How to Cite:
Al nuemi, H. M., & Ibrahim, R. H. (2022). Hypertension among people with diabetes mellitus: Prospective study. *International Journal of Health Sciences*, *6*(S5), 7470–7484.
https://doi.org/10.53730/ijhs.v6nS5.10783

Hypertension among people with diabetes mellitus: Prospective study

Hashim Mustfa Al nuemi
College of Nursing, University of Mosul, Mosul City, Iraq

Radhwan Hussein Ibrahim
College of Nursing, University of Mosul, Mosul City, Iraq

***Abstract*---**Background & Aim: Hypertension is a leading cause of death and disability in people with type 2 diabetes mellitus (T2DM). Despite the fact that type 2 diabetes is more common in City of Mosul-Iraq, little is known about the prevalence of hypertension and the risk factors that go along with it in people with the disease. It was therefore necessary to investigate the prevalence and related variables of hypertension in type 2 diabetes mellitus patients. Methods & Materials: For this study, a tertiary care diabetes clinics from November 2021 to April 2022 were surveyed. Patients with type 2 diabetes at the Al Wafa clinics of were included in the study's source population. A systematic interviewer-administered questionnaire was used to collect data. SPSS software was used to capture the data. Results: (66.7) percent of the (600) participants were women, with a mean age of 53.84 years and a range of 18 to 68 years, more than a quarter of individuals were current smokers, frequent exercisers with obesity, and more than a third were obese and centrally obese. There were substantially more obese and centrally obese persons among CHD patients than among the general population in terms of age, gender, education level, previous smoking, regular exercise, and central obesity (all P 0.05). Conclusion: Hypertension affects almost half of all diabetes patients in Iraq. Diabetes patients in northern Iraq are more likely than those in other regions of Iraq to suffer from hypertension, and this trend has persisted over the past few years.

***Keywords*---**Hypertension, Diabetes Mellitus, Mosul.

1 Introduction

Hypertension is a growing public health issue that contributes significantly to morbidity and mortality. It is a common condition that often coexists with diabetes and exacerbates its complications.(Abdissa & Kene, 2020).Hypertension

dramatically increases the risk of peripheral vascular disease, stroke, retinopathy, and nephropathy in diabetics. It also speeds up the progression of heart disease.(Nouh, Omar, & Younis, 2017) By 2025, a total of 1.56 billion people worldwide are expected to have high blood pressure.(Kearney et al., 2005; Kemche, Saha Foudjo, & Fokou, 2020). Diabetes mellitus and high blood pressure are diseases that affect each other and make a person more likely to get atherosclerotic cardiovascular disease.(Venugopal & Mohammed, 2014) Prevention of HTN is preferable than treatment, especially in people with diabetes (Saeedi et al., 2019). The systemic dysfunction caused by HTN would be challenging to treat.(Lieb, Enserro, Sullivan, & Vasan, 2015) The prevention is also in accordance with the WHO's Global Action Plan, which set a 25 percent decrease in HTN prevalence as one of its three targets.(Vuori, 2018) Recent research has shown that medication that focuses on blood pressure can be successful in lowering the problems that are associated with diabetes. (Group, 1998) The purpose of this study was to determine the prevalence of Hypertension among people with diabetes who visited a diabetes clinic in the City of Mosul-Iraq

2 Materials and Methods

Study design: A cross-sectional methodology was utilized to gather data from patients visiting the Al Wafa diabetic clinic in city of Mosul, Iraq, between November 2021 and March 2022. This is a diabetic specialty clinic in Mosul that was founded in 1996. Prior to data collection, the Ethics Committee of the Ninevah Health Directorate granted ethical permission for the research. Participants: Patients with HT and DM2 who had been clinically diagnosed according to current standards, were at least 18 years old, and had given written permission to be included in the study were included. Patients who were not physically or mentally competent to provide permission, as well as those who were already taking part in other clinical trials that may conflict with ours, were excluded from the research.

Variables: We recorded the following data for each patient: Blood pressure (BP), waist circumference (WC), arm circumference, mid-upper arm circumference (MUC), smoking habit, alcohol use, history of cardiovascular disease (CVD), serum creatinine level, estimated glomerular filtration rate (eGFR), urinary albumin: creatinine ratio (ACRor), total cholesterol (TC) and HDL cholesterol (HDL) cholesterol (LDL), triglycerides, baseline glycemia (BG), glycated hemoglobin (HbA1C), and ambulatory blood glucose levels. According to European Society of Hypertension and American Diabetes Association guidelines, clinical factors include hypercholesterolemia, diabetes, cardiovascular disease, and clinical blood pressure.

To test BP, the methods described in medical literature were employed. SBP was defined as 130mm Hg and DBP as 80mm Hg at the time of the study, according to the AHT guidelines in place. A recent critical review led us to calculate the proportion for less rigorous BP management (140/85mm Hg) in addition to the existing recommendations. A GFR of 60 ml/min/1.73 m was defined as renal failure using the MDRD calculation and the creatinine level in the bloodstream. Data sources/ measurement: This study used a structured interview

questionnaire and an abstract of medical records to get its information. The structured interview questionnaire was used to get information about the person's gender, age, family income, level of education, and smoking status. It was also used to get clinical information about the person's history of high blood pressure, use of antihypertensive drugs, and length of diabetes. A trained nurse took measurements of the person's height and weight, among other things. The height and weight measurements that were used to figure out BMI were taken in a private place using standard methods recommended by the WHO. A SECA Platform lever scale from Germany was used to measure the weight to the nearest 0.25 Kilogram (kg).

A telescopic height rod attached to the SECA scale was used to measure height, and the results were written down to the nearest 0.5 centimeters (cm). The formula used to figure out BMI was: (weight in kilograms / (height in meter 2)
Study size The sample size was calculated using the formula n = p(1-p) X Z2/i2, where 'n' is the expected sample size, 'p' is the estimated proportion of Moroccans with diabetes (6.6%), 'Z' is the critical value (percentile) for the standard normal distribution (1.96 for a 95% confidence interval CI95), and I is the acceptable margin of error. We selected an interval over a set value for security. I is 1-2%. The total sample size was 600 after applying the inclusion and exclusion criteria. Statistical methods Data were input, cleaned, and analyzed using SPSS for Windows 20.0. Univariate and multivariate analyses were used to determine Hypertension and sociodemographic factors. The logistic regression model was used to determine the outcome-independent variable connection. To choose entire model candidates at a p-value of 0.25. Multivariable binary logistic regression with an adjusted odds ratio (AOR) was used to assess the model's independent impact, and model fitness was evaluated using Hosmer and Lemeshow at p0.05.

Results

The study Tables summarized participants' demographic characteristics based on their illness condition. (66.7) percent of the (600) participants were women, with a mean age of 53.84 years and a range of 18 to 68 years, more than a quarter of individuals were current smokers, frequent exercisers with obesity, and more than a third were obese and centrally obese. There were substantially more obese and centrally obese persons among CHD patients than among the general population in terms of age, gender, education level, previous smoking, regular exercise, and central obesity (all P 0.001). An only stroke had significantly different outcomes (P 0.05). Stroke patients were shown to have higher mean ages, percentages of ex-smokers, frequent exercisers, and central obesity (P 0.05) than the general population.

The prevalence of Hypertension was 71.2 percent (95 percent confidence interval: 70.8 percent to 76.1 percent) among T2DM patients at the time of their initial visit. Forty percent of diabetic individuals with Hypertension had stage 1 hypertension, whereas ten percent had stage 2 hypertension. In the current study, 351 T2DM patients without Hypertension at baseline were followed for one year. Significantly higher rates of uncontrolled hypertension were seen in individuals older than 60 years (p = 0.027), those with uncontrolled DM (HbA1c

7%) (p = 0.008), and those with a positive family history of hypertension (p = 0.000). (p-value 0.013)

Table 1: Socioeconomic and demographic information about the participants

Variable	Categories	n (%)
Age	40-49	34.9
	50-59	37.1
	60-69	27.2
	Above70	0.8
Gender	Male	33.3
	Female	66.7
Marital status	Single	10.1
	Married	49.8
	Divorced	5.5
	Widowed	34.6
Employment	Unemployed	74.4
	Employed	25.6
Duration of diabetes	Less than 5 years	11.7
	5-10 years	31.0
	More than 10 years	57.3
Smoking status	Never	62.6
	Ex-smoker	20
	Current smoker	17.4
BMI	Underweight	7.5
	Normal	17.5
	Overweight	29.8
	Obese	45.2
Family history of Hypertension	No	2.1
	Yes	97.9

Table 2: Comparison of sociodemographic characteristics between patients with HT and patients without HT

Variable	Categories	HT		P-value
		Yes, n (%)	No, n (%)	
Age*		60.99 (10.02)	54.98 (11.36)	0.001*
Gender	Men	35.7	30.9	0.704
	Women	64.3	69.1	
Marital status	Single	9.8	7	0.007*
	Married	45.2	45.5	

	Divorced	9.3	8	
	Widowed	35.6	39.5	
Employment	Unemployed	77	71.6	0.372
	Employed	23	28.4	
BMI	Underweight	4.9	10	0.001*
	Normal	14.8	20.3	
	Overweight	26.0	33.7	
	Obese	54.3	36	
Smoking status	Never	55.5	68.1	0.001*
	Ex-smoker	23.8	17.8	
	Current smoker	20.7	14.1	
Duration of DM	≤5 years	46.8	15.1	0.003*
	>5-10years	29.1	40.8	
	More than 10 years	24.1	44.1	
Family history of Hypertension	No	3.3	1.9	0.001*
	Yes	96.7	98.1	
Sedentary activity	≤4 hours	52.2	65.9	0.001*
	>4 hours	47.8	34.1	
Sleep duration	≤7.5 hours	33.4	56.9	0.684
	>7.5 hours	66.6	43.1	
Stress	No or low stress	36.8	52.8	0.001*
	Moderate or high stress	63.2	47.2	
Salt consumption after diabetes	No change in consumption	22.4	30.4	0.001*
	Minimally reduced	27.8	34.4	
	Substantially reduced	16.4	19.7	
	Stopped at all	33.4	15.4	
Physical activity	Low	10.6	7.2	0.008*
	Moderate	62.7	57.2	
	High	26.7	35.6	

Table 3: Comparison of laboratory parameters between patients with HT and patients without HT

Variables	Hypertension		P-value
	Yes	No	
Low-density lipoprotein (mg/dl)	110 (82-139)	106 (83-130.5)	0.293
High-density lipoprotein (mg/dl)	41 (33-51)	41 (34-49)	0.426
Total cholesterol (mg/dl)	175 (139-214)	165 (131-226)	0.028*
Serum creatinine (mg/dl)	1.0 (0.8-1.2)	0.82 (0.7-1.1)	0.007*
Hemoglobin A1c (%)	8.4 (7-10)	8.6 (7.2-9.8)	0.624

Table 4: Type 2 diabetes patients who have high blood pressure are more likely to have other risk *factors*

Physical activity	Low	10.6	
	Moderate	62.7	0.158
	High	26.7	0.038
Family history of Hypertension	Negative	3.3	
	Positive	96.7	0.001
Smoking status	Never	55.5	
	Ex-smoker	23.8	0.001
	Current smoker	20.7	0.001
BMI	Normal	4.9	
	Underweight	14.8	0.711
	Overweight	26.0	0.021
	Obese	54.3	0.001
Sedentary activity	≤4 hours	52.2	
	>4 hours	47.8	0.015
Stress	No or low stress	36.8	
	Moderate or high stress	63.2	0.001
Creatinine		1.0 (0.8-1.2)	0.003

3 Discussions

Many studies have attempted to show a link. However, methodological issues and differences between hypertension and diabetes frequently make their interpretation challenging. Many research in non-diabetic subjects discovered statistically significant associations between blood pressure and other glycemic markers(Sunkara & Ahsan, 2017) This link appeared to be independent of age, obesity level, or heart rate, and it was stronger in people with higher heart rates.(Petrie, Guzik, & Touyz, 2018) The impact of sympathetic pathways, whether neutral or humoral, on both blood pressure and blood glucose regulation has been offered as a possible explanation for this relationship (Cryer, Horani, & DiPette, 2016) This is unlikely to be a whole explanation, however, because there is still a link between these two variables after controlling for heart rate, which is thought to be a measure of sympathetic activity. Drury examined other putative pathogenic mechanisms explaining the link between hypertension and diabetes. (Han, Rice, & Cai, 2016)

Anomaly in catecholamines, insulin, renal salt metabolism, and the renin-angiotensin system are among them. Epidemiological studies are difficult to confirm such assumptions due to methodological issues in measuring biochemical variables in large groups of people (Hunter, Dhaun, & Bailey, 2022). Thyrotoxicosis, pheochromocytoma, Cushing's syndrome, acromegaly, and primary hyperaldosteronism are all endocrine illnesses that can cause diabetes and hypertension. Renal artery stenosis does not appear to be more common in people with diabetes. (Chan et al., 2022)

Hypertension (HTN) is present in more than 50% of patients with diabetes mellitus (DM) and contributes significantly to both micro and macrovascular disease in DM. Hypertension in the diabetic individual markedly increases the risk and accelerates the course of cardiac disease, peripheral vascular disease, stroke, retinopathy, and nephropathy(Mekuria, Kifle, & Melak, 2022; Tharaheswari & Yogamoorthi, 2030). Indeed, the risk for cardiovascular disease (CVD) is four-fold higher in patients with both DM and HTN as compared to the normotensive non-diabetic controls(Fan, 2017; Pavlou et al., 2018)

To this point, a meta-analysis of 102 prospective studies involving 698,782 individuals found that DM is responsible for approximately a two-fold increased risk for coronary heart disease, stroke and deaths from cardiovascular cause, including heart failure, cardiac arrhythmia, sudden death, hypertensive disease, and aortic aneurysms (Carvalho, de Almeida, Borges, & Campos, 2018). Most diabetic individuals' hypertension is "essential" and cannot be explained by renal dysfunction. Increased peripheral vascular resistance appears to cause hypertension in type I and type II diabetes. Blood pressure in diabetics may also be caused by an increase in the amount of salt that may be exchanged in the body.(Lee et al., 2018) It's becoming more and more clear that insulin resistance/hyperinsulinemia may be a major contributor to hypertension in people with both modest and obvious carbohydrate metabolism problems. In type II diabetes mellitus, increasing insulin levels have been linked to an increased risk of cardiovascular disease. In diabetics, lipid metabolic problems, platelet dysfunction, and abnormalities in clotting factors are other risk components for cardiovascular disease. Reduced excessive cardiovascular risk as well as blood pressure reduction are the primary objectives of antihypertensive medication in patients with coexisting diabetes.(Di Giosia et al., 2018; Glovaci, Fan, & Wong, 2019) Diabetes mellitus (DM) and hypertension are often co-occurring conditions that increase the risk of cardiovascular disease and cardiovascular death. DM patients at Al Wafa clinics are the focus of this study, which sought to create the prevalence of hypertension and its risk factors. A fourfold to fivefold increase in mortality is connected with the incidence of hypertension in this form of diabetes, mostly due to coronary artery disease and stroke.(Arjunan, 2020) Diabetes mellitus (DM) is the primary cause of death among patients, accounting for 86% of all DM-related fatalities. (Motala, Mbanya, Ramaiya, Pirie, & Ekoru, 2022)

In the present study the prevalence of HT among DM is (). The result of this study, in agreement with study of Hosanna Nigist Ellen Mohamed Memorial Hospital, Southern Ethiopia, according to these findings, hypertension was found to be prevalent in 55 percent of patients with type 2 diabetes who attended a chronic illness follow-up clinic at Hosanna NEMM hospital, with 50 percent of them being discovered for the first time during the study period.(Tadesse, Amare, Hailemariam, & Gebremariam, 2018) Furthermore, another study in Gaborone, Botswana, identified hypertension in 61.2 percent of diabetic patients. Hypertension was seen in 64.4 percent of female DM patients and 53.1 percent of male DM patients. Female sex was linked to a higher risk of hypertension (P=0.0001). Hypertension was linked to older age (P=0.00). In those over 50 years old, the percentage of hypertensive people in the DM population jumped to 70.9 percent.(Tapela et al., 2020)

Risk factors

Age

HTN risk was greater in T2DM patients aged 50–59 years than in those aged 50–59 years. Previous studies in Iraq and Jourdan confirmed this study. This finding can be explained by the fact that with age, atherosclerosis and the thickening of the arteries occur, and each layer of blood arteries undergoes a complicated transformation. The thickening of arterial walls disrupts normal blood flow, allowing fatty and calcium deposits to build inside the arteries, narrowing the artery and causing hypertension. Ageing caused by the thickening of the endothelium damages the integrity of the endothelium and reduces the availability of vasodilators such as nitric oxide.

Gender

From the point of view of gender, In our survey, 63 percent of the members were female, whereas the remaining 37 percent were male, indicating a considerable gender divide. The difference may not reflect the actual distribution of diabetes in the population because this is a small institution-based cross-sectional study. The prevalence of hypertension differed across the gender; around 60% of males and 77% of females were hypertension. In contrast, 40.3 percent of males and 23.2 percent of normal-hypertensive females had normal blood pressure. Again, this is a significant difference that may or may not reflect the true distribution of hypertension among diabetic patients in the community. One cause for this disparity could be cultural: most, if not all, women in this society are confined to their homes and only go out when necessary.

BMI

Obesity is linked to hypertension in type 2 diabetes patients, according to the current study, which supports previous findings (Poykko et al., 2003; van den Berg, Kloppenborg, Kessels, Kappelle, & Biessels, 2009). Because adipocytes in obese people activate angiotensinogen, which increases sodium reabsorption and causes volume overload in the kidneys (Hall, do Carmo, da Silva, Wang, & Hall, 2019), obesity promotes hypertension in obese persons by increasing free fatty acids (FFA), which may cause HT by causing inflammation or affecting the renal system. Inflammation causes endothelial dysfunction, which leads to vasoconstriction and arterial stiffness, resulting in hypertension (Kostov & Halacheva, 2018). Furthermore, when an individual is obese or overweight, they have insulin resistance and high bad cholesterol levels, which causes blood vessels to constrict. Hypertension develops gradually in a person (Tam, Morais, & Santosa, 2020).

Physical exercise

Other factors contributing to the high prevalence of diabetes and hypertension in both men and women may include a lack of exercise and physical activity, as well as rapid urbanization as a result of internal displacement of people from vast

agricultural areas to the outskirts of Kabul, and, ultimately, a lack of suitable exercise environments. Other factors.

In persons with T2DM, the passive activity state has also been established as an independent driver of hypertension. The patients' chances of staying in a passive state for 4 or more hours each day were nearly 2 times greater than the controls. The SUN cohort supports this conclusion. (Weatherall, Paprocki, Meyer, Kudel, & Witt, 2018) and a cross-sectional investigation at the Hossana NEMM hospital (Tadesse et al., 2018). It also backs the country's NSAP for NCD prevention, emphasising health promotion and disease prevention and behavioural risk factors. As a result, this endeavour must be bolstered and sustained (Lang, Barling, & Caraher, 2009). The connection between a sedentary lifestyle and HT could be explained by persons who stay low physical activity, which may lead to obesity and HT (Bouchard, Blair, & Haskell, 2012).

Duration of DM

After controlling for the confounding effects of age, HbA1c, and other relevant variables, our findings revealed that hypertension is positively linked with the duration of diabetes. The severity of macro-and microvascular problems, which contribute to the development of renal and atherosclerotic hypertension, is linked to the duration of diabetes.

T2DM and HTN are two of the most common disorders in adults worldwide, affecting a considerable percentage of the population. Creating national and international health programs to prevent and control the burden of such comorbid illnesses requires reliable information regarding the prevalence of hypertension in various world areas. Both are significant risk factors for atherosclerosis and cardiovascular disorders, such as heart attack and stroke. If the two conditions coexist, the risk of complications is often multiplied. More than half of Type 2 diabetic patients (55%) were hypertensive in this study. The findings show that age, gender, marital status, clients' residence, and typical working hours have a significant relationship.

Periodic health education and awareness activities regarding biological and behavioral factors such as the importance of physical activity, avoidance of smoking and alcohol should be provided. Awareness on knowledge about early signs and symptoms and risk factors needs to be imparted to the study population, and the subsequent positive attitudes and practices adopted by Periodic studies should reassess the community in the same population in the future.

Smoking

Smoking significantly raises the risk of cardiovascular disease (CVD) for both the general population and type 2 diabetes patients. (Charlton et al., 2019; do Vale Moreira et al., 2020; Liu et al., 2020). Therefore, treatments to avoid or quit smoking, together with cardiovascular risk factor management including glycemic control, blood pressure management, and cholesterol management, are essential recommendations for the prevention of CVD in diabetes.(Carlsson, Andersson,

Talbäck, & Feychting, 2021). Cigarette smoking is a major risk factor for cardiovascular disease and HT, especially myocardial infarction, stroke, and sudden death. (Avilova & Muslimakhon, 2022; Kondo, Nakano, Adachi, & Murohara, 2019). Prolonged smoking and the development of hypertension are still linked in some way, although the exact nature of that connection is still up for debate. Numerous epidemiological studies have found no independent association between smoking and hypertension despite the fact that smoking has an immediate pressor impact on the heart. Smoking, on the other hand, has long been seen as a risk factor for the development of hypertension. Smoking's effects on the cardiovascular system are the result of a multifactorial interaction involving hemodynamics, the autonomic nervous system, and a number of vasoactive agents. (Shao, Wang, Tian, & Tang, 2020). Few studies have examined the long-term effects of smoking on arterial stiffness, and the available information is inconclusive at best. " (Ciumărnean et al., 2021). There was no significant change in baseline brachial-ankle pulse wave velocity between chronic smokers and nonsmokers in Kim et alstudy, .'s however. Circulatory system damage caused by persistent smoking may be exaggerated by assessments of arterial compliance in young people, according to new research. Previous research has shown a significant rise in aortic stiffness with age, although peripheral arterial stiffness remained rather constant. As a result, the idea that smoking promotes arterial stiffness, resulting in chronically increased blood pressure and harm to target organs, seems appealing and reasonable. Smoking and diabetes have a mutually reinforcing effect on the occurrence of CVD events, according to our data. Cigarette smoking and diabetes both raise the risk of cardiovascular disease (CVD) on their own. (Eliasson, 2003; Śliwińska-Mossoń & Milnerowicz, 2017), and among people with diabetes, smoking is the key lifestyle risk factor for CVD [6]. There is also a correlation between passive smoking and higher risk of cardiovascular disease (CVD) among those who are current smokers compared to those who are never smokers. (Śliwińska-Mossoń & Milnerowicz, 2017). It is important to note that persons with diabetes are more likely to smoke and have a lower smoking quit rate than non-diabetics, and secondhand smoke exposure should be reduced or avoided as a public health precaution.(Sowers, Epstein, & Frohlich, 2001). Few prospective studies have looked into the impact of smoking and diabetes on the risk of cardiovascular disease (CVD) and found no evidence that those with diabetes had an increased risk of CVD from smoking than those without diabetes.(Grundy et al., 1999).

Family history

Finally, those with Type 2 Diabetes who had a family history of hypertension were more likely to have high blood pressure. Cases with a family history of hypertension had a twofold increase in chances compared to those without. The study done at Hossana NEMM Hospital is in agreement with the findings of this study. (Dalo, Yarlagadda, & Tatiparthi, 2017). The fact that genetics has a role in the development of hypertension lends credence to this.

A non-modifiable risk factor is having a history of hypertension in one's family. Family studies have shown that hypertension is an inherited condition, with blood pressure correlations between siblings and parents and offspring.(Ranasinghe, Cooray, Jayawardena, & Katulanda, 2015). Approximately

30 percent of the variable in blood pressure may be attributable to hereditary factors, which range from 25 percent in pedigree studies to 65 percent in twin studies. (Awoke, Awoke, Alemu, & Megabiaw, 2012), (Aniza, Nurmawati, Hanizah, & Ahmad Taufik, 2016). The increased renal proximal sodium reabsorption, as well as genetic traits associated with high blood pressure, such as high sodium-lithium counter-transport, low urinary kallikrein excretion, elevated uric acid level, high fasting plasma insulin concentrations, high-density LDL sub-fractions, fat pattern index, oxidative stress, and body mass index, are among the various mechanisms proposed to explain the relationship between hypertension and positive family history of hypertension. (Iloh, Chuku, Obiegbu, Ofoedu, & Ikwudinma, 2013). Most chronic noncommunicable illnesses have a strong link to a person's family history, which is an unchangeable representation of a person's genetic predisposition, as well as their exposure to similar environments and lifestyles. (Kumara, Perera, Dissanayake, Ranasinghe, & Constantine, 2013). For public health and preventative medicine, tracing one's family history is a realistic and helpful technique (Abdulah, 2014) (Sachdev, 2011). The cheap cost, increased acceptance, and the fact that it reflects common genetic and lifestyle characteristics are all advantages of using family history as a risk assessment tool. To identify high-risk populations long before hypertension is diagnosed and to focus treatments and disease preventive measures, family history is beneficial for screening purposes, despite the fact that it cannot be changed. (Ahmed et al., 2015). In the prevention of hypertension, it is important for people to be aware of the risks they face, and lifestyle changes have been shown to be effective. In this way, the utilization of family history as a public health intervention to help prevent hypertension is showing encouraging results.(Osadnik et al., 2018)Biological and behavioral aspects, such as the necessity of physical exercise and avoiding smoking and drinking, should be addressed regularly in health education and awareness programs. Knowledge of early signs and symptoms and risk factors must be taught and appraised by future studies in the same group to ensure that the positive attitudes and actions adopted by the community are maintained

In conclusion, this study has found a bi-directional association between obesity and self-esteem among Iraqi students in addition to cross-sectional correlations. Obesity and increased weight-related measurements lead to a significant drop in self-esteem over time. In addition, higher self-esteem leads to a lower body mass index over time.

References

Abdissa, D., & Kene, K. (2020). Prevalence and determinants of hypertension among diabetic patients in jimma university medical center, southwest Ethiopia, 2019. *Diabetes, Metabolic Syndrome and Obesity: Targets and Therapy, 13*, 2317.

Abdulah, A. A. F. A. (2014). *The Risk Factors among Hypertensive Patients at Al kalakla Health Centers, Khartoum State, Sudan (2013).* University of Gezira,

Ahmed, S. M., Sami, W., Alanazi, H., Aljarbaa, T., Alkhamis, S., & Almutiri, F. (2015). A study of risk factors for Diabetes & hypertension among Expatriate workers in Majmaah city, Saudi Arabia. *Int. J. Health Rehabil. Sci.(IJHRS), 4*, 103-114.

Aniza, I., Nurmawati, A., Hanizah, Y., & Ahmad Taufik, J. (2016). Modifiable risk factors of cardiovascular disease among adults in rural community of Malaysia: a cross sectional study. *Malaysian Journal of Public Health Medicine, 16*(1), 53-61.

Arjunan, C. (2020). *A Study on Serum Uric Acid Levels in Type 2 Diabetes Patients and Its Association with Cardiovascular Disease.* Tirunelveli Medical College, Tirunelveli,

Avilova, K. X., & Muslimakhon, A. (2022). RISK FACTORS FOR CARDIOVASCULAR DISEASES. *Барқарорлик ва Етакчи Тадқиқотлар онлайн илмий журнали, 2*(1), 268-273.

Awoke, A., Awoke, T., Alemu, S., & Megabiaw, B. (2012). Prevalence and associated factors of hypertension among adults in Gondar, Northwest Ethiopia: a community based cross-sectional study. *BMC cardiovascular disorders, 12*(1), 1-6.

Bouchard, C., Blair, S. N., & Haskell, W. L. (2012). *Physical activity and health*: Human Kinetics.

Carlsson, S., Andersson, T., Talbäck, M., & Feychting, M. (2021). Mortality rates and cardiovascular disease burden in type 2 diabetes by occupation, results from all Swedish employees in 2002–2015. *Cardiovascular Diabetology, 20*(1), 1-10.

Carvalho, D. S., de Almeida, A. A., Borges, A. F., & Campos, D. V. (2018). Treatments for diabetes mellitus type II: new perspectives regarding the possible role of calcium and cAMP interaction. *European journal of pharmacology, 830*, 9-16.

Chan, Q., Wren, G. M., Lau, C.-H. E., Ebbels, T., Gibson, R., Loo, R. L., . . . Steffen, L. M. (2022). Blood pressure interactions with the DASH dietary pattern, sodium, and potassium: The International Study of Macro-/Micronutrients and Blood Pressure (INTERMAP). *The American journal of clinical nutrition*.

Charlton, R., Green, A., Shaddick, G., Snowball, J., Nightingale, A., Tillett, W., . . . Parkinson Andrew Spackman Eldon, P. s. g. B. A. B. L. B. M. B. S. C. L. D. C. D. E. F. C. F. O. H. H. H. P. J. J. M. V. P. J. (2019). Risk of type 2 diabetes and cardiovascular disease in an incident cohort of people with psoriatic arthritis: a population-based cohort study. *Rheumatology, 58*(1), 144-148.

Ciumărnean, L., Milaciu, M. V., Negrean, V., Orăşan, O. H., Vesa, S. C., Sălăgean, O., . . . Vlaicu, S. I. (2021). Cardiovascular risk factors and physical activity for the prevention of cardiovascular diseases in the elderly. *International journal of environmental research and public health, 19*(1), 207.

Cryer, M. J., Horani, T., & DiPette, D. J. (2016). Diabetes and hypertension: a comparative review of current guidelines. *The journal of clinical hypertension, 18*(2), 95-100.

Dalo, A., Yarlagadda, R., & Tatiparthi, R. (2017). Assessment of asthma treatment outcomes among adult outpatients at Nemmh Chest Clinic in Hadiya Zone, Southern Ethiopia. *Journal of basic and clinical pharmacy, 8*(3).

Di Giosia, P., Giorgini, P., Stamerra, C. A., Petrarca, M., Ferri, C., & Sahebkar, A. (2018). Gender differences in epidemiology, pathophysiology, and treatment of hypertension. *Current atherosclerosis reports, 20*(3), 1-7.

do Vale Moreira, N. C., Hussain, A., Bhowmik, B., Mdala, I., Siddiquee, T., Fernandes, V. O., . . . Meyer, H. E. (2020). Prevalence of metabolic syndrome by different definitions, and its association with type 2 diabetes, pre-diabetes,

and cardiovascular disease risk in Brazil. *Diabetes & Metabolic Syndrome: Clinical Research & Reviews, 14*(5), 1217-1224.
Eliasson, B. (2003). Cigarette smoking and diabetes. *Progress in cardiovascular diseases, 45*(5), 405-413.
Fan, W. (2017). Epidemiology in diabetes mellitus and cardiovascular disease. *Cardiovascular endocrinology, 6*(1), 8.
Glovaci, D., Fan, W., & Wong, N. D. (2019). Epidemiology of diabetes mellitus and cardiovascular disease. *Current cardiology reports, 21*(4), 1-8.
Group, U. P. D. S. (1998). Tight blood pressure control and risk of macrovascular and microvascular complications in type 2 diabetes: UKPDS 38. *Bmj, 317*(7160), 703-713.
Grundy, S. M., Benjamin, I. J., Burke, G. L., Chait, A., Eckel, R. H., Howard, B. V., . . . Sowers, J. R. (1999). Diabetes and cardiovascular disease: a statement for healthcare professionals from the American Heart Association. *Circulation, 100*(10), 1134-1146.
Hall, J. E., do Carmo, J. M., da Silva, A. A., Wang, Z., & Hall, M. E. (2019). Obesity, kidney dysfunction and hypertension: mechanistic links. *Nature Reviews Nephrology, 15*(6), 367-385.
Han, C., Rice, M. W., & Cai, D. (2016). Neuroinflammatory and autonomic mechanisms in diabetes and hypertension. *American Journal of Physiology-Endocrinology and Metabolism, 311*(1), E32-E41.
Herman, H., Ardani, I. G. A. I., Aryani, L. N. A., Windiani, I. G. A. T., Adnyana, I. G. N. S., & Setiawati, Y. (2022). Signs and symptoms of depression in children and adolescents with type 1 diabetes mellitus: A case report. International Journal of Health & Medical Sciences, 5(1), 150-153. https://doi.org/10.21744/ijhms.v5n1.1861
Hunter, R. W., Dhaun, N., & Bailey, M. A. (2022). The impact of excessive salt intake on human health. *Nature Reviews Nephrology*, 1-15.
Iloh, G. U. P., Chuku, A., Obiegbu, N. P., Ofoedu, J. N., & Ikwudinma, A. O. (2013). Frequency of cardiovascular risk factors in adult Nigerians with family history of non-communicable cardiovascular disease in a primary care clinic of a tertiary hospital in a resource-constrained environment of Eastern Nigeria. *American Journal of Health Research, 1*(1), 17-25.
Kearney, P. M., Whelton, M., Reynolds, K., Muntner, P., Whelton, P. K., & He, J. (2005). Global burden of hypertension: analysis of worldwide data. *The Lancet, 365*(9455), 217-223.
Kemche, B., Saha Foudjo, B. U., & Fokou, E. (2020). Risk factors of hypertension among diabetic patients from Yaounde central hospital and Etoug-Ebe Baptist health centre, Cameroon. *Journal of Diabetes Research, 2020*.
Kondo, T., Nakano, Y., Adachi, S., & Murohara, T. (2019). Effects of tobacco smoking on cardiovascular disease. *Circulation Journal, 83*(10), 1980-1985.
Kostov, K., & Halacheva, L. (2018). Role of magnesium deficiency in promoting atherosclerosis, endothelial dysfunction, and arterial stiffening as risk factors for hypertension. *International journal of molecular sciences, 19*(6), 1724.
Kumara, W. N., Perera, T., Dissanayake, M., Ranasinghe, P., & Constantine, G. R. (2013). Prevalence and risk factors for resistant hypertension among hypertensive patients from a developing country. *BMC research notes, 6*(1), 1-7.
Lang, T., Barling, D., & Caraher, M. (2009). *Food policy: integrating health, environment and society*: OUP Oxford.

Lee, C. J., Hwang, J., Lee, Y.-h., Oh, J., Lee, S.-H., Kang, S.-M., . . . Park, S. (2018). Blood pressure level associated with lowest cardiovascular event in hypertensive diabetic patients. *Journal of hypertension, 36*(12), 2434-2443.

Lieb, W., Enserro, D. M., Sullivan, L. M., & Vasan, R. S. (2015). Residual cardiovascular risk in individuals on blood pressure–lowering treatment. *Journal of the American Heart Association, 4*(11), e002155.

Liu, G., Hu, Y., Zong, G., Pan, A., Manson, J. E., Rexrode, K. M., . . . Sun, Q. (2020). Smoking cessation and weight change in relation to cardiovascular disease incidence and mortality in people with type 2 diabetes: a population-based cohort study. *The Lancet Diabetes & Endocrinology, 8*(2), 125-133.

Mekuria, A. B., Kifle, Z. D., & Melak, A. D. (2022). Level of knowledge, prevention practice, and predictors towards stroke among diabetic and hypertensive patients having a follow up at University of Gondar Comprehensive Specialized Referral Hospital, Northwest Ethiopia. A cross-sectional study. *Clinical Epidemiology and Global Health*, 100950.

Motala, A. A., Mbanya, J. C., Ramaiya, K., Pirie, F. J., & Ekoru, K. (2022). Type 2 diabetes mellitus in sub-Saharan Africa: challenges and opportunities. *Nature Reviews Endocrinology*, 1-11.

Nouh, F., Omar, M., & Younis, M. (2017). Prevalence of hypertension among diabetic patients in Benghazi: a study of associated factors. *Asian Journal of Medicine and Health, 6*(4), 1-11.

Osadnik, T., Pawlas, N., Lonnie, M., Osadnik, K., Lejawa, M., Wądołowska, L., . . . Gawlita, M. (2018). Family history of premature coronary artery disease (P-CAD)—A non-modifiable risk factor? Dietary patterns of young healthy offspring of P-CAD patients: A case-control study (MAGNETIC project). *Nutrients, 10*(10), 1488.

Pavlou, D. I., Paschou, S. A., Anagnostis, P., Spartalis, M., Spartalis, E., Vryonidou, A., . . . Siasos, G. (2018). Hypertension in patients with type 2 diabetes mellitus: Targets and management. *Maturitas, 112*, 71-77.

Petrie, J. R., Guzik, T. J., & Touyz, R. M. (2018). Diabetes, hypertension, and cardiovascular disease: clinical insights and vascular mechanisms. *Canadian Journal of Cardiology, 34*(5), 575-584.

Poykko, S. M., Kellokoski, E., Horkko, S., Kauma, H., Kesaniemi, Y. A., & Ukkola, O. (2003). Low plasma ghrelin is associated with insulin resistance, hypertension, and the prevalence of type 2 diabetes. *Diabetes, 52*(10), 2546-2553.

Ranasinghe, P., Cooray, D. N., Jayawardena, R., & Katulanda, P. (2015). The influence of family history of hypertension on disease prevalence and associated metabolic risk factors among Sri Lankan adults. *BMC Public Health, 15*(1), 1-9.

Sachdev, B. (2011). Prevalence of hypertension and associated risk factors among Nomad Tribe groups. *JOURNAL OF ANTHROPOLOGY, 7*, 125.

Saeedi, P., Petersohn, I., Salpea, P., Malanda, B., Karuranga, S., Unwin, N., . . . Ogurtsova, K. (2019). Global and regional diabetes prevalence estimates for 2019 and projections for 2030 and 2045: Results from the International Diabetes Federation Diabetes Atlas. *Diabetes research and clinical practice, 157*, 107843.

Shao, C., Wang, J., Tian, J., & Tang, Y.-d. (2020). Coronary artery disease: from mechanism to clinical practice. *Coronary Artery Disease: Therapeutics and Drug Discovery*, 1-36.

Śliwińska-Mossoń, M., & Milnerowicz, H. (2017). The impact of smoking on the development of diabetes and its complications. *Diabetes and Vascular Disease Research, 14*(4), 265-276.

Sowers, J. R., Epstein, M., & Frohlich, E. D. (2001). Diabetes, hypertension, and cardiovascular disease: an update. *Hypertension, 37*(4), 1053-1059.

Sunkara, N., & Ahsan, C. H. (2017). Hypertension in diabetes and the risk of cardiovascular disease. *Cardiovascular endocrinology, 6*(1), 33.

Suryasa, I. W., Rodríguez-Gámez, M., & Koldoris, T. (2021). Health and treatment of diabetes mellitus. International Journal of Health Sciences, 5(1), i-v. https://doi.org/10.53730/ijhs.v5n1.2864

Tadesse, K., Amare, H., Hailemariam, T., & Gebremariam, T. (2018). Prevalence of hypertension among patients with type 2 diabetes mellitus and its socio demographic factors in Nigist Ellen Mohamed Memorial Hospital Hosanna, Southern Ethiopia. *J Diabetes Metab, 9*(4), 4-10.

Tam, B. T., Morais, J. A., & Santosa, S. (2020). Obesity and ageing: Two sides of the same coin. *Obesity Reviews, 21*(4), e12991.

Tapela, N. M., Clifton, L., Tshisimogo, G., Gaborone, M., Madidimalo, T., Letsatsi, V., . . . Lockman, S. (2020). Prevalence and determinants of hypertension awareness, treatment, and control in Botswana: a nationally representative population-based survey. *International journal of hypertension, 2020*.

Tharaheswari, M., & Yogamoorthi, A. (2030). Studies on Dyslipidemia in Diabetic and Non Diabetic Hypertensive Patients. *Studies*, 3.

van den Berg, E., Kloppenborg, R. P., Kessels, R. P., Kappelle, L. J., & Biessels, G. J. (2009). Type 2 diabetes mellitus, hypertension, dyslipidemia and obesity: a systematic comparison of their impact on cognition. *Biochimica et Biophysica Acta (BBA)-Molecular Basis of Disease, 1792*(5), 470-481.

Venugopal, K., & Mohammed, M. (2014). Prevalence of hypertension in type-2 diabetes mellitus. *CHRISMED Journal of Health and Research, 1*(4), 223.

Vuori, I. (2018). World health organization and physical activity. *Progress in Preventive Medicine, 3*(1), e0012.

Weatherall, J., Paprocki, Y., Meyer, T. M., Kudel, I., & Witt, E. A. (2018). Sleep tracking and exercise in patients with type 2 diabetes mellitus (step-D): pilot study to determine correlations between Fitbit data and patient-reported outcomes. *JMIR mHealth and uHealth, 6*(6), e8122.