focus on impact of depression in type-2 diabetic patients and supporting them within their homes and communities to manage stress and follow healthy lifestyle.

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ANNEXURE 1

Data Collection Tool

ASSOCIATION OF DIET WITH DEPRESSION AMONG TYPE-2 DIABETIC PATIENTS VISITING TERTIARY CARE HOSPITALS IN RAWALPINDI CITY

Please answer every question & read all questions carefully and select the most appropriate answer. You are requested to fill all information accurately so that appropriate results can be derived. All information will be kept confidential and your identity will not be disclosed at any time.

Name of Researcher: Nimra Inayat **Respondent's Signature:**

Organization: Al-Shifa School of Public Health Rawalpindi ----------

SECTION-A

A: Socio-demographics:

1- Age?

- ☐ 21-30 Years
- ☐ 31-40 Years
- ☐ 41-50 Years
- ☐ 51-60 Years
- ☐ Above 60 Years

2- Gender?

- ☐ Male
- ☐ Female

3- Marital status?

- ☐ Married
- ☐ Unmarried

4- Height: _____ , Weight: _____

BMI (Body Mass Index)?

- ☐ Underweight (<18.5)
- ☐ Normal Weight (10.5-24.9)
- ☐ Overweight (25.0-29.9)
- ☐ Obese (>30.0)

5- Employment Status

- ☐ Employed
- ☐ Unemployed

6- Monthly income?

- ☐ <20,000
- ☐ 20,000-30,000
- ☐ 30,000-40,000
- ☐ >40,000

7- Education attainment?

- ☐ Illiterate
- ☐ Primary
- ☐ Intermediate
- ☐ Graduate

8- Smoking Status?

- ☐ Smoker
- ☐ Non-smoker

9- Any Other family member with diabetes?

- ☐ Yes
- ☐ No

10- Diabetes Duration?

- ☐ Less than 5 years
- ☐ Five to Ten years
- ☐ More than 10 years

11- Comorbidities?

- ☐ Hypertension
- ☐ Renal Disease
- ☐ Cardiovascular Disease
- ☐ Lung disease
- ☐ None

B: Any specific precautions had you taken from past two months.

	Yes (0)	No (1)
Continue Regular Medication	☐	☐
Increase physical activity	☐	☐
Regular glucose monitoring	☐	☐
Weight Management	☐	☐
Adapt regulated daily meal plans comprising of low GI carbohydrates	☐	☐

SECTION-B

	(0)	(1)	(2)	(3)
1.	I am no more worried about my health than usual	I am worried about my physical problems like aches, pains, upset stomach, or constipation	I am very worried about physical problems and it's hard to think of much else	I am so worried about my physical problems that I cannot think of anything else
2.	I haven't lost much weight, if any, lately	I have lost more than five pounds	I have lost more than ten pounds	I have lost more than fifteen pounds
3.	My appetite is no worse than usual	My appetite is not as good as it used to be	My appetite is much worse now	I have no appetite at all anymore
4.	I don't get more tired than usual	I get tired more easily than I used to	I get tired from doing almost anything	I am too tired to do anything
5.	I can sleep as well as usual	I don't sleep as well as I used to	I wake up 1-2 hours earlier than usual and find it hard to get back to sleep	I wake up several hours earlier than I used to and cannot get back to sleep
6.	I do not feel sad	I feel sad	I am sad all the time and I can’t snap out of it	I am so sad and unhappy that I can’t stand it
7.	I am not particularly discouraged about the future	I feel discouraged about the future	I feel I have nothing to look forward to	I feel like future is hopeless and that things can never improve
8.	I am no more irritated by things than I ever was	I am slightly more irritated now than usual	I am quite annoyed or irritated a good deal of the time	I feel irritated all the time

9.	I get as much satisfaction out of things as I used to	I don't enjoy things the way I used to	I don't get real satisfaction out of anything anymore	I am dissatisfied or bored with everything
10.	I don't feel I am being punished	I feel I may be punished	I expect to be punished	I feel I am being punished
11.	I don't feel that I look any worse than I used to	I am worried that I am looking old or unattractive	I feel there are permanent changes in my appearance that make me look unattractive	I believe that I look ugly
12.	I don't cry any more than usual	I cry more now than I used to	I cry all the time now	I used to be able to cry, but now I can't cry even though I want to
13.	I have not lost interest in other people	I am less interested in other people than I used to be	I have lost most of my interest in other people	I have lost all of my interest in other people
14.	I make decisions about as well as I ever could	I put off making decisions more than I used to	I have greater difficulty in making decisions more than I used to	I can't make decisions at all anymore
15.	I can work about as well as before	It takes an extra effort to get started at doing something	I have to push myself very hard to do anything	I can't do any work at all

SECTION-C

	How Often do you take?	**Daily (0)**	**1-2 times a day (1)**	**Once a week (2)**	**2-4 time a week (3)**	**Never (4)**
1.	Breakfast					
2.	Lunch					
3.	Dinner					
4.	Snacks					
5.	Refined Grains					
6.	Whole Grains					
7.	Dairy Products					
8.	Fruits					

9.	Vegetables					
10.	Poultry					
11.	Meat					
12.	Oily Fish					
13.	Pulses & Legumes					
14.	Nuts & Seeds					
15.	Beverages					
16.	Tea without sugar					
17.	Baked foods					
18.	Fast foods					
19.	Dessert					
20.	Candy & Sweets					

راولپنڈی شہر میں ٹرشری کیئر ہسپتال کا دورہ کرنے والے ٹائپ-2 ذیابیطس کے مریضوں کے درمیان ڈپریشن کے ساتھ خوراک کی ایسوسی ایشن

براہ کرم ہر سوال کا جواب دیں اور تمام سوالات کو غور سے پڑھیں اور مناسب ترین جواب منتخب کریں۔ آپ سے درخواست ہے کہ تمام معلومات کو درست طریقے سے پُر کریں تاکہ مناسب نتائج حاصل کیے جا سکیں۔ تمام معلومات کو خفیہ رکھا جائے گا اور آپ کی شناخت کسی بھی وقت ظاہر نہیں کی جائے گی۔

ادارہ: الشفاء سکول آف پبلک ہیلتھ راولپنڈی

محقق کا نام: نمرہ عنایت　　　　جواب دہندہ کے دستخط: ----------------------

سیکشن-اے

سماجی آبادیات

1- عمر؟

☐ 03-21 سال

☐ 03-01 سال

☐ 03-01 سال

☐ 03-01 سال

☐ 03 سال سے اوپر

2- جنس؟

☐ مرد

☐ عورت

0- ازدواجی حیثیت؟

☐ شادی شدہ

☐ غیر شادی شدہ

0- لمبائی: ______، وزن: ________

باڈی ماس انڈیکس (؟

☐ کم وزن)<1.80(

☐ عام وزن)2082-1380(

☐ زیادہ وزن)2282-2083(

☐ اپاٹو (0383<)

0- مازمت کی حیثیت

☐ ملازم

☐ بے روزگار

0- ماہانہ آمدنی؟

☐ 230333<

☐ 030333-230333

☐ 03033-030333

☐ 030333>

7- تعلیم کا حصول؟

☐ ناخواندگی

☐ پرائمری

☐ انٹرمیڈیٹ

☐ گریجویٹ

. تمباکو نوشی کی حیثیت؟

☐ تمباکو نوشی

☐ تمباکو نوشی نہ کرنے والا

2- خاندان کے کسی دوسرے فرد کو ذیابیطس ہے؟

☐ جی ہاں

☐ نہیں

13- ذیابیطس کا دورانیہ؟

☐ 0 سال سے کم

☐ پانچ سے دس سال

☐ 13 سال سے زیادہ

11- Comorbidities؟

☐ ہائی بلڈ پریشر

☐ گردوں کی بیماری

☐ دل کی بیماری

☐ پھیپھڑوں کی بیماری

☐ کوئی نہیں۔

ب: آپ نے پچھلے دو مہینوں سے کوئی خاص احتیاط برتی ہے۔

جی ہاں (0)	نہیں (1)	
☐	☐	باقاعدہ ادویات جاری رکھیں
☐	☐	جسمانی سرگرمی میں اضافہ ۔
☐	☐	گلوکوز کی باقاعدگی سے نگرانی
☐	☐	وزن کا انتظام
☐	☐	کاربوہائیڈریٹ پر مشتمل روزانہ کے کم GI کھانے کے رنگ والے پلانز کو اپنانا۔

سیکشن بی

(3)	(2)	(1)	(0)
میں اپنے جسمانی مسائل سے اس قدر پریشان ہوں کہ اس کے علاوہ کچھ سوچ بھی نہیں سکتا۔	میں جسمانی مسائل سے بہت پریشان ہوں اور بہت کچھ سوچنا مشکل ہے۔	میں اپنے جسمانی مسائل جیسے درد، درد پیٹ کی خرابی یا قبض سے پریشان ہوں۔	میری اپنی صحت کے بارے میں معمول سے زیادہ پریشان نہیں ہوں۔
میں نے پندرہ پاؤنڈ سے زیادہ وزن کم کیا ہے۔	میں نے دس پاؤنڈ سے زیادہ وزن کم کیا ہے۔	حال ہی میں میں نے پانچ پاؤنڈ سے زیادہ وزن کم کیا ہے۔	میں نے زیادہ وزن کم نہیں کیا ہے
مجھے بالکل بھی بھوک نہیں ہے۔	میری بھوک اب بہت زیادہ خراب ہے۔	میری بھوک اتنی اچھی نہیں ہے جتنی پہلے ہوتی تھی۔	میری بھوک معمول سے زیادہ خراب نہیں ہے۔
میں کچھ بھی کرنے سے بہت تھک جاتا ہوں۔	میں تقریباً کچھ بھی کرنے سے تھک جاتا ہوں۔	میں پہلے سے کہیں زیادہ آسانی سے تھک جاتا ہوں۔	میں معمول سے زیادہ نہیں تھکتا۔
میں پہلے سے کئی گھنٹے پہلے جاگ جاتا ہوں اور واپس سو نہیں سکتا۔	میں معمول سے 1-2 گھنٹے پہلے جاگ جاتا ہوں اور مجھے دوبارہ سونا مشکل لگتا ہے۔	مجھے پہلے جیسی نیند نہیں آتی۔	میں ہمیشہ کی طرح سوتا ہوں۔
میں اتنا اداس اور ناخوش ہوں کہ میں اسے برداشت نہیں کر سکتا۔	میں ہر وقت اداس رہتا ہوں اور میں اس سے باہر نہیں نکل سکتا۔	مجھے دکھ ہوتا ہے۔	مجھے دکھ نہیں ہوتا۔

مجھے لگتا ہے کہ مستقبل ناامید ہے اور چیزیں کبھی بہتر نہیں ہو سکتیں۔	مجھے لگتا ہے کہ میرے پاس انتظار کرنے کے لئے کچھ نہیں ہے۔	میں مستقبل کے بارے میں مایوسی محسوس کرتا ہوں۔	میں مستقبل کے بارے میں خاص طور پر مایوس نہیں ہوں۔
میں ہر وقت چڑچڑا محسوس کرتا ہوں۔	میں اس وقت کافی ناراض یا چڑچڑا ہوں۔	میں اب معمول سے تھوڑا زیادہ چڑچڑا ہوں۔	میں چیزوں سے زیادہ چڑچڑا نہیں ہوں جتنا میں پہلے تھا۔
میں ہر چیز سے مطمئن یا بیزار ہوں۔	مجھے اب کسی بھی چیز سے حقیقی اطمینان حاصل نہیں ہوتا۔	میں چیزوں سے لطف اندوز نہیں ہوتا جس طرح میں کرتا تھا۔	مجھے چیزوں سے اتنا ہی اطمینان ملتا ہے جتنا میں پہلے کرتا تھا۔
مجھے لگتا ہے کہ مجھے سزا دی جا رہی ہے۔	مجھے سزا کی توقع ہے۔	مجھے لگتا ہے کہ مجھے سزا مل سکتی ہے۔	مجھے نہیں لگتا کہ مجھے سزا دی جا رہی ہے۔
مجھے یقین ہے کہ میں بدصورت لگ رہا ہوں۔	میں محسوس کرتا ہوں کہ میری ظاہری شکل میں مستقل تبدیلیاں آ رہی ہیں جو مجھے غیر پرکشش نظر آتی ہیں۔	میں پریشان ہوں کہ میں بوڑھا نظر آ رہا ہوں یا غیر پرکشش۔	مجھے نہیں لگتا کہ میں پہلے سے زیادہ بدتر نظر آتا ہوں۔
پہلے رونا آتا تھا لیکن اب میں چاہ کر بھی رو نہیں سکتا۔	میں اب ہر وقت روتا ہوں۔	میں اب پہلے سے زیادہ روتا ہوں۔	میں معمول سے زیادہ نہیں روتا۔
میں نے دوسرے لوگوں میں اپنی ساری دلچسپی کھو دی ہے۔	میں نے دوسرے لوگوں میں اپنی زیادہ تر دلچسپی کھو دی ہے۔	مجھے پہلے کی نسبت دوسرے لوگوں میں کم دلچسپی ہے۔	میں نے دوسرے لوگوں میں دلچسپی نہیں کھوئی ہے۔
میں اب بالکل بھی فیصلے نہیں کر سکتا۔	مجھے پہلے سے زیادہ فیصلے کرنے میں زیادہ دشواری ہوتی ہے۔	میں نے پہلے سے زیادہ فیصلے کرنے کو روک دیا۔	میں فیصلے کرتا ہوں جیسا کہ میں کبھی کر سکتا ہوں۔
میں کوئی کام بالکل نہیں کر سکتا۔	مجھے کچھ بھی کرنے کے لیے خود کو بہت مشکل سے دھکیلنا پڑتا ہے۔	کچھ کرنا شروع کرنے کے لیے ایک اضافی کوشش کی ضرورت ہوتی ہے۔	میں پہلے کی طرح کام کر سکتا ہوں۔

سیکشن سی

آپ کتنی بار کھاتے ہیں؟	روزانہ (3)	دن میں 1-2 بار (1)	ہفتے میں کئی بار (2)	ہفتے میں 0-2 بار (0)	کبھی نہیں (0)
ناشتہ					
دوپہر کا کھانا					
رات کا کھانا					
فاسٹ فوڈ اناج					
دودھ کی بنی ہوئی اشیا					
پھل					
سبزیاں					
مرغی					
گوشت					
مچھلی یا سمندری غذا					
انڈے					
گری دار میوے اور بیج					
مشروبات					
چینی کے بغیر چائے					
سبز یا کالی چائے					
فاسٹ فوڈز					
چٹنی					
کینڈی اور میٹھائیاں					

بچی شرکت کا شکریہ!

ANNEXURE 2

Scale Reliability

Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.406	.526	15

Figure 9: Reliability of BDI questionnaire

Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.837	.827	19

Figure 10: Reliability of FFQ questionnaire

ANNEXURE 3

Informed Consent Form

I am Nimra Inayat, student of MSPH- Final Semester, Al-Shifa School of Public Health, Al-Shifa Eye Hospital, Rawalpindi. I am doing research on Association of dietary patterns with depression among type-2 diabetic patients visiting tertiary care hospitals in Rawalpindi city.

PURPOSE OF THE RESEARCH

The purpose of this study is to find out the frequency of depression and dietary patterns of type-2 diabetic patients visiting tertiary care hospitals in Rawalpindi city.

PARTICIPATION

I do not anticipate that taking this study will contain any risk or inconvenience to you. Your participation is strictly voluntary and you may withdraw your participation at any time without penalty. I request you to answer the questions as honestly as possible. It will take no longer than 20 minutes to complete a questionnaire. All information collected will be used only for research purpose and will be kept highly confidential. Your identity and your responses will not be identifiable; all data will be stored anonymously. As this is solely a student project no incentive will be provided. Once study is completed, I would be happy to share the results with you if you desire.

Thank you for agreeing to participate in this study. Your feedback is important.

Consent

I have read and understand the information sheet and agree to take part in the study.

Signature_____ **Date**_____

ANNEXURE 4
IRB Letter

AL-SHIFA SCHOOL OF PUBLIC HEALTH
PAKISTAN INSTITUTE OF OPHTHALMOLOGY
AL-SHIFA TRUST, RAWALPINDI

No: SOPH/IRB/13-17
29th March, 2022

TO WHOM IT MAY CONCERN

This is to certify that **Nimra Inayat** D/O **Muhammad Inayat** is a student of Master of Science in Public Health (MSPH) final semester at Al-Shifa School of Public Health, PIO, Al-Shifa Trust Rawalpindi. He/she has to conduct a research project as part of curriculum & compulsory requirement for the award of degree by the Quaid-i-Azam University, Islamabad. His/her research topic which has already been approved by the Institutional Review Board (IRB) is **"Association of diet with depression among type-2 diabetic patients visiting tertiary care hospitals in Rawalpindi city".**

Please provide his/her necessary help and support in completion of the research project. Thank you.

Sincerely,

Dr. Ayesha Babar Kawish
Head
School of Public Health, PIO
Al-Shifa Trust, Rawalpindi

AL-SHIFA TRUST, JEHLUM ROAD, RAWALPINDI – PAKISTAN
Tel: +92-51-5487820-472 Fax: +92-51-5487827
Email: info@alshifaeye.org Web Site: www.alshifaeye.org

ANNEXURE 5

Gantt chart

Activities	March 2022	April 2022	May 2022	June 2022	July 2022	August 2022
Literature Search						
Synopsis writing and IRB approval						
Pilot testing						
Data collection and entry						
Data analysis						
Write-up						
Thesis submission						

ANNEXURE 6

Budget

BUDGET ITEM	*TRANSPORT*	*STATIONARY & INTERNET*	*PRINTING*	*PUBLISHING*
PILOT TESTING	**500 Rs/-**	**2000 Rs/-**	**2000 Rs/-**	**-**
DATA COLLECTION	**8,000 Rs/-**	**4,000 Rs/-**	**-**	**-**
THESIS WRITE-UP	**1,000 Rs/-**	**5,000 Rs/-**	**8,000 Rs/-**	**20,000 Rs/-**
TOTAL EXPENDITURE	**14,000 Rs/-**	**11,000 Rs/-**	**10,000 Rs/-**	**20,000 Rs/-**
GRAND TOTAL	55,000 Rs/-			