

Prevalence and Predictors of Hypertension-Type 2 Diabetes Mellitus Comorbidity among Patients in Wachemo University Nigest Elleni Mohammed Memorial Referral Hospital, Southern Ethiopia

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Abstract

Introduction: Hypertension in patients with diabetes mellitus is an important public health challenge because of the associated morbidity, mortality, the cost to the society, greater healthcare resource utilization, higher incidence of depression, and lower quality of life. Controlling Hypertension-Type 2 Diabetes Comorbidity is important to limit the morbidity and costs for the health care systems derived from diabetic complications. Despite the dire effects of hypertension in type 2 diabetic patients, there is paucity of evidences in the country which indicates the magnitude and predictors of hypertension in people with type 2 diabetes. Thus, the aim of this study was to assess the prevalence and predictors of hypertension-type 2 diabetes Mellitus among patients in Wachemo University Nigest Elleni Mohammed Memorial Referral Hospital.

Methods: A hospital based cross-sectional study was conducted from March 6-31, 2017. A total of 365 type II diabetic patients on follow up were included in the study and data was collected by using structured questionnaire. The collected data was analyzed using SPSS version 20.0. Bivariate and multivariate logistic regression analysis was used for identifying the predictors.

Result: The overall Hypertension-Type 2 Diabetes Mellitus Comorbidity status was 59.7%. The mean systolic blood pressure was 136.26 mmHg (SD ± 17.34) while that of diastolic blood pressure was 83.75 mmHg (SD ± 9.77). Age of 46 - 60 years [AOR = 2.07; 95% CI: 1.19, 3.58], rural residence [AOR = 1.75; 95% CI: 1.04, 2.95], hours spent in sedentary activity of 4 - 6 hours [AOR = 2.92; 95% CI: 1.53, 5.57], family history of hypertension [AOR = 3.2; 95% CI: 1.92, 5.32], overweight [AOR = 2.30; 95% CI: 1.37, 3.87] and obesity [AOR = 6.03; 95% CI: 2.42, 15.05] were an independent predictors of hypertension-Type 2 Diabetes Mellitus Comorbidity.

Conclusion: Hypertension-Type 2 Diabetes Mellitus Comorbidity status is highly prevalent in this population. Overweight and obesity were the topmost predictors of Hypertension-Type 2 Diabetes Mellitus Comorbidity. Age, family history of hypertension, and hours spent in sedentary activity had association with hypertension. We need to give due emphasis on use of dietary approach to stop hypertension (DASH), lifestyle modification and regular physical exercises for those type 2 diabetics who are living in rural and urban residences + rural residence. Further study is needed to explain why rural type 2 diabetics are at increased risk of developing hypertension in Ethiopia.

Keywords: Hypertension; Type 2 Diabetes Mellitus; Comorbidity; Southern Ethiopia

Abbreviations

BMI: Body Mass Index; CHD: Coronary Heart Disease; CHF: Congestive Heart Failure; DASH: Dietary Approach to Stop Hypertension; DM: Diabetes Mellitus; HTN: Hypertension; HRQoL: Health Related Quality of Life; GI: Glycemic Index; PAL: Physical Activity Level; WCU NEM-MRH; Wachemo University Nigest Elleni Mohammed Memorial Referral Hospital; WHO: World Health Organization

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Introduction

Hypertension is one of the leading causes of the global burden of disease. It is estimated to cause 7.5 million deaths, about 12.8% of the total of all annual deaths throughout the world [1]. It doubles the risk of cardiovascular diseases, including coronary heart disease (CHD), congestive heart failure (CHF), ischemic and hemorrhagic stroke, renal failure, and peripheral arterial disease [2].

The increase in the prevalence of diabetes mellitus (DM) is notably strongly associated with hypertension in addition to other multiple prevalent risk factors [3]. This disease commonly affects people with type 2 diabetes. It is unknown why there is such a significant correlation between the two diseases, but it is widely assumed that obesity, a high-fat, high-sodium diet, and inactivity have led to a rise in both conditions [4]. Since both hypertension and DM have potentially serious medical consequences with significant negative effect on productivity and socioeconomic development even when either of them exists in an individual, how would it be difficult if they exist together as a comorbid disease in an individual?

As it is indicated in various researches, the prevalence of hypertension among diabetics is significantly higher than that of non-diabetic patients [5-9]. Its prevalence is increasing further as people ages and the frequency of obesity increases [10,11]. Diabetes and hypertension seem to comparably impair health related quality of life (HRQoL) [12].

According to the American Diabetes Association (ADA), the combination of hypertension and type 2 diabetes is particularly lethal and can significantly raise a person's risk of having a heart attack or stroke. Having type 2 diabetes and high blood pressure also increases the chances of developing other diabetes-related diseases, such as kidney disease, and retinopathy, which may cause blindness. In addition, their coexistence is also associated with the emergence of resistant hypertension [4,13].

Early detection of hypertension and related cardiovascular risk factors is important to limit complication of DM. In our country, little or no data exists about the prevalence of HTN and related factors among type 2 DM patients. It is worthy to have a picture of this condition and its associated factors in the study area.

Aim of the Study

The study aimed to assess Hypertension-Type 2 Diabetes Mellitus comorbidity status and its predictors among chronic care clinic attending patients in Wachemo University Nigest Eleni Mohammed Memorial Referral Hospital, Southern Ethiopia.

Materials and Methods

Study design and setting

An institution based cross sectional study design was conducted from March 6 to 31, 2017 at Wachemo University Nigest Eleni Mohammed Memorial Referral Hospital. The hospital is located at Hossana town; which is the capital of Hadiya zone in southern nation nationalities and peoples region. It is 232 km far from Addis Ababa, the capital of Ethiopia and 157 km from the regional capital, Hawassa. The study was conducted in chronic care clinic which is under the department of internal medicine, providing care and follow up for patients with chronic diseases.

Population and inclusion criteria

The study population consist of all sampled type 2 diabetic patients who visited chronic care clinic at the hospital. Type 2 DM patients who were following chronic care clinic in the hospital and aged 18 years and older were included in the study. Pregnant women since it is difficult to differentiate whether they have gestational hypertension or chronic (true) hypertension especially after 20th week of gestation, patients who have taken caffeine during the hour preceding the reading and those who have smoked during the preceding 30 minutes were excluded since these factors may affect the BP readings and falsely elevate the result. In addition, patients who were seriously ill at the time of data collection were excluded.

Sample size and sampling technique

The sample size was determined using single population proportion assumption, taking 61.2% the prevalence of hypertension among type 2 DM [14], with 5% marginal error and 95% confidence interval (CI) of certainty (alpha = 0.05). The final sample size was estimated

as 365. Systematic random sampling technique was used to recruit participants in the study. We have taken the first client randomly, and every second type 2 DM patient who attended the clinic during the data collection period was included and interviewed.

Data collection and measurements

Data was collected using structured questionnaire adopted from other similar study and anthropometric measurements after reviewing the record of the chronic care clinic. Blood pressure was measured using mercury sphygmomanometer (adult size) and stethoscope. It was taken in sitting position from the left arm in a single visit after the patient rested for at least 5 minutes before measurement. Those patients with BP of hypertensive range were repeated at least 4 hours apart from the time of previous measurement.

Height and weight measurements were taken to calculate BMI to determine nutritional status of the study participants. Weight of participants was taken using standard beam balance and the scale was checked and calibrated to zero before each measurement. Participants' weight was measured after removing heavy clothes and recorded to the nearest 0.1 kg. Height measurement of participants was taken using the standard measuring scale. Participants' take-off their shoes, stand erect, and look straight in horizontal plane. The occiput, shoulder, buttocks, and heels touched measuring board and height was recorded to the nearest 0.1 cm.

Data quality assurance

To ensure quality of the data, the questionnaire was pretested in a similar setting different from study area, training was given to data collectors for one day before the survey so as to ensure consistency and reduce intra and inter observation difference before data collection and the collected data was checked for completeness and consistency on the day of collection. Supervision and monitoring was made every day by the assigned supervisor and principal investigators. The weighing scale was calibrated to the zero level before each measurement and tested using standard scale during weight measurement.

Data processing and analysis

After data collection, each questionnaire was checked for completeness and code was given before data entry. Data was entered into Epi-Data version 3.1 and exported to SPSS version 20.0 for analysis. The results were presented by using frequency tables, graph and descriptive summaries. To identify factors associated with prevalence of hypertension among type 2 Diabetic Patients, logistic regression analysis was done after checking that all the preliminary assumptions of the model were not violated. Bivariate analysis was performed for each variable to select candidate variables for multivariable logistic analysis. Variables in bivariate analysis with p value < 0.25 was taken as candidates for multivariable logistic analysis. Multiple logistic regression analysis was used to control the effect of confounding variables and to identify associated risk factors for prevalence of hypertension. Adjusted odds ratio along with 95% CI is estimated to identify factors associated with hypertension in multivariable logistic regression. Level of statistical significance was declared at p-value less than 0.05.

Ethical consideration

Ethical clearance was obtained from WCU College of Medicine and health sciences ethical Review committee. Participants were informed about the purpose and procedures of the study and consent was obtained from each study participant. All information obtained from participants during the study was kept confidential. Participants who are unwilling to participate in the study and those who wish to quit their participation at any stage were informed to do so without any restriction.

Result

Socio-demographic characteristics

A total of 365 Type 2 diabetic patients were included in the analysis with a response rate of 100%. Of the total study participants, 239 (65.5%) were males and 158 (43.3%) of them found in the age group 46 - 60 years. The mean age of the respondents was 50.85 with SD of ± 10.37 years. From the total type 2 diabetic patients, 308 (84.4%) were married, 103 (28.2%) were government employee and 122 (33.4%) had primary education (Table 1).

Variables	Frequency (%)	95% CI
Sex of respondents		
Male	239 (65.5)	60.5 - 70.4
Female	126 (34.5)	29.6 - 39.5
Age group		
31 - 45	137 (37.5)	32.6 - 42.5
46 - 60	158 (43.3)	38.4 - 48.8
> 60	70 (19.2)	14.8 - 23.6
Marital status		
Single	47.0 (12.9)	9.3 - 16.4
Married	308 (84.4)	80.5 - 88.5
Divorced	4 (1.1)	0.3 - 2.2
Widowed	6 (1.6)	0.5 - 3.3
Occupational status		
Farmer	69 (18.9)	14.8 - 22.7
Merchant	48 (13.2)	9.6 - 16.7
government employee	103 (28.2)	23.6 - 32.9
Self-employee	74 (20.3)	16.2 - 24.7
Housewife	71 (19.5)	15.3 - 23.6
Educational status		
no education	44 (12.1)	8.8 - 15.3
Primary	122 (33.4)	28.8 - 38.1
Secondary	78 (21.4)	17.3 - 25.8
Above secondary	121 (33.2)	28.5 - 37.5
Residence		
Urban	228 (62.5)	57.3 - 67.1
Rural	137 (37.5)	32.9 - 42.7

Table 1: Socio-demographic characteristics of type 2 diabetic patients attending chronic care clinic of WCU NEMMRH, Southern, Ethiopia, 2017(n = 365).

Health related characteristics

Two hundred sixty six (72.9%) Type 2 DM patients were on oral hypoglycaemic agent and the remaining 99 (27.1%) were insulin users. Two hundred thirty three (63.8%) of the respondents had family history of hypertension; of which 142 (38.9%) had family history of hypertension with their first degree relative. In this study, 293 (80.3%) participants know their status of hypertension; of which 179 (49%) responded as they have hypertension (Table 2).

Life style and behavioural factors

From the total of 365 type 2 diabetic patients, 351 (96.2%) of them drink coffee; of which majority of them (175(49.9%)) drink coffee twice per day. Of the respondents in the study, 21 (5.8%) of them were smokers, 35 (9.6%) were chat chewers, and 60 (16.4%) were alcohol consumers (Table 3).

Variables	Frequency (%)	95% CI
Duration of DM		
< 5 yrs	242 (66.3)	61.6 - 71.2
≥ 5 yrs	123 (33.7)	28.8 - 38.4
Type of medication		
Oral hypoglycemic agent	266 (72.9)	68.2 - 77.3
Insulin	99 (27.1)	22.7 - 31.8
Family history of hypertension		
Yes	233 (63.8)	59.2 - 68.8
No	132 (36.2)	31.2 - 40.8
Family member with hypertension		
First degree relative	142 (38.9)	34.0 - 43.6
Second degree relative	91 (24.9)	20.8 - 29.3
Know their hypertension status		
Yes	293 (80.3)	75.9 - 84.4
No	72 (19.7)	15.6 - 24.1

Table 2: Health related characteristics of type 2 diabetic patients attending chronic care clinic of WCU NEMMRH, Southern Ethiopia, 2017(n = 365).

Variables	Frequency (%)	95% CI
Drinking coffee		
No	14 (3.8)	1.9 - 6.0
Yes	351(96.2)	94.0 - 98.1
Cigarette smoking		
No	344(94.2)	91.8 - 96.4
Yes	21 (5.8)	3.6 - 8.2
Chat chewing		
No	330 (90.4)	87.4 - 93.4
Yes	35 (9.6)	6.6 - 12.6
Drinking alcohol		
No	305 (83.6)	80.0 - 87.4
Yes	60 (16.4)	12.6 - 20.0
Doing vigorous intensity activity		
Yes	48 (13.4)	9.9 - 17.3
No	316 (86.6)	82.7 - 90.1
Doing moderate intensity exercise		
Yes	180 (49.3)	44.4 - 54.2
No	185 (50.7)	45.8 - 55.6
Swimming or riding bicycle		
Yes	18 (4.9)	3.0 - 7.1
No	345 (94.5)	92.3 - 96.7
Hours spent in sedentary activity		
< 4hrs/day	273 (74.8)	70.4 - 79.2
4 - 6 hrs/day	86 (23.6)	19.2 - 27.9
> 6 hrs/day	6 (1.6)	0.5 - 3.0

Table 3: Life style and behavioural characteristics of type 2 diabetic patients attending chronic care clinic of WCU NEMMRH, Southern Ethiopia, 2017(n = 365).

Diet related characteristics

From the total of 365 respondents, 266 (72.9%) of them eat fruit <4days/week and 290 (79.5%) of them eat vegetables < 4 days/week. Three hundred three (83%) of the respondents use cholesterol oil for food preparation (Table 4).

Variables	Frequency (%)	95% CI
Eating fruits		
<4 day	266 (72.9)	67.9 - 77.3
> = 4 day	99 (27.1)	22.7 - 32.1
Eating vegetables		
<4 day	290 (79.5)	75.1 - 83.6
> = 4 day	75 (20.5)	16.4 - 24.9
Type of oil or fat		
Vegetable oil	62 (17.0)	13.2 - 20.8
Cholesterol oil	303 (83.0)	79.2 - 86.8
Eating meal outside		
No meal out side	143 (39.2)	34.5 - 44.1
1 - 2 meal/week	194 (53.2)	48.2 - 58.4
> = 3 meal/week	28 (7.7)	4.9 - 10.4
BMI		
<18.5 (thinness)	13 (3.6)	1.7 - 5.5
18.5 - 24.9 (Normal)	135 (37.4)	32.4 - 42.7
25 - 29.9 (overweight)	163 (45.2)	40.2 - 50.1
30and more (Obese)	50 (13.9)	10.5 - 17.5

Table 4: Diet related characteristics of type 2 diabetic patients attending chronic care clinic of WCU NEMMRH, Southern Ethiopia, 2017(n = 365).

Prevalence of hypertension-type 2 diabetes mellitus comorbidity

The overall prevalence of hypertension-Type 2 diabetes Mellitus comorbidity was found to be (59.7% (95% CI 54.8 - 64.7)) (Figure 1). Of which overweight accounted 29.9% (Figure 2). The prevalence among females was 76(60.3%). The mean systolic blood pressure was 136.26 mmHg (SD ± 17.34) while that of diastolic blood pressure was 83.75 mmHg (SD ± 9.77). The prevalence of hypertension among type 2 DM rural residents was found to be 88 (64.2%).

Predictors of hypertension-type 2 diabetes mellitus comorbidity

In the study, all the preliminary assumptions were checked and found to be satisfied. Consequently, age, religion, residence, vigorous intensity activity, moderate intensity activity, sedentary life style, alcohol drinking, family history of HTN and nutritional status were significantly associated with hypertension status in bivariate analysis.

The final result in multivariable logistic regression analysis of this study confirmed that age, residence, hours spent in sedentary activity, family history of HTN and nutritional status were significantly associated with hypertension status among Type 2 DM patients (Table 5).

Discussion

This study revealed high prevalence of Hypertension-Type 2 Diabetes Comorbidity (59.7%) among patients. This finding is in line with a study conducted in Benin city Nigeria, Kenya, and Nigeria which reported a prevalence of 54.5%, 58.9%, 60% respectively [15,16,18].

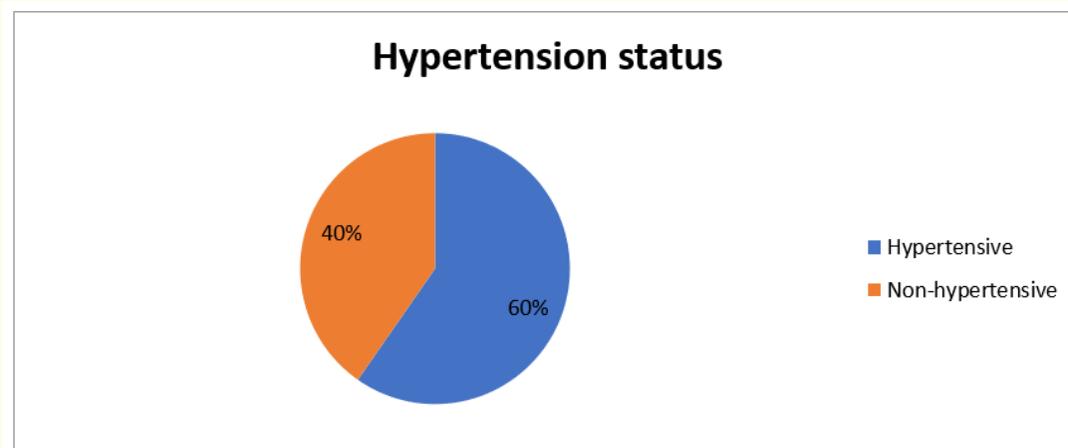


Figure 1: Prevalence of Hypertension-Type 2 diabetes Mellitus comorbidity among patients attending chronic care clinic of WCU NEMMRH, Southern Ethiopia.

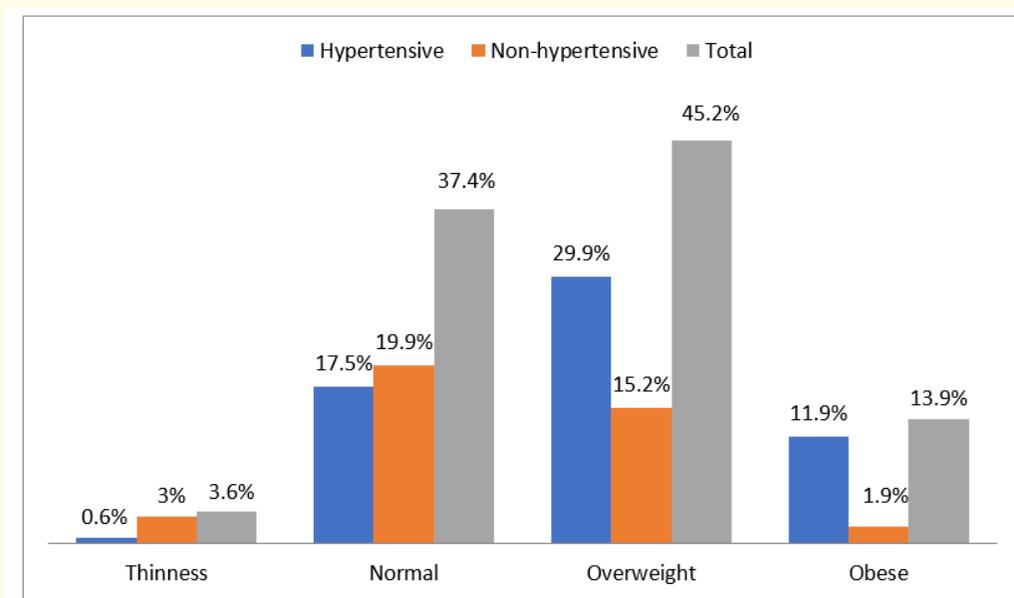


Figure 2: Hypertension-Type 2 diabetes Mellitus comorbidity and nutritional status of patients attending chronic care clinic of WCU NEMMRH, Southern Ethiopia.

However, it is higher than what was reported from India, 42.7%, 27.3% in rural Uganda, 11.8% in Peri-urban Uganda and 13.3% in Tanzania [16,19]. On the other hand, it is lower than the reported prevalence from the study conducted in Gaborone, Botswana, 61.2%, United Arab Emirates 63%, Jimma University specialized hospital, 61.2% and study in Eastern Morocco, 69.9% [5,6,17,20]. This difference might

Explanatory Variables	Hypertension status		COR 95% CI	AOR 95% CI	P-Value
	Yes	No			
Age in year					
31 - 45	68	69	1	1	
46 - 60	107	51	2.13 (1.33, 3.42)	2.07 (1.19, 3.58)	0.010*
> 60	43	27	1.62 (0.90, 2.91)	1.61 (0.82, 3.17)	0.170
Hours spent in sedentary activity (Hr/day)					
1 - 3	147	126	1	1	
4 - 6	67	19	3.02 (1.723, 5.30)	2.92 (1.53, 5.57)	0.001*
7 and above	4	2	1.71 (0.31, 9.516)	4.93 (0.475, 51.17)	0.181
Nutritional Status (BMI)					
Normal (18.5-24.9 kg/m ²)	63	74	1	1	
Thinness (<18.5 kg/m ²)	2	11	0.21 (0.04, 0.97)	0.25 (0.04, 1.39)	0.113
Overweight (25-29.9 kg/m ²)	110	55	2.24 (1.40, 3.59)	2.30 (1.37, 3.87)	0.002*
Obese (>30 kg/m ²)	43	7	7.02 (2.95, 16.71)	6.03 (2.42, 15.05)	< 0.001*
Family history					
No family history	57	75	1	1	
Had family history	161	72	2.942 (1.89, 4.58)	3.20 (1.92, 5.32)	< 0.001*
Residence					
Urban	130	98	1	1	
Rural	88	49	0.739 (0.48, 1.14)	1.75 (1.04, 2.95)	0.037*

Table 5: Predictors of Hypertension-Type 2 diabetes Mellitus comorbidity among patients attending chronic care clinic of WCU NEMMRH, Southern Ethiopia, 2017 (n = 365).

*Statistically significant at p-value < 0.05; 1 is Odds ratio for reference category.

be due to population difference, sample characteristics in which some of them used rural or urban only but in this study we used both urban and rural residents in the sample and the use of primary data most likely explains the difference in the prevalence of hypertension.

Age was identified as one of the major associated factors of hypertension status in the study and the result confirmed that Type 2 diabetic patients with age of 46 - 60 years had twice higher odds to be hypertensive than 31 - 45 years. The result was supported by study conducted in Botswana [5], in United Arab Emirates [6] and in Jimma Ethiopia [21]. The possible justification for this might be due to comorbidities and other diabetes mellitus complications that will develop later than the earliest age, and this age group might also be less likely to adhere with the treatments and to diabetes mellitus care.

In the study residence was found to be one of the predictors of hypertension status, thus the odds of rural resident type 2 diabetics to be hypertensive was twice higher than their counterparts. The finding was in agreement with study finding which indicates comorbid diabetes and hypertension were significantly associated with residing in rural communities in Uganda and Sri Lanka [19,22]. This might be due to late diagnosis of DM, inadequate diabetes mellitus care, less follow up, poor adherence with DM medication and less awareness on nutritional status.

The result of analysis confirmed that hours spent in sedentary activity is also one of the significant risk factors, then in the study patients who stayed 4 - 6 hrs /day in sedentary activity had 3 times higher odds to be hypertensive to be hypertensive as compared to patients who stayed less than 4hours/day. The finding was in-line with study conducted in Northern Chinese Adults and in Oman [23,24].

This might be due to the reason that these patients life style is against the three key factors to manage DM according to WHO guideline i.e. exercise, medication and food. The less energy expenditure may also contribute to fat accumulation which may cause atherosclerosis which is in favour of hypertension development. It might also be due to decreased physical activity level (PAL) i.e. < 1.75 which leads to “unhealthy weight gain” which again predisposes a person for hypertension and other metabolic syndrome [25].

Family history of hypertension was another significant predictor of hypertension-type2 DM comorbidity; as a result patients who had family history of hypertension had 3 times higher odds to have hypertension than those who had no family history. This might be explained by the contribution of genetic factors for the development of hypertension.

One of the main significantly associated factors was nutritional status. Patients who were overweight had twice and obese had 6 times higher odds to have hypertension than the normal counter parts. This finding was supported by research conducted in Eastern Morocco [20]. This might be due to the fact that those individuals who are overweight and obese has less energy expenditure than their energy intake and high glycemic index (GI) dietary preference which in turn leads to the accumulation of fat in the body and then development of hypertension. The limitations of this study were recall bias and the cross sectional nature of the study prevents it from making causal inference. The other limitation is inability to check the association of hypertension with lipid profiles due to lack of resources.

Conclusion

Hypertension-Type 2 Diabetes Mellitus Comorbidity status is highly prevalent in this population. Overweight and Obesity were the topmost predictors of Hypertension-Type 2 Diabetes Mellitus Comorbidity. Here In the study age of patients, residence, hours spent in sedentary activity and family history of HTN were other significantly associated variables with hypertension-Type 2 DM comorbidity. Routine screening and proper management of hypertension-type 2 diabetes Mellitus comorbidity is highly recommended. Emphasis should be given on lifestyle modification, regular physical exercises and use of dietary approach to stop hypertension (DASH) as a guide to prevent unhealthy weight gain. Further researches with advanced methods are recommended.

Competing Interest

The author(s) declare(s) that there is no conflict of interest regarding the publication of this paper.

Authors' Contributions

KS, NT and BM conceived and designed the study, acquisition of data, analysis, and drafting of the paper.

DW and BM were involved in design of the study, acquisition of data, editing, and commenting the paper for intellectual content. All authors were involved in reviewing the article and approved the initial manuscript.

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