Ethiopian Journal of Medical and Health Sciences
2023, Volume 3, Issue 1
https://journals.hu.edu.et/hu-journals/index.php/ejmhs

Open Access
ISSN (online): 2789-7087

Original Article

Glycemic control and its predictors among ambulatory type 2 diabetic patients attending the diabetic clinic of Hawassa University Comprehensive Specialized Hospital, Ethiopia

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Abstract

Background: Glycemic control remains the major focus in the management of type 2 diabetes mellitus. Poor glycemic control constitutes a major public health problem and a risk factor for the development of acute and chronic diabetes complications. This study aimed to assess glycemic control and its predictors among adult diabetic patients attending Hawassa Comprehensive Specialized Hospital (HUCSH), south Ethiopia.

Methods: A hospital- based cross-sectional study was conducted among 185 type 2 diabetes patients attending the diabetic clinic at HUCHS from June 1, 2021 to August 31, 2021. A systematic sampling technique was used to select patients identified based on clinical diagnosis. The data was collected via a structured questionnaire first, followed by a review of the patients' medical records. Descriptive statistics and logistic regression analyses were carried out. Logistic regression analysis identified predictors of glycemic control based on variables with a p-value below 0.05.

Results: The prevalence of poor blood glucose control among adult ambulatory type 2 diabetes patients were 70% (95% confidence interval [CI]: 63% - 76%). The median of 3-months fasting blood sugar (FBS) was 149mg/dl (IQR =88, ranging from 70 to 349 mg/dl. Factors associated with good glycemic control were adequate physical activates (adjusted odds ratio (AOR) = 14.26, 95% CI = 3.31–61.47) and treatment with metformin anti-diabetic medication (AOR = 8.20, 95% CI = 1.97–34.04).

Conclusion: Glycemic control status of patients with type 2 diabetes was generally poor. Participants who had adequate physical activities and anti-diabetic treatment with metformin had significantly higher odds of good glycemic control. Educational strategies should focus on optimizing glycemic control approaches that lead to better overall health and reduced risk of complications associated with poorly managed diabetes.

Keywords: type 2 diabetes mellitus, glycemic control, predictors, Ethiopia

Introduction

Diabetes mellitus is a chronic condition characterized by the inability of the pancreas to produce insulin or the body's inability to effectively utilize the insulin it produces (1). This leads to resistance to insulin and intolerance to glucose, resulting in elevated blood sugar levels (hyperglycemia) and disruptions in lipid and protein metabolism. Over time, these metabolic abnormalities can lead to complications such as cardiovascular disease, retinopathy, nephropathy, and neuropathy (2). There are three main types of diabetes. Type 1 diabetes is characterized by a complete lack of insulin production. Type 2 diabetes primarily results from insulin resistance, where the body does not respond properly to insulin. Gestational diabetes occurs during pregnancy and usually resolves after childbirth (3).

Four recommended diagnostic tests for diabetes include measuring fasting plasma glucose levels, 2-hour post-load plasma glucose levels after an oral glucose tolerance test, hemoglobin A1c (HbA1c) levels, and random blood glucose levels with symptoms. Diabetes is diagnosed if fasting glucose is ≥7.0 mmol/l (126 mg/dl), 2-hour post-load glucose is ≥11.1 mmol/l (200 mg/dl), HbA1c is ≥6.5% (48 mmol/mol), or random blood glucose is ≥11.1 mmol/l (200 mg/dl) with symptoms (4).

In the past few decades, non-communicable diseases (NCDs) have gained significant attention globally, particularly in low- and middle-income countries (LMIC). Among these diseases, diabetes mellitus has emerged as a major global health issue. According to the Centers for Disease Control and Prevention (CDC), the diabetes community has three choices: prevention; management through diet, exercise, self-monitoring of blood glucose levels, and medication (when necessary); and improved care to prevent severe complications (5-6).

The global surge in diabetes results from a mix of socioeconomic, demographic, environmental, and genetic factors. The rise, mainly in type 2 diabetes, is linked to factors like obesity, poor diets, and inactivity. Additionally, childhood-onset type 1 diabetes is increasing due to urbanization and lifestyle changes, including higher calorie intake and sedentary habits (1).

Proper glycemic control is crucial for preventing diabetes complications. International guidelines highlight glycated hemoglobin (HbA1c) measurement as the preferred monitoring parameter. HbA1c values within the past three months reflect a patient's glycemic status. Lowering HbA1c significantly reduces the risk of complications and overall mortality. Early and adequate glycemic control improves macrovascular outcomes and minimizes diabetes-related issues, emphasizing the importance of managing HbA1c levels (8, 2). Alternatively, HgA1c levels above 7% (equivalent to > 53mmol/mol) are strongly associated with an elevated risk of both macrovascular and microvascular complications, regardless of the primary treatment used (2). Present calculations indicate that approximately 50% of individuals with diabetes are unable to reach and sustain the recommended target for glycemic control (9).

Glycemic control in type 2 diabetes is influenced by clinical (age, sex, genetics) and non-clinical factors (lifestyle, education, obesity). Management is impacted by both modifiable and non-modifiable elements. (8). Poor glycemic control results from various factors, including delayed insulin therapy, treatment non-adherence, and lifestyle choices like diet and

exercise, creating a complex and multifaceted challenge to manage blood glucose levels (8-10). A study found that diabetes duration, age, family history, job, education, drug use, BMI, abdominal circumference, hypertension, glucose levels, and lifestyle factors influence glycemic control. Poor control correlates with complications, emphasizing the importance of addressing these factors for better outcomes. (10).

Female gender, older age, overweight, larger waist circumference, HIV infection, chronic diseases, and longer diabetes duration are linked to increased risk of poor blood sugar control. These factors independently predict uncontrolled glycemia (7). Unemployed individuals, those lacking family or social support, and those with limited knowledge about diabetes were more likely to experience poor glycemic control (11). Although the occurrence of diabetes mellitus is becoming more common in Ethiopia, there have been only a limited number of studies investigating the status of glycemic control and its contributing factors. As a result, the objective of this study was to identify the factors that contribute to adequate glycemic control among diabetic patients who visit Hawassa Comprehensive Specialized Hospital in Sidama, Ethiopia.

Methods and materials

Study design, period and Study area

A hospital-based cross-sectional study was conducted at Hawassa University Comprehensive Specialized Hospital (HUCSH) from June 1, 2021 to August 31, 2021. The hospital is located in Hawassa City of Sidama region, Southern Ethiopia, which is situated 275 km away from Addis Ababa, the capital city of Ethiopia. It serves over a hundred thousand attendees annually from adjacent zones and regions such as Sidama, Oromia, Southern Nations, Nationalities, and Peoples, as well as Somalia. At the time of the study, 622 diabetic patents were on follow up at the diabetic clinic with three specialized doctors. The hospital has a capacity of 480 beds for inpatient services and operates a diabetic clinic that serves the southern part of Ethiopia.

Population

The source population consisted of all adult ambulatory type 2 diabetic patients who visited the diabetic clinic of HUCSH. The study population were randomly selected type 2 diabetic patients who visited the diabetic clinic of HUCSH at the time of the study.

Inclusion Criteria

- Patients who had willingness to participate;
- Patient aged ≥18 years;
- Patients who had complete medical records;
- Patients diagnosed with type 2 diabetes and had at least 3 months consecutive follow-up;
- Ambulatory patients who were taking at least one antidiabetic drug.

Exclusion Criteria

- Patients who were not fasting.

Sample size and sampling technique

The sample size for our study was calculated using a single population proportion formula with the assumption of a 5% margin of error, a 95% level of confidence, and a prevalence of poor glycemic control at Tikur Anbessa Specialized Hospital estimated to be 68.3% (8). The calculation resulted in a sample size of 333. However, considering that the expected number of the source population (N) was 391, finite-population adjustments were made to obtain the required minimum sample size. A 10% non-

response rate was also considered. Consequently, a total of 198 patients were included in the study.

The data for this study was collected from the registered information at HUCSH. From this information, it was found that approximately 391 patients with type 2 diabetes age > 18years were actively attending follow-up clinics based on their appointments during three months. To determine the sampling interval (k^{th} interval), the total number of patients (391) was divided by the desired sample size (198), resulting in a value of 1.97, which was rounded up to 2. Using a lottery system, the first participant with type 2 diabetes was randomly selected. Subsequently, every second patient after the initial selection was included as a study participant. This sampling procedure was conducted each day throughout the data collection process.

Data collection procedure and tools

The data collection for this study involved two components. The first component consisted of conducting patient interviews, while the second component involved a retrospective review of patient charts spanning a three -month period for each patient. To collect the data, a structured questionnaire and an abstraction format were used, which were developed after reviewing relevant literature (11, 12, 13). During three consecutive months of follow-up visits, fasting blood glucose levels were measured. The average of three measurements taken over this period was then calculated to determine the level of glycemic control. Weight was measured to the closest 10 g using a beam balance with the individuals standing without shoes and wearing light clothes. Similarly, individuals' heights were measured to the closest 0.1 cm when erect and with their heads in the Frankfort plane. The adults' BMI was then estimated by dividing their body weight by their height in square metres (kg/m^2). The questionnaire was translated into three local languages, namely *Afan Oromo*, *Sidaamu Afoo*, and Amharic, and interviews were conducted to collect patient data including socio-demographic characteristics, medication adherence, self-care activities, and family history of diabetes, smoking status, alcohol consumption, and chat chewing habits. Additionally, certain clinical data, current therapeutic regimen, and laboratory values were obtained from each patient's medical records, with informed consent obtained prior to data collection.

Variables of the study

Dependent variable

- Glycemic control (poor or good)

Independent variables

- Socio-demographic variables (age, sex, educational status, marital status, occupation, monthly income)
- Clinical factors (duration of diabetes, family history of diabetes, type of diabetes, comorbidities)
- Medication-related variables (type of antidiabetes medication and Polypharmacy)
- Diabetes self-care practice and knowledge factors (self-monitoring of blood glucose [SMBG])
- Adherence to antidiabetic medication
- Knowledge of target blood sugar
- Personal knowledge of diabetes
- Diet adherence, physical activity, alcohol use, chewing chat and smoking status.

Operational definition

- Glycemic Control level: the glycemic control of each patient is categorized as good if the 3-month average FBS ranged from 80 to 130 mg/dl; a value >130 mg/dl is considered to indicate poor glycemic control (14). If fasting blood sugar is below 70 mg/dL, it is generally

considered low and may indicate hypoglycemia (low blood sugar).

- FBS- is the level of blood sugar measured after at least 8 hours of fasting (14).

- Physical Activity: patients with diabetes who participated in at least 30 min of physical activity daily or participated in a specific exercise session were considered to have adequate physical activity; otherwise, the patient was classified as having inadequate physical activity.

- SMBG: patients who performed SMBG at their respective home for >3 days during the last 7 days were considered to have performed SMBG.

- Medication adherence: patients who took all the prescribed antidiabetic medications during the last 7 days were considered to be medication adherent.

- Co-morbidity: patients with any chronic disease that coexisted with their diabetes were considered to be co-morbid (15).

- Polypharmacy: polypharmacy is defined as the use of ≥5 medications(16).

- BMI: BMI was classified as underweight (<18.5 kg/m^2), normal weight (18.5–24.9 kg/m^2), overweight (25.0–29.9 kg/ m^2) or obese (≥30.0 kg/m^2) (17).

Data quality management

A pre-test was done on twenty patients, some weeks before data collection had been started to check for uniformity and understandably of the checklist. The final tool was developed with some modifications after a thorough and deep review of inputs obtained during the pre-test. The pre-tested patients were excluded from the analysis. The principal investigator gave one-day training for data collectors on study's purpose, how to conduct a patient interview and collect data from the patient chart. The principal investigator was closely supervising the data collection process and gave feedback and correction daily to make sure the quality of data was maintained. Participants with incomplete data were excluded from the analysis.

Data processing and analysis

At the beginning, completeness and consistencies of the data were checked, then entered into EpiData and exported to IBM SPSS Statistics version 25. Descriptive statistics were utilized to analyze socio-demographic variables and relevant clinical data. Categorical variables were described using frequencies and percentages, while continuous variables were expressed as means and standard deviations. Variables with a p-value $\leq$ 0.25 in the bivariate analysis were included in the multivariate binary logistic regression analysis. Lastly, variables with a p-value < 0.05 were considered statistically significant. To assess the strength of association, odds ratios (ORs) with 95% confidence intervals (CIs) were calculated for each variable. The results were summarized and presented using tables and figures.

Results

Socio-demographic characteristics of study participants

A total of 198 patients were involved in our study, among which 185 were candidates for analysis. Among the 185 participants, 93 (50.3%) were females. The median age of the study population was 50 years, with interquartile range of 16. The age range varied from 19 to 95 years. The majority of participants, 157 (84.9%), were married. Furthermore, 94 participants (50.8%) had received education up to diploma and above. Occupational analysis revealed that 91 (49.2%) of the patients were merchant/self-

employed, followed by 51 (27.6%) who were employees. Additionally, 91 (49.2%) patients reported a greater than 10360 birr of monthly family income (Table 1).

Table 1: Socio-demographic characteristics of type 2 diabetes patients attending the diabetic clinic of HUCSH, Hawassa, Ethiopia (n=185)

Variable	Category	Number (%)
Sex	Male	92(49.7)
	Female	93(50.3)
Age (in years)	18-40	50(27)
	41-60	102(55.1)
	>60	33(17.8)
Marital status	Single	7(3.8)
	Married	157(84.9)
	Divorced	5(2.7)
	Widowed	16(8.6)
Educational status	Unable to read and write	19(10.3)
	Primary school (grade 1-8)	44(23.8)
	Secondary school (grade 9-12)	28(15.1)
	Higher education (Diploma and above)	94(50.8)
Occupation	Farmer	19(10.3)
	Merchant/self-employed	91(49.2)
	Employee	51(27.6)
	Housewife	16(8.6)
	Student	2(1.1)
	Retirement	6(3.2)
Monthly family income (ETB)*	Very low (≤1585)	13(7.0)
	Low (1586-5347)	8(4.3)
	Average (5348-8016)	36(19.5)
	Above average (8017-10359)	37(20.0)
	High (>10360)	91(49.2)

ETB, Ethiopian birr; *Based on Ethiopian Civil Service monthly salary scale for civil servants

Diabetes self-care activities of participants

The findings related to the study participants' smoking, alcohol consumption, khat chewing habits, self-care activities, drug adherence, and knowledge of optimum blood sugar are presented in Table 2. The majority of the study participants never smoked (97.8%), never consumed alcohol (78.9%), and never chewed a khat (93.5%). Additionally, 65.4% of participants had good drug adherence, and 83.2% of patients possessed knowledge of optimum blood sugar.

Table 2: Diabetes self-care activities and knowledge characteristics of type 2 diabetes patients attending diabetic clinic of HUCSH, Hawassa, Ethiopia (n=185).

Self-care activities	Category	Number (%)
Smoking status	No, never	181(97.8)
	Yes, previously	4(2.2)
	Yes, currently	0
Alcohol consumption	No, never	146(78.9)
	Yes, previously	27(14.6)
	Yes, currently	12(6.5)
Chat chewing status	No, never	173(93.5)
	Yes, previously	12(6.5)
Diet adherence	Good	146(78.9)
	Poor	39(21.1)
Physical activity	Adequate	112(60.5)
	Inadequate	73(39.5)
Drug adherence	Yes	121(65.4)
	No	64(34.6)
Knowledge of optimum blood sugar	Yes	154(83.2)
	No	31(16.8)

Clinical characteristics of patients

Among the study participants, the majority (69.2%) had a healthy weight, while 90.3% had disease duration of less than 10 years. The median of 3-months fasting blood sugar was 149 with interquartile range of 88 ranging from 70 to 349 mg/dl. Table 3 shows that 47.0% of the patients had comorbidity, with hypertension being the most common condition (constituting 75.9% of those with comorbidities). Regarding the use of antidiabetic medications, 30.8% of participants were taking metformin combination with glibenclamide. Only small proportions

(18.4%) of the patients were on polypharmacy, using multiple antidiabetic medications simultaneously (Table 3).

Blood glucose control status

Figure 1 shows that 70% of adult ambulatory type 2 diabetes patients (95% confidence interval [CI]: 63%, 76%) had an average FBS value of >130 mg/dl in the past three months, indicating poor glycemic control.

Factors associated with blood glucose control

Based on the results of bivariate analysis, gender, age group, alcohol consumption, diet adherence, physical activity, antidiabetic medications, and polypharmacy were significant at p-value $\leq$ 0.25 and identified as candidate variables for multivariable analysis.

Table 3: Clinical characteristics of type 2 diabetes patients attending the diabetic clinic of HUCSH, Hawassa, Ethiopia (n=185)

Clinical characteristics	Category	Number (%)
BMI	Underweight	4(2.2)
	Healthy weight	128(69.2)
	Overweight	46(24.9)
	Obese	7(3.8)
3 months average FBS (mg/dl)	80-130	56(30)
	>130mg/dl)	129(70)
Duration of DM (years)	<10	167(90.3)
	≥10	18(9.7)
Family history of DM	Yes	4(2.2)
	No	181(97.8)
History of DKA/HHS	Yes	36(19.5)
	No	149(80.5)
Presence of comorbidities	Yes	87(47.0)
	No	98(53.0)
Types of comorbidities	HTN	66(75.9)
	HF	5(5.7)
	IHD	4(4.6)
	HTN + IHD + CKD	4(4.6)
	HTN + CKD	4(4.6)
	HTN + Dyslipidemia + HIV	3(3.4)
	HTN + stroke	1(1.2)
Antidiabetic medication	Insulin	49(26.5)
	Metformin	31(16.8)
	Metformin + Insulin	48(25.9)
	Metformin + Glibenclamide	57(30.8)
Polypharmacy	Yes	34(18.4)
	No	151(81.6)

BMI, body mass index; FBS, fasting blood sugar; DM, diabetes mellitus; DKA, diabetic ketoacidosis; HHS, hyperosmolar hyperglycemic state; HTN, hypertension; HF, heart failure; IHD, ischemic heart disease; HIV, human immunodeficiency virus

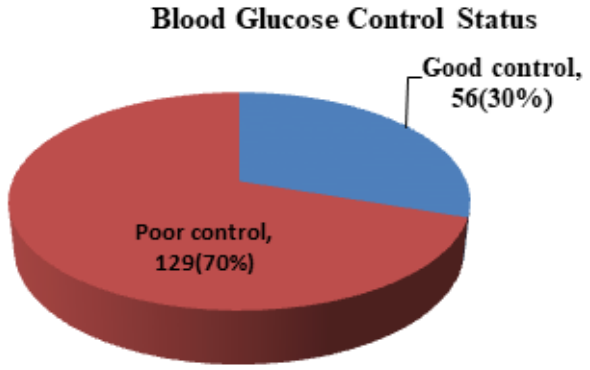

Figure 1: Blood glucose control status of type 2 diabetes patients attending the diabetic clinic of HUCSH, Hawassa, Ethiopia (n=185)

After controlling for various demographic and clinical factors, this study found that only physical activity and the use of metformin had significant associations with blood glucose control. In a multivariable analysis (Table 4), good glycemic control was found to be 14.26 times higher among diabetic patients with adequate physical activities (AOR = 14.26, 95% CI = 3.31–61.47). Similarly, diabetic patients with the treatment of metformin anti-diabetic medications control their blood sugar level better (AOR = 8.20, 95% CI = 1.97–34.04) than diabetic patients with the treatment of insulin anti-diabetic medications.

Table 4: Bivariate and multivariate logistic regression analysis of factors associated with blood glucose control among type II diabetic patients attending diabetic clinic of HUCSH, Hawassa, Ethiopia (n=185)

Variables	Glycemic control		OR (95% CI)		P-value
	Good	Poor	Crude	Adjusted	
Diet adherence					
Good	55(37.7)	91(62.3)	22.97(3.07, 172.0)	7.63(0.83,70.05)	0.073
Poor	1(2.6)	38(97.4)	1	1	
Alcohol consumption					
No, never	50(34.2)	96(65.8)	2.60(0.55, 12.35)	-	
Yes, previously	4(14.8)	23(85.2)	0.869 (0.14, 5.55)	-	
Yes, currently	2(16.7)	10(83.3)	1	-	
Physical activity					
Adequate	52(46.4)	60(53.6)	14.95(5.11, 43.77)	14.26(3.31, 61.47)	0.001*
Inadequate	4(5.5)	69(94.5)	1	1	
Anti-diabetic medications					
Metformin	18(58.1)	13(41.9)	1.85(0.74, 4.59)	8.20(1.97, 34.04)	0.004*
Metformin + Insulin	6(12.5)	42(87.5)	0.19(0.07, 0.53)	0.39(0.13, 1.18)	0.094
Metformin + Glibenclamide	11(19.3)	46(80.7)	0.32(0.13, 0.76)	0.510(0.20, 1.32)	0.165
Insulin	21(42.9)	28(57.1)	1	1	
Polypharmacy					
Yes	6(17.6)	28(82.4)	0.43(0.17, 1.11)	0.90(0.29, 2.76)	0.856
No	50(33.1)	101(66.9)	1	1	

*Statistically significant at $p<0.05$; OR, odds ratio; CI, confidence interval

Discussion

Glycemic control is crucial for managing type 2 diabetes mellitus, but poor control is a widespread concern among patients and a risk factor for complications (12). The aim of this study was to assess glycemic control and its influencing factors among type 2 diabetic patients at Hawassa University Comprehensive Specialized Hospital in southern Ethiopia. The prevalence of poor blood glucose control among adult ambulatory type 2 diabetes patients was 70%. The mean fasting blood glucose level was found to be 163±61.9 mg/dl. This value was comparable to a previous study conducted in Malaysia (17) where the level was 166.5±86.4 mg/dl. However, it was lower than the findings from a study at Debre Tabor General Hospital in northwest Ethiopia (12) and a prospective observational study at Mettu Karl Referral Hospital in southwest Ethiopia (13). The differences in results might be due to variations in sample sizes, as our study included a smaller number of participants.

Due to shared risk factors, individuals with type 2 diabetes mellitus are more likely to experience complications such as cardiovascular problems, end-stage renal disease, and hypertension (18). In our study, 87 patients (47%) were found to have comorbidities, which aligns closely with a study conducted at Shanan Gibe Hospital in southwest Ethiopia (51.7%) (19). However, our findings were higher than a study conducted in Tigray, northern Ethiopia, which reported a comorbidity rate of 33.8% (20). This variation could be attributed to differences in the study design, as the Tigray study used an unmatched case control approach. Among the different types of comorbidities, hypertension was the most prevalent, accounting for 75.9% and consistent with studies conducted in the USA (21) and Turkey (22).

In our study, we discovered that 69.7% of our patients had uncontrolled blood glucose levels. This result is similar to findings from studies conducted at Tikur Anbessa Specialized Hospital in Ethiopia (8) and Debre Tabor General Hospital (12), which reported rates of 68.3% and 71.4% respectively. However, our study found a lower rate compared to a study conducted in southeastern Nigeria (23), which reported a rate of 83.3%. The difference in rates may be attributed to the fact that the Nigerian study only included patients over 30 years of age.

The identification of risk factors for blood glucose control is crucial for identifying high-risk patients who need close monitoring. In the present study, poor diet adherence was not independently associated with glycemic control. This finding was contrary to studies conducted in Ethiopia (24), Brazil (25), and Malaysia (26). Evidence-based nutrition guidelines for diabetes prevention and management recommend a diet low in carbohydrates and high in fiber. However, the choice of diet should consider various factors, including overall nutritional quality, patient preference, and diet acceptability (27).

Studies have highlighted the importance of daily physical activity in regulating blood sugar levels and preventing related health issues, even in individuals without existing conditions (1, 28). The present study also confirmed that adequate physical activity is linked to good glycemic control, a finding consistent with research conducted in Iran (29) and Ethiopia (30). The American Diabetes Association (ADA) asserts that exercise enhances blood glucose management in type 2 diabetes, lowers the risk of comorbidities, aids in weight loss, and improves overall well-being (31). Similarly, the American Association of Clinical Endocrinologists (AACE) advises patients that any form of physical activity is beneficial and encourages them to strive for increased activity levels (32).

Acute alcohol consumption does not cause clinically significant changes in blood sugar levels. However, chronic alcohol consumption in diabetic patients can lead to increased blood sugar levels (33). In this study, it was found that alcohol consumption was not associated with glucose control. This difference may due to the use of relatively smaller sample size in this study.

In this study, treatment with metformin showed significant improvement in glycemic control for type 2 diabetes patients. This result was supported by multiple studies (34-37). Metformin's ability to lower blood glucose, its affordability leading to better adherence, and lower occurrence of side effects make it the recommended first-line drug for monotherapy and combination therapy for type 2 diabetes patients according to clinical guidelines such as the American Diabetes Association (ADA) (38) and the American Association of Clinical Endocrinologists (AACE) (32). Study shows in Ethiopia, insulin therapy alone in type 2 diabetic patients has also shown to be associated with persistent poor glycemic control (39).

The present study examined glycemic control among type 2 diabetes patients in Hawassa, Southern Ethiopia, where research on this topic is limited. The findings can serve as a baseline for future studies. However, it should be noted that this study is cross-sectional, so it cannot establish causal relationships between predictors and outcomes and the small sample size that may affect the generalizability and statistical power. Additionally, the analysis only included drugs prescribed at the most recent follow-up and did not account for drug changes or discontinuations. Due to a lack of laboratory facilities, fasting blood glucose was used to assess glycemic control instead of glycated hemoglobin, which provides a more accurate measure over a 3-month period.

Conclusion

The study found glycemic control among type 2 diabetic patients to be poor. A strong link between good glycemic control and factors like adequate physical activity and taking metformin was found. Emphasizing lifestyle changes and proper medication management is crucial for improved glycemic control in type 2 diabetes. Educational efforts should target optimizing glycemic control for overall health and reduced complications. Health professionals must adhere to treatment guidelines, and there's a need for regular household visits by health workers to provide education and trace defaulters. Continuous motivation, supervision, and evaluation at diabetes facilities are essential to reduce poor glycemic control in type 2 diabetes patients.

Acknowledgement

We would like to thank Pharma College, Department of Public Health. Our gratitude typically goes to the study participants and data collectors for their valuable time, commitment, and their support in during the study. We want to express our appreciation Hawassa University's Compressive Specialized Hospital for their assistance during the conduct of the study.

Ethical considerations

A letter of ethical approval was received from the Ethical Review Board of Pharma College, School of Public Health (Ref.No: R/C/S/D/023/14, June 25, 2021). Additionally, prior permission was obtained from HUCSH, specifically the Diabetes Ambulatory Clinic. Before collecting data, informed written consent was obtained from all study participants. Each patient was informed about the study's objective and given assurance of confidentiality. Individuals were also informed that they were free to withdraw from the study at any time

without affecting their access to hospital services. To ensure patient confidentiality, patient identifiers were omitted, and instead, codes were used. The data abstraction formats did not include the patient's name or address.

Data Availability statement

The datasets analyzed during the current study are available upon reasonable request from the corresponding author. ktefera2015@gmail.com.

Conflicts of Interest

The authors declare that they have no competing interests

Funding statement

Pharma College had funded the research. The funding college had no part in study design, information gathering, and analysis, judgment to publish, or development of the manuscript.

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