Prevalence of prediabetes and related cardiovascular risk factors among Employees of Ayder Comprehensive Specialized Hospital, Tigray, Northern Ethiopia

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Prevalence of prediabetes and related cardiovascular risk factors among Employees of Ayder Comprehensive Specialized Hospital, Tigray, Northern Ethiopia.

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Abstract

Background: Prediabetes, also known as intermediate hyperglycaemia; is defined as a glycemic state which is higher than normal, but lower than the threshold for full blown diabetes. It is considered as an important risk factor for diabetes and its associated complications. However evidences show that these consequences can be averted or delay through lifestyle modifications. Therefore determining its magnitude is a critical step to plan for such mitigation measures.

Methods: A cross sectional study was conducted on employees of a tertiary care hospital from March - June/2019. Socio-demographic data were collected using self-administered questionnaire. Anthropometric and blood pressure measurements were performed following WHO guideline. Biochemical parameters were assayed following standard operating procedures. SPSS version 20 was used for data entry and analysis. Categorical variables were summarized using frequencies and percentages. Normality test was performed in advance of describing the numeric data and log transformations were carried out when appropriate. International Diabetes Federation (IDF) and American Diabetes Association (ADA) criteria were used to classify the glycemic status. Likewise IDF and revised National Cholesterol Education Program Adult treatment panel III (NCEP ATP III) were employed for the diagnosis of metabolic syndrome.

Result: we engaged a total of 265 employees in this study. About 35.1% were males and 64.9% were females. Median age was 29 (9) years. Prediabetes was diagnosed in 5.7 % and 18.1% of the participants based on IDF and ADA criteria respectively. While equally 3.4% of them had FBS levels that satisfy the criteria for diagnosis with frank diabetes. In addition 55.1% had a metabolic risk as implied by their waist to height ratio (WtHR), 24.2% had hypertriglyceridemia,

27.9% had above optimal LDL and 57% had decreased HDL. Taken together 17.9% and 21.9% of the participants had metabolic syndrome according to IDF and revised NCEP ATP III criteria respectively. Magnitude of dysglycemia and metabolic syndrome found to increase with age of employees.

Conclusion: the prediabetes and metabolic syndrome prevalence observed in the hospital employees was comparable with the general population.

Key words: Prediabetes, metabolic syndrome, hospital employees

Background

Prediabetes is a medical condition in which the blood glucose level is higher than the normal value but not high enough to meet the criteria for the diagnosis of diabetes mellitus (1). It is characterized by fasting plasma glucose 100 – 125 mg/dL and/or plasma glucose level 140 – 199 mg/dL two hours after a 75g oral glucose load. These conditions are known as impaired fasting glucose (IFG) and impaired glucose tolerance (IGT), respectively (2). It is also defined by hemoglobin A1C levels of 5.7–6.4% as additionally introduced by the American Diabetes Association (ADA) (3).

Prediabetes produces no symptoms but it is a substantial risk factor for developing type-2 diabetes mellitus and its sequel, which include heart disease, stroke, nerve damage, kidney failure, and eye problems (4,5). It has been estimated that a pre-diabetic person is 5 to 15 times more likely to develop type-2 diabetes mellitus compared to a person with normal blood glucose levels (6,7). Likewise in comparison with adults who have normal glucose; people with impaired fasting glucose have a two- to three-fold increased prospective risk of cardiovascular events, which are most marked in younger subjects (8). Additionally Shreds of evidence show that some long-term damage to the body, especially the heart and circulatory system, may already be occurring during pre-diabetes (9).

Nevertheless, studies report that for pre-diabetic patients, lifestyle modification can help prevent or reduce its progression to diabetes by 40–70%. This emphasizes the need for early diagnosis, initiate evidence-based intervention and closely monitor cases (10,11). Unfortunately, majority of the people have no idea that they have pre-diabetes as the condition develops gradually and without warning. The symptoms of type 2 diabetes (frequent urination, excessive thirst,

increased appetite, weight loss, blurred vision, and exhaustion) are not necessarily obvious when someone become pre-diabetic. As a result, most individuals with the disease present late, when life-style measures can no longer avert disease (9).

Currently, the population with pre-diabetes has reached approximately 318 million around the world, accounting for 6.7% of the total number of adults. About 69.2% of these pre-diabetes population lives in low- or middle-income countries (LMIC) (12). Being one of the LMIC, our continent Africa is facing this increasing burden. Contemporary estimates show that the prevalence of prediabetes in Africa is about 7.9% (13). If it is not intervened, this estimated prevalence of prediabetes is supposed to be doubled by the year 2040 (14).

In Ethiopia, the national prevalence was reported to be 5.4% (15). Moreover various institutional and community-based studies in different parts of the country indicated an increasing prevalence of prediabetes. However, the magnitude varies with the weight of the implicated risk factors in a given target (16,17). The situation in hospital employees is debatable. Some argue hospital staffs are particularly vulnerable to the condition because of the work circumstances that doomed them to have interrupted sleep and spent large hours in a sedentary position. Others claim that they are supposed to be better aware of how to prevent it and hence could have less risk. Thus the aim is to assess the prevalence of prediabetes among employees of a tertiary care hospital in North Ethiopia.

Materials and methods

Study design and study setting

This was a cross sectional study conducted from March - June/2019. The study setting was Ayder Comprehensive Specialized Hospital (ACSH), Mekelle, North Ethiopia. The aim of the study was to determine the prevalence of prediabetes and undiagnosed diabetes among the employees of the tertiary care hospital.

Sample size and sampling

The sample size was calculated based on the reported prevalence of pre-diabetes indicated in a study conducted in Ambo, North West Ethiopia, which was 19.5% (16). The calculation was done using a single population proportion formula considering 5% tolerable error and 95% confidence level. Accordingly, the minimum sample size was 241. However, considering a 10% non-response rate the final sample size became 265.

Ayder Comprehensive Specialized Hospital was selected purposively considering the availability of laboratory facilities and the number of employees. There were a total of 1802 employees of which 500 were administrative and the remaining 1302 were clinical staff. Nurses were predominant in their number among the clinical staff, 800. While Physicians, Laboratory technologists, Pharmacists, Anesthesiologists' physiotherapists and radiographers' together accounted for the remaining 502 employees. The data was proportionately allocated across the disciplines and study subjects from each discipline were selected by simple random sampling technique.

Data collection tools and data collectors

A self-administered structured questionnaire was utilized to collect socio-demographic and other relevant study variables. Two BSc nurses collected the socio-demographic, anthropometric and clinical data. Two Laboratory technologists with BSc qualifications involved in collection, processing and analysis of the biochemical data. The principal investigator supervised the overall process on a daily basis. One day training was given to both data collectors in order to keep the uniformity of data collection.

Anthropometric and blood pressure measurement

Standing height without shoes was measured to the nearest 0.1 cm using portable height measuring equipment (SECA 877). Weight was also measured to the nearest 0.1 kg with participants wearing light clothing and without shoes using a pre-calibrated digital weighing scale (SECA 877). Body mass index (BMI) was calculated as weight divided by height squared (kg/m^2). Waist circumference was measured using a constant tension tape across the umbilicus level. Similarly hip circumference was measured at the highest extension of the buttock. Both measurements were carried twice and the average value was recorded.

Blood pressure was measured using a validated blood pressure machine (OMRON M2 device). Two readings were taken for systolic blood pressure (SBP) and diastolic blood pressure (DBP). The initial measurement was done after the patient took 10 minutes rest. The second measurement was taken 5 minutes right after the initial measurement. An average of the two was recorded as per the WHO recommendation.

Biochemical measurement

Five 5 ml venous blood sample was collected to determine participants' fasting blood glucose level and lipid profiles. The collected blood sample was allowed to clot for 30 minutes and get centrifuged at 2000 rpm for 5 minutes. Blood sugar was determined immediately using enzymatic peroxidase method. Lipid profile parameters including total cholesterol, high-density lipoprotein (HDL) and triglycerides (TG) were measured from an aliquot of serum stored at -20°C . Low-density lipoprotein (LDL) was calculated using Friedwald formula. $\text{LDL-C} = \text{TC} - [\text{HDL-C} + \text{triglyceride}/5]$ (18). The protocol indicated in the manufacturer's instructions (ABX Pentra C 400) was strictly followed throughout the analytical process.

Diagnosis of prediabetes

Various organizations have defined prediabetes with criteria that are not uniform. The World Health Organization (WHO) has defined prediabetes as a state of intermediate hyperglycemia using two specific parameters, impaired fasting glucose (IFG) defined as fasting plasma glucose (FPG) of 6.1-6.9 mmol/L (110 to 125 mg/dL) and impaired glucose tolerance (IGT) defined as 2 h plasma glucose of 7.8-11.0 mmol/L (140-200 mg/dL) after ingestion of 75 g of oral glucose load or a combination of the two. The American Diabetes Association (ADA) on the other hand, has the same cut-off value for IGT (140-200 mg/dL) but has a lower cut-off value for IFG (100-

125 mg/dL) and has additional hemoglobin A1c (HbA1c) based criteria of a level of 5.7% to 6.4% for the definition of prediabetes (19,20). Since the oral glucose tolerance test (OGTT) is technically demanding and the cost for HbA1c is expensive, the classification of subjects in this study was made based on impaired fasting glucose (IFG).

Data quality management and control

To assert the quality of data, the questionnaire was pretested and the entire data collection process was strictly supervised, during the data collection. Additionally, the questionnaires were cross-checked after each interview and coded serially. Moreover, the laboratory analysis was carried out in a properly calibrated analyzer (ABX Pentra C-400) with controls running alongside the subject sample for validating the process as per the standard operating procedure and manufacturer's instructions.

Data Analysis

SPSS version 20 was used for data entry and analysis. Categorical variables were summarized using frequencies and percentages. Normality test was performed for all numeric data. Normally distributed variables were described using arithmetic mean and standard deviation. Non-Gaussian continuous variables were log transformed and described using geometric mean and 95% confidence interval. Median and interquartile ranges were reported for continuous variables that remain non-Gaussian after transformation. International Diabetes Federation (IDF) and American Diabetes Association (ADA) criteria were used to classify the glycemic status. Likewise IDF and revised National Cholesterol Education Program Adult treatment panel III (NCEP ATP III) were employed for the diagnosis of metabolic syndrome. The level of statistical significance was set at 5% ($p < 0.05$).

2. Results

Socio-demographic characteristics of the participants

The present study was conducted on a total 265 participants. The study participants were 20-57 years old and their median age was 29 (9) years. About 93 (35.1%) were males and 172 (64.9%) were females (data not shown). Both clinical and supportive staffs were included in the study. Majority of the participants were from the clinical staffs, 192 (72.5%). The remaining, 73 (27.5%), were from the supportive staff and this was done considering their employment proportion, table 1.

Table 1 Socio-demographic characteristics of the study participants (n = 265)

Variables		Male, N (%)	Female, N (%)	Total, N (%)
Marital status	Married	41 (15.5)	100 (37.7)	141 (53.2)
	Single	51 (19.2)	56 (21.1)	107 (40.4)
	Divorced	0 (0)	13 (4.9)	13 (4.9)
	Widowed	1 (0.4)	3 (1.1)	4 (1.5)
Age	20- 29	41(15.5)	95(35.8)	136(51.3)
	30 – 39	40(15.1)	55(20.8)	95(35.8)
	40 – 49	9(3.4)	16(6.0)	25(9.4)
	50 – 59	3(1.1)	6(2.3)	9(3.4)
Occupation	Nurse	29(10.9)	88 (33.2)	117 (44.2)
	Laboratory	8 (3.0)	9 (3.4)	17 (6.4)
	Pharmacy	6 (2.3)	11 (4.2)	17 (6.4)
	Physician	19 (7.2)	10 (3.8)	29 (11.0)
	Supportive	26 (9.8)	47 (17.7)	73 (27.5)
	Others	5 (1.9)	7 (2.6)	12 (4.5)
Educational status	Primary school (1-8)	0 (0.0)	6 (2.3)	6 (2.3)
	Secondary school (9-12)	2 (0.8)	14 (5.3)	16 (6.0)
	High-grade completed (college, University)	91 (34.3)	152 (57.4)	243 (91.7)
Monthly income, ETB	601- 1650.00	6(2.3)	6(2.3)	12(4.5)
	1651.00 - 3200.00	17(6.4)	35(13.2)	52(19.6)
	3201.00 - 5250.00	26(9.8)	60(22.6)	86(32.5)
	5251-7800	30(11.3)	36(13.6)	66(24.9)
	7801-10900	8(3.0)	23(8.7)	31(11.7)
	>10900	6(2.3)	12(4.5)	18(6.8)

ETB –Ethiopian Birr

Anthropometric and biochemical characteristics of the study participants

Except for high-density lipoprotein and waist circumference in women the geometric means for the anthropometric and biochemical parameters assessed in this study were within the reference range stated for healthy people. However considering individual status, a significant proportion of participants had shown deviance from the normal in a number of features. For instance 22.3% of the participants were underweight while 16.2% being with a body mass index of 25 kg/m² and above. More than half, 55.1%, of the participants had an increased risk for central obesity as characterized by their waist to height ratio greater or equal to 0.5. A total of 9.1% and 21.5% employees had fasting blood sugar (FBS) values above the criteria stated for normal by the international diabetes federation (IDF) and American Diabetes Association (ADA) respectively. Similar derangements were also noted on the profile for serum lipids. About 27.9% and 24.2% of the participants had LDL and triglyceride values above optimal. Whereas, 82.3% of males and 60.8% of females had a decreased record for serum HDL, table 2.

229 **Table 2 Anthropometric and biochemical characteristics of participants by glycemic level (n= 265)**

Feature		FBS <110 mg/dl	FBS ≥110 mg/dl	Total	P. value
BMI	21.36 (17.76, 25.69)*				
	<18.5 kg/m ²	59 (24.5)	0 (00)	59 (22.3)	0.000
	18.5 - 24.9 kg/m ²	148 (61.4)	15 (62.5)	163 (61.5)	
	≥ 25 kg/m ²	34 (14.1)	9 (37.5)	43 (16.2)	
WC (male)	84.45 (74.05, 96.30)*				
	< 94 cm	197(94.7)	50 (87.7)	247 (93.2)	0.065
	≥ 94 cm	11 (5.3)	7 (12.3)	18 (6.8)	
WC (female)	80.61 (69.31, 93.76)*				
	< 80 cm	134 (64.4)	34 (59.6)	168 (63.4)	0.30
	≥ 80 cm	74 (35.6)	23 (40.4)	97 (36.6)	
WHR (male)	0.19 (0.13, 0.26)*				
	< 0.9 cm	176 (84.6)	44 (77.2)	220 (83)	0.13
	≥ 0.9 cm	32 (15.4)	13 (22.8)	45 (17)	
WHR (female)	0.18 (0.12, 0.28)*				
	< 0.85 cm	160 (76.9)	37 (64.9)	197 (74.3)	0.05
	≥ 0.85 cm	48 (23.1)	20 (35.1)	68 (25.7)	
WHtR	0.25 (0.20, 0.30)*				
	< 0.5	116 (48.1)	3 (12.5)	119 (44.9)	0.000
	≥ 0.5	125 (51.9)	21(87.5)	146 (55.1)	
SBP	112.3 (13.53)#				
	< 130 mmHg	222 (48.1)	20 (83.3)	242 (91.3)	0.141
	≥ 130 mmHg	19 (7.9)	4 (16.7)	23 (8.7)	
DBP	71.31(9.8)#				
	< 85 mmHg	224 (92.9)	23 (95.8)	247 (93.2)	0.499
	≥ 85 mmHg	17 (7.1)	1 (0.4)	18 (6.8)	
Total CHOL	156.31 (125.2, 195.1)*				
	< 200 mg/dl	216 (89.6)	20 (83.3)	236 (89.1)	0.259
	≥ 200 mg/dl	25 (10.4)	4 (16.7)	29 (10.9)	
LDL	84.55 (60.75, 117.67)*				
	< 100 mg/dl	176 (73)	15 (62.5)	191 (72.1)	0.193
	≥ 100 mg/dl	65 (27)	9 (37.5)	74 (27.9)	
HDL (male)	40.64 (32.65, 50.60)*				
	< 40 mg/dl	201 (83.4)	17 (70.8)	218 (82.3)	0.108
	≥ 40 mg/dl	40 (16.6)	7 (29.2)	47 (17.7)	
HDL (female)	47.63 (39.29, 57.74)*				
	< 50 mg/dl	149 (61.8)	12 (50)	161 (60.8)	0.18
	≥ 50 mg/dl	92 (38.2)	12 (50)	104 (39.2)	
TAG	100 (74.69, 133.88)*				
	< 150 mg/dl	149 (80.5)	7 (29.2)	201 (75.8)	0.00
	≥ 150 mg/dl	47 (19.5)	17 (70.8)	64 (24.2)	

230 * Geometric mean (95% confidence interval), #Arithmetic mean (Standard deviation), ^- frequency (%),
231 BMI- body mass index, WC- waist circumference, WHR- Waist to hip ratio, WHtR- Waist to height ratio,

SBP- systolic blood pressure, DBP- diastolic blood pressure, CHOL- cholesterol, LDL- low density lipoprotein, HDL- High density lipoprotein, TAG- Triacylglycerol

Clinical characteristics of the study participants

In this study 5.7 % and 18.1% of the participants were in the prediabetic range based on the IDF and ADA criteria respectively. While equally 3.4% of participants had their FBS values in the diabetic range according to both IDF and ADA criteria, table 3. The impairments in fasting blood sugar were found to increase with the age of the participants with apex at 40 - 49 years (figure 1).

Table 3 Fasting blood sugar level by IDF and ADA criteria

Criteria	Normoglycemic, N (%)	Prediabetic, N (%)	Diabetes, N (%)
IDF	241 (90.9)	15 (5.7)	9 (3.4)
ADA	208 (78.5)	48 (18.1)	9 (3.4)

Figure 1 Fasting blood sugar levels across age categories (based on IDF)

Likewise an overall 17.4% and 21.9% of the participants had metabolic syndrome according to IDF and revised NCEP ATP III criteria respectively. High-density lipoprotein (HDL) was the most deranged parameter among the metabolic syndrome components, followed by waist circumference (figure 2). There was no huge difference among sexes in relation to the prevalence of metabolic syndrome. However individuals in the higher age category were found to have a higher proportion of metabolic syndrome as compared to the young age in both criteria. Concerning metabolic syndrome in relation to fasting blood sugar (FBS) level, the prevalence varies with the criteria used to classify FBS. Only 9.6% of individuals had metabolic syndrome among those with normal FBS as compared to 45.6% among those with elevated FBS when using the ADA criteria. However, 69.6% of participants had metabolic syndrome among those with normal FBS as compared to 30.4% amid those who had elevated FBS if IDF was considered for categorizing blood sugar level, table 3.

Figure 2 Prevalence of derangement among components of metabolic syndrome (IDF)

Table 3 Prevalence of metabolic syndrome by classification criteria, sex, age category and glycemic level (n=265)

Features		IDF Criteria		Revised NCEP ATP III criteria	
		No MetS	MetS	No MetS	MetS
Overall		219 (82.6)^	46 (17.4)	207 (78.1)	58 (21.9)
Sex	Male	81 (87.1)	12 (12.9)	71 (76.3)	22 (23.7)
	Female	138 (80.2)	34 (19.8)	136 (79.1)	36 (20.9)
Age category	20-39	201 (87)	30 (13)	191 (82.7)	40 (17.3)
	40-59	18 (52.9)	16 (47.1)	16 (47.1)	18 (52.9)
FBS ADA	< 100 mg/dl	188 (90.4)	20 (9.6)	186 (89.4)	22 (10.6)
	>=100 mg/dl	31 (54.4)	26 (45.6)	21 (36.8)	36 (63.2)
FBS IDF	< 110 mg/dl	209 (95.4)	32 (69.6)	201 (97.1)	40 (69)
	>=110 mg/dl	10 (4.6)	14 (30.4)	6 (2.9)	18 (31)

^ - frequency (%), FBS – Fasting blood sugar, ADA – American Diabetic Association, IDF – International Diabetes Federation

Discussion

Overt type 2 diabetes mellitus (T2DM) is preceded by an intermediate condition called prediabetes. This state exists for years and is an important target for deterrent interventions as shreds of evidence implied progression to T2DM can be delayed or averted through lifestyle modifications (21,22) (21,22). Hence, mark early screening of people for prediabetes as exceedingly imperative. In view of this the current study has assessed the occurrence of prediabetes on employees of a tertiary care hospital and found it to happen on 5.7% and 18.1% of them according to IDF and ADA criteria respectively.

The marked variation in the frequency of pre-diabetes between the WHO/IDF and ADA cut-offs is due to the differences in setting up the upper limit. WHO/IDF chose to keep the upper limit of the range of normal fasting blood glucose at 110 mg/dl. However, the ADA sets the upper limit of the range at 100 mg/dl. Both organizations have their own rationales. The ADA cut-off allows early identification of cases and swift management of prediabetes. On the other hand the higher cut-off on WHO/IDF minimizes the number of people diagnosed with prediabetes in order to fit the cost of intervention program with the capacity of resource-constrained countries (19,20). However, fasting plasma glucose level of 100 mg/dl and higher is correlated with higher occurrence of diabetes related complications in several studies (20). Moreover offering education on lifestyle modification poses less economic harm compared to the potential benefits of revering it before becoming frank diabetes and putting individuals on a chronic care. Hence the discussion hereafter is based on the ADA result.

The 18.1% prevalence of prediabetes observed in the present study is in line with the 15.7% prevalence of prediabetes revealed among healthcare professionals in Poland and 22.3% reported among administrative staff in Southern Nigeria (23,24). However it is much lower than the 51.0% reported among Armed Forces Hospital employees in Kuwait (25). The exceedingly higher prevalence in the later study is due to the fact that the study was carried out among professionals who had high risk scores for diabetes. On the other hand the current result is similar with the findings found from population studies in Ethiopia (26,27), Northeast China(28), Eastern Uganda (29) and Bangladish (30). However it is higher than the findings from other studies in Ethiopia (31), Tanzania and Uganda(32), Canada (33) and lower than those from

Oman (34), Iraq (35), Saudi males(36), China (37) and Ecuador (38). This could be explained by genetic, socio-demographic and lifestyle differences.

It is understood that people with pre-diabetes have an increased risk of progression to T2DM (1,39). Evidences tell that people with IFG or IGT develop frank T2DM at a rate of approximately 5% per year. The risk appears similar with either IFG or IGT, and is highest when people have both simultaneously (1). In the present study 3.4% of the employees had diabetes. This result is concordant with the 3.7% reported prevalence of diabetes among the hospital administrative staff in South Nigeria (24). Nevertheless it is lower than the diabetes prevalence revealed among health care workers in Poland. The observed difference could be due to variation in health checking behavior among the African and Western societies where people in the West can check and get aware of their prediabetes status early so that take the necessary measures to hamper its progression to full blown diabetes.

Blood glucose in the prediabetic range is modestly correlated with many risk factors, including general and central obesity, blood pressure, triglyceride and lipoprotein levels (40). In consequence the strength of the glycaemia effect in itself depends on the extent to which related vascular risk factors are taken into account (10). In this study an overall 17.9% and 21.9% of the participants had metabolic syndrome according to IDF and revised NCEP ATP III criteria respectively. This is in agreement with the 15.4% IDF based prevalence in Nigeria (41), 15.5% prevalence in a multi-center study in Latin America (42) and 22.4% and 24.2% metabolic syndrome on NCEP ATP III based criteria in Iran and Nigeria respectively (43,44).

However it is lower than the 12.0% prevalence of metabolic syndrome in Taiwanese hospital employees as stated based on American Heart Association/National Heart, Lung, and Blood Institute (AHA/NHLBI) criteria (45). The lower prevalence in this particular study could be due to the consideration of a relatively higher waist circumference cut off (≥ 102 for male and ≥ 88 for female) as compared to the ≥ 94 cm and ≥ 80 cm in the IDF and NCEP ATP III criteria (45). Similarly the present finding is lower than the overall MS prevalence of 12.8%, 16.2% in males and 11.6% in females, among workers in a university hospital in Brazil. This could be due to the fact that the participants in this particular study were predominantly females, 72.4%, as the rate in males was comparable enough to the current report (46). In general, owing to the young age and presumed better awareness, significant proportion of the employees had metabolic

syndrome. This could be due to excessive workloads, extended working hours, and shift work the health care workers experience as demonstrated in other studies (46–48).

Finally the study has its own strengths and limitations. Proportional allocation of clinical and administrative employees of the hospital was the strength of the study. On the other hand the study has some limitations. Purposive selection of the study site was one shortcoming. Another limitation was the study did not show the actual prevalence of diabetes among the employees, as known patients with DM were excluded. In addition, glycemic study was determined based on single fasting blood glucose measurement, and hence misclassification due to transient fluctuations might have occurred though we tried to limit its extent by considering such possibilities in our selection criteria.

Conclusion

Notable proportion of the employees had prediabetes and metabolic syndrome which are comparable to the prevalence observed in the general population. The prevalence of prediabetes and metabolic syndrome were found to increase with age of the employees. This implies the need for awareness creation about prediabetes and its complication, even among the health professionals. Moreover the presence of employees with a blood sugar status that lies within the diabetic range (undiagnosed DM) also warrants an attention to be given for periodic health checkup. Further research is commendable to address the aforementioned gaps.

Abbreviations: ADA – American Diabetic Association, American Heart Association/National Heart, Lung, and Blood Institute (AHA/NHLBI), BMI- body mass index, DBP- diastolic blood pressure, ETB-Ethiopian birr, FBS – Fasting blood sugar, FPG – fasting plasma glucose, HgA1c- Hemoglobin A1c, HDL- High density lipoprotein , IDF – International Diabetes Federation, IGT- Impaired glucose tolerance, IFG-Impaired fasting glucose, LDL- low density lipoprotein ,LMIC - low- or middle-income countries, NCEP ATP III -National Cholesterol Education Program Adult treatment panel III, OGTT- Oral glucose tolerance test, SBP- systolic blood pressure, TAG- Triacylglycerol, T2DM-Type 2 diabetes mellitus, WC- waist circumference, WHtR- Waist to height ratio, WHR- Waist to hip ratio, WHO- World Health Organization

Ethics approval and consent to participate: This project was approved by the ethics committee of the Institutional Review Board of College of Health Sciences, Mekelle University. Participants were consented prior to their recruitment to the study.

Consent for publication: Not applicable

Availability of data and materials: The datasets utilized for the current study are available from the corresponding author on reasonable request.

Competing interests: The authors declare that they have no competing interests.

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Authors' contributions: GK designed the project, supervised the data collection process, and handled the laboratory work, data analysis and manuscript preparation. MH, DT and KR involved in designing the project and reviewing the findings. HA involved in designing the project, performing data analysis & interpretation as well as preparing the final manuscript. All authors revised and approved the final manuscript.

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Figures

Figure 1

Fasting blood sugar levels across age categories (based on IDF)

Figure 2

Prevalence of derangement among components of metabolic syndrome (IDF)