



Magnitude of fruit and vegetable consumption and its associated factors among patients with type 2 diabetes mellitus (T2DM) attending health services at selected health centers in Yeka subcity, Addis Ababa: a cross-sectional study

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ABSTRACT

Objective To assess the fruit and vegetable (FV) consumption, and associated factors among patients with type 2 diabetes mellitus (T2DM) attending health services at selected health centres.

Methods Institution-based cross-sectional study design was conducted. A study was conducted in selected health centres of Yeka subcity, Addis Ababa, from 2 March 2022 to 5 May= 2022. The sample comprised 285 patients with T2DM chosen by simple random sampling technique. Data collection was carried out via a structured questionnaire, followed by interviews and further analysed using SPSS V.25. Descriptive statistics were performed to describe the study population's characteristics, while logistic regression was used to identify the factors linked to FV consumption.

Results The study's findings indicated that the recommended amount of FV consumption was low among study participants at 25.8%, with a range of 20.9%–31.5%. The consumption of FV was linked to various factors, including food prepared by house servants (adjusted OR (AOR) 2.23, 95% CI 1.01 to 4.97), having knowledge about FV intake (AOR 4.38, 95% CI 1.88 to 10.15), accessibility of FV (AOR 4.54, 95% CI 2.05 to 10.09), affordability to buy FVs (AOR 2.32, 95% CI 1.04 to 5.18), perceiving FVs as preferable (AOR 4.51, 95% CI 2.13 to 9.54) and awareness of WHO recommendations (AOR = 0.25, 95% CI, 0.11–0.55).

Conclusion About one-fourth of study participants consume more than five servings of FV every day, which is the recommended quantity of servings. Eating food prepared by servants, having no information, difficulty accessing FV, not affording to buy FV, not perceiving FV as a preferable food for diabetics, having awareness about WHO recommendations on FV were factors significantly associated with FV consumption among people with T2DM. Hence health information dissemination about

WHAT IS ALREADY KNOWN ON THIS TOPIC

⇒ The magnitude of fruit and vegetable (FV) consumption, and associated factors among patients with type 2 diabetes mellitus (T2DM) are known in developed countries, but nothing is known in Ethiopia.

WHAT THIS STUDY ADDS

⇒ The result of this study provides data about magnitude of FV consumption among patients with T2DM in Ethiopia, and it helps to elucidate factors associated with it that might be unique to the study setting.

HOW THIS STUDY MIGHT AFFECT RESEARCH, PRACTICE OR POLICY

⇒ The results of this study will help healthcare professionals create awareness and disseminate information about FV consumption of people with T2DM to improve dietary practice of patients with diabetes. The study also helps the leadership of the health system, programme managers and policy-makers to establish national guidelines about FV consumption of patients with diabetes. It is important to conduct qualitative research to explore how those associated factors influence FV consumption of people with T2DM.

recommended FV consumption among people with T2DM should be strengthened.

INTRODUCTION

Diabetes is the seventh-greatest cause of mortality worldwide by 2030, according to the WHO.¹ It affects 425 million people



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worldwide, with type 2 diabetes mellitus (T2DM) accounting for 90%–95% of it.² Diabetes prevalence has increased from 285 million in 2010 (6.4%) to 439 million in 2030 among individuals aged 20–79 in various nations.³

An increased diet of fruits, vegetables and whole grains, on the other hand, has a health advantage for patients with T2DM.⁴ However, 81 countries, accounting for 55% of the global population, had average fruit and vegetable (FV) availability that exceeded the WHO's minimum target.⁵ Only 40 countries, representing 36% of the worldwide population, met more strict age-specific recommendations.⁵ Only around 18% of low-income and middle-income countries reached the WHO recommendation.⁶

Fruits and vegetables (FV) are rich sources of essential micronutrients, that is, vitamins, minerals and dietary fibres required for the normal daily functionality of the body.⁷ Diets rich in whole grains, fruits, vegetables, legumes and nuts have been shown to reduce the risk of diabetes and improve glycaemic control and blood lipids in patients with diabetes.⁸ A meta-analysis of data from cohort studies showed a 9%–25% reduction in the risk of developing T2DM in those with low to high dietary fibre intake.⁹

According to the ADA, the best options of fruit suitable for people with diabetes include apples with the skin on, apricots with the skin on, bananas, avocado, strawberries, grapes, oranges, melon, peaches with the skin on, pears with the skin on, tart cherries, whereas the worst options include canned fruit in syrup, coconut, dried fruit and packaged juices.¹⁰

The best vegetable options suitable for people with diabetes, according to the ADA, include artichoke hearts, asparagus, beets, brussels sprouts, cruciferous veggies, including broccoli and cauliflower, cucumbers, dark, leafy greens, such as spinach, kale, and Swiss chard, jicama, onions and peppers, whereas vegetables to enjoy in moderation include corn, peas, sweet potatoes, white potatoes, winter squash, such as pumpkin, acorn squash, and spaghetti squash and yams.¹⁰

The evidence indicated that micronutrients like magnesium and vitamin C obtained from different fruits and vegetables contributed to reducing the risk and progression of T2DM. According to the evidence, increasing dietary magnesium intake is associated with a reduced risk of stroke, heart failure, diabetes and all-cause mortality.¹¹ Similarly, supplementation of vitamin C in patients with T2DM can significantly reduce blood glucose levels, which can be obtained from FVs.¹²

FVs are sources of biologically important minerals such as calcium (Ca), magnesium (Mg), iodine (I), zinc (Zn), selenium (SE), iron (Fe), copper (Cu) and silicon (Si).¹³ In addition, according to evidence, a lower intake of FVs increases the risk of obesity, while obesity is a predisposing factor for diabetics.¹⁴ Similarly, the evidence showed that intakes of >4 servings per day reduced the risk of weight gain.¹⁵ Higher intakes of FVs were associated with lower mortality.¹⁶

Low FV consumption, on the other hand, is a major global risk factor for morbidity (linked to micronutrient deficiencies) and early mortality.¹⁷ Inadequate FV eating is responsible for around 2.7 million deaths each year.¹⁸ Another piece of research suggests that a shortage of FVs may have caused between 5.6 and 7.8 million premature deaths worldwide in 2013.¹⁹

Similarly, a lack of FV consumption has a morbid effect. Obesity is one of the leading risk factors for Non Communicable Disease (NCDs) such as cardiovascular disease, hypertension, coronary artery disease, strokes, heart failure and other types of chronic diseases such as T2DM, cancer, chronic respiratory diseases, bone and joint diseases, and neurodegenerative diseases, according to evidence from various studies.^{1 20–23}

Less consumption of fruits and vegetables is caused by a variety of factors, including sociodemographic factors such as age, gender, marital status, educational level and household head; socioeconomic factors such as income, housing condition, availability and affordability; and psychosocial factors such as perception, self-efficacy and knowledge.^{18 24–29} In another way, less consumption may have many effects on individual health or the community, as well as further stifling the economy.²⁴ It worsens the illness's severity and progression if not treated promptly.^{22 28}

Although research on FV consumption among patients with diabetes in sub-Saharan Africa (SSA) is limited, particularly, in the current study area and of the concern in Ethiopia. Therefore, the aim of this study is to assess the consumption of fruits and vegetables among people with T2DM and identify their associated characteristics.

METHODS AND MATERIALS

Study setting and period

The study was carried out in selected Yeka subcity health centres. Three woredas were chosen from the 12 woredas in the Yeka subcity, namely woreda 08, woreda 06 and Hidase health centres. All listed health centres provide service including outpatient department (OPD), inpatient department, maternal and child health, emergency service, follow-up service for chronic illness including TB, HIV/AIDS and DM. The woreda 08 health centres serve a total population of 31 546 people, where 400 of whom have T2DM. While 30 185 individuals are serviced by Woreda 06 health centres and approximately 126 patients with T2DM receive health services at health centres, Hidase Health Centre has a total population of 19 821, of which 184 are T2DMs. The research was carried out from 2 March 2022 to 5 May 2022.

Study design

An institution-based cross-sectional study design.

Population

Source of population

All patients with T2DM attended health services at selected health centres of Yeka subcity.

Study population

All patients with T2DM attended health services at selected health centres in Yeka subcity fulfill the inclusion criteria.

Eligibility criteria

Inclusion criteria

- Patients with T2DM attending health services at selected health centres.

Exclusion criteria

- Patients with recall problems and patients in life-threatening situations or severely ill patients were excluded.

Sample size determination

To determine the required sample size (n) for the study, the formula to estimate a single population proportion was used considering certain assumptions. The critical value for normal distribution was set at 95% CI to 1.96 (Z value at $\alpha=0.05$), denoted as $Z_{\alpha/2}$. A similar study conducted in Kenya reported that 21.5% of respondents consumed five or more servings of fruits and/or vegetables per day.¹⁶ Therefore, for this study, the success rate P was set at 21.5%. The margin of error d (w) was set at 0.05 with a 95% CI level, as determined by the study.

$$n = \frac{(Z_{\alpha/2})^2 P(1-p)}{d^2}$$

$$n = \frac{(1.96)^2 \cdot 0.215(1-0.215)}{0.05^2}$$

n=259

The final sample size is 285 after 10% of non-response rate is added.

Sampling procedure

In the Yeka subcity, total candidates of 12 health centres were identified, out of which 3 health centres, comprising one-fourth of the total health centres were chosen at randomly using the lottery simple random sampling method. From the selected health centres, a suitable participant was subsequently selected using the systematic random sampling technique with an interval of 2 figure 1.

Dependent variable

Adequacy of FV consumption in amount.

Independent variables

- Sociodemographic factors: age, marital status, education level, household head, who prepared food and family size.
- Socioeconomic factors: income, availability and affordability.
- Psychosocial and related factors: perception, self-efficacy and knowledge.

Operational definition

Good FV consumption

Consumption of at least five serving of FVs per day.³⁰

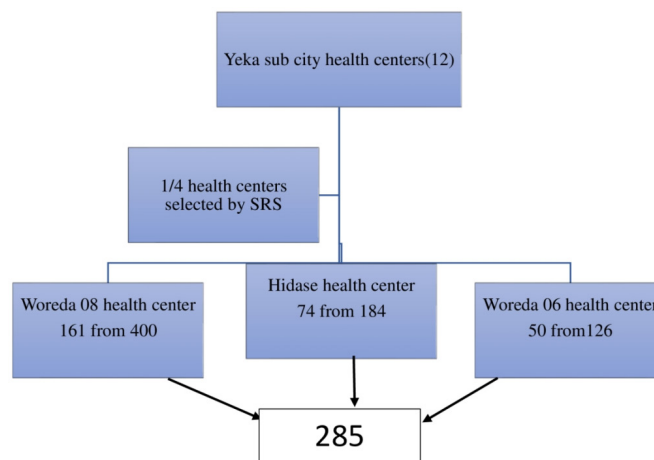


Figure 1 Schematic diagram of the sampling magnitude of fruit and vegetable consumption and associated factors among patients with T2DM attending health services at selected health centres in Yeka Sub City, Addis Ababa, Ethiopia, 2022. SRS, simple random sampling; T2DM, type 2 diabetes mellitus.

Data collection tools and method

The data collection process involved the use of face-to-face interviews, which were conducted using well-designed structured questionnaires. These questionnaires were curated to encompass a range of critical factors such as sociodemographic, socioeconomic and psychosocial indicators, as well as specific questions pertaining to FV consumption patterns. The design and structure of the questionnaire were informed by reviewed literature suggestions on optimal methodologies for capturing data in studies of this nature.

In order to ensure that the questionnaires were appropriate and valid, a rigorous pretesting phase was carried out. Approximately 5% of potential participants in the study were selected for this process, during which they provided feedback on the clarity and relevance of the questions. This step was crucial in ensuring that the questions used in the final survey accurately captured the desired information from the respondents in an efficient and effective manner.

Data quality control

In order to maintain the highest standards of data quality, an intensive training programme was provided to the data collectors with the aim of minimising technical and observer-based bias. The collection of data was carried out using a structured paper based questionnaire, which was administered by interviewers in accordance with strict guidelines and protocols.

To ensure that the process was conducted in a manner that was both ethical and appropriate, three qualified nurses were recruited to serve as data collectors, while two additional nurses served as supervisors. The training programme, which lasted for one full day, was designed to cover all relevant aspects of the study, including detailed information on the purpose of the research, specific

details of the questionnaire and maintaining strict confidentiality in line with ethical standards.

To further strengthen the accuracy of data collection, the structured questionnaire was translated into Amharic, a language spoken in the study area, and then back-translated into English to ensure a high level of precision and accuracy. The content validity of the tool was assessed by subjecting it to a rigorous review process by relevant professionals to ensure that it aligned with the conceptual framework of the research area.

Prior to the actual survey, a pilot study was conducted using the translated Amharic version of the questionnaire in order to pretest its efficacy. Feedback from this process was used to refine and modify the questionnaire accordingly. The reliability of the tool was also assessed using a test-retest method to ensure that it could deliver consistent results over time.

Data processing and analysis

The data were collected by using paper-based questionnaire, checked for completeness and consistency, and then entered into Epidata V.3.1. The data were cleaned, coded and finally exported to the SPSS software V.25 for analysis.

Descriptive statistics were used to describe the study population and relevant variables. Logistic regression was fitted to identify the association between dependent (FV consumption) and independent variables. The analysis was conducted to select candidate variables for the initial multivariable model. Those variables that showed an association with FV consumption at a $p < 0.2$ were included in an initial multivariable logistic regression model.

Both crude and adjusted ORs (AOR) with their corresponding 95% CIs were used to determine the strength of the association. Assumptions of logistic regression were checked before the final multivariable analysis using probability bivariable graphs and collinearity diagnostics (variance inflation factor and correlation matrix).

The final multivariable model's goodness of fit was checked using the classification table percentage, Hosmer-and-Lemeshow χ^2 test and log-likelihood χ^2 test. A $p < 0.5$ was used to declare the statistical significance of the findings in this study. The results were presented using text, tables and graphs based on the types of data.

Patient and public involvement

None.

RESULTS

Sociodemographic characteristics of respondents

Of the 285 candidates approached for the study, an impressive 267 individuals completed and returned the prepared questionnaires, resulting in an outstanding response rate of 93.6%. The median age of the respondents was 50 years old, and their IQR spanned a period of 11 years. In terms of family size, the minimum number observed was two members, and the maximum was seven. Primary or high school attendance was common among

Table 1 Sociodemographic characteristics of respondents of patients with type 2 diabetes attending health services at selected health centres of Yeka subcity, Addis Ababa, Ethiopia, 2022

Variables	Category	Frequency	Per cent
Gender	Male	135	50.6
	Female	132	49.4
Educational status	Non-formal education	37	13.9
	Primary and high school	132	49.4
	Higher education	98	36.7
Marital status	Married	232	86.9
	Single/divorced/widow	35	13.1
Head of family	Father	205	76.8
	Mothers	52	19.5
	Daughter/son	10	3.7
Who prepared food	House wife	134	50.2
	Servant	133	49.8
Having information	Yes	104	39
	No	163	61
Primary source of information	Health workers	52	50.2
	Television	39	37.9
	Book/magazine	12	11.7

132 (49.4%) of the respondents, while a significant majority of 232 (86.9%) had not undergone any formal education. The prevailing head of household role was held by fathers, representing 205 individuals (76.5%), whereas a smaller group of approximately 35 individuals (13.1%) were widowed, single or divorced. The data obtained revealed that approximately 104 respondents (39%) had knowledge about FV consumption habits, with most obtaining their information from healthcare providers (52 individuals, representing 50.2%) (table 1).

Socioeconomic and psychosocial-related variables

The study's findings suggest that a significant majority of the 267 respondents (138 individuals or 51.7%) had easy access to fruits and vegetables. Moreover, 142 individuals (53.2%) reported being able to afford the cost of these foods. However, perceptions of fruits and vegetables as preferred foods for patients with diabetes were not widely held, with 147 individuals (65.2%) indicating otherwise. Likewise, a majority of respondents (147 individuals or 55.1%) believed that FV consumption could increase blood sugar levels, although most of them (150 individuals or 56.2%) were not deterred from consuming these foods. While approximately 122 individuals (45.7%) had previously received dietary counselling, only 96 individuals (36%) had been advised on the preferability of fruits and vegetables. A majority of the respondents (191 individuals or 71.5%) appeared to be unaware of the WHO's

Table 2 Socioeconomic and psychosocially related variables: respondents of patients with type 2 diabetes attending health services at selected health centres in Yeka Sub city, Addis Ababa, Ethiopia, 2022

Variables	Category	Frequency	Per cent
Accessibility	Yes	138	51.7
	No	129	48.3
Affordability	Yes	142	53.2
	No	125	46.8
Perceived FV as preferable	Yes	93	34.8
	No	174	65.2
Perceived FV as increase blood glucose	Yes	147	55.1
	No	120	44.9
Consuming without fear	Yes	150	56.2
	No	117	43.8
Having counselling on food	Yes	122	45.7
	No	145	54.3
Counsellor address FV merits	Yes	96	36
	No	171	64
Aware WHO recommendation on FV	Yes	76	28.5
	No	191	71.5
FV, fruit and vegetable.			

recommendations regarding FV consumption practices (table 2).

Self-report for the reason of not consuming FV consumption

In this study, about 75 (37.9%) of respondents were not consuming FV due to disliking eating FVs.

The magnitude of FV consumption

The findings of this study revealed that the magnitude of FV consumption among patients with diabetes was 25.8% (20.9%–31.5%).

Factors associated with FV consumption

First, binary logistic regression was conducted to select potential candidate variables for multivariable logistic regression. The variables with a $p < 0.25$ were selected as candidates for multivariable logistic regression. Those variables are age, sex, income, who prepared food, having information about the availability and affordability of FV, perceiving FV as preferable, perceiving FV as increasing blood sugar, consuming without fear, having to counsel, taking action by the counsellor and being aware of the WHO recommendation.

Next, multivariable logistic regression was computed between dependent variables and selected candidate variables. Before interpretation, the fitness of the model was

checked. Finally, the remaining variables were declared to have a $p < 0.05$ and marked as variables associated with FV consumption. Those variables are who prepared food, having information about FV, accessibility of FV, affordability to buy FV, perceiving FV as preferable and awareness of WHO recommendations.

According to the findings of this study, the person who prepared food was a predictor of FV consumption. Patients who ate food prepared by servants were 2.23 times more likely to consume less than the recommended amount of FVs as compared with patients who ate food prepared by housewives (AOR 2.23, 95% CI 1.01 to 4.97). Similarly, having information about FV is one of the factors associated with FV consumption. According to the findings of this study, respondents who had no information were 4.38 times more likely to consume less than the recommended amount of FV as compared with those who had information (AOR 4.38, 95% CI 1.88 to 10.15).

Accessibility and affordability of FV are other factors identified during this study. Based on our findings, the respondents who had difficulty accessing FV were 4.54 times more likely to consume less than the recommended amount of FVs as compared with those who could easily access them (AOR 4.54, 95% CI 2.05 to 10.09). In a similar way, respondents who could not afford to buy FV were 2.32 times more likely to consume less than the recommended amount of FV as compared with those who could afford to buy it (AOR 2.32, 95% CI 1.05 to 5.18).

Perceiving FVs as preferable for diabetes cases and other factors associated with FV consumption. According to this finding, respondents who did not perceive FV as a preferable food for diabetics were 4.51 times more likely to consume less than the recommended amount of FV as compared with those perceived as preferable (AOR 4.51; 95% CI 2.13 to 9.54). Regarding the awareness of the WHO recommendation on FV, it is identified as another important factor associated with FV. The findings of this study revealed respondents who were aware of WHO recommendations were less likely to consume less than the recommended amount of FV as compared with those who had no awareness (AOR 0.25, 95% CI 0.11 to 0.55) (table 3).

DISCUSSION

The finding of this study revealed that the magnitude of FV consumption among people with T2DM was 25.8% (with a 95% CI 20.9% to 31.5%). This finding is consistent with other research from other parts of the world, including Nigeria¹⁷ and Brazil,³¹ where FV intake rates were reported to be 27.0% and 23%, respectively. Additionally, other research conducted on both vegetable and fruit consumption revealed a rate of 25.5%.³² These findings emphasise the significance of studying dietary patterns, especially for those with chronic conditions such as diabetes. This implies that consuming FVs significantly impacts glycaemic control in individuals

Table 3 Factors associated with fruit and vegetable (FV) consumption among patients with type 2 diabetes attending health services at selected health centres in Yeka Sub City, Addis Ababa, Ethiopia, 2022

Variables	Category	FV consumption		COR (95% CI)	AOR (95% CI)	Value
		Less than recommended	Recommended amount			
Who prepared the food?	Housewife	84	50	1	1	
	Servant	114	19	3.57 (1.96 to 6.49)	2.23 (1.01 to 4.97)	<0.05
Having information	Yes	69	35	1	1	
	No	129	34	1.92 (1.10 to 3.35)	4.38 (1.88 to 10.15)	<0.002
Accessibility of FV	Yes	86	52	1	1	
	No	112	17	3.98 (2.15 to 7.37)	4.54 (2.05 to 10.09)	<0.001
Affordability(cost)	Yes	83	42	1	1	
	No	115	27	2.15 (1.23 to 3.77)	2.32 (1.04 to 5.18)	<0.050
Perception of the preferability of vegetables and fruits	Good	99	51	1	1	
	Not good	99	18	4.89 (2.73 to 8.76)	4.51 (2.13 to 9.54)	<0.001
Awareness of the WHO recommendation	Yes	42	34	0.27 (0.15 to 0.49)	0.25 (0.11 to 0.55)	<0.002
	No	156	35	1	1	

AOR, adjusted OR; COR, crude OR.

with T2DM. Dietary fibre, particularly soluble fibre such as viscous β -glucan, affects satiety, glucose, insulin responses and gut hormone responses. Consumption of dietary fibre is inversely related to T2DM progression.³³

However, the fruit consumption rate found in this study of individuals with diabetes was higher than that reported in other studies conducted in different regions. For instance, it was found to be greater than the rate seen in a study conducted in Peru (8.5%),³² as well as the study conducted in Uganda, which found a rate of 12.2%.¹⁸ Additionally, other studies have reported even lower fruit intake rates, with one study observing only a 3.8% consumption rate.³⁴ There are several factors that may contribute to these disparities, including variations in sociodemographic factors or methodological approaches. For instance, in this study, all participants were residents of urban areas with moderate income levels. It is possible that the study conducted in Uganda, which included both urban and rural participants, may have influenced the magnitude of FV intake seen in that population.

Additionally, it is worth noting that the fruit intake rate observed in this study was lower than that seen in studies conducted in other regions. For instance, the study conducted in Delhi reported a rate of 33.3%,⁷ while another study from Brazil, which focused on boys specifically, reported an even higher consumption rate of 36.7%.³¹ However, these differences could be attributed to various factors, such as differences in sample size, sociodemographic status or methodological approaches employed across studies. It is also possible that food culture and availability could play an important role in shaping these dietary patterns. For example, food culture varies widely across different countries and regions, and

cultural practices may shape the choices and preferences for certain types of foods.

An interesting finding of this study was that the individual who prepared food was found to be a predictor of FV consumption. Specifically, our analysis revealed that when households employed home servants for food preparation, the odds of consuming lower amounts of fruits and vegetables increased. This finding is somewhat inconsistent with previous research, which may not have included this variable or may not have explored its potential impact on dietary patterns.

The study underscores the importance of being informed about the benefits of FV consumption, as well as other contributing factors that can impact dietary patterns. Our findings indicate that having access to, and absorbing this information, has a protective effect on FV intake. This is in line with research conducted in Korea, which found a similar relationship between having knowledge about healthy eating habits and behaviours.²⁶ However, it is worth noting that the level of information provided was not measured in that study.

The importance of accessibility cannot be overstated, particularly in light of the potential challenges that individuals may face in obtaining fresh fruits and vegetables. That is why our finding indicated respondents who have difficulty accessing fruits and vegetables were 4.54 times more likely to consume less than the recommended number of fruits and vegetables compared with individuals who have easy access to them. This finding is consistent with the results of a similar study conducted in Jakarta and Bogor.²⁹

Recent studies have shed light on the critical role that affordability plays in FV consumption among at-risk populations. In fact, a lack of financial resources was found

to be a significant factor that was associated with lower levels of FV intake. The findings of our study indicate that those who face difficulty in purchasing FV are more likely to consume less than the recommended amount, a trend that has also been observed in studies conducted in other regions including Malaysia and SSA.^{24 25}

Our study has shown that perceptions play a significant role in FV consumption among at-risk populations. Specifically, our findings indicate that individuals who do not perceive FV as preferable for managing diabetes are more likely to consume less than the recommended amount. These findings are consistent with previous studies conducted in regions such as Korea, which have identified similar patterns of perception regarding the role of FV in managing disease.^{26 28 35}

The level of awareness regarding WHO recommendations on FV consumption is directly linked to the overall knowledge level of individuals. Our study has revealed that those who were not aware of WHO's recommendations had higher odds of consuming less than five servings of FV per day as compared with those who were aware. This finding is consistent with previous research conducted in various regions, including Korea, which has identified a similar trend.^{26 28}

LIMITATIONS OF THE STUDY

This study is limited to assess perception of participants by standard tools. In addition, since the study depends on self-report, there might be social desirability and recall bias from respondents. Also, study was not out of the limitations of cross-sectional study like identifying the temporal relationship.

CONCLUSION AND RECOMMENDATION

According to our study, only a mere one-fourth of the participants consumed the recommended number of fruits and vegetables, which is five or more servings per day. Eating food prepared by servants, having no information, difficulty accessing FV, not affording to buy FV, not perceiving FV as a preferable food for diabetics, having awareness about WHO recommendations on FV were factors significantly associated with FV consumption among people with T2DM.

It is clear that effective counselling and education campaigns are necessary in order to promote healthy eating habits and increase awareness about the critical role that fruits and vegetables play in maintaining optimal health for individuals living with diabetes. This should not be limited to just those living with diabetes but for everyone in general, as it can lead to an overall healthier lifestyle. To accomplish this, it is recommended that nutritional education is provided to home servants as well to promote healthy eating within households. Additionally, media coverage should be improved to make information about FV benefits, availability and healthy recipes more accessible to the general public.

More over, it is important to conduct qualitative research to explore how those associated factors influence FV consumptions of people with T2DM including identification of suitable and non-suitable FV in local context since some of the FV are full of sugar. Finally, improvements to the market system are needed in order to make fruits and vegetables more accessible and affordable for everyone. By taking a multifaceted approach involving education programmes, targeted campaigns and collaboration among multiple stakeholders such as healthcare professionals, policy-makers, food retailers and NGO's, we can ensure optimal health outcomes for at-risk populations.

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Contributors BH, TBE, LW, AOL and EKB participated in the conception and design of the study. BH, ATS and TAR carried out the data collection. BH, TBE, LW and EKB participated in the data analysis and interpretation. BH, ATS and LW drafted the manuscript, and TBE and EKB reviewed and edited it. EKB act as guarantor. All authors read and approved the final manuscript.

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Patient consent for publication Consent obtained directly from patient(s).

Ethics approval This study involves human participants and ethical approval for this study was obtained from the Institutional Review Board (IRB) of Addis Ababa Health Bureau with reference number 209/2022. Participants gave informed consent to participate in the study before taking part.

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