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Research Article

Diabetes Prevalence and Associated Factors in the Adult Population Aged 25-64 in the Humbo Districts of Woliata Zone

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Abstract

Background: The burden of disease caused by NCDs is quickly growing in emerging nations, with substantial social, economic, and health repercussions. However, data on the prevalence of diabetes and related variables among adults aged 25-64 years in Ethiopia, particularly in drought-stricken areas, is limited. The goal of this study is to find out how common diabetes is and what variables contribute to it in the middle-aged population.

Methods: From January to February 2020, a community-based cross-sectional survey was undertaken among adults aged 25-64 years in Humbo district, southern Ethiopia. 587 people were chosen using a multi-stage sampling process. Weight, height, and fasting blood glucose levels were all measured. To enter data into a computer, Epi Data version 3.1 was utilized, which was subsequently exported to SPSS version 20 for analysis. Descriptive statistics and bivariate and multivariate logistic regression analyses were performed, and statistical significance was determined at a p-value of less than 0.05.

Results: Diabetes was found in 5.9% of the research participants (95 percent CI: 3.8-7.8). Age 45-54 (AOR = 4.80, 1.25, 18.32), physical inactivity (AOR = 5.33, 1.37, 20.72), family history of diabetes mellitus (AOR = 6.34, 95 percent CI: 2.43, 16.55), and obesity (AOR = 3.26, 95 percent CI: 1.43, 7.42) were all significantly associated with diabetes, according to multivariable logistic regression.

Conclusion: The findings demonstrated the need for implementing educational public policies to encourage population behavior changes in order to prevent and control diabetes.

Keywords: Associated Factors; Diabetes; Prevalence; Fasting Blood Glucose; Ethiopia

Introduction

Diabetes mellitus (DM) is a metabolic disorder marked by protracted hyperglycemia as a result of either insufficient insulin synthesis by the pancreas or an improper cell response to the generated insulin [1]. It is a serious problem for public health around the world and is primarily caused by lifestyle modifications [2,3]. Diabetes has various impacts on the health, socioeconomic status, and productivity of nations in general as well as individuals, particularly in urban and developed countries as opposed to rural and developing countries [4].

Diabetes was responsible for 416,000 deaths in Africa in 2021 [5]. The estimated incidence of diabetes is globally rising. According to the forecast, it will rise from 463 million people affected in 2019 to 578 million in 2030 and 700 million in 2045. In a similar trend, the total number of people with diabetes in Africa is predicted to increase by 129%, reaching 55 million by 2045 [6].

According to a report from the WHO regional office for Africa, DM is a "rapidly expanding non-communicable disease epidemic in Africa" [7]. By 2030, the WHO predicted that 1.8 million people in Ethiopia would have diabetes [8]. One of the four top priority noncommunicable diseases (NCDs) targeted for prevention and control globally is diabetes [9]. Diabetes is classified as a chronic metabolic disease that results in high blood sugar levels as a result of insufficient insulin levels, ineffective insulin use, or both. Over time, diabetes increases the risk of having life-threatening complications like retinopathy, neuropathy, nephropathy, stroke, and lower limb amputation. Type 1, type 2, and pregnancy-related (gestational) diabetes mellitus are the different types of diabetes. Type 2 diabetes, which accounts for more than 90-95% of all cases of diabetes, is the most common type of the disease and results from insulin resistance. Type 2 diabetes can be prevented if it is discovered or detected early [10].

International Diabetes Federation's (IDF) 2017 study states that in Ethiopia, 2.567 million adults in the country between the ages of 20 and 79 have diabetes (5.2%). Additionally, 30,972 deaths overall were due to diabetes, accounting for 1% of all deaths [6,11]. In 2016, the WHO reported that 3.8 percent of Ethiopia's population (4.0 percent of men and 3.6 percent of women) had diabetic morbidity [11]. In addition, Ethiopia has three-quarters (75.1%) of persons with undiagnosed diabetes mellitus, which accounts for about 1,603,100 people in 2014 [12,13]. Various studies have determined various risk factors for the development of DM. Poor eating and dietary habits, tobacco use, a lack of physical activity, overweight and obesity, excessive alcohol intake, aging, and hypercholesterolemia are the most prevalent [14-16].

In Ethiopia, data on DM is sparse. The majority of clinical data is not examined and made available to decision-makers in a timely manner. The main goal of the study was to obtain actual and relevant information about non-communicable diseases and their risk factors among the Humbo districts of Wolaita Zone's middle-aged population in southern Ethiopia.

Methods and Materials

Study setting

The study was conducted in Humbo District, Wolaita Zone, and Southern Ethiopia. Humbo is situated 408 kilometers from Addis Abeba, 178 kilometers from Hawassa, and 18 kilometers from the zone's capital, Wolaita Soddo. The woreda has a total population of 161,792, of whom 81,151 are men and 80,641 are women [17]; Around 5% of its population are urban dwellers. The majority of the inhabitants (87.1%) were protestants, 7.9% were Orthodox Christians, and 4.17% were Catholics [18]. The largest ethnic group reported in Humbo was the Welayta (96.33%).

Study design, source population and study population

We used a cross-sectional community-based study. Adult men and women, aged 25 to 64, residing in the Humbo District were eligible to participate. All randomly selected adult men and women of Humbo District aged 25 and above were considered the study population.

Sample size determination

The sample size was calculated using the single population proportion formula, with an assumption of 3.6% diabetes prevalence reported from North West Ethiopia [19] and a confidence interval of 95% (Z/2 = 1.96), power of 80%, margin of error of 5%, design effect of 2.0, and a 10% non-response rate, yielding a final sample size of 587 participants.

Sampling procedure

Respondents were selected by a multi-stage sampling technique. There were 41 kebeles in the district, two of which were urban. Out of these, 10 kebeles were selected using a simple random sampling technique. The research participants were chosen from the target population using a multistage selection approach proportionate to the size of the households in each of the districts' selected kebele. The sample size was allocated according to the population size in each chosen kebele. The sample size allocated to each kebele was then divided by the number of households in the kebele to determine the proportion of people to be examined in each selected kebele after the sample size for each kebele was determined. This allowed a systematic sampling technique to be used in order to select the study units in the selected households. The sampling interval was calculated by dividing the total households in the selected study kebele by the final sample size, which was every 13th household. Then, the first households were selected from each kebele by spinning a pen where the tip was pointed. Finally, one individual was selected out of the eligible adults in each household using a lottery method.

Inclusion criteria

The age group included in this study was 25-64 years old and had resided in the area for at least 6 months.

Exclusion criteria

People with mental and physical disabilities, the incapacitated and bedridden, and self-reported pregnant mothers were all excluded.

Data collection

The data was collected in three categories using the World Health Organization's (WHO) stepwise approach to noncommunicable disease surveillance [20]. It was first written in English. The English version was translated into the local language to help data collectors and respondents understand it better. To assure consistency, it was also back-translated into English by another language specialist. Four clinical nurses were in charge of data collection, with two supervisors possessing a B.Sc. in health officer/nursing and fluency in the local language. Data collectors and supervisors received two days of training and practical demonstrations on interview tactics and glucose measuring processes. Socio-demographic data including age, sex, gender, educational level, family history of diabetes mellitus, marital status, ethnicity, and religion, and behavioral characteristics including khat chewing, smoking, alcohol consumption, and physical activity were collected under the supervision of the principal investigator. The questionnaire was pretested for question clarity on people representing 5% of the participant sample size who were located outside of the research region, and changes were made to the questionnaires based on the results. The interviewers measured and documented the participant's height, weight, and fasting blood glucose after the interview was completed. Digital scales (SECA 813, Germany) were used to measure weight, which were read and adjusted to the closest 0.1 kg between each measurement. Participants stood in upright posture without shoes, and the findings were recorded to the nearest 0.5 cm using a portable stadiometer (SECA, Germany). The measurements were taken twice, with the average used in the study. A glucometer was used to test fasting blood glucose as per the WHO recommendations [21]. Peripheral blood samples were collected by finger puncture early in the morning before participants took their breakfast.

Measurements and definitions

The original data used to extract the secondary data were collected using the WHO-STEPWISE technique, which includes survey questions for step I, physical body measures for step II, and laboratory testing for step III. The following definitions were used:

- **Fasting blood glucose:** Estimation of blood glucose acquired from a patient who has fasted for at least 8 to 12 hours without eating or drinking [22].
- **Impaired fasting glucose:** Defined as fasting blood glucose level 110mg/dL ≤ IFG <126 mg/dL (6.1-6.9mmol/L) [22].
- **Diabetes mellitus:** 1. FPG 7.0 mmol/L (126 mg/dl) or 2. normal blood glucose levels but on diabetic control strategy during the survey or 3 [22].

Obesity, overweight, and normal weight were generally defined as a BMI of 30 kg/m^2 or higher, a BMI between 25 and 30 kg/m^2, and a BMI of 18.5-24.9 kg/m^2, respectively [23].

Low fruit and vegetable intake: fewer than five servings of fruit and vegetables per day, or less than 400 grams per day [22].

Physically inactive: The study community's physical activity level was assessed using leisure-time physical activity. Physical inactivity is defined as a person who does not match any of the following criteria: Three days of vigorous intensity action (jogging or brisk walks) for at least 20 minutes each day or five days of moderate intensity activity (gentle exercise or walking) for at least 30 minutes per day [22].

Data quality control

The data collectors and supervisors were adequately trained in all procedures. Before the measurement, the weighing scale was thoroughly calibrated, and a respondent was measured in good lighting. The participant was required to stand upright, shoes removed, and head held erect while his or her height was measured. Every day following data collection, a check was conducted by the principal investigator to assess the completeness of the questionnaire, ensuring that all items were filled in correctly and that the primary investigator fixed any errors. The weighing scale was calibrated every day before going out into the field.

Data analysis and management

The data were coded and put into Epi-Data version 3.1 statistical software, and IBM SPSS version 23 was used to conduct the analysis. Descriptive summary measures were used to describe the study population and measure the prevalence of diabetes. A bivariate analysis was performed to see the association between dependent and independent variables. Multicollinearities were also checked among selected variables by calculating the variance inflation factor (VIF) and tolerance (1-R). A VIF of 10 and above or a tolerance (1-R) of close to zero was a concern for multicollinearity. All continuous data were checked for normality using the Kolmogorov-Smirova test at a p-value < 0.05. The Hosmer-Lemeshow goodness-of-fit statistic was used to assess whether the necessary assumptions for the application of multiple logistic regression are fulfilled. To control for potential confounders, a multivariable logistic regression analysis was performed between dependent and independent variables. Both crude and adjusted odds ratios with a 95% confidence interval were reported to measure the strength of association between exposure and outcome variables. P 0.05 was declared statistically significant.

Ethical considerations

This study was approved by the Ethical Review Committee of Wolaita Sodo University's College of Health Sciences and Medicine. The study's purpose was described to the participants, and each respondent gave informed verbal and written consent prior to the interview. Participants who had high fasting blood sugar levels were connected to the health facilities for proper care and treatment.

Results

Socio-demographic and economic characteristics of respondents

A total of 578 adults with a 98.5% response rate were included in this study. A detailed demography of the study population is shown in Table 1. More than half of the participants were female (N = 326; 56.4%). The majority lived in rural areas (N = 473; 81.8%). The mean age of the study participants was 36.8 years (SD = 8.2), and two hundred fifty-six (44.3%) fell into the age group between 25 and 34 years. The majority (N = 491; 84.9%) were married, and the majority (N = 468; 84.1%) were protestant Christians. The majority were from Woliata ethnic groups (N = 543; 93.9%).

Variable (n = 576)	Category	Frequency	Percent (%)
Sex	Male	252	43.6
	Female	326	56.4
Age	25-34	256	44.3
35-44	201	34.8	
45-55	94	16.3	
55-64	27	4.7	
Residence	Urban	105	18.2
Rural	473	81.8	
Educational status	No formal education	181	31.3
Grade 1-8	78	13.5	
Grade 9-12	187	32.4	
Diploma or degree and Post graduate	132	22.8	
Maritalstatus	Married	491	84.9
Single	80	13.8	
Divorced and Widowed	7	1.2	
Religion	Protestant	468	84.1
	87	15.1	
Orthodox Other	5	0.9	

Ethnicity Amahara Other*	Wolaita	543	93.9
	20	3.5	
	15	2.6	
Occupation NGO Merchant Daily laborer Unemployed Farmer House wife Other**	Governmental	74	12.8
	6	1.0	
	129	22.3	
	15	2.6	
	8	1.4	
	136	23.5	
	168	29.1	
	42	7.3	
Wealth index Medium Rich	Poor	192	33.2
	176	30.4	
	210	36.3	

Table 1: Socio-demographic characteristics of the study participants (N = 576) in Humbo District, Southern Ethiopia, 2020**.**

* = Gurage, Hadya, Oromo, Gamo, Dawuro ** = Student, farmer, carpenter.

Behavioral and dietary practices

Twenty respondents (3.5%) were smokers during the time of the survey. Of these, 7 (1.2%) smoked on a daily basis. At least sixty respondents (10.4%) had a history of drinking alcohol at least once. However, of these respondents, 3 (10.7%) were drinking alcohol one to three times per month and four (14.4%) were taking alcohol on a daily basis (Table 2) while the rest were casual drinkers (Table 2).

Variable (n = 578)	Category	Frequency	Percent (%)
Smoking currently	Yes	20	3.5
	No	558	96.5
Smoking daily	Yes	7	1.2
	No	571	98.8
Ever used alcohol	Yes	30	55.2
	No	548	94.8
Frequency of alcohol use	Daily	4	14.3
	5-6 days per week	13	46.4
	1-4 days per week	6	21.4
	1-3 days per month	3	10.7
	< once per month	2	7.1
Walk or use bicycle for at least 10 minutes	Yes	490	84.8
	No	88	15.2
Transportation use	Motor vehicle	194	33.5
	Foot and motor vehicle alternatively	384	66.5
Vigorous activity work	Yes	113	19.6
	No	465	80.4

Moderate intensity work	Yes	262	45.3
	No	316	54.7
Vigorous sports	Yes	7	1.2
	No	571	98.8
Moderate sports	Yes	25	4.3
	No	553	95.7
Sitting time in work	<3 hours	477	82.5
	≥3 hours	101	17.5

Table 2: Life style among study subjects in Humbo District, southern Ethiopia, 2020.

The majority of 465 (80.4%) and 316 (54.7%) of our study participants were not engaged in vigorous or moderate work, respectively. Similarly, 571 (98.8%) and 553 (95.7%) participants reported that they were not engaged in vigorous and/or moderate sports, respectively. One hundred and one (17.5%) of their work is done while sitting for more than three hours (Table1).

Eighty-nine (15.4%) of the respondents consume fatty meats at least once per week. Of these, 80 (85.1%) eat meat more than two days per week. Seventy-eight (13.5%) of the respondents ate highly processed foods, and of those, 24 (58.5%) consumed them one to two days per week. Nearly one third of 165 (65.1%) use egg products, and of those, 51 (28.7%) consume them more than two days per week. The majority (N = 490; 84.8%) cook daily with saturated oil. Regarding fruit and vegetable consumption, 319 (55.2%) and 85 (14.7%) of the study participants consumed fruit and vegetables less than two days per week, respectively (Table 3).

Variable (n = 578)	Category	Frequency	Percent (%)
Fatty Flesh Meats consumption	Yes	89	15.4
	No	489	84.6
Fatty Flesh Meats/week	1-2 days	14	14.9
	>2 days	80	85.1
Processed food consumption	Yes	78	13.5
	No	500	86.5
Processed food consumption/week	1-2 days	24	58.5
	>2 days	17	41.5
Egg product consumption	Yes	165	28.5
	No	413	71.5
Egg product consumption days/ week	1-2 days	127	71.3
	>2 days	51	28.7
Oil used for food preparation	Vegetable oil	85	14.7
	Saturated oil	490	84.8
	Others	3	0.5
Fruit consumption/week	0-2 days	319	55.2
	3-4 days	190	32.9
	5-7 days	69	11.9
Vegetable use/week	0-2 days	85	14.7
	3-4 days	330	57.1
	5-7 days	163	28.2

Table 3: Dietary factors among study subjects in Humbo District, Southern Ethiopia, 2020.

Body mass index (BMI)

The mean BMI of the respondents was 21.56 (2.965 SD) kg/m^2. One quarter (26.3%) of participants were overweight, while 6.6% were obese.

Prevalence of diabetes mellitus

The overall prevalence of diabetes mellitus was 5.9% (95% CI: 4.0-7.8). The prevalence of diabetes mellitus was 3.2% (95% CI: 1.7-4.9) in rural areas and 18.1% (95% CI: 11.4-25.7) in urban areas. In rural areas, the prevalence was 6.1% among men and 0.8% among women. In urban areas, the prevalence was 15% among men and 20% among women.

Factors associated with diabetes mellitus

The following factors showed a statistically significant association with diabetes mellitus in the assessed community: age, alcohol use, physical activity, family history of diabetes, and BMI. The odds ratio of DM was about five times higher in study participants aged 45-54 years compared to those aged 25-34 years. The odds of diabetes mellitus were about six times higher (OR95%CI = 2.4, 16.5) among those study participants who had a family history of diabetes compared to those without a family history of diabetes. The prevalence of diabetes was approximately four times higher (OR95%CI = 1.1, 11.7) among alcohol users. Smoking cessation had a protective effect (OR 95% CI = 0.05, 0.7). Obesity increased the odds of developing diabetes by threefold (OR95%CI = 1.44, 7.4). Furthermore, the odds of developing diabetes were approximately 5 times higher (OR95%CI = 1.3, 20.7) among physically inactive study participants. The current study found that sex, residence, socioeconomic factors like educational status and wealth index, and healthy behaviors like sedentary behavior and eating fruits and vegetables did not reveal a statistically significant association with DM (Table 4).

Variable	Category	Diabetes Mellitus (DM)		Crude OR (95% CI)	Adjusted OR (95% CI)
		Yes N (%)	No N (%)		
Age category	25-34	2(5.9)	254(46.7)	1	1
	35-44	12(35.3)	189(34.8)	0.825(0.258, 2.788)	0.675(0.174, 2.625)
	45-54	16(47.1)	78(16.3)	8.112(2.899, 22.70) *	4.803(1.259, 18.325) *
	55-64	4(11.8)	23(4.7)	2.739(0.816, 9.200)	1.085(0.267, 4.418)
Sex	Male	19(55.9)	233(42.8)	1.691(0.841, 3.398)	1.667(0.734, 3.789)
	Female	15(44.1)	311(57.2)	1	1
Residence	Urban	19(55.9)	86(15.8)	6.74(3.30, 13.79) ***	2.553(0.945, 6.899)
	Rural	15(44.1)	458(84.2)	1	1
Current Smoking	Yes	6(17.6)	14(2.6)	1	1
	No	28(82.4)	530(97.4)	0.123(0.044, 0.345)	0.202(0.053, 0.773)
At least moderate physical activity	Yes	4(11.8)	21(3.9)	1	1
	No	30(88.2)	523(96.1)	3.442(1.10, 10.68) *	5.336(1.374, 20.725) *
Family history of Diabetes Mellitus	Yes	6(17.6)	43(7.9)	6.66(2.93, 15.13) ***	6.344(2.431, 16.558)***
	No	28(82.4)	501(92.1)	1	1
BMI of responder	Underweight/Normal			1	1
	Overweight			1.948(1.220, 3.109) *	2.829 (1.683, 4.757) *
	Obesity			2.467(1.157, 5.25) **	3.264 (1.434, 7.427) **

Table 4: Bivariate and multivariable logistic regression analysis of factors associated with diabetes mellitus among adults 25-64 years old in Humbo District, Southern Ethiopia, 2020.

*p-value< 0.05, **p-value<0.01, *** p-value<0.001

*p-value< 0.05, **p-value<0.01, *** p-value<0.001

Discussion

Developing nations like Ethiopia are seeing an increase in the prevalence of diabetes mellitus and the related controllable risk factors [24]. This study aimed to determine the prevalence and risk factors associated with diabetes mellitus among adults in the Humbo District. The overall prevalence of diabetes mellitus in this study was 5.9%. The independent factors identified for diabetes were age, physical inactivity, family history of diabetes, and BMI. The national DM prevalence was estimated to be 2%-3% in the general population [25] and 4.36%in the Ethiopian adult population (20-79 years) [26] which is lower than the prevalence found in our study (5.9%). The prevalence is even higher when compared to the 2019 country level, which is 4%, as estimated by the IDF [27]. The higher DM prevalence in this study is in line with the greatest expected increase in DM worldwide, especially in developing countries. The major incidence of diabetes in developing countries is anticipated to be due to the increase in urbanization and lifestyle changes, which include increasingly sedentary behaviors, less physical activity, and a nutrition transition, as indicated by the higher intake of foods that are rich in calories but nutrient-poor. In the current study, age was an independent risk factor for diabetes mellitus, and diabetes was 4.8 times more common among people in the age group of 45-54 years as compared to those aged 25-34 years. Aging is frequently accompanied by a rise in body fat, which could help insulin resistance develop. Furthermore, aging is associated with a decrease in -cell proliferative potential and an increase in apoptotic sensitivity [28]. Our finding is not consistent with other studies [29,30]. The shorter life expectancy of people with diabetes mellitus in our communities might be one of the possible factors for the reduced prevalence seen in older age brackets. Furthermore, the study populations may have been exposed to various risk factors linked with diabetes mellitus early in life, resulting in diabetes developing in younger and middle-aged people. The study also discovered that the prevalence of diabetes was roughly three times higher in obese study participants than in normal or underweight participants. This is similar to other studies conducted in North Florida [31]. This might be due to rapid urbanization and industrialization, which have resulted in changes in food habits and decreased physical activity, resulting in unbalanced energy gain and a high prevalence of overweight or obesity, which indicates fat storage. Overweight or obesity, together with a rise in body fat and cholesterol levels, are known risk factors for the development of diabetes. Obesity may result from decreased levels of adiponectin, an insulin sensitizer, and higher levels of adipokines and cytokines, which predispose to insulin resistance [32]. Additionally, fat accumulation, especially in the liver, is linked to obesity and raises insulin [33]. A crucial underlying issue that connects obesity to DM is mitochondrial dysfunction. Excessive energy substrates impair cell function and decrease insulin sensitivity, which in turn affects lipid and glucose metabolism by causing mitochondrial malfunction [34]. Previous studies have linked a family history of diabetes to an increased risk of developing diabetes mellitus [35,36]. The fact that people with a family history of diabetes have the same genetic components as those without, as well as the fact that families tend to share the same lifestyle choices and behaviors, are two possible explanations. Furthermore, it is possible that individuals did not track their specific fasting period, and this has increased the prevalence of DM in general. We were unable to control the temporal associations between DM and the related covariates since the study was cross-sectional. A longitudinal study is required to ascertain the temporal and causal links between the variables and DM. Another drawback of this study may be the absence of other variables, such as viral infection (like HIV), which may be related to diabetes mellitus. Activities and patterns of drug and alcohol use were solely evaluated through interviews, which may not have been reliable due to recollection bias. Even though the prevalence and risk factors for diabetes in elderly individuals vary, this study did not differentiate between type 1 and type 2 diabetes.

Conclusion

In the Humbo district, diabetes mellitus is a common condition among adults. If the right steps are not taken to reduce the burden, patients may face serious, life-threatening complications from the disease, and the district and country's health systems may incur needless, expensive costs. Active blood pressure and blood sugar monitoring should be taken into consideration, especially in a community environment. Controlling the burden of diabetes mellitus requires developing community health education programs on disease awareness and the value of exercise and diet.

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Competing Interests

The authors have declared that no competing interests exist.

Data Availability

Contact correspondent authors through email if there is a need for a database.

Author Contributions

All authors contributed significantly to the work reported, whether in the conception, study design, execution, data acquisition, analysis, and interpretation, or in all of these areas; they participated in drafting, revising, or critically reviewing the article; they gave final approval of the version to be published; they agreed on the journal to which the article has been submitted; and they agreed to be accountable for all aspects of the work.

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