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SOURCES AND AMOUNT OF DIETARY FIBER INTAKE AND ITS EFFECT ON GLYCEMIC CONTROL AMONG TYPE 2 DIABETIC PATIENTS ON FOLLOW UP IN GENERAL GOVERNMENT HOSPITALS, ADDIS ABABA, ETHIOPIA, 2024: CROSS-SECTIONAL STUDY

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APPROVED BY THE BOARD OF EXAMINERS

This is to certify that the thesis prepared by Feven Hailu entitled "**sources and amount of dietary fiber intake and its effect on glycemic control among Type 2 diabetic patients on follow up in general government hospitals, Addis Ababa, Ethiopia, 2024: Cross-sectional study "** and submitted in partial fulfillment of the requirements for the Degree of Master in public health nutrition complies with regulations of the University and meets the accepted standards with respect to originality and quality.

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List of Acronyms

AAU	Addis Ababa University
AARHB	Addis Ababa Regional Health Bureau
ADA	American Diabetes Association
BMI	Body Mass Index
BP	Blood pressure
DM	Diabetes Mellitus
DF	Dietary fiber
FBS	Fasting Blood Sugar
HbA1C	Hemoglobin A1C
IDF	International Diabetes Federation
PSEM	Portion Size Estimation Method
RDA	Recommended Daily Allowance

Abstract

Background: Several comprehensive studies and evidences support the role of fiber in glycemic control. The glucose-lowering effect of fiber intake has not been consistently demonstrated in the literature and the effect related with source and amount of fiber intake of Type 2 DM patients. Although poor glycemic control has become more prevalent in Ethiopia in recent years, such information however is contextually limited in Ethiopia. Thus, this study attempted to examine the sources and quantify amount of dietary fiber intake and its effect on glycemic control of Type 2 DM patients.

Objective: To determine the sources and amount of dietary fiber intake and its effect on glycemic control among Type 2 DM patients on follow up general government hospitals of Addis Ababa, Ethiopia ,2024

Methods: A facility-based cross-sectional study was conducted among 282 Type 2 DM patients selected from Zewedtu Memorial Hospital, Yekatit 12 hospital and medical college, Tirunesh Bejing hospital and Ras desta Dametew hospital from March, 2024 to April, 2024. Data was collected from study participants using KOBO collect mobile data collection app. Repeated multiple pass 24-hour recall was used to collect dietary data. Dietary data was collected using portion size estimation methods and analyzed in to nutrient using Nutrisurvey2007.The final data analyzed using the Statistical Product and Service Solutions (SPSS) version 27.The association between dietary fiber and glycemic control was assessed with Pearson correlation and declared strong if Pearson coefficient was above 0.7.

Result :The most predominant source of dietary fiber intake was cereal (79.5%). The mean (SD) dietary fiber intake and HgA1C were 32.5 ± 20 g/d and 7.61 ±1.49 respectively. Dietary fiber has an inverse correlation with HgA1c, with a Pearson correlation of -0.383 (p value <0.001). Of all measures of glycemic control total energy, duration of DM followup and dietary fiber were positive significant association with poor glycemic control with a P value<0.05. .

Conclusion : Dietary fiber intake of respondents were inline with the recommendation. Incorporating fiber rich food in a diet improves glycemic management of Type 2DM patients .Therefore, consumption diet rich in fiber for Type 2 DM patients is recommended.

1. Introduction

1.1 Background

Diabetes mellitus is a heterogeneous group of metabolic disorder that arises from an increase in blood sugar level as a result of the defect in insulin secretion, insulin action or both. Type 1 and Type 2 DM are most widely used classification. Type 1 diabetes is caused by an autoimmune destruction of pancreatic beta cells, resulting in absolute insulin deficiency, while Type 2 diabetes is caused by an insulin receptor malfunction and varying degrees of insulin resistance (1). Type 2 DM is most prevalent and accounts for about 90% of patients. The International Diabetes Federation (IDF) Diabetes Atlas of 2021 reports that 537 million people worldwide are affected by diabetes, with projections showing 783 million by 2045. This has led to 6.7 million deaths in 2021. Africa has the fastest growing prevalence of Type 2 diabetes, with 24 million people in 2021 and 416 thousand deaths by 2021. Ethiopia about 1.9 million peoples suffer from diabetes in 2021(2) .

Management of diabetes mellitus needs both nutrition therapy and medication interventions. Poorly managed diabetic mellitus leads to micro-vascular and macro-vascular complication including cardiovascular disease (CVD), neuropathy, nephropathy, lower limb amputation, and retinopathy(3). However if appropriate management of diabetes is achieved, these serious complications can be delayed or prevented all together (2). Dietary modification is mainstay of management for Type 2 DM patients along with medication. Dietary fiber intake is associated with decreasing all-cause mortality in DM patients (4).

Codex Alimentarius Commission (CAC) define dietary fiber as a polymer of carbohydrates that contains ten or more monomeric units and is incapable of being digested by the body's own enzymes in the intestine (5). Dietary fiber can be categorized based on its ability to form gels, its solubility in water, its viscosity, and its fermentation by the gut microbe. Thus, dietary fiber can be classified as soluble or insoluble from this metabolic perspective .Dietary fibers that are neither soluble in water nor fermentable by gut microbe are categorized as insoluble fiber. Polysaccharide polymers, such as lignin, cellulose, hemicellulose, and certain resistant starch are the most common types of insoluble fiber. While water soluble dietary fibers are soluble in water, and forms viscous gel substances and highly fermentable by gut microbiota. The most

common types of soluble dietary fiber are Pectin, inulin, mucilage, glucomannan and β-glycan's polysaccharide (6).

Most natural foods contain dietary fiber, even though the amount and the type of fiber found in that specific food varies depending on the source. Foods containing dietary fiber include approximately one-third soluble and two-third insoluble fiber (7). Dietary fiber is typically found in four major food groups such as fruits, vegetables, legumes and cereals. The most common sources of soluble fiber are fruits such as avocado, bananas, dates, orange, apples, and berries. Tomato, carrot, cucumber, cauliflower and broccoli are excellent sources of fiber from vegetable category. From legumes, almonds, peanuts, peas, lentil and chick peas are excellent sources. Whereas, whole grains and cereal bran's, including all bran products corn ,wheat and rice are important providers of insoluble dietary fiber(6,8).

The American Diabetes Association (ADA) advises increasing fiber intake to 14 gm/1000 kcal per day, or roughly 25 g/day for women and 38 g/d for men, in order to meet the recommendations for the general population (6).On the other hand Research Society for the Study of Diabetes in India (RSSD) recommends that dietary fiber intake should be in the range of 25g - 40 g/day (9). The National Institute of Nutrition's (NIN) revised RDA 2020 standards recommend consuming 40g/2000 kcal of dietary fiber per day (8). Therefore, estimating the amount of dietary fiber intake of Type 2 DM patients and the common dietary sources in the context of Ethiopia warrants further study.

1.2 Statement of the problem

Glycemic control is the optimal blood sugar level in DM patients .Glycosylated hemoglobin (HbA1c), fasting blood glucose (FBG), and postprandial glucose (PPG) are the three parameters used to assess the glycemic control in DM patients .Among these, glycosylated hemoglobin (HbA1c) is the gold standard ,which represents an individual's average blood glucose level over the previous 2-3 months (10). The American Diabetes Association (ADA) defines good glycemic control at a cutoff of glycosylated hemoglobin (Hb1Ac) 7% and fasting blood glucose range is 100 to 125 mg/dL (5.6 to 6.9 mmol/L) (11).

Globally, only half of Type 2 DM patients had optimal glycemic control (12). The pooled prevalence of poor glycemic control in sub Saharan Africa was 30% (95% CI:27.6–32.9) (13).

Ethiopia has high prevalence of poor glycemic control of 61.92% (95% CI: 57.92, 65.92) and only one- third of patients [(32.6% (95% CI: 28.3, 36.9)] had good glycemic control (14). Cross sectional studies done at different regions of Ethiopia revealed that the prevalence of poor glycemic control varies among regions and ranged 45.2% (Dire dewa) to73.8% (Addis Ababa) (15–19).

There are numerous factors that affect glycemic control in Type 2 DM patients. Age , gender , lower income, low level of education , family history of diabetes, longer duration of diabetes, medication burden, treatment modality, smoking, alcohol consumption, and presence of other comorbidity were the factors significantly associated with poor glycemic control (13). Moreover dietary adherence is also one of the major determinant of glycemic control (20). A meta-analysis in 2022 in Ethiopia evidenced that over half of Type 2 DM patients have poor dietary adherence (58.9%). Therefore, to improve glycemic control, diabetes patients are urged to follow the guideline to consume high-fiber, low-glycemic-index, and low-fat foods (17).

In recent years, numerous literature have demonstrated the significance of dietary fiber on glycemic control of Type 2 DM. Umbrella review of meta-analysis of RCT evidenced that dietary fiber has significant role in reducing HbA1C and FBS level among Type 2 DM patients (21). Further individual studies illustrated that dietary fiber intake reduces glycemic indices by delaying gastric emptying and lowers glucose spike in Type 2 DM (6,22).A meta-analysis of RCT further supported that fiber rich diet results in lowering hemoglobin A1c from 0.55- 0.66% and fasting blood sugar level 0.55- 0.80mmol/L(23,24).

Despite there are many research on dietary fiber in different countries, however there is no any research that quantifies the amount of dietary fiber intake and correlates the effect of dietary fiber on glycemic control in Type 2 DM patients in Ethiopia. In light of this, this study examined typical sources of dietary fiber and measured the intake of dietary fiber among Type 2 DM patients within Ethiopia's setting.

1.3 Significance of the study

Although there are many research on dietary fiber in elsewhere, evidences that quantifies the amount of dietary fiber intake and correlates the effect of dietary fiber on glycemic control in Type 2 DM patients within the setting of Ethiopia is unavailable. Therefore identifying the common sources of dietary fiber and estimating the amount of dietary fiber intake of diabetic patients provided us with a clear picture of the dietary fiber intake of diabetic patients and whether they adhere to the recommended dietary guidelines or not, as these factors are crucial in the improvement of glycemic control of diabetic mellitus.

As there has been an increase in poor glycemic control and poor dietary adherence among diabetic patients in Ethiopia recently, this study would provide comprehensive understanding about the source and amount of dietary fiber and its effect with glycemic control, and there by serves as guiding evidence based dietary fiber recommendation and intervention for management of diabetic patients. Furthermore finding from this study would provide a baseline data for health care professionals, policy makers and future researchers.

1.4 Research question

1. What are the common sources of dietary fiber among Type 2 DM patients at general government hospitals ,Addis Ababa ,Ethiopia ?

2. What is the daily dietary fiber intake of Type 2 DM patients at general government hospitals, Addis Ababa, Ethiopia ?

3. What is the effect of dietary fiber on glycemic control among Type 2 DM patients on follow up at general government hospitals, Addis Ababa, Ethiopia?

2. Literature Review

2.1 Search Strategy

PubMed and Google scholar were used to search by using a Boolean operator like “AND” and “OR”. Using this Boolean operator, searched as follows: “ Dietary fiber “AND “ DM ” / “ Dietary fiber AND/ OR glycemic control ” “ Dietary fiber AND/ OR Hemoglobin A1C”.

The study area for this literature review encompassed low, middle, and high-income countries, focusing solely on studies published or written in the English language. The participants under study were Type 2 DM patients with the research design limited to randomized controlled trials (RCT) and longitudinal studies such as case-control and cross-sectional studies. The study period considered for inclusion was within the last 10 years, ensuring the relevance and timeliness of the data analyzed. Furthermore, it is important to note that the articles included exclusively conducted on human participants .

Key words: Dietary fiber, glycemic control, hemoglobin A1C, diabetes mellitus

2.2 Role of dietary fiber in Type 2 DM

Dietary fiber (DF) has essential role in maintaining optimal glycemic control by delaying post prandial glucose spike by several mechanism: increase insulin sensitivity, this can be achieved by colonic fermentation of dietary fiber by gut microbe .This results in formation of short-chain fatty acids (SCFA). The SCFAs includes acetate, propionate and butyrate. As result this would reduce gluconeogenesis, decreased activity of pancreatic amylase and delays entrance through lumen towards carbohydrate sources. Furthermore it has been proven to promote satiety, which consequently contribute to weight loss and it has also anti-inflammatory actions on both gut epithelial and immune cells. The mechanism of dietary fiber on different metabolic parameters are summarized below (25–27). (Figure 1)

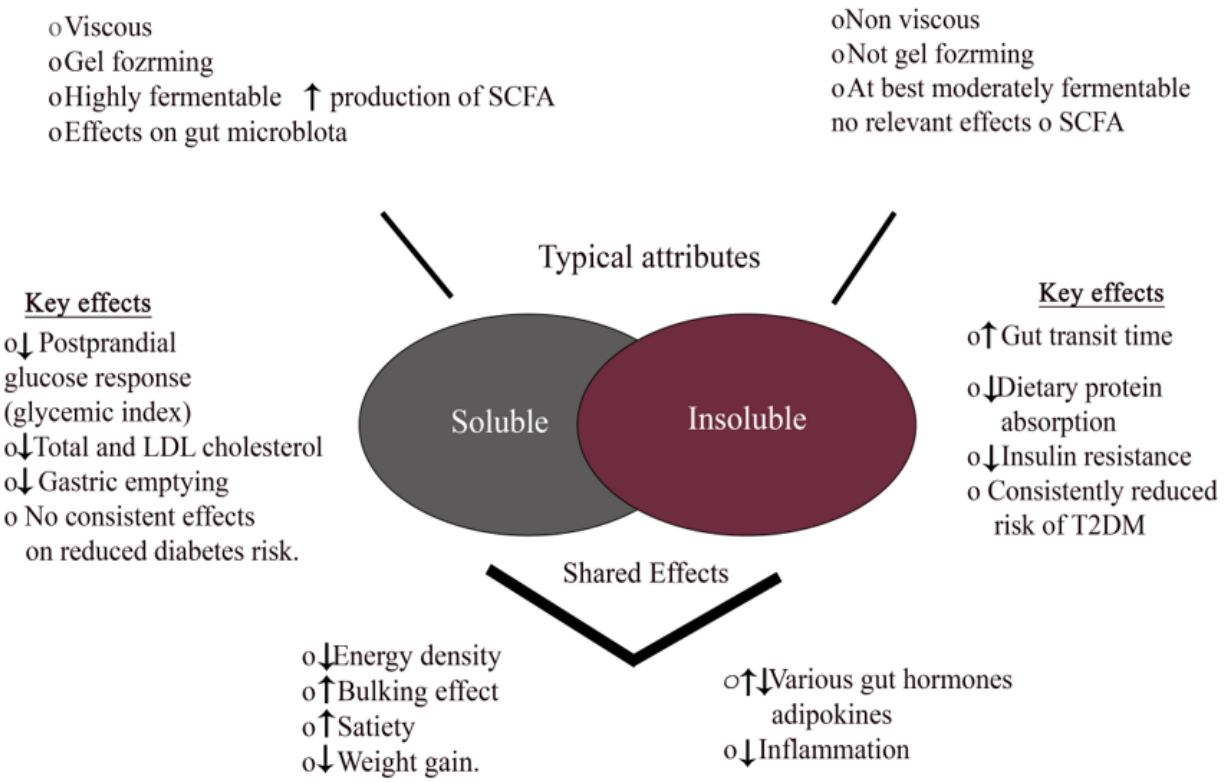

Figure 1:The physiologic effect of DF intake on a certain metabolic factors, insulin resistance, and the risk of developing type 2 Diabetes, SCFAs (short-chain fatty acids), T2DM, type 2 diabetes; ↓, decreased; ↑, increased**(28)**.

According to meta analysis in 2018 showed that the risk of Type 2 DM being reduced by consumption of high fiber in diet by 15-19% with cereal fibers being the most advantageous (21). Another meta-analyses of nine prospective studies reported that consumption of cereal reduces the risk of diabetes by 23%, whereas high fruit consumption more than 30g/d reduced the risk by 6%. Moreover,the risk of Type 2 diabetes could be reduced by 20–30% by incorporating cereals and whole grain in diet (25,29).Over all, these findings provide important insight on how diets high in fiber might reduce the risk of Type 2 DM. Saying this , identifying the sources and quantifying the dietary fiber intake of Type 2 DM patients would give us a comprehensive picture of their dietary fiber intake, which is very important for the management of Type 2 DM patients.

2.3 Sources of dietary fiber

Whole fresh fruits are rich source of soluble fiber, with studies showing that consuming 200 grams or more per day reduces the risk of diabetes by 10%. A fruit consumption more than seven times per a week might lower the risk by of Type 2 DM by 48.6% (95% CI [0.368–0.948]) . In Ethiopia the Commonly consumed fruits are oranges, bananas, lemons, avocados, mangoes, pineapples, and strawberries, all of this fruits contain varies amount of fiber. However, little is known about the consumption of wild fruits and vegetable species in Ethiopia (30,31).

Almonds, nutrient-rich nuts grouped under legumes, are essential for regulating blood sugar levels and can decrease fasting insulin and glucose by 4.1% and 0.8% compared to a control diet. Pulses, a variety of legumes like chickpeas, lentils, and dry peas, are commonly consumed in Ethiopia. A meta-analysis showed that pulse consumption lowers acute postprandial glucose concentration by over 2.5mmol/l and reduces hemoglobin A1C and fasting blood sugar in Type 2 DM patients (32,33).

Cereals are good source of dietary fiber, with pysllium being a type soluble fiber. Pysllium-containing fiber supplements can improve fasting blood sugar levels and HbA1c. Incorporating pysllium in a diabetic diet can improve glucose control. On the other hand taking an Oat ß-glucan supplements could reduce hemoglobin A1C and FBS, however shows a smaller improvement in hemoglobin A1C as compared to pysllium supplements (34).According to a longitudinal study in eight European countries reported that three fourth (75%) of dietary fiber comes from three food groups namely cereals, vegetables, and fruits . Cereals was the predominant source of fiber (38%). Eighty one of this cereal fiber comes from bread. The rest is contributed by fruits and nuts (20%), vegetables (18%), potatoes and tubers (9), and legumes (5%) . The mean dietary fiber intake of European countries differs from 19.9 g/day (Sweden) to 25.2 g/day (Denmark) (35).

A recent systematic review and network meta-analysis 46 RCTs in 2023 identified 16 types of dietary fibers as intervention. Of all soluble fibers, Galactomannans, which is frequently present in legume seeds, had the greatest effect on reducing the levels of HbA1c (92.33%) and fasting blood glucose (SUCRA: 85.92%). With regard to fasting insulin level, β-glucans (SUCRA: 73.45%), and psyllium (96.67%) were the most effective interventions to reduce hemoglobin A1C (36).

A study in Nigeria found that cereal, legumes and nuts, roots and tubers, vegetables, and fruits were the primary sources of dietary fiber. Rice was the most consumed cereal, accounting for 2.8 ± 0.2 g of dietary fiber..The most commonly consumed fruit was apple having dietary fiber 2.0 ± 0.2 g. from tubers cassava was common source 2.8 ± 0.5. Cow pea and broad pea were good sources of legume fiber accounting high fiber content 5.2 ± 0.1g/ day (37).

Several comparable cross-sectional studies conducted in Ethiopia to ascertain the fiber content of food groups revealed that the most common foods consumed by majorities of Ethiopian population and having high fiber content were cereal (teff = 9.8%), fruits (avocado = 3.1%), vegetables (kale = 20.4%), nuts (2.8%), tubers (2.8%), seeds (sunflower = 21.7%), and legumes (chickpea = 16.91%)(38–44).

2.4 Dietary fiber and glycemic control in Type 2 DM

Dietary fiber is essential for maintaining better glycemic control in Type 2 DM patients. A 2021 meta-analysis found that the Eastern Mediterranean region's total fiber intake was 21.8 g/d, below the recommended level (45). The US population had a 16 g/d intake, with blacks having a lower intake of 13g/day compared to whites (46). A 2018 study in South Africa found total fiber intake of 4.6 g/d (47). Ethiopia's FAO nutrient and energy supply trend report showed a maximum per capita fiber supply of 43 g/d in 2011 (48).

A meta-analysis randomized clinical trial suggested that consuming high amount of dietary fiber up to 42.4g/d or taking soluble fiber supplement up to 15g/d lowered both fasting plasma glucose by 9.97 mg/dl (95% CI −18.16 to −1.78) and hemoglobin A1c by 0.55% (95% CI −0.96to −0.13). Hence incorporating fiber in diabetic diet or taking fiber supplements enhances better glycemic control (23). Similar study carried out in china revealed that the average daily fiber intake of DF was 15.91 g/ d and FBS was 8.12±2.78mmol/l in the control group while patients in the intervention group were 8.26±2.84mmol/l. The findings of study indicated that high amount of dietary fiber were able to improve glycemic markers in Type 2 DM (49).

A cross sectional study in Japanese Type 2 DM patients reported that dietary fiber intake has an inverse associated with body mass index, fasting plasma glucose, and HbA1c after adjusting all factors.The mean fiber intake of Type 2 DM patients was 7.60 g/day, with fruits being the most abundant source (65.4±0.2%)(50). A similar study found that the mean dietary fiber intake of

Type 2 DM was 13.83 ± 0.4 g/day. Among all the study participants about 48% of the population having a desirable fiber intake. The study also found that lower intake of dietary fiber was significantly associated with poor glycemic control, longer disease duration, and lack of education in Type 2 diabetes patients. Despite this, Mexican patients had good fiber intake but slightly poorer glycemic control compared to Japanese Type 2 DM patients (51). However, there is a significant recall bias and a possibility of under reporting of data because the FFQ used to assess dietary data was conducted over a one-year period; for these reasons, this study is suggested.

A study in China showed that the mean dietary fiber intake of Type 2 DM patients was 8.5g/d and a hemoglobin A1C level was 7.4%. The study also found that fiber intake was negatively associated with glycemic control. Therefore as fiber intake increases the adjusted odds ratios for poor glycemic control decreased . The average consumption levels of nutrients did not vary with the duration of the disease, but the average levels of FPG and HbA1c increased with increasing duration (52). Another study in china , 2021 by Jin et al also found a significant negative association between total dietary fiber and HbA1c, BMI, and BP. The mean dietary fiber intake was 15.2 g/d and the hemoglobin A1C was 7.9±1.2%.The findings from the study suggests that increasing dietary fiber improved glycemic control among Type 2 DM patients (53).

A prospective study involving 1,414 Type 2 DM patients in Japan found that mean daily dietary fiber in quartiles varied from 8.7 to 21.8 g. The mean dietary fiber intake was positively associated with protein and fat intake, but not with carbohydrate intake. Type 2 DM patients in higher quartiles were significantly associated with age, sex, and high physical activity and low smoking levels. HgA1c varied across quartiles from 66% to 68%, with a marginal difference. The study concluded that increasing fiber intake ensures better glycemic control in Type 2 DM patients (54)**.**

A cross-sectional and one longitudinal study reveled that the mean intake of dietary fiber was 6.9 g/day (IQR: 4.6 to 10.0) at baseline, slightly lower than 7.4 g/day at the first follow-up and 7.1 g/day at the second follow-up.The HbA1c level was higher in the second follow-up, with median values of 8.0%, 7.8%, and 7.8%, respectively. Although the study didn't found significant association with HbA1c level while increasing dietary fiber intake (55). A Similar cross sectional study in Thailand showed that mean fiber intake among Type 2 DM who have

controlled glycemic control was 8±4 g ,while in Type 2 DM that have poor glycemic control the mean fiber intake was 9±4g. The study didn't find any significant association between hemoglobin A1C and fiber intake (56). Although this study used three-day dietary record that might not be representative of dietary intakes of Type 2 DM patients and moreover this might not consider for seasonal variations in food intake, and included small sample size.

A cross sectional study among obese and non-obese Korean type 2 DM found that dietary fiber intake was significantly lower in obese men compared with non-obese men (14.3 ± 4.6 vs 15.2 ± 4.5 g/1,000 kcal, $P < 0.001$) while hemoglobin A1c was 7.4±1.4% in obsess and 7.6±1.6 % in non-obese. In this study we see slightly high fiber intake and high hemoglobin A1C in non-obese patients as compared to obsess type. In contrast to men; there was no difference in dietary fiber intake between the obese and non-obese women diabetes patients. Therefore the study found significant association between fiber intake and BMI among Type 2 DM patients (57). In view of this, the assertion of incorporating fiber rich food into diabetic diet to enhance better glycemic management in Type 2 DM patients warrants further study.

A cross-sectional study in 2018 in Sudan that used the 24-hour recall method to assess the nutrition status of Type 2 DM patients found the mean energy intake was 1596±243.55 kcal, while carbohydrate intake was 216±12.8 g. The mean protein intake was 84.9±9.05 and the mean fat intake was 59.05±7.77, while the mean dietary fiber intake was 6.75±2.83. The 24-hour dietary recall shows that the mean dietary fiber and energy intake per day of the respondents were below the dietary goals (1800 Kcal) (38 g/day for males and 25 g/day for females), respectively, and fat intake per day was slightly above the dietary guideline (30 g/day). The fasting blood sugar level was 215.60 ±63.58 higher than that normal range of 100-125 mg/dL, and hemoglobin a1C was 12.09± 1.64 higher than normal rage. 4-5.5% The study didn't found significant association between dietary fiber and glycemic control(58).

According to a comparable study conducted in Kenya in 2018 with the goal of evaluating the daily practices of patients with Type 2 Diabetes, the average consumption of calories and carbohydrates were 161.9 g and 1486.4 kcal, respectively, while the average intake of protein and fat was 55.6 g and 66.2 g, and the average intake of dietary fiber was 37.9 g. While protein, fat, and dietary fiber were within the acceptable range, where as energy was lower than recommended range (59).

2.5 Glycemic control and determinants factors among Type 2 DM patients

A 2016 systematic review of 13 articles in Arabian Gulf Council countries in 2016 demonstrated that six of articles demonstrated a negative correlation between age and HbA1c level. Nevertheless, no correlation was discovered in the seven remaining articles. Ten articles examined the relationship between gender and glycemic control. Of these, one study reported that female gender was associated with poor glycemic control compared to male gender (adjusted OR: 2.84,p value <0.05) while in other study being female was associated with better glycemic control (adjusted OR: 1.5, p value: 0.001) , however in remaining eight article there was no correlation between gender and glycemic control. Two articles evaluated the impact of family of diabetes on glycemic control. In one study family history was associated with poor glycemic control but other didn't found any association, Three out of eight studies that evaluated the association between the duration of diabetes and glycemic control have found an association but the remaining five didn't found any association(60). According to report from systematic review in 2022 showed that age, gender, education status, waist circumference, body mass index ,family history, cigarette smoking, exercise and other comorbidity were statistically associated with poor glycemic control (61).

In 2017 cross sectional study was conducted in Type 2 Saudi Arabian patients . The finding from the study showed that patients that have poor glycemic control tend to be older, have a family history of diabetes, exercise insufficiently, and are overweight or obese (62). A consecutive study in Ethiopia found that waist to hip ratio of 0.9 or greater for males and 0.85 or greater for females; lack of self-monitoring blood glucose; presence of comorbidity; duration of diabetes mellitus; physical activity of three days or less; total cholesterol of 200 mg/dl or more; and types of anti diabetic medication were factors independently predicted poor glycemic control (63).

2.6 Conceptual framework

Several literatures have been used as foundation to develop the conceptual framework for this study.(Figure 2)

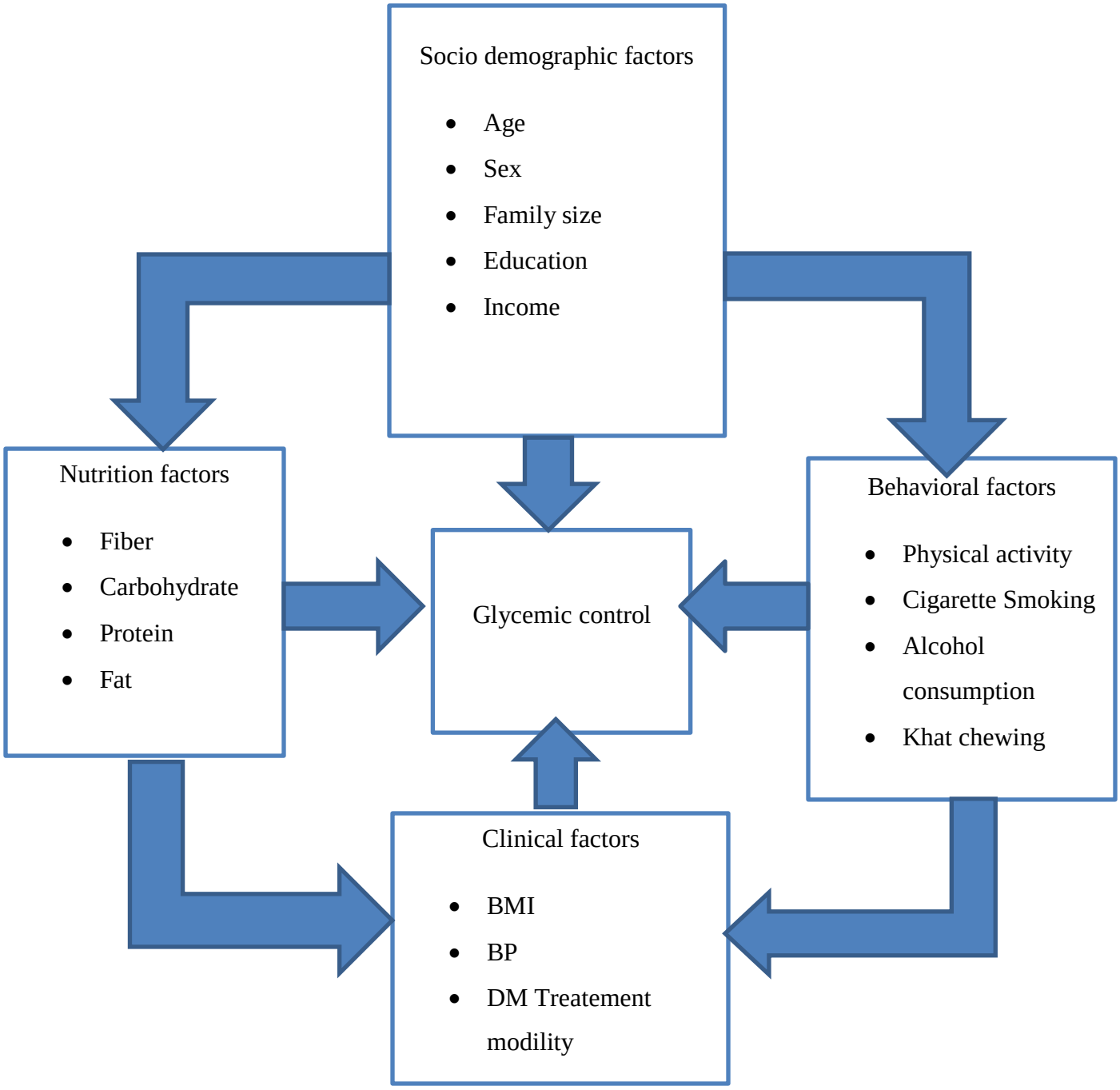

Figure 2:A Conceptual framework for determinants of glycemic control among Type 2 DM patients adopted from different literatures**(51,60–63)**.

Socio-demographic characteristic includes age, sex, martial status, family size, occupation, education and income .These factors have directly affects glycemic control and also indirectly affect nutritional status and nutritional factor affects glycemic control. Some studies listed above showed that older age, female gender, lower education, and income have been associated with poor glycemic control. Nutritional factors include fiber intake, macro nutrients intake and total energy. These factors direct affects glycemic control. For instance high intake of dietary fiber has positive effect on glycemic control. Moreover over consumption macro nutrients such carbohydrate and protein and fats could result in rapid glucose spike and this would results in poor glycemic control.

Behavioral factors include physical activity, cigarette smoking, alcohol consumption, and khat chewing. Literature listed above showed that regular physical activity can improve insulin sensitivity, which leads to better glycemic control. On the other hand, alcohol consumption can interfere with blood glucose metabolism. Smoking and Khat chewing increase insulin resistance and worsen glycemic control. Clinical factors include body mass index, waist circumference, and blood pressure. These factors are usually associated with insulin resistance and poor glycemic control.

Nutritional and behavioral aspects are influenced by sociodemographic variables. According to the literature previously mentioned, sociodemographic characteristics like age, gender, income, and educational attainment might have an influence on a person's macro nutrient intake, alcohol use, smoking habit, and exercise habits. For example, young people are more prone than older people to participate in intense physical exercise.Men often drink more alcohol and smoke cigarette .While those with less education tend to drink more alcohol; nevertheless, access to healthful meals might be influenced by an individual's income. Those who have high income tends to have nutritious foods.

Both Behavioral factors and nutritional factors directly affects clinical factors such as BMI, and and blood pressure and this would indirectly affects glycemic control.

3 .Objective

3 .1General objective

To determine the sources and amount of dietary fiber intake and its effect on glycemic control among Type 2 DM patients on follow up in general government hospitals, Addis Ababa Ethiopia 2024.

3.2 Specific objective

- To determine sources of dietary fiber among Type 2 DM patients on follows up in general government hospitals, Addis Ababa Ethiopia 2024.
- To estimate the amount of dietary fiber intake of Type 2 DM patients on follow up in general government hospitals, Addis Ababa Ethiopia 2024.
- To examine the effect of dietary fiber intake on glycemic control among Type 2 DM patients on follow up in general government hospitals, Addis Ababa Ethiopia 2024.

4 Methods and materials

4.1 study area and setting

The study was carried out in Addis Ababa, the capital city of Ethiopia . Based on 2022 figures from central Stastical Agency (CSA) of Ethiopia , Addis Ababa divided into 11 sub cities and 120 district administrations. The city covered a total area of 530.14 square kilometers with 3,686,068 total populations consisting of 1389817 male and 157478 female and 100% of the population were urban dwellers (64). Addis Ababa regional health bureau (AARHB) took the major responsibility to coordinate the overall health care activities of the city. In Addis Ababa, there were 13 governmental hospitals, 98 health centers and more than 40 private hospitals. The total number of diabetic patients in city was 31,915 (65).

4.2 Study design and period

A Facility based cross sectional study was conducted among Type 2 DM patients who had one or more follow up vists at general government hospitals in Addis Ababa, Ethiopia from March to April, 2024.

4.3. Source and Study population

4.3.1 Source population

All Type 2 DM patients who had one or more follow up visits in general government hospitals in Addis Ababa, Ethiopia.

4.3.2 Study population

All Type 2 DM patients who had one or more follow up visits in general government hospitals with DM clinic in Addis Ababa, Ethiopia.

4.4 Eligibility criteria

4.4.1 Inclusion criteria

All Type 2 DM patients who were 18 years and above who had at least one follow up in the general government hospitals with DM clinic in Addis Ababa, Ethiopia

4.4.2 Exclusion criteria

To ensure that the results are applicable to the study population ,all pregnant women and lactating mothers, patients with critical illness such as advanced malignancy, compensated liver cirrhosis and patients under renal replacement therapy and patients with drug-induced diabetes and patients receiving steroid treatment was excluded because pregnant and lactating women have unique nutritional needs that may vary during pregnancy and breastfeeding, indicating a need for tailored dietary strategies. Additionally, critical illness and drug-induced diabetes required specialized medical treatment and dietary interventions that could affect the results of the study. Steroids can also affect blood sugar levels and may interfere with the ability to accurately measure the effects of dietary fiber on glycemic control.

4.5 Sample size determination and sampling technique

4.5.1 Sample size determination

Sample size was computed for each objective separately. A sample size for first descriptive objective aimed to determine source of dietary fiber was computed using single population formula. The study utilized the most frequently consumed food items and their respective fiber proportions to determine the primary sources of dietary fiber for each group. The proportion for total fiber was taken from each source such as cereal (teff = 9.8 %), fruits (avocado=3.1%), vegetables (kale =20.4%) , nut (2.8%), tubers (2.8%) , seed (sunflower 21.7%)and legumes (chickpea=16.91%) (38–44).

The final calculated sample size was using proportion of fiber in sunflower (21.7%) with 95% confidence level ,5% level of significance, 5% margin of error and 10% non-response rate, was 287 .

$n= (Z\ \alpha/2)^2 \times p\ (1-p)/d^2$

P	Z α /2(95% CL)	D	N
0.217	1.96	0.05	287

While the sample size for the second objective aimed to estimate the fiber intake of type 2 diabetic was computed using single mean formula using the following assumptions: the proportion of fiber intake of adult given with mean ±SD was 19.27 ± 7.07 (51), with 5% level of significance, margin of error was computed 5% of the mean , 10% of non-respondent. The final calculated sample size was 228.

$$n= (Z\ \alpha/2)^2 \times (\ SD)^2/d^2$$

SD	Z α /2(95% CL)	D(5% of μ)	N
7.07	1.96	0.962	228

The sample size for third inferential objective aimed to assess the effect of dietary fiber on glycemic control was computed using G-power 3.1 software with the following assumption: - 95% confidence interval, power of 95% and effect size of moderate (0.3) (66) and was added a non-response rate of 10% and the final calculated sample size was 148.

Effect size	Z α /2(95% CL)	D	N
0.3	1.96	0.05	148

Since the descriptive objective estimated SS accommodates all, the final working sample size was 287.

4.5.2 Sampling procedure

Among hospitals that are under the administration of AARHB only four had DM follow up clinic. The remaining two were Gandhi memorial hospital and Minilik specialized comprehensive hospital. Since Gandhi hospital didn't have DM clinic and Minilik was specialized not general hospital . Due to this reason these two hospitals were not included in the study. Therefore the study was conducted in this four general government hospitals namely:-

Zewedtu Memorial Hospital, Yekatit 12 hospital and medical college, Tirunesh Bejing hospital and Ras desta Dametew hospital. The average of three-month patient flow estimates of total patients visiting the endocrine outpatient department taken from registry of each DM clinic on an average was 710 Type 2 DM patients per month at Zewedtu Memorial Hospital hospital, 465 patients per month at Yekatit 12 hospital and medical college, 460 patients per month at Ras desta Dametew hospital and 265 patients per month at Tirunesh Bejing hospital were seen in the three months preceding the study. Study participants was included in the study using simple random sampling technique i.e. :-N/SS (1900/ 287 = 6.6 rounded to 7) and thus, every seven was approached to participate in study among those who came for the appointements . (Figure 3)

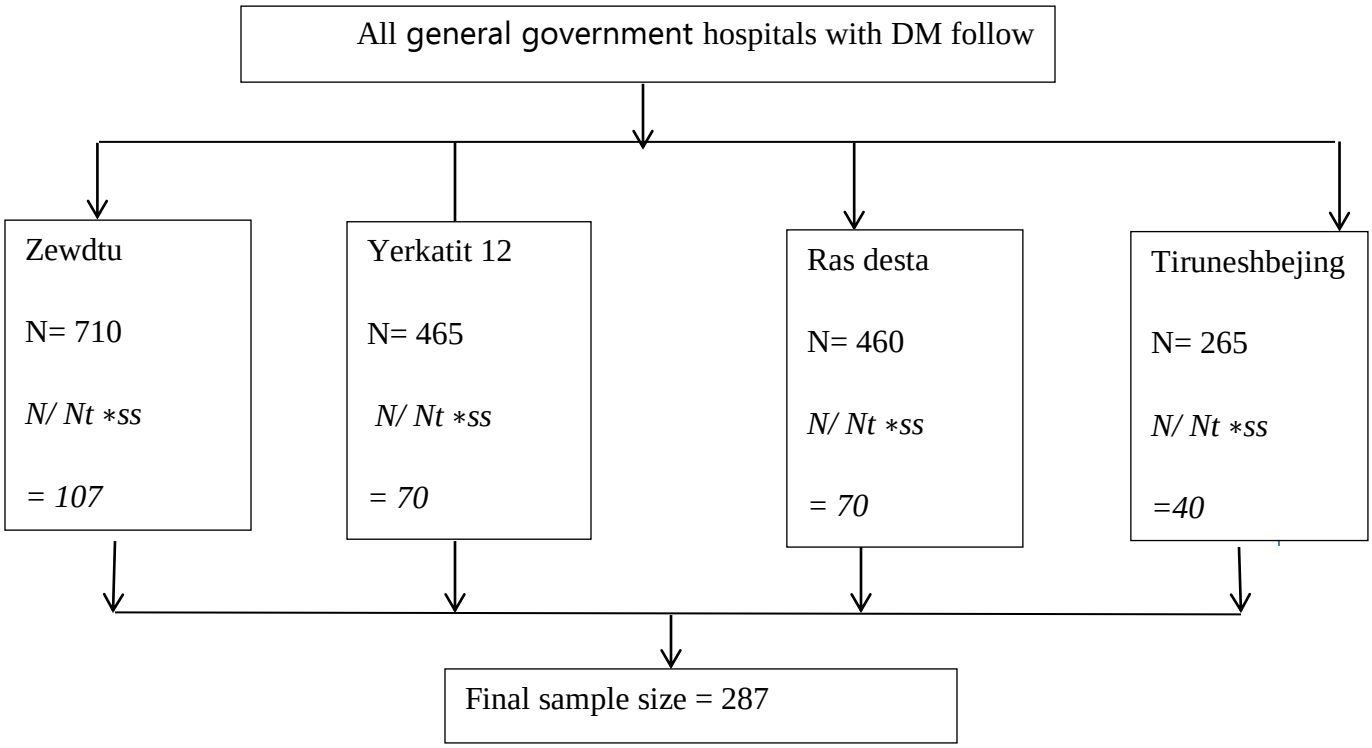

Figure 3: Schematic representation of sampling procedures

4.6 Study variables

4.6.1 Outcome variable

Glycemic control

- Good glycemic control

- Poor glycemic control

4.6.2 Exposure variable

Dietary fiber

4.6.3 Possible confounding variable

- Socio-demographic(Age , Sex , Martial status,Family Size ,Occupation, Educational status ,Income and Religion)
- Behavioral factors (Smoking ,Alcohol consumption , khat chewing and physical activity)
- Nutritional factors (macro nutrient such as carbohydrate , protein and total fat)
- Clinical factors (Body mass index, duration of illness, medication and other comorbidity)

4.7 Data Collection

The data collection took place over a period of one month at the chosen general government hospital by four public health officers (Bsc) and two supervisors (Bsc nutrition) using KOBO tool box. Kobo Collect was a mobile data collection app developed by KoboToolbox, enabled users to collect field data from smartphones or tablets in remote locations without an internet connection. The collected data, including surveys and questionnaires, was sent to a KoboToolbox server for storage and analysis. The server, hosted by KoboToolbox, functions as a central repository for the collected data, allowed users to access and manage the information. The app used a process called "data synchronization" to send the collected data to the server, which allowed authorized users to view and analyze the data. The server also provided tools for managing and organizing the collected data, as well as generating reports and visualizations.

Before data collection, a two-day theoretical and practical training was given for the data collectors on the purpose of the study, data collection techniques ,the procedures of interview for 24 hour recall and as well as how to use KOBO tool box .The training was given by the principal investigator. Data collection was done by the WHO STEPS-wise approach to NCD surveillance. It was a standardized, simple tool used to collect, analyze, and disseminate data on NCD risk factors. It contained key behavioral risk factors: tobacco use, alcohol use, physical inactivity, as well as key biological risk factors: overweight and obesity, raised blood pressure,and raised blood glucose. Some modifications was made to the STEPs approach in order to fit with this research. Dietary data was collected using a repeated multi pass 24-hour

recall method using proxy weighting methods using dietary scale, and sample measurements, including fasting blood glucose, hemoglobin A1C (obtained from the record), blood pressure, height, and weight measurement were measured from all systematically allocated study participants was interviewed on the day of their scheduled follow-up appointment at selected general government hospitals.

A. Sociodemographic , behavioral and clinical data

A structured questionnaire was used to collect sociodemographic characteristics, health behaviors, and clinical characteristics. The first section was sociodemographic characteristics, which include questions on age, sex, martial status, family size, occupation, education, income, and religion. The second section was behavioral characteristics, which includes questions on cigarette smoking, alcohol consumption, khat chewing and physical activity. The third part was clinical characteristics, which include questions on duration of disease, treatment modality, co-morbidity, family history of DM, and current medication use.

B. Assessment of anthropometric measurement

Anthropometric measurements was obtained and includes weight and height .Weight was be measured using a balanced digital scale to the nearest 0.1 kg (without shoes and in light clothes). Height was measured to the nearest 0.1cm with participants in standing position with heads, backs and buttocks vertically aligned to the height gauge and without shoes. Body mass index (BMI) was calculated as weight in kilograms (kg) divided by the square of height in meters (kg/m^2). All these measurements was taken during the interview according to the standard protocol.

C. **Blood pressure measurement**

A digital electronic sphygmomanometer was used to measure blood pressure after patients rested and completely stabilized for at least 5 min in the assessment room from the right upper arm. Two readings of BP was taken within 2-3 min differences to maintain the accuracy of measurement and lastly the mean value was taken and documented to assess BP status. In addition, the third BP measurement was taken, if the two measurements varied by 10 mmHg

within 2-3 min differences in a single study participant and lastly the mean value of three measurements was taken to determine BP status.

D. Assessment of dietary intake

Dietary data was collected using a repeated multiple-pass 24-hour recall approach. while a second 24-hour recall was repeated for 29 (10% of the sample size) respondents allocated to each hospital, due to feasibility of time and resources on non fasting days (Monday, Tuesday and Thursday). A multiple pass 24 hour was dietary assessment method in which information on the type and quantity of all food and drinks consumed in previous 24 hour period was collected. A multi stage probing technique was used that have four steps or passes to enhance recall of foods and beverages consumed.

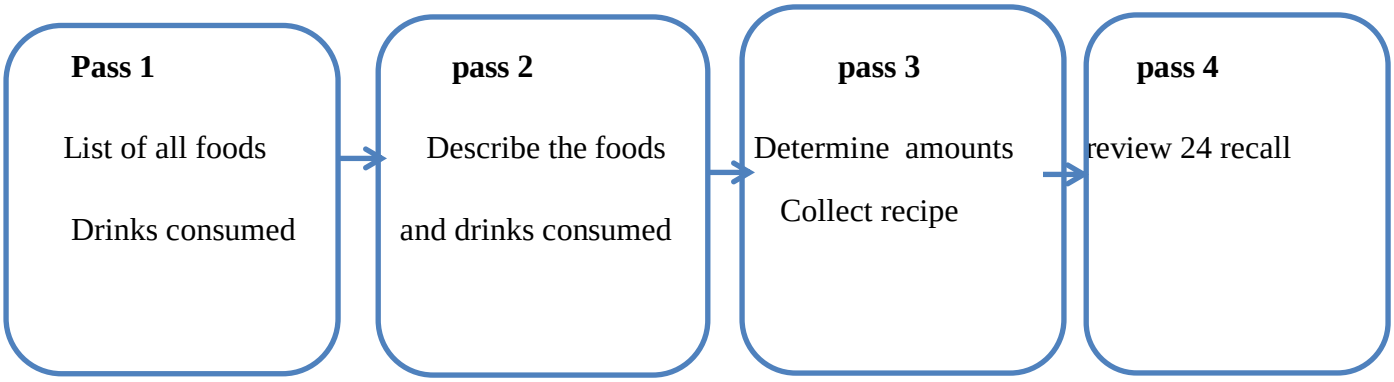

Figure 4: Multi pass 24 hour recall technique

Proxy weighting methods using a dietary scale were used to have a more accurate portion size estimate. The commonly used portion size estimation methods (PSEM) were Direct weight of the actual foods (g), Standard unit size(Size and number), Proxy weight using play dough (g), Proxy weight with a liquid(Water (g)) ,Proxy weight using rice (g) ,Proxy weight using maize flour (g) and Food price (67).

Table 1 PSEM method and kinds of foods that can be estimated using a specific PSEM method

Methods	Example of foods that can be measured using this method
Direct weight of the actual foods.	All foods (When they are available)
Standard unit: size & number: respondents report a uniform unit consumed, and, if relevant, multiples or fractions of the selected unit	Enjera Vegetables: Onion, tomato, Eggs Canned beverages: Soda, fruit juice Bouillon cubes (Magi, Knor)
Proxy weight using playdough: which can be shaped into different sizes and shapes.	Foods that do not have a uniform shape Roots and tubers: Potato, cassava Pieces of meat, chicken, fish Baked and fried dough foods: Bread, kokor Fruits and vegetables: Tomato, Banana Slices of fruits: papaya Mixed dishes (stiff): Porridge
Proxy weight using rice	Grains, legumes, seeds, flours, powdered milk, sugar, salt Diced/sliced fruits and vegetables: carrots, cabbages
Proxy weight using maize flour: Maize four is poured into a plate or bowl to represent the amount consumed.	Flours
Proxy weight with a liquid: Water: Water is poured into a cup or bowl to represent the amount consumed.	Milk, tea, coffee, fruit juice, alcoholic drinks, cooking oil

	Thin porridge, soups, sauces, stews
Food price	Bread , Vegetable bundles

Once the amount of food or drink consumed was estimated by PSEM method then multiplied it with portion size conversion factor to get the actual consumed food or drink by each study participant. The food items were taken from revised EFCT (Ethiopian food composition table) (68,69). Few food list which was not included in EFCT were borrowed from Kenya food composition table (70) , West Africa food composition table (71) and USDA composition table (72)

Table 2: PSEM conversion factor for each PSEM method

PSEM factor	Conversion factor
Play dough	1.217
Rice	0.82
Water	1
Enjera	Standard one Enjera = 310g which was taken from national survey(EPHI)

E. Assessment of biochemical data biomarkers

The fasting blood sugar level was obtained from respondents taking 1~1.5ml venous blood specimen in a vacuum tube containing sodium fluoride by laboratory technician who were working in respective hospitals and it was measured by applying a drop of blood to a chemically treated, disposable 'test-strip', which was then inserted into an electronic blood glucose meter. The reaction between the test strip and the blood was detected by the meter and displayed in units of mg/dL or mmol/L. The device used for F.B.S. analysis was (Mindry semiauto chemistry, model BA-88A, S.N WR-04002031) and the kit that was used in this device was Bio MedGlucose L.S, normal level in the plasma 100 to 125 mg/dL (5.6 to 6.9 mmol/L, and sensitivity: 0.4 mg/dl).

The last reading of hemoglobin A1C (HbA1c) was abstracted from patients chart .The abstracted last reading was taken 1 - 3 months before the date of data abstraction.

4.8 Operational and Standard definitions

- Good glycemic control - A diabetic patient having HbA1c below 7% and fasting blood sugar level between 100 mmol/l– 125 mmol/ was taken as good glycemic control.(11)
- Poor glycemic control - A diabetic patient having HbA1c above 7% and fasting blood sugar level < 70mmol/dl or > 126 mmol/dl was taken as poor glycemic control (11).
- Total fiber intake for adults - 20–35 grams (14 g/1000 kcal per day) which roughly 25 g/d for women and 38 g/d for men(1)
- Physical activity

  Adequate physical activity - Adults aged 18- 64 years should do at least 150– 300 minutes of moderate-intensity aerobic physical activity (73).

  Blood pressure classification standard (74)
- Normal blood pressure - < 120/80 mm Hg
- Elevated blood pressure - 120–129/< 80 mm Hg
- Stage 1 hypertension - 130–139 mm Hg (systolic) or 80–89 mm Hg (diastolic)
- Stage 2 hypertension -≥ 140 mm Hg (systolic) 0r ≥ 90 mm Hg (diastolic)

  BMI classification standard (75)
- Underweight - BMI under 18.5 kg/m^2
- Normal weight - BMI greater than or equal to 18.5 to 24.9 kg/m^2
- Overweight – BMI greater than or equal to 25 to 29.9 kg/m^2
- Obesity – BMI greater than or equal to 30 kg/m^2

General hospital: A general hospital was defined as one that has three or more outpatient departments in its scope, namely chronic, pediatric, and adult department and hospital that manage uncomplicated cases and referrals and not specialized (76) .

4.9 Data quality management

The questionnaire was prepared in English and then translated to Amharic and back to English to check the consistency of the questions. During data collection the supervisors supervised all activities during the data collection. In order to assess the clarity of tool and variable pretest was done on 20 T2DM patients prior to the actual data collection on other hospitals. After the

pretest, unclear questions was identified and then corrective measure was done. During the data retrieval process regular monitoring and supervision of the overall was done by the investigator to check completeness and consistency of the recorded data.

4.10 Data Analysis Procedure

Data was checked for completeness and all responses from KOBO tool box was coded and exported to Statistical Package for Social Science (SPSS) version 27 software to analyze the data. Nutrient content per 100 gm from each food item was listed and entered to Nutri survey software 2007 .Then the converted grams was entered to software to obtain the needed nutrients for each study participant. Finally results for continuous variables was presented as mean ± standard deviation (SD) and categorical variables were presented as frequency and percentages. The association between dietary fiber and glycemic control was determined with Pearson correlation and chi square test . Binary logistic regression model was used to evaluate the determinant of glycemic control (outcome variable). For factors with p value $p < 0.25$ in bi variable analysis was exported to multi variable binary regression analysis . For all statistical significance tests, adjusted odds ratio (A0R) with 95 % C1 and $p<0.05$ was used.

4.11 Ethical consideration

Ethical clearance was obtained from Addis Ababa Public Health and Emergency Management Directorate.Communication with the different hospital officers was made through a formal letter obtained from Addis Ababa University. All data collection procedures was performed in accordance with standard protocol .Informed written consent was taken from each study participant to confirm their willingness after explanation of the objective of the study .The study participant was assured that they are free to withdraw their consent and discontinue participation in the study without any form of prejudice. To keep confidentiality of of any information provided by study participants, the data collection procedures was anonymous. In the study collected 1–1.5 ml of blood from the patient's finger by a laboratory technician using a sterile technique was collected . During blood drawing, there would minimal pain associated with it. The study would not have any direct benefit for the participants except knowing their blood glucose level, blood pressure, and BMI status at the end of the study, and if there was any pathological sign, the study participant was linked to the health care provider for treatment and diagnosis.

4.12 Dissemination of results

Result would be submitted to Addis Ababa Public Health and Emergency Management Directorate. Result would be disseminated for Addis Ababa Health Bureau and Ethiopian diabetic association. Furthermore, the finding would be presented on appropriate seminars, conferences and workshops. And publishing with scientific journal would be considered.

5. Results

5.1 sociodemographic characteristics of respondents

A total of 287 Type 2 DM patients who had at least one follow up at general government hospitals were approached, of whom 282 completed the study with 98.2% response rate. Among the study participants, 145 (51.4%) were males, nearly half (44.3%) were in the age group of 50–65years and about half (50.4%) had a family size of three to six members and 165 (58.5%) were earning above 5,000 birr, and 86 (30.5%) of them were self-employed (Table 3).

Table 3: Socio-demographic characteristic of Type 2 DM patients who were on follow up in general government hospitals Addis ababa ,Ethiopia ,2024

Variable	Frequency	Percentage
Sex		
Male	145	51.4
Female	137	48.6
Age		
18 - 24years	2	0.8
25 - 34 years	11	3.9
35 - 49 years	74	26.2
50 - 65 years	125	44.3
Above 65 years	70	24.8
Education status		
Less than primary school	46	16.3
Primary school completed	21	7.4
Secondary school completed	61	21.6
Preparatory completed	46	16.3
University or college completed	46	16.3
Post graduate completed	62	22.0

Martial status		
Married	222	78.7
Divorced/single	38	13.5
Widowed	22	7.8
Family size		
1-3 family members	104	36.9
4-6 family members	142	50.4
Above 7 family members	36	12.8
Occupation status		
Government employed	40	14.2
Non government employed	38	13.5
Self employed	86	30.5
House wife	33	11.7
Retired	63	22.3
0ther **	22	7.8
Monthly income		
<1500 birr	39	13.8
1500-5000 birr	78	27.7
above 5000 birr	165	58.5

Other* (not specified) Other** contract work

5.2 Behavioral factors affecting glycemic control

Out of all study participants, 37 (13.1%) had smoked cigarette; of them, only 3 (1.1%) were smoking at the time of the study. The majority (90%) had the habit of exercising for at least 30 minutes, and among those that had the habit of exercising, 166 (57.8%) exercised for more than 30 minutes within the previous 24 hours before the time of data collection.(Table 4)

Table 4: Behavioral factors among Type 2 DM patients who were on follow up in general government hospitals, Addis ababa,Ethiopia,2024

Variable	Frequency	Percentage
Habit of smoking cigarette within past one year		
Yes	37	13.1
No	245	86.9
Currently smoking cigarette With in 30 days		
	3	1.1
Yes	279	98.9
No		
Habit of drinking alcohol within past one year	92	32.6
Yes	190	67.4
No		
Currently drinking alcohol occasionally		
Yes	38	41.3
No	54	58.7
Habit of consuming alcohol within 30 days		
Yes	22	59.5
No	15	40.5
If yes how often do you drink alcohol		
Once week	6	27.3
2-3 times a week	8	36.4
3-5 times a week	4	18.2
6-7 times a week	4	18.2
Habit of chewing khat		
Yes	30	10.6
No	252	89.4
Habit of >30 minutes exercise		
Yes	225	79.8
No	57	20.2

5.3 Health profile of respondents

Out of 162 Type 2 DM patients, hypertension was the number one co-morbidity disease reported and was accounting for 99 (61.1%), followed by hyperlipidemia (42 (25.9%). The proportion of respondents using diabetic tablets and insulin was 189 (67%) and 49 (17.4%) , respectively. Two hundred fifty-four study participants made dietary modifications when they were diagnosed with DM (Table 5).

Table 5: Health profile of Type 2 DM patients who were on follow up in general government hospitals,Addis ababa,Ethiopia 2024

Variable	Frequency	Percentage
Duration of disease		
< 5 years	97	34.4
5-10 years	100	35.5
above 10 years	85	30.1
Duration of follow up		
< 5 years	104	36.9
5-10 years	102	36.2
above 10 years	76	27.0
Have other comorbidity disease		
Yes		
No	162	57.4
	120	42.6
Type of commodities disease		
Hypertension	99	61.1
Hyperlipidema	42	25.9
CVD	12	7.4
Other	9	5.6
Total	162	100
Method of DM control used		
Insulin	50	17.7
Tablet	100	35.5
Insulin and tablet	132	46.8
Have family history of DM		
Yes	119	42.2
No	163	57.8

Dietary modification since DM		
Yes	254	90.1
No	28	9.9
Hospital admission history		
Yes	130	46.1
No	152	53.9
Complications related to DM		
Yes	116	41.1
No	166	58.9

5.4 Biochemical test, blood pressure and body measurement of the respondents

More than half (56.7%) had poor glycemic control. About 53.5 % were of normal weight, but on the other hand, about 10.6 % were obese .One hundred ten (39%) had stage 2 hypertension.(Table 6)

Table 6: Biochemical ,blood pressure and body mass index of Type 2 DM patients who were on follow up in general government hospitals Addis Ababa ,Ethiopia ,2024

Variable	Frequency	Percentage
Hemoglobin A1C		
Good glycemic control	116	43.3
Poor glycemic control	152	56.7
Body mass index(BMI)		
Normal weight	151	53.5
Overweight	101	35.5
Obesity (1st &2nd class)	30	10.6

Blood pressure		
Normal BP	58	20.6
elevated BP	73	25.9
stage 1 hypertension	41	14.5
stage 2 hypertension	110	39.0

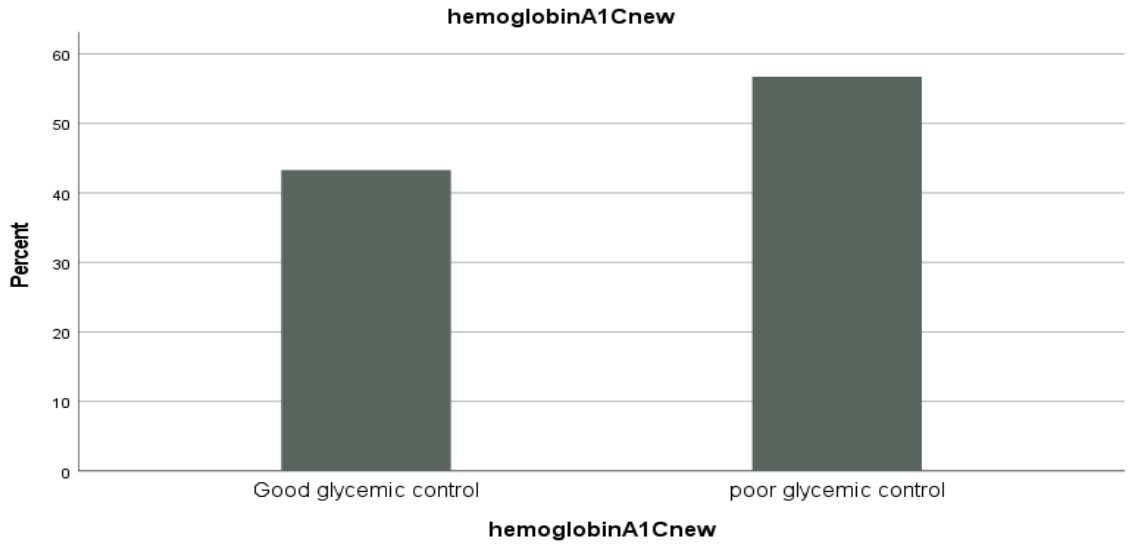

Figure 5: Prevalence of glycemic control among Type 2 DM patients in general government hospitals ,Addis Ababa ,Ethiopia 2024

5.4.1 Biochemical test of the respondents

The mean fasting blood sugar level was 152.4 ± 44.3, and hemoglobin A1c was 7.61 ± 1.49 (Table 7)

Biochemical variable	Mean+SD	American Diabetic Association (ADA)
Fasting blood sugar(mg/dl)	152.4 ± 44.3	70- 130
HbA1C(%)	7.61 ± 1.49	<7%

Table 7: Biochemical test results of respondents Vs recommended

5.5 Sources of dietary fiber

There were six major food groups identified of which, more than three-fourths were cereals, followed by vegetables (7%) and legumes (6.2%). Based on 24-hour recall data. from the cereal group (white teff injera), vegetables (kale), fruits (avocado and banana), legumes (lentil), and nuts and seeds (Sunflower Fitit), were the most common food items consumed by the majority participants(Figure 5)

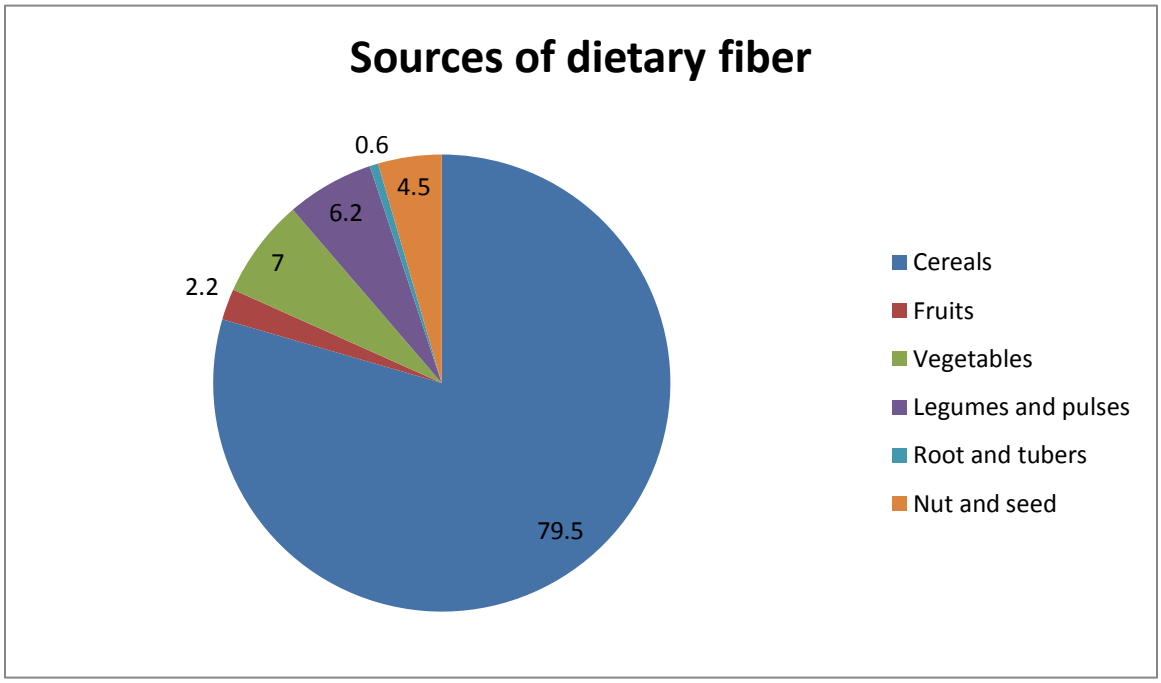

Figure 6: Food groups consumed among Type 2 DM patients in general government hospitals prior the study

5.6 Nutrient intake of Type 2 DM patients

The mean energy intake was 1673.95±743.1. When the macro-nutrient mean intake was seen, carbohydrate was 295.86 ± 124.9, protein was 50 ± 24.9 , total fat was 28.12 ± 26 , The mean dietary fiber intake was 32.5 ± 20 g/day. Regarding micro-nutrients, the mean calcium was 526.3±261.9 mg/d and iron was 232.9 ± 129.2 mg/day (Table 8)

Table 8: Nutrient intake of Type 2 DM patients Vs recommended on follow up in general government hospitals Addis Ababa Ethiopia , 2024

Nutrients	Mean+SD	Recommended daily allowance (RDA)
Energy (kcal)	1673.95 ±743.1	2000- 3000 kcal/day
Carbohydrate g/day %	295.86 ±124.9 73.15±8.5	50-60(% of total energy)
Protein g/day %	50±24.9 12.33±2.6	10-15% (% of total energy)
Fat g/day %	28.12±26 14.46±7.5	25-30%(% of total energy)
Fiber g/day	32.5 ± 20	20-35 g\day
Water g/day	1194.6 ±778.6	2l
Calcium(mg/day)	526.3±261.9	2500mg/day
Iron(mg/day)	232.9±129.2	45mg/day

5.7 The correlation between first and second 24 hour recall of respondents

There was a strong significant correlation between first and second recall with Pearson correlation coefficient was 0.728 and (p value <0.01) (Table 9)

Table 9: The correlation between first and second 24 hour recall among Type 2DM patients in government hospital,Addis Ababa.Ethiopia,2024

Variable		Dietary fiber of 1^{s} 24 recall	Dietary fiber of 2nd 24 recall
dietary fiber 1st recall	Pearson Correlation	1	.728**
	P value		.000
	N	287	29
**. Correlation is significant at the 0.01 level (2-tailed).			

5.8 Association between dietary fiber and glycemic control

Over Half (50.6%) took dietary fiber with in the recommendation (20-35g/d) range for having good glycemic control. Seventy one (83.5%) have low dietary fiber intake have poor glycemic control . (Table 10)

Table 10: Cross tabulation between dietary fiber and glycemic control (using HgA1C) among Type 2 DM patients in general government hospitals ,Addis Ababa ,Ethiopia 2024

Dietary fiber categories	**HemoglobinA1C categories**			
	Good glycemic control N (%)	**poor glycemic control**	Total	
Low	14 (16.5%)	71(83.5%)	85(100.0%)	P <0.001
Recommended	41(50.6%)	40(49.4%)	81(100.0%)	
High	61(59.8%)	41(40.2%)	102(100.0%)	
Total	116(43.3%)	152(56.7%)	268(100.0%)	

5.9 Correlation of dietary fiber with hemoglobinA1c

.The total dietary fiber exhibited an inverse correlation with hemoglobin A1c with Pearson coefficient of -0.383 ($p<0.001$) but didn't show no correlation with BMI , FBS and blood pressure .(Table 11)

Table 11:Pearson bivariate correlation of total dietary fiber with potential variables among Type 2 DM patients in general government hospital ,Ethiopia 2024

Dietary fiber		BMI	BP	Dietary fiber	Hemolglobin A1C	FBS
	Pearson Correlation	-.093	-.063	1	-.383**	.076
	P value	.118	.290		.000	.202
	N	282	282	282	268	282
**. Correlation is significant at the 0.01 level (2-tailed).						

5.10 Association between explanatory variables and glycemic control

Binary logistic regression was used to determine the association between glycemic control and explanatory variables. The outcome of logistic regression stated that the selected model was a good logistic regression model fit since the Hosmer-Lemeshow goodness of fit was 0.712, which was greater than 0.05. It showed that the logistic regression was a good fit for the data set.

Table 12:Hosmer and Lemeshow Test

Hosmer and Lemeshow Test			
Step	Chi-square	df	Sig.
1	5.420	8	.712

Additionally the pseudo R square, the regression result showed that the square of the correlation between the model predicted value and the actual value of the outcome of this correlation was 23.9% . the model explained 23.9 % of the variance in glycemic control .

Table 13: Model Summary

Model Summary			
Step	-2 Log likelihood	Cox & Snell R Square	Nagelkerke R Square
1	314.161[a]	.178	.239

The variables exercise, dietary fiber, energy, type of DM control, and duration of disease had a p value <0.25 and were the candidates for multi variable analysis. Only dietary fiber, energy and duration of disease retained their significance with poor glycemic control with p value<0.05.Dietary fiber had inverse association with glycemic control, whereas energy and duration of DM follow up had direct association with glycemic control.

The study found that patients who had a longer duration (5–10 years) of diabetes were two times more likely **(AOR:2.038 ;95%CI :1.017,4.085)** to had poor glycemic control compared with patients with relatively shorter (< 5 years) duration of diabetes. Conversely, being a diabetic patient with a duration of more than 10 years has 2.62 times higher **AOR: 2.621; 95%CI**

:1.341,5.120), odds for poor glycemic control compared to a patient who was living with diabetes with a duration of less than 5 years**.**

Holding other potential confounders held constant ,one unit increase in total energy was associated with one percent increase in likelihood of poor glycemic control. **(AOR:1.010; 95 % CI:1.000,1.010)**

While all other variables were held constant , a unit increase in intake of dietary fiber among Type 2 DM patients was associated with a 5 % decrease in the odds of poor glycemic control. **(AOR: 0.950; 95 % CI: 0.930,0.970)**

Table 14: Bi variable and Multi-variable analysis for determining predictors of poor glycemic control among Type 2 DM patients at government hospitals in Addis Ababa, Ethiopia, 2024

Variable	Glycemic control		COR	AOR	P value
	Poor	Good			
Exercise					
Yes	91(78.4%)	133(87.5 %)	1.923(1.001,3.696)	1.555(0.745,3.246)	0.24
No	25(21.6%)	19(12.5%)	1	1	
Energy			1.000(0.999,1.000)	**1.010(1.000,1.010)***	**0.040**
Duration of DM follow up					
< 5 years	54(35.5%)	38(32.8%)	1	**1**	
5-10 years	64(42.1%)	32(27.6%)	1.923(1.048,3.529	**2.038(1.017,4.085)***	**0.045**
>10 years	34(22.4%)	46(39.7%)	2.706(1.465,4.998)	**2.621(1.341,5.120)***	**0.005**
Type DM control					
Insulin	32(2.1%)	18(5.5)	1.146(0.581,2.262)	1.469(0.670,3.221)	0.337
Tablet	44(28.9%)	49(42.2)	0.579(0.336,0.996)	0.661(0.355,1.230)	0.191
Both	76(50%)	49(42.2%)	1	1	
Dietary fiber			0.963(0.949,0.976)	**0.950(0.930,0.970)***	**<0.001**

1 =indicate the reference category * significance association at P value < 0.005 *Adjusted for energy, type of diabetic control , duration of diabetic follow up, dietary fiber and exercise

6. Discussion

There was limited epidemiological evidence regarding the dietary fiber intake of Type 2 diabetes patients in Ethiopia. This study represented the first attempt to quantify the fiber intake of type 2 diabetes patients in the country. The research also identified the main sources of dietary fiber in this population and investigated the impact of fiber intake on glycemic control. The study revealed that, on average, patients consumed 32.5 ± 20 g/day of fiber, with cereals accounting for 79.5% of the intake. The average HgA1C level was 7.61 ± 1.49, and more than half (56.7%) of the patients had poor glycemic control. Importantly, the findings indicated a positive association between dietary fiber intake and improved glycemic control.

Type 2 DM patients have diverse dietary patterns. Among the foods consumed by Type 2 diabetic patients during regular meals, cereals, legumes, vegetables, fruits, nuts, seeds, and tubers were the major food groups that have a high dietary fiber contribution in Type 2 diabetic patients. Cereals accounted for 79.5%, followed by vegetables (7%) and legumes (6.2%), fruits (2.2%), nuts and seeds (4.5%), and roots and tubers (0.6%). The findings from this study implied that cereal was the predominant source of dietary fiber. The finding from this study was higher as compared to Sudanese type 2 DM patients; the predominant source of fiber comes from vegetables, which accounted for about 50%, followed by fruits (20%). This difference in source of dietary fiber could be explained as Sudanese people tend to eat more vegetables and fruits than cereals, mainly due to the diverse climate and agricultural practices in Sudan. There was also a cultural preference for vegetable-based dishes and fruits were widely available and affordable in Sudanese population. On the other hand, Ethiopians focused more on cereals like teff, wheat, and barley, reflecting their culinary traditions and agricultural practices. Despite these differences, both Ethiopian and Sudanese cuisines shared similarities in their use of spices and stews. Furthermore the finding from this study was also higher than a cohort study done in eight European countries, which was cereal contributed (38%) of total fiber (35). This difference was attributed due to the fact that in Ethiopian staple diets, injera was made from teff, which has a higher fiber contribution than cereal groups(40) and Ethiopian diet was more plant based as compared to Europeans. On the other hand, when we compared the other food groups, fruit intake was low in this study, it was 2.2% as compared to the Japanese diet, which was 65.4%

(50) .This could be related to the fact that the accessibility and affordability of fruits was low in our country.

In terms of dietary patterns consumed by Type 2 DM patients, the carbohydrate intake in percentage was 73.15 ±8.5, which was more than the RDA recommendation (50–60% of total energy). Whereas was comparable with the national consumption survey done in Ethiopia, where the overall population carbohydrate intake was 73.5%(77). The higher carbohydrate consumption was also similar to a Saudi Arabian studies of Type 2 DM patients (56,78) . Despite the fact that carbohydrate was a key macro nutrient that could influence blood sugar levels, this study didn't found any significant relationship with glycemic control .However other study had shown that low carbohydrate diet could decrease HbA1c by 7.9% as compared to those that have high carbohydrate intake (79).Therefore reducing high carbohydrate intake in Type 2 DM patients helps in achieving desirable glycemic control.

The 24-hour recall showed that the respondents' total energy intake was 1673.95 ±743.1 kcal, falling below the recommended range of 2000–3000 kcal. Carbohydrates contributed the highest proportion of energy. This finding was slightly higher than that of individuals with Type 2 diabetes in Sudan , which was 1596 ± 243.55 kcal (80). In contrast, those in Uganda with Type 2 diabetes had a higher mean energy intake of 1960.2 ± 594.6 kcal/ day(81). And Kenyan type 2 DM patients' 2204 ±433.4 kcal/day (59). The discrepancy in energy intake might be due to under reporting by overweight individuals and over reporting by those of normal weight. The study's findings highlighted the significant impact of total energy intake on glycemic control, indicating that higher total energy intake was associated with a greater likelihood of poor glycemic control **(AOR:1.010; 95% CI:1.000,1.010).** It was found that one percent increase in the likelihood of poor glycemic control for every unit increase in total energy emphasized the importance of monitoring and managing energy intake in individuals with diabetes. These results were consistent with previous cross-sectional study that have also demonstrated a positive correlation between glycemic control and energy intake (**AOR:1.010; 95%CI:1.000,1.010)** (82)**.** However, it is important to note that, while total energy intake is a crucial factor, caloric restriction remains a fundamental aspect of achieving good glycemic control. Therefore, individuals with diabetes should be educated and encouraged to adopt dietary strategies that prioritize appropriate energy intake and caloric restriction to effectively manage their blood sugar levels.

Dietary fiber is a simple dietary component that has a crucial role in regulating blood sugar levels in type DM patients. In terms of dietary fiber intake, the study found that Type 2 diabetes patients consumed an average of 32.5±20 g/day, which aligned with the recommended daily allowance of 20–35 g/day.This intake was higher than that of Ugandan patients (23.2+8.0g/day) (80), South African patients(19.73±8.82g/day)(83),Sudanese patients(6.75±2.83g/day)(58) and Ghanaian patients (24.0±7.9g/day)(84) ,but lower than that of Kenyan patients (37.9 g/day)(59). The possible explanation for the higher dietary fiber intake in Ethiopia compared to Sudan, Uganda, and South Africa could be the traditional Ethiopian diet, which typically included a variety of whole grains, legumes, and vegetables rich in fiber. Additionally, cultural practices and food availability in Ethiopia might also play a role in the higher fiber intake. On the other hand, the lower dietary fiber intake in Ethiopia compared to Kenya could be due to differences in culinary traditions, agricultural practices, and food preferences between the two countries. Economic factors and access to diverse food sources might also contribute to variations in fiber intake among these countries. However, our results were higher when compared to the East Mediterranean Region, which was 21.8 g/day (35). Moreover, this finding was also higher than that of Mexican Type 2 DM patients (13.83±0.4g/day) (51), Japan Type 2 DM patients (8.7–21.6g/day) (54), and Thailand Type 2 DM patients (8±4 g/day) (56). This is manly due to the fact that the Ethiopian staple diet (traditional Ethiopian cuisine) was rich in whole grains, legumes, and pulses; moreover, the major staple diet was injera teff, which was a cereal group, and it was consumed by the majority of Ethiopians. In addition, the Ethiopian diet was more plant-based as compared to the Mediterranean diet. All these possible factors contributed to high fiber levels among Type 2 DM patients as compared with other countries.

The current study also found mean hemoglobin A1c was 7.61±1.49 and fasting blood sugar level was 152.4 ± 44.3mg/dl . About 56.7% of the total Type 2 DM patients had poor glycemic control. The prevalence of poor glycemic control was lower with a cross-sectional study in southern Ethiopia, which found that 70.8% had poor glycemic control (85). The discrepancy could be due to the fact that the respondents in this study had high dietary adherence to recommendations and potentially higher fiber intake. This implied that dietary habits and adherence to dietary guidelines might have a significant impact on glycemic control outcomes among diabetic patients. However, comparing this finding with similar study in Nigeria, where the prevalence of poor glycemic control was 55%, shows some consistency(86). This suggested

that there might be regional variations in dietary habits, access to healthcare, or other economical factors that could contribute to differences in glycemic control outcomes among Type 2 DM patients.

The current study also found correlation between glycemic control and dietary fiber with Pearson coefficient **- 0.383 (p value<0.001).** This indicated that there was weak negative correlation between outcome variable (glycemic control) and explanatory variable(dietary fiber). The finding implied as dietary fiber intake increase and there was moderate decrement in glycemic control. Moreover the finding from the study revealed a unit increase in intake of dietary fiber among Type 2 DM patients was associated with a 5 % decrease in the odds of poor glycemic control **(AOR: 0.950; 95 % CI: 0.930,0.970).**This showed that an adequate intake of dietary fiber has an impact on blood sugar regulation. As patients increase their fiber intake, there would be better glycemic control. The findings from this study was consistent with what has been reported by authors ,regarding the effect of fiber on glycemic control in reducing postprandial glucose level and improving glycemic control(50–52,54,87). This could best explained by the fact that dietary fiber has a benefit in improving glycemic control by reducing postprandial glucose spikes and improving insulin sensitivity. Additionally, a fiber rich diet has been associated with increasing satiety and reducing food intake and appetite, and finally, dietary fiber has a prebiotic role in promoting the growth of gut microbiota. and these bacteria have a role in metabolism, which could result in regulating blood sugar levels(25).

In type 2 diabetes patients with follow-up for DM lasting 5–10 years, the odds of poor glycemic control was 2.03 times greater than in those with follow-up for DM lasting less than 5 years. (95%CI: 1.017, 4.085); AOR: 2.038. The result aligned with previous comparable cross-sectional study conducted in Ethiopia (AOR: 2.14, 95%CL: 1.19–3.85) (88). This was also consistent with several similar studies (86,89). Moreover ,the present study also showed that a longer duration of diabetes, more than 10 years, was significantly associated with poor glycemic control (AOR: 2.621; 955CL: 1.341, 5.120). This was inline with study done in northern west Ethiopia (AOR: 2.20; 95% CI: 1.18–4.08) (85). This finding implied that there was poor glycemic control over time. One possible reason for this could be the gradual decline in insulin secretion over time, caused by the malfunctioning of B cells and increased resistance to insulin function causing impaired blood sugar control. Additionally, it could be challenging for patients to consistently

monitor their blood sugar levels and adjust their treatment accordingly. As a result, it is important to implement measures that focus on education and emphasize self-care activities, particularly for individuals with longer duration of the disease.

7. Strength and Limitation

7.1.Strength

This study's strength was its ability to pinpoint the sources of fiber in the diets of Type 2 diabetes patients and assess the contribution of each source along with food item.This was achieved by utilizing the multi-pass 24-hour recall method with proxy PSEM to estimate portion sizes and quantify fiber intake of Type 2 DM patients. Moreover ,this study generated evidences for the first time on dietary fiber intake of Type 2 diabetes in government hospitals. The use of the electronic device KOBO tool for data collection was also a key strength, as it effectively managed missing data and ensured comprehensive and accurate information.

7.2.Limitation

The study had some limitations. Firstly, it did not include private hospitals ,so generalization is limited to government hospitals only. Secondly, the cross-sectional design used may not accurately measure the effect of dietary fiber and glycemic control. Additionally, meal recipes were not collected due to the facility-based nature of the study, which is more feasible in a community setting. Thirdly, some data collection periods coincided with fasting seasons, which could potentially impact the study's findings as respondents typically consume fiber-rich foods during these times, leading to an increase in overall fiber intake. Fourthly certain predictor variables, such as wealth index, were not assessed in this study. Lastly , The scarcity of prior research in a specific area of study was another limitation. Despite efforts to thoroughly review existing literature, it was discovered that there was limited literature available that directly addressed the research problem on a local and regional level. This posed challenges in the interpretation of the findings.

However, the challenges encountered during this process were notable. The reliance on paper-based methods proved to be time-consuming and susceptible to errors. Specifically, inaccuracies in the fiber content of certain food items were identified during data entry. To address this issue, cross-referencing and correction were performed using data from the USDA and the West African Food Composition Table. Furthermore, the analysis of nutrient data from the Nutri Survey 2007 presented challenges due to its lack of user-friendliness, necessitating additional effort and time for effective navigation.

8.Conclusion

In conclusion, this study analyzed the dietary fiber intake of Type 2 diabetes mellitus (DM) patients in Ethiopia, revealing a mean intake of 32.5 ± 20 g/day, with cereal being the primary source (79.5%). This finding aligned with dietary fiber recommendations for diabetic patients. Meanwhile, findings from this study add evidence about the amount of dietary fiber intake of Type 2 diabetic patients in government hospitals in Ethiopia. Furthermore, it was found that a higher intake of dietary fiber was associated with good glycemic control. Total energy, duration of DM follow-up, and dietary fiber were the significantly associated predictors for glycemic control . These findings also support increasing fiber intake as an effective approach to improve glycemic control in Type 2 DM patients.

9.Recommendation

The findings of the study highlight several key recommendations for various stakeholders involved in the management of Type 2 diabetes. Firstly ,Researchers are encouraged to leverage advanced data collection tools like ODK for 24 hour recall to ensure the accuracy and reliability of data related to dietary fiber intake and its impact on glycemic control in diabetic patients. Further strong epidemiological studies in this area are essential to deepen our understanding of different type of fiber on blood sugar levels in individuals with Type 2 diabetes. Additionally, there is a need for the development of simplified validated tools for assessing fiber intake in diabetic patients, which can streamline the process of monitoring and promoting dietary changes. By providing practical and user-friendly tools, healthcare providers can empower patients to make informed choices and effectively incorporate fiber-rich foods into their daily routines.

Secondly , it is advised that the Ethiopian Public Health Institute (EPHI) take proactive steps to update the Ethiopia food consumption table to reflect commonly consumed foods and accurately assess the fiber content of items such as coffee and tea. This will provide more comprehensive and reliable data for future research and policy-makers.

Health professionals play a crucial role in the management of Type 2 diabetes, and it is recommended that they prioritize counseling on fiber-rich diets for their diabetic patients.Overall, the recommendations stemming from this study underscore the importance of promoting fiber-rich diets as a key component of comprehensive care for individuals with Type 2 diabetes. By implementing these suggestions, stakeholders can work together to improve outcomes and enhance the quality of life for those living with this chronic condition.

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11. Annex

I. Annex : Information sheet and consent Form

English version information sheet and consent form for participating in the study "sources and amount of dietary fiber intake and its effect on glycemic control among Type 2 DM patients on follow up in general government hospitals Addis Ababa, Ethiopia"

A. Information sheet

Title of the study: sources and amount of dietary fiber intake and its effect on glycemic control among Type 2 DM patients on follow up in general government hospitals Addis Ababa, Ethiopia", facility based cross sectional study 2024.

Name of Investigator: Feven Hailu (BSc.)

Name of the Organization: AAU

Name of the Sponsor: Addis Ababa University

Introduction: this information sheet is prepared for general government hospitals which have follow up in DM clinics in Addis Ababa. The aim of the form is to make purpose of research, data collection procedures clear to the above concerned offices and get permission to conduct the research.

Purpose of the Research Project: To determine the sources and amount of dietary fiber intake and its effect on glycemic control among Type 2 DM patients on follow up in general government hospitals, Addis Ababa Ethiopia.

Procedure: In order to accomplish the research objective a single 24 hour recall method was used to gather dietary data and each research participant would have their height, weight and blood pressure measured in accordance with standard protocol. Next, though a skilled laboratory worker used sterile techniques and a syringe to draw 1-1.5 ml of blood from the participant's finger for a biochemical test (fasting blood sugar).

Risk and/or Discomfort: During blood collection, there was some little pain and discomfort. However the rest of body measurement didn't cause any harm or discomfort to the study participant. Nothing on the form was used to identify the person, not even their name. And confidentiality was guaranteed, with all information gathered being kept private. Additionally, the data was utilized only for the research project.

Benefit: The study didn't have direct benefit for the participants except knowing blood glucose level, blood pressure and BMI status at the end of the study and if there is any pathological sign study participant would be linked to the health care provider for treatment and diagnosis. It helps researcher to determine the source and quantify amount of fiber intake and see effect on glycemic control among Type 2 DM patients, this would help to give evidence based dietary recommendation for Type 2 DM patients.

Confidentiality: To assure the confidentiality of the information, data was collected by those who had training on the process and have clinical background without mentioning the name of the participants. The information obtained from this study was revealed to principal investigator and was stored in a computer locked by password.

Person to contact: the following contact addresses was given to contact investigator at any time Feven Hailu , AAU University, College of Health Sciences, Department of Nutrition and Dietetics: principal investigator

FEVEN HAILU: Tele: 0925319178; e-mail: fevenhailu1921@gmail.com

B. Subject Information Sheet

Identification Code: _____

Greetings,

My name is …….. I am here on behalf of Feven Hailu masters of public health nutrition student at Addis Ababa University, School of public health. She is doing a research on "sources and amount of dietary fiber intake and its effect on glycemic control among Type 2 DM patients on follow up in general government hospitals, Addis Ababa Ethiopia". She has received permission from Addis Ababa university school of public health.

Your cooperation and willingness to participate in the interview, body measurement & providing blood sample is very helpful in determining the common sources and quantifying the amount of dietary fiber. I assure you that all information that you give will be kept strictly confidential. Your participation is voluntary and you are not obliged to answer any question you do not want to answer. If you are not still comfortable with interview, please be free to stop me any time you like, there is no harm if you don't answer the questions and no special benefit you get except knowing blood glucose level, blood pressure and BMI status at the end of the study and if there is any pathological sign you will be linked to the health care provider for treatment and diagnosis. If you are willing to participate, the interview questions and measurements will take 30 minutes. I would like to interview you few questions regarding socio-demographic characteristics; health status, health related and medication use; and dietary assessment. Body measurements (height, weight , blood pressure and blood sample will be taken for biochemical measurements.

We would be thankful if you spend some time with us answering questions.

1. If yes, Name of interviewer_____ Signature_____

2. If no, skip to the other participant

For more information and question here is the contact address of the investigator:

FEVEN HAILU: Tele: 0925319178; e-mail: fevenhailu1921@gmail.com

I. Annex:- Consent form

Code of study participant _____

I have been informed about a study plan that is entitled with "sources and amount of dietary fiber intake and its effect on glycemic control among type 2 diabetic patients on follow up in general government hospitals, Addis Ababa, Ethiopia" and for this purpose , body measurement and blood sample will be taken from me. The aims of this study were explained to me well and I was informed about blood sample collection procedure for laboratory investigation. For that purpose a 1-1.5ml of blood sample will be collected by assigned laboratory technician using sterile procedures using needle and cotton. I have been told that there might be some pain that is associated with the blood collection. I have been also informed the benefit of collecting blood will provide important information to determine the blood sugar level and this will help to see the effect of dietary fiber on glycemic control. I am also informed that all the information contained within the questionnaire and laboratory investigation is to be kept confidential. I have been informed that laboratory results will be disclosed to me whenever the result is ready and in case the result had any pathological indication, I am told that I will be linked to the health care provider for further diagnosis and treatment.

Moreover, I have also been well informed of my right to decline to cooperate and make myself withdraw from the study. It is therefore with full understanding of the situation that I gave the informed consent voluntarily to the researcher to use the specimen taken from me for the investigation.

Based on the understanding of the information and I give information, Are you willing to

Participate in this study?

A) Yes

B) No

(1) If yes, I will continue a

2) If no I will skip to next participant after writing the reasons of refusal.

Respondent

Signature _____Date_____

Interviewer

Name_____ Signature_____

Questionnaires number_____

Date of interview_____ Starting time_____ Completed_____

Result of interview

A) Completed

B) Not completed

C) Partially completed

D) Refused

Checked by Supervisor: Name _____Signature_____

Address: Cell phone +251 (0) 925319178

Email: fevenhailu1921@gmail.com

Instruction: circle all the possible answers of the respondent from the choice provided

II. Annex : English version Questionnaires

Survey information

_____Hospital name

_____Interviewer ID

_____Patient ID

_____Contact phone number and address of the patient

_____Date of completion of the data

Instruction: I request you kindly to go through each question and give your responses by circling your answer for the chose part and write your answer for the fill in the blank.

I. Questioner

I. Socio- demographic, Behavioral and clinical characteristics

1.Socio- demographic characteristics		
101. Sex	1.Male 2.Female	
102.Age in years	1.18-24 years old 2.25-34 years old 3. 35-49 years old 4. 50- 65 years old 5. above 65 years old	
103. Education status	1.No formal schooling 2.Less than primary school 3.Primary school completed 4.Secondary school 5.High school completed	

	6.College/University completed 7.Post graduate degree 8.Refused	
104.Marital status	1.Single 2.Currently married 3.Divorced 4.Widowed	
105. Family size	1. 1-3 members 2..4- 6 members 3. 7-9 members 4. above 10 members	
106. What is your main occupation?	1.Government employee 2.Non-government employee 3. Self-employed 4. House wife 5. Retired 6.Non-employed 7.Refused	
107. Average monthly income?	1.<1500 ETB 2.1500-5000 ETB 3. >5000 ETB	
2. Behavioral factors		
201. Have you ever smoked cigarette? If no go to question 203	1.Yes 2.No	
202. Do you currently smoke cigarette?	1.Yes 2.No	

203. On average, how many cigarettes do you smoke?	1.1-5 cigarette 2. 5-10 cigarette 3. above 10 cigarette	
204. Have you ever drink alcohol? If no go to question 208	1.Yes 2.No	
205. Do you currently drink alcohol?	1.Yes 2.No	
206. Have you consumed an alcoholic drink with in the past 30 days?	1.Yes 2.No	
207. If yes how often and how much do you drink alcohol?	Frequency---------- Type---------- Amount----------	
208. Have you ever chew kchat?	1.Yes 2.No	
209. Do you do any physical activity (> 30min walk, or fitness training >3 times per wk)?	1.Yes 2.No	
210. Have you done physical activity within the past 24 hours?	1.Yes 2.No	
3. Clinical characteristic and medication use		
301. How long have you Been diagnosed?	1.Less than 5 years 2.5-10 years 3.More than 10 years	

302. How long has it been since you started DM follows up??	1.less than 2 years 2. 2-5 years 3 5-10 years 4. more than 10 years	
303. Do you have other Comorbidity diseases	1.Yes 2.No If yes what type of co morbidity? 1. 1.Hypertension 2.Hyperlipidemia 3.CVD	
304. Are you taking any medication?	1.Yes 2.No	
305. How do you control your diabetes by (multiple answer is possible)	1. insulin 2.Tablets 3.controlling 4.exercise 5.Other	
306. Do you have family history of Diabtes?	1.Yes 2.No	
307. Have you ever made a complete change of dietary habit when yu know you have diabtes?	1.Yes 2.No	
308. Did you have any admission history?	1.Yes 2.No	
309. Have you ever had any complication related to Diabtes?	1.Yes 2.No	

Interactive 24-hour Recall

Form for Recording the Interactive 24-hour Recall

Interviewer: _____ Day food eaten: _____ Interview date: _____				Location: _____ Sex: _____ Subject ID: _____ Age: _____ Weight: _____		
Time	Place eaten	Food or drink	Description and cooking Method	Amount eaten	weight equivalent	Food code

Probe for alcohol: 1. Yes 2. No						
Was food intake unusual? 1. Yes 2. No If yes, how was it unusual?						
Was it a feast day? 1. Yes 2. No Was it a market day? 1. Yes 2. No Was it a fasting day? 1. Yes 2. No						

II. Blood pressure ,anthropometric and biochemical measurement

1. Blood pressure measurement				
Measurement	1	2	3	Average
1.Diastolic (mmHg)				
2.Systolic (mmHg)				
2. Anthropometric measurement				
Measurement	1	2		Average
3.Weight (kg)				
4.Height (cm)				
3. Biochemical test				
6. Time of spacemen taken?	_____Hour: minute			
7. FBS	_____mg/dl			
8. HbA1C	_____ %			

III. Annex : Amharic version subject information sheet

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ህብረተሰብ ጠፍ ሳይንስ

የተጠየቂው/ መላሾች የሚጃ ቅፅ

እንደምን አደሩ / ዋሉ ፡፡ ስሜ---------- ይባላል:: የመጣሁት የአዲስ አበባ ዩንቨርስቲ ህብረተሰብ ሳይንስ ጠፍ ሁለተኛ ዲግሪ ተማሪ የሆነችውን ፌቨን ኃይሉን ወክዬ ነው፡ ፡ ሁለተኛ ዲግሪዋን ለመሚቅ “የ ምግብ ፋይበር አወሳሰድ ምንጮች እና መጠን እና ከስኳር መጠን ቁጥጥር ጋር ስላለው ግንኙነት በአዲስ አበባ ኢትዮጵያ አጠቃላይ ሆስፒታሎች ክትትል በሚደረግባቸው ሁለኛዉ ዓይነት የ ስኳር ህመምተኞች ላይ ሲሆን ከአዲስ አበባ ዩኒቨርስቲ እና ከሆስፒታሎቹ ፍቃድ አግኝታ ምርምር ጥናት እየ ሰራች ነው፡ ፡ እርስዎ የተመረጡት በዚህ ሆስፒታል የ ስኳር ህክምና ክትትል በሚድረጎ ነው፡ ፡ በመሆኑም ሁለተኛ የ ስኳር አይነት ያላቸዉ ስኳር ህመምተኞች ይሳተፉ፡ ፡ በቃለ መጠይቁ፣ የ ሰውነት መለኪያ እና የ ደም ናሙና በማቅረብ ላይ ለመሳተፍ ያለዎት ትብብር እና ፍላጎት የ ምግብ ፋይበር ከስኳር መጠን ቁጥጥር ላይ ያለውን ተጽእኖ ለመለየት በጣም ጠቃሚ ነው። እርስዎ የሚሰጡት መረጃ በሚኒ በሚስጥር እንደሚጠበቅ አረጋግጣለሁ። የ እርስዎ ተሳትፎ በፈቃደኝነት ነው እና እርስዎ መመለስ የሚፈልጉትን ማንኛውንም ጥያቄ ለመመለስ አይገደዱም። አሁንም በቃለ መጠይቅ ካልተመቻችሁ፣ ለጥያቄዎች መልስ ካልሰጡምን ምጉዳት የ ለውም በፈለጋችሁት ጊዜ አቁመኝ። በጥናቱ የ ደም ወስጥ የ ስኳር መጠንን፣ የ ደም ግፊትን እና የ ክብደትና ቁመት ሁኔታን ከሚወቅ በቀር ምንም ልዩ ጥቅም የ ለውም ። የ ጥናቱ መጨረሻ እና ማንኛውም ፓቶሎጂ ምልክት ካለ ለህክምና እና ለምርመራ ከተገ ቢው ቦታ ጋር ይገ ናኛሉ። ከጥናቱ ተገ ቢውን አመጋገ ብ እንዴት ማሻሻል እንዳለብዎ ይረዳሉ፡ ፡ ከዚህም በተጨማሪ የ ጥናቱ ወጤት የ ስኳር ህመምተኞች አመጋገ ብ ይበልጥ ለማሻሻል ለተመራማሪዎች በዚህ ዙሪያ ለሚሰሩ አካላት እንደ መሻሻያ ገ ለግላል፡ ፡ ለመሳተፍ ፈቃደኛ ከሆኑ የ ቃለ መጠይቁ ጥያቄዎች እና ልኬቶች 30 ደቂቃዎች ይወስዳሉ።

ከእኛ ጋር ጥያቄዎችን በመመለስ ጥቂት ጊዜ ስለሚያሳልፉ እናመሰግናለን

አዎ ከሆነ ፣ የ ጠያቂውስም_____ ፊርማ_____

ካልሆነ ፣ ወደ ሌላኛውተሳታፊ ይዝለሉ

ለበለጠ መረጃ እና ጥያቄ የ ሞርሚውአድራሻ እዚህ አለ፡ -

ፌቨን ኃይሉ: ሰልክ : 0925319178; e-mail: fevenhailu1921@gmail.com

<u>አባሪ፥ - የ ፍቃድ ቅፅ</u>

የ ጥናት ተሳታፊ ኮድ_____

“የ ምግብ ፋይበር አወሳሰድ ምንጮች እና ማጠን እና ከስኳር ማጠን ቁጥጥር ጋር ስላለው ግንኙነት በአዲስ አበባ ኢትዮጵያ አጠቃላይ ሆስፒታሎች ከትትል በሚደረግባቸው ሁለኛዉ ዓይነት የ ስኳር ህመምተኞች መካከል ያለዉ ግንኙነት” በሚል ርዕስ የ ጥናት እቅድ ተነ ግሮኛል እና ለዚህ አላማ ጥያቂ እና የ ደም ናሙና ከእኔ ይወሰዳል። የ ዚህ ጥናት ዓላማዎች በ ደንብ ተብራርተዉልኛል እና የ ተለመደዉን የ ላቦራቶሪ ምርመራ ሂደት ተከትሎ ስለ ደምናሙና ስብስብ መረጃ ተነ ግሮኛል ። ለላቦራቶሪ ምርመራ የ ደምናሙና አሰባሰብ ሂደት ተነ ግሮኛል። ለዚሁ ዓላማ ከ1-1.5ml የ ደም ናሙና በ ተመደበው የ ላቦራቶሪ ቴክኒሻን መርፌ እና ጥጥ በ ማጠቀም የ ጸዳ አሠራሮችን በ ማጠቀም ይሰበሰባል። ከ ደም ስብስብ ጋር የ ተያያዘ ህመም ሊኖር እንደሚችል ተነ ግሮኛል ። በ ተጨማሪም ደም መስብሰብ ጥቅሙ የ ደም ስኳር ማጠን ለ መወሰን ጠቃሚ መረጃ እንደሚሰጥ እና ይህም የ አመጋገብ ፋይበር በ የ ደም ስኳር ቁጥጥር ላይ ያለዉን ተጽእኖ ለ ማየት ይረዳል። በ ተጨማሪም በ ማጠይቁ እና በ ቤተ መከራ ወስጥ የ ተካተቱት መረጃዎች በ ሚሰጥር እንዲያዙ ተረድቻለሁ። ወጠጩ በ ተዘጋጀ ቁጥር የ ላብራቶሪ ወጠጮቹ እንደሚ ለጠፉኝ እና ወጠጩም የ ፓቶሎጂካል ምልክት ካለበት ለ በለጠ ምርመራ እና ህክምና ከጠፍ ባለ መያው ጋር እንደሚ ናኝ ። በ ተጨማሪም፣ ለ መተባበር እና ራሴን ከ ጥናቱ የ መውጣት መብቴን በ ደንብ ተረድቻለሁ። ስለ ዚህ ሁኔታዉን ሙሉ በ ሙሉ በ ሚዳት ለ ተመራማሪው ከእኔ የ ተወሰደዉን ናሙና ለ ምርመራ እንዲጠቀምበት በ ፈቃደኝነት ፈቃድ የ ሰጠሁት። በ ሚጠዉግንዛቤ ላይ በ መሳረት እና መረጃን እሰጣለሁ።

ፈቃደኛ ነዎት በ ዚህ ጥናት ወስጥ ይሳተፉ?

1) አዎ

2) አይ

አዎ ከ ሆነ ፣ እቀጥላለሁ

አይሆንም ከ ሆነ የ እንቢታ ምክንያቶችን ከጻፍኩ በ ኋላ ወደ ቀጣዩ ተሳታፊ እዘልላለሁ።

ምላሽ ሰጪ

ፊርማ_____ ቀን _____

ጠያቂ

ስም_____ ፊርማ

ማጣይቆች ቁጥር _____

የ ቃለ ማጣይቁ ቀን _____ የ መ ሻ ሰዓቱ _____ ተጠ ቀቀ_____

የ ቃለ ማጣይቁ ወጤት

ሀ) ተጠ ቀቀ

ለ) አልተጠ ቀቀም

ሐ) በ ከፊል የ ተጠ ቀቀ

መ) እ ምቢ አለ ።

በ ተቆጣጣሪ የ ተረ ጋገ ጠ፡ ስ ም_____ ፊርማ_____

የ ዳሰ ሳ ሚ ጃ----------

የ ሆስ ፒታል ስ ም----------

የ ጠያ ቂ መታ ወቂያ ኮ ድ----------

የ ታካ ሚ መታ ወቂያ ኮ ድ----------

የ ታካ ሚውን ስ ልክ ቁጥር እ ና አ ድራ ሻ ያ ግ ኙ----------

ሚ ጃ ው የ ተጠ ቀቀ በ ት ቀን ----------

መመሪ ያ ፡ እ ያ ን ዳ ን ዱ ን ጥ ያ ቄ በ ሚ ለ ፍ ምላ ሻ ች ሁ ን ለ ተ ሚ ጠ ው ክ ፍ ል በ ማ ዞ ር ምላ ሻ ች ሁ ን እ ን ድ ት ሰ ጡ በ ት ህ ትና እ ጠ ይ ቃ ለ ሁ እ ና ም ባ ዶ ው ን ለ መ ሟ ት ሚ ል ሱ ን ይ ፃ ፉ ።

ክፍል አንድ:- ቃለ መጠይቅ

1.ማህበራዊ-የስነ -ሕዝብ ባህሪያት		
101. ፆታ	1.ወንድ 2. ሴት	
102. እድሜበዓመታት	1.18-24 ዓመት 2.25-34 ዓመታት 3. 35-49 አመት 4. 50-65 ዓመት 5. ከ 65 ዓመት በላይ	
103. የትምህርት ሁኔታ	1. ምንምመደበኛ ትምህርት 2.ከአንደኛ ደረጃ ትምህርት ያነሰ 3.የመጀመሪያ ደረጃ ትምህርት ያጠናቀቀ/ች 4.ሁለተኛ ደረጃ ትምህርት 5.ሁለተኛ ደረጃ ትምህርት ያጠናቀቀ /ች 6.ኮሌጅ/ዩኒቨርስቲ ያጠናቀቀ/ች 7. የድህረ ምረቃ ዲግሪ	
104.የጋብቻ ሁኔታ	1. ያላገባ 2.አሁን ባለትዳር 3.የተለያዩ/የተፋታ 4.የሞተበት	
105. የቤተሰብ ብዛት	1. 1-3 አባላት 2..4-6 አባላት 3. 7-9 አባላት 4. ከ 10 በላይ አባላት	

106. ዋና ሥራህ ምንድን ነ ወ?	1. የ መን ግስት ሰ ራተኛ 2 የ ግለ ሰብ ተቀጣሪ 3. የ ግል ስ ራ 4. የ ቤት እ መቤት 5. ጡ ረታ 6. ሌላ	
107. አ መ ካይ ወር ሃ ዊ ገ ቢ?	1.<1500 ብር 2.1500-5000 ብር 3. >5000 ብር	
ክፍል ሁለት፡ - ማጠይቅ		
201. ሲ ጋራ አ ጨ ህ ታ ወ ቃ ለ ህ? አ ይ ከ ሆነ ወደ 204 እ ለ ፍ	1. አ ዎ 2. አ ይ ደ ለ ም	
202. በ አ ሁ ኑ ጊ ዜ ሲ ጋራ ያ ጨ ሉ?	1. አ ዎ 2. አ ይ ደ ለ ም	
203.አ ዎ ከ ሆነ በ አ መ ካይ በ ቀን ወ ስ ጥ ም ን ያ ህ ል ሲ ጋራ ታ ጨ ስ ለ ህ?	1. 1-5 ሲ ጋራ 2. 5-10 ሲ ጋራ 3. ከ 10 በ ላ ይ ሲ ጋራ	
204.አ ል ኮ ል ጠ ጥ ተ ህ ታ ወ ቃ ለ ህ? አ ይ ከ ሆነ ወደ 206 እ ለ ፍ	1. አ ዎ 2.አ ይ ደ ለ ም	
205. አ ል ኮ ል የ ማ ጨ ት ል ም ድ አ ለ ህ? አ ይ ከ ሆነ ወደ 208 እ ለ ፍ	1. አ ዎ 2 አ ይ ደ ለ ም	

206.ባለፉት 30 ቀናት አልኮል ማጨት ጠጥተህ ታውቃለህ?	1. አዎ 2. አይደለም	
207. አዎ ከሆነ ምን ያህል ጊዜ እና ምን ያህል አልኮል ይጠጣሉ?	ድግግሞሽ _____ ዓይነት _____ መጠን _____	
208. ቻት ቅጠል ታውቃለህ?	1. አዎ 2. አይደለም	
209. ማንኛውንም የአካል ብቃት እንቅስቃሴ (> የ30 ደቂቃ የእግር ጉዞ ወይም የአካል ብቃት ስልጠና >በሳምንት 3 ጊዜ) ያደርጋሉ?	1. አዎ 2.አይደለም	
210. ባለፉት 24 ሰዓታት ወስጥ አካላዊ እንቅስቃሴ አድርገዋል?	1. አዎ 2. አይደለም	
<u>ክፍል ሶስት ፡ - ማጨይቅ</u>		
301. ስኳር እንዳለብህ ከተነገረህ ምን ያህል ጊዜ ሆነህ?	1. ከ 5 ዓመት በታች 2.5-10 ዓመታት 3.ከ 10 አመት በላይ	
302. የስኳር ክትትል ከጀመርክ ምን ያህል ጊዜ ሆነህ?	1.ከ2 አመት በታች 2. 2-5 ዓመታት 3 5-10 ዓመታት 4. ከ 10 ዓመት በላይ	
303. ሌሎች ተያያዥ ተጓዳኝ በሽታ አሎት?	1. አዎ 2. አይደለም ካለ ምን አይነት 1 ደምግፊት	

	2 ኮሌስትሮል ሜጨሞር 3 የልብ ችግር	
304. አሁን ላይ መድሃኒት እየ ወሰድክ ነ ው?	1. አዎ 2. አይደለ ም	
305. ስኳርህን በምን መንገ ድ ነ ው የ ምትቆጣጠረ ው? (ብዙ መልስ ማግኘት ይቻላ ል)	1. ኢንሱሊን 2. ታብሌቶች 3.መቆጣጠር 4. የ አካል ብቃት እን ቅስቃሴ ሚድረግ 5.ሌላ	
306. በቤተሰብ ስኳር ያለበት ሰው አለ?	1. አዎ 2. አይደለ ም	
307.ሆስፒታል ተኝተህ ታክመህ ታውቃለህ?	1. አዎ 2 አይደለ ም	
308 ስኳር እንዳለብህ ካወቅህ በኋላ የ አመጋገ ብ ልማድህን ቀይረሃ ል?	1 አዎ 2 አይደለ ም	
309. ከስኳር ጋር በተገ ናኘ የ ተወሳሰቡ የ ጠፍ አጋጥመህ ያ ውቃል?	1 አዎ 2 አይደለ ም	

<u>ክፍል አራት ፡ - ማጠይቅ</u>

የ 24 ሰአት የ ምግብ ሁኔ ታ ማጠይቅ ቅጽ

ጠያቂው: _____ ምግቦቹ የ ተወሰዱበት ቀን: _____ የ ቃለ ማጠይቁ ቀን: _____				ክብደት: _____		
ሰአት	የ ተበላበት ቦታ	ምግብ/ማጠጥ	ስለ ምግቡ እና ስለ ተሰራበት መንገድ ገለጻ	ምን ያህል ተወሰደ	ተቀራራቢ የ ምግቡ ማጠን ክብደት ግምት	የ ምግቡ መለያ ኮድ
የ ተወሰደውምግብ ከተለመደውየ ተለየ ነ በረ? 1 አዎ 2 አይ						

አዎ ከሆነ በምን መልኩ?	
የበዐል ቀን ነበር? 1 አዎ 2 አይ የገበያ ቀን ነበር? 1 አዎ 2 አይ የጾምቀን ነበር? 1 አዎ 2 አይ	

ክፍል 2 -የደምግፊት፣ አንትሮፖሜትሪክ እና የደምናማ ልኬት

የደምግፊትልኬት				
ልኬት	1	2	3	አማካኝ
1.ዲያስቶሊክ (ሚሜ				
2.ሲስቶሊክ (ሚሜ)				
አንትሮፖሜትሪክ መላኪመላኪያ				
ልኬት	1	2		አማካኝ
3.ክብደት (ኪግ)				
4.ቁመት (ሴሜ)				
ናማ ወጠሯ				
6. የተወሰደውናማ ጊዜ	_____ ሰዓት: ደቂቃ			
7. የደምስኳር (FBS)	_____ ሚግ/ ዲሊ			
8. ሄሞግሎቢን A1C (HbA1c)	_____ %			

IV. Annex: Training Manual

1. Introduction

Dietary fiber is polysaccharide polymer with ten monomer units which aren't digestible by intestinal enzymes. Several comprehensive studies and evidences support the role of fiber in glycemic control; however the glucose-lowering effect of fiber intake has not been consistently demonstrated in the literature, indicating the effect related with source of fiber and amount of fiber intake of Type 2 DM patients. Furthermore, although poor glycemic control has become more prevalent in Ethiopia in recent years, research on the hypoglycemic effect of dietary fiber is contextually limited in Ethiopia. For these reasons, the current study is proposed.

2. Objective

1. Training Goals:

Provide understanding of the study's purpose: Help data collectors grasp the research objectives and their role in achieving them.

Clarify data collector roles and responsibilities: Outline expected tasks, duties, and ethical considerations for data collection.

Demonstrate data collection methods: Train on proper procedures for gathering accurate and complete data using the questionnaire and checklists.

2. Training Method:

Interactive participation: Encourage active involvement through discussions, questions, and practice activities.

Group sessions: Facilitate learning through shared understanding and peer interaction.

Role-playing: Simulate real-life scenarios to solidify data collection skills and address potential challenges.

3. Training Schedule:

Introduction (15minutes): Overview of the study, its importance, and ethical considerations.

Data collection methods (30 minutes): Detailed explanation of questionnaire use, observation techniques, and recording procedures.

Participant roles and responsibilities (10-20 minutes): Clarification of data collector and supervisor duties, expectations, and communication channels.

4. Materials:

Informed consent forms: Ensure informed participation and data privacy protection.

Writing tools: Pencils for questionnaires and pens for note-taking.

Questionnaires: Standardized instruments for consistent data collection.

5. Payment:

200 Ethiopian birr: Compensation for data collectors' time and effort.

6. Participant Roles and Responsibilities:

6.1 Data Collectors:

Active training participation: Demonstrate commitment and eagerness to learn.

Eligibility criteria understanding: Recognize who can and cannot be included in the study.

Consent acquisition: Obtain informed consent from participants before data collection.

Accurate data recording: Use questionnaires and checklists diligently to capture accurate findings.

6.2 Supervisors:

Training delivery: Provide comprehensive training covering all data collection aspects.

Questionnaire verification: Ensure completeness and accuracy before distributing questionnaires.

Data collector support: Offer guidance, answer questions, and address any concerns during data collection.

Payment management: Distribute compensation to data collectors as agreed upon.

Data entry and coding: Ensure accuracy and proper format for collected data.

Confidentiality maintenance: Protect participant anonymity and data privacy throughout the research process.

7. Participant Expectations:

Study participants should sign the consent letter for the approval in participating in the study

Participants should the respond to all the instruction on the questionnaires through the data collector

8. Data Collection Procedures:

Questionnaire rehearsal: Familiarize with the questionnaire format and content beforehand.

Initial greetings and introduction: Introduce yourself professionally and explain the study purpose.

Consent form explanation: Read aloud the consent form, ensuring participant understanding and voluntary agreement.

Questionnaire administration: Ask questions clearly and politely, following the prescribed order.

Respondent inquiries: Address questions with respect and clarity, avoiding personal opinions or bias.

Voluntary participation: Never pressure anyone to participate in the study.

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V. Annex :-curriculum vitae

PERSONAL INFORMATION

- **Date of birth ……. 26/June/1999**
- Gender ……. ……. Female
- Nationality ……. Ethiopian

EDUCTIONAL BACKGROUND

ACADEMIC YEAR	SCHOOL/COLLEGE	GROUTED IN	LOCALITY
Since 2022	Addis ababa universy	MPH Nutrition candidate	AA
2018 – 2021	University Of Gondar	BSC Pubic Health	Gondar
2016 & 2017	School of Aygoda	11th & 12th grade	Saris, A.A
2014 & 2015	School of Aygoda	9th &10th grade	Saris, AA
2009 – 2013	School of Aygoda	4th -8th grade	Bole Bulbula,AA
2003 – 2008	Akaki Adeventist Mishen School	Kindergarten – 3rd grade	Akaki kaliti ,A A

EDUCATIONAL QUALIFICATION

- ❖ BSC degree in Public Health

WORK EXPRIANCE

- A good participants and group leader during educational attachment, Team training program (TTP) in Maraki health center and community Health attachment , which was organized by university of Gondar college of medicine and health science TTP office.
- Free service at different non-governmental Institution like AGAPE family charity association in Gondar
- Worked as public health officer at Aba Welde Tinsaye mothers and child welfare association (NGO clinic) for year

TRAINING

I have completed short term training on Project management at AAU commerce.

REFERENCES

1. Dr. Eyoel Sebsibe (lecturer, Department of Gynecology and obstetrics university of' Gondar),

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2. Mr. Tsegaw Amare (BSC, MPH Assistance Prof) head, dep of public health ……..(FAX 251-8-11-14-79), E-mail-GCMS@eth.healthnet.org

3. Mr. Getsyeneh Antehunegn (BSC, MPH in Epidemiology and Biostatics Team training program coordinator Lecturer at department of Epidemiology and Biostatics….(+251)91SS62455, E-mailGetayeneh.AntehunegJv@uog.edu.et or getayenehantehunegh@gmail.com