

# Prevalence of hypertension in type-II diabetes mellitus

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## Abstract

**Objective:** To determine the prevalence of hypertension in patients with diabetes mellitus (DM) and association with hypertension and diabetic complications.

**Materials and Methods:** In this study one hundred and thirty diabetic cases were evaluated for hypertension on diabetic patients by measuring their blood pressure and using a sphygmomanometer in Al-Beroni Teaching Hospital, Kapisa Province. The other obtained data included age, sex, weight, height, body mass index.

**Study Design:** A cross-sectional study. Sample Size: 130.

**Inclusion Criteria:** All Type-2 diabetic patients who are on treatment of diabetes.

**Exclusion Criteria:** a. Newly diagnosed diabetes, b. Seriously ill patients, c. Refused to be a part of the study, d. Pregnancy, e. Type-1 diabetes mellitus.

**Results:** Eighty-five out of 130 cases had hypertension, thus giving a prevalence rate of (65.4%) in 85. Sixty three Females (74%) were hypertensive than males 22(25.9%), but this difference was not more significant.

**Conclusions:** This study showed that the prevalence of diabetes and especially high blood pressure rate is high in this society and the prevalence of both diseases in women is higher than men. The majority of these risk factors are variables that we can control them with our life style. Therefore, general training and prevention should be focused on promoting a healthy life style in society with more attention to women. Hypertension is prevalent in persons with DM. It has shown that adequate control of the blood pressure reduces the microvascular and macrovascular complications of DM.

Prevalence of hypertension noted in 85(65.4%) in diabetic patients with BP was normal in 45 (34.6%), 5(3%) patients were prehypertensive, 53(18%) patients were in stage-1 hypertension, and 27 (14.5%) had stage-2 hypertension. Macrovascular and microvascular complications noted in 15 (11.5%).

**Keywords:** Hypertension, macro vascular, type-2 diabetes mellitus

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## Introduction

Chronic diseases are one of the most important health problems in the world, affecting the economic, social situation and quality of life in patients. Hypertension is one of the most common circulatory disorders, which is a global problem, and is a common, asymptomatic disease, often called “silent killer”. The World Health Organization (WHO) estimates that at least one billion people in the world have hypertension and about 1.7 million people each year die because of this disease. The hypertension acceptable blood pressure level in healthy people is 140/90 mm Hg [1]. Diabetes mellitus is a common and a serious disease with chronic complications and constitutes a substantial burden for both patient and health care system. According to the International Diabetes Federation (IDF) Diabetes Atlas 2011, the number of people living with diabetes is expected to rise from 366 million in 2011 to 552 million by 2030 if preventive programs are not put in place. Type-2 diabetes mellitus

(T2DM) is the predominant form of diabetes worldwide, accounting for 90% of cases globally. Sex, age, and ethnic background are important factors in determining the risk of developing T2DM [2].

Diabetes mellitus (DM) and hypertension are diseases reported to be the first and second leading cause of all deaths in both developed and developing countries [3].

Diabetes refers to a set of disorders in carbohydrate, fat, and protein metabolism by the lack of insulin secretion or decreased sensitivity of the tissues to insulin. Diabetes is a multifactorial disease, and it seems that genetic and environmental factors are involved in the disease. Type 2 diabetes is one of the major health problems in the world, which is rising rapidly in most parts of the world, and it is predicted that more than 592 million people will suffer from diabetes by 2035. This is the most common type of diabetes in the whole world and accounts for about 90% of diabetics. According to a study, the prevalence of type 1 diabetes is also found to be about 0.3 among people aged 30 or below [2-4].

Increasing age, the presence of obesity, and worsening renal function all contribute to an increased likelihood of hypertension in people with diabetes; which makes both crucial public health concerns for the twenty first century [5]. One of the most important causes of death in the world is cardiovascular diseases, among that the causes of these diseases, blood pressure and diabetes are known as the major risk factors for these diseases [6].

Hypertension is an extremely common co-morbidity amongst persons with diabetes mellitus (DM) and is said to be twice as prevalent in diabetics than in non-diabetic individuals. It has also been shown that hypertension in diabetic persons is associated with accelerated progression of both microvascular (retinopathy, nephropathy and neuropathy) and macrovascular (atherosclerotic) complications. Macrovascular disease accounts for the majority of deaths in patients with Type 2 DM. Recent studies have demonstrated the effectiveness of blood pressure treatment in reducing the complications of diabetes [7]. Risk of T2DM-related complications, including death, stroke, and the need for retinal photocoagulation. Weight loss helps correct insulin resistance and dyslipidemia found in patients with T2DM [8]. Deaths from cardiovascular disease and diabetes are highest in low- and middle-income countries and lowest in high-income countries [9]. Recent recommendations from the American Diabetes Association and the European Association for the Study of Diabetes note that aggressive management of cardiovascular risk factors, which include high blood pressure and obesity, may be even more beneficial in patients with T2DM because of their increased risk of cardiovascular morbidity and mortality [10].

Knowing the proportion of the T2DM population at additional risk of complications from hypertension and obesity is an important public health measure to determine public and private resource requirements to reduce these risk factors or care for patients after cardiovascular events. Many epidemiologic reports describe separate prevalence rates for hypertension, obesity, and diabetes among the general population or present prevalence rates of hypertension or obesity in patients with diabetes but often without separating data for type 1 versus type 2 diabetes [11-12]. Diabetes Mellitus and hypertension are common diseases that coexist at a greater frequency than chance alone would predict [13]. Hypertension in the diabetic individual markedly increases the risk of peripheral vascular disease, stroke, retinopathy, nephropathy, and accelerates the course of cardiac disease. Diabetic nephropathy is an important factor involved in the development of hypertension in diabetics. Population

studies suggest that elevated insulin levels, which often occurs in type II diabetes mellitus, is an independent risk factor for cardiovascular disease. Other cardiovascular risk factors in diabetic individuals include abnormalities of lipid metabolism, platelet function, and clotting factors [14]. Data from several epidemiologic studies have suggested that the prevalence of hypertension in patients with diabetes mellitus is approximately 1.5-2.0 times greater than in non-diabetic population [15]. In patients with insulin-dependent diabetes mellitus (IDDM), hypertension is generally not present at the time of diagnosis. As renal insufficiency develops, blood pressure rises and may exacerbate the progression to end-stage renal failure. In non-insulin-dependent diabetes mellitus (NIDDM), many patients are hypertensive at the time of diagnosis. The incidence of hypertension in NIDDM is related to the degree of obesity, advanced age and extensive atherosclerosis that is typically present, and it probably includes many patients with essential hypertension [16]. The incidence and prevalence of type 2 diabetes are increasing. Hypertension affects approximately 70% of patients with diabetes and is approximately twice as common in persons with diabetes as in those without. Some prescription and over-the-counter medications, as well as supplements, can increase the blood pressure [17-19]. These substances also can interfere with medications that used to decrease the blood pressure. Some pain and anti-inflammatory medications can cause water retention. Birth control hormones contain hormones that may raise the blood pressure by narrowing the small blood vessels. Most important, insulin can increase blood pressure through several mechanisms: Increased renal sodium re-absorption, activation of the sympathetic nervous system, alteration of transmembrane ion transport, and hypertrophy of resistance vessels [18].

### Materials and Methods

This was a cross-sectional, descriptive study one hundred and thirty persons with DM (diagnosed by using the 1999 WHO criteria), the patients were included in the study according to inclusion criteria, who consented, were coming to Al-Beroni Teaching Hospital. Samples were drawn randomly; there was no cut-off age or body mass index (BMI). The study period was 12 months from January to December, 2019 and from an individual patient, the duration of the study was one day. There were no study-specific visit and the data was recorded during their routine visit to the outpatient department. The obtained data include age, anthropometrical indexes, duration of diabetes and blood pressure. The weight was recorded in kilograms to the nearest 0.1 kg by using a weighing scale, and the height was recorded in meters to the nearest 0.05 m. The body mass index (BMI) was calculated as the weight in kilograms divided by the square of the height in meters. The waist circumference was measured by using a non-stretch metric tape and taken at the mid-point between the rib cage and iliac crest, while hip circumference was taken at the maximal circumference of the buttocks. Patients were diagnosed as having Type 1 DM if the diagnosis of DM was made before the age of 30 years and the patients were on insulin for survival of DM. Classification of patients as Type 2 DM was based on clinical grounds of non-dependence on insulin for survival. Hypertension was defined as (systolic BP  $\geq$  140 or diastolic BP  $\geq$  90 mmHg) on at least two occasions or reported regular use of antihypertensive medication, Uncontrolled BP was defined as a systolic BP of  $\geq$  140 mmHg and/or a diastolic BP of  $\geq$  90 mmHg. Controlled BP was defined as a systolic BP of  $<$  140 mmHg and/or a diastolic BP of  $<$  90 mmHg. Detailed history of all the patients regarding the duration of diabetes, mode of diagnosis was

asked. A fasting blood glucose (FBG) level above 125 mg/dl was considered uncontrolled, Detailed history regarding personal habits like smoking, alcoholism, tobacco-chewing was noted. Information about family history of diabetes was recorded. General and systemic examination was done for each study subject. Physical examination was undertaken after the interview was over. It included height, weight, and blood pressure. For recording blood pressure, students were individually invited in a room and were allowed to be seated quietly for 5-10 minutes to eliminate anxiety and restlessness. Blood pressure (BP) was recorded in sitting position in right arm, using a standard mercury sphygmomanometer with appropriate cuff size. Systolic blood pressure (SBP) was determined by the onset of the “tapping” Korotkoff sounds (K1) and fifth Korotkoff sound (K5), or the disappearance of Korotkoff sounds, was recorded as diastolic blood pressure (DBP). Hypertension was defined as average of two readings recorded 3 minutes apart on two separate occasions that are greater than or equal to SBP 140 and/or DBP 90 mm of Hg. Data was collected with a structured questionnaire and entered in master sheet and statistically analyzed. Patients were in the relevant hospital and informed about the purpose of the study before questionnaire was distributed. The questionnaires were reviewed for missing portion or ambiguity. Incomplete or unclear questionnaires were excluded from the study.

**Results**

Overall of 130 patients were included in the study among that, 80 (61.5%) were females, 50 (38.5%) In Eighty-five of patients hypertension was present; 63 (48%) females and 22 (17%) males [Table 1]. BP was normal in 45 (34.6%), 5 (4%) patients were prehypertensive, 53 (40.8%) patients were in stage-1 hypertension, and 27 (21%) had stage-2 hypertension [Table 2].

Thirty-seven (28.5%) were of normal BMI, 57 (44%) were overweight, and 35 (27%) are obese [Table 3]. Prevalence of hypertension noted in 85 (65%) diabetic patients, 15 (11%) patients had various microvascular- and macrovascular-related complications. patients were in the age-group of 30-80 years with mean age of 52 years, age group 30-39 (6.1%), 40-49 (27.7%), 50-59 (40%), 60-69 (17.7%), 70-80 (8.5).

**Table 1: Association between hypertension and gender of patient**

	Hypertension	NIL hypertension	Total
Male	22	28	50
Female	63	17	80
Total	85	45	130

**Table 2: Association between hypertension stage and gender of patient**

	Prehypertension	stage1 hypertension	stage2 hypertension	Total
Male	1	12	9	22
Female	4	18	63	85
Total	5	30	72	107

**Table 3: Body Mass Index of patient**

		Normal BMI		Overweight	Obese
Male		17		22	10
Female	20		35	25	
Total		37	57	35	

**Table 4: Association between age group and gender of patient**

Age %	Male	Female	Total
30-39		3 5 8	6.1
40-49	14	22 36	27.7
50-59		19 33 52	40
60-69		10 13 23	17.7
70-80	4 7	11	8.5

**Discussion**

In our study, the prevalence of hypertension was noted in 85 (65.4%) patients, hypertension is twice as prevalent in diabetics than in nondiabetic patients. The prevalence of hypertension in person with DM is worldwide variable. A similar prevalence of 62% hypertension in women with DM was reported by Azizi et al in Tehran, the capital of Iran [2], also the prevalence of hypertension in this study among the 20-29 age group was 6.6% in men and 5.3% in women and in the 60-69 age group, it was 62.2% in women and 47.3% in men, by considering that various studies in Iran which have reported different statistics ranging from 8% to 85% for the prevalence of hypertension in diabetic patients [3]. The prevalence of hypertension among patients with DM in our study (65.4%) was lower than among DM patients in Jordan and Benghazi. Because of using the definition of systolic BP of 130 mmHg or above and or diastolic BP 80 mmHg or above, which is one of the highest reported prevalence. Among patients with diabetes mellitus in Jordan [10]. Among 1952 Saudi type 2 diabetes mellitus patients, hypertension was present in 78.1% (80.5% of men and 75.8% of women) using the definition of hypertension based on systolic BP >130 mmHg and/> 80 mmHg [2]. In US adults with diabetes there was an increased prevalence of 77% with hypertension definition as ≥130/80 mmHg [14].

In Abdelbagi et al the prevalence of hypertension among patient with DM Was 45.6% which showed a high prevalence of hypertension among patient with DM in northern Sudan. Notably, older age, male gender, employment, duration of DM and obesity were significant predictors of hypertension [12]. Also On study by Abdissa D, show hypertension prevalence in 70-72% (70.9% of males and 73.9% of females) [1]. Other research by Faiza Nouh, the study reports (85.6%) prevalence of hypertension among diabetic patients in Benghazi Age, sex, physical activity, duration of DM, and BMI were the variables associated with prevalence of hypertension among Benghazi diabetic patients [10]. In Mashhad, the prevalence of hypertension in diabetic patients was 51.6%. In the study of Safaee et al, the prevalence in diabetic patients in Isfahan was 56.2%. In a study by Kalantari et al on type 1 diabetic patients, the prevalence of hypertension was 7.7% by considering the fact that in Iran there are different statistics on the prevalence of hypertension in diabetic patients [12].



According to 32 reviewed articles (1992-2017), the prevalence of hypertension in diabetic patients in Iran was 51% (55% in patients with type 1 diabetes and 53% in patients with type 2 diabetes). According to the statistics reported in the seventh report of the blood pressure monitoring committee, Chobanian et al estimated that 50% of diabetic patients had hypertension [13]. It shows that is consistent with our study.

The frequency of hypertension in Type 2 DM is related to the degree of obesity, advanced age and extreme atherosclerosis that is present in these patients. Hyperglycemia and increase in total body exchangeable sodium leading to extracellular fluid accumulation and expansion of the plasma volume contributes to the pathogenesis of hypertension in DM [20].

In India, although the overall hypertension rate among patients with T2DM in the study by Tharkar et al was 39%, the urban prevalence was 63.2% and the rural prevalence was 36.8%. Hypertension prevalence among adults from the general population in urban India ranges from 20% up to 40% and in rural areas from 12% up to 17%. Therefore, the by-locality hypertension rates reported by Tharkar et al are consistent with the expectation of hypertension rates that are 1.5 to 2 times higher in persons with T2DM than in those without diabetes. Similarly, the hypertension rates among patients with T2DM were higher than rates reported for the general population in Iran, Japan, Mexico and Romania [11].

According to the results of the American Diabetes Association, the prevalence of hypertension in diabetic, Hyperinsulinemia induces hypertension through increased renal tubular reabsorption of sodium and water, increased sympathetic nervous system activity, proliferation of vascular smooth muscle cells, and alterations of transmembrane cation transport. At physiological concentrations, insulin decreases urinary this study assesses the prevalence of hypertension among diabetic patients [2-7]. Control of hypertension among patients with diabetes can largely affect cardiovascular diseases outcomes because the relationship between hypertension and risk of cardiovascular diseases events is continuous, consistent, and independent of other risk factors. prevalence of hypertension among diabetic patients. Age, sex, physical activity, duration of DM, and BMI were the variables associated with prevalence of hypertension among diabetic patients [17]. Data from several epidemiological studies have suggested that the prevalence of hypertension in patients with diabetes mellitus is approximately 1.5-2 times greater than in an appropriately matched non-diabetic population. In patients with insulin-dependent diabetes mellitus (IDDM), hypertension is generally not present at the time [18]

### Conclusions

The prevalence of hypertension amongst persons with DM in this study is high. Individuals with both hypertension and diabetes are at high risk for both microvascular and macrovascular complications of DM. Diabetic patients with hypertension should be treated with appropriate antihypertensive drugs and carefully monitored to ensure satisfactory blood pressure control and prevention of the end-organ complications of hypertension.

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