



CODEN [USA]: IAJPBB

ISSN: 2349-7750

**INDO AMERICAN JOURNAL OF  
PHARMACEUTICAL SCIENCES**<http://doi.org/10.5281/zenodo.3593051>Available online at: <http://www.iajps.com>

Research Article

**ESSENTIAL HYPERTENSION, PREVALENCE, AND  
DETERMINANTS AMONG ADULT TYPE II DIABETIC'S  
PATIENTS IN AL ADEL PRIMARY HEALTH CARE  
CENTER, MAKKAH, 2018**<sup>1</sup>Osama Mohammed Noor, <sup>2</sup>Ahmed Al-Katheri, <sup>3</sup>Saud Al Zahrani<sup>1,2</sup> Family Physician, Ministry of Health, Saudi Arabia<sup>3</sup> Family Medicine/ Public Health Consultant, Saudi Arabia**Abstract:****Aim:** To determine the prevalence of HTN and its risk factors among diabetic patients.**Method:** This was a cross-sectional study conducted among 292 diabetes patients attend Al Adel PHCC during September 2018.**Result:** Out of 292 diabetics patients, 172 (58.9%) were male and 120 (41.1%) were female, with mean age  $52.82 \pm 7.05$ , 281 (96.2%) were Saudi, 102 (34.9%) had university degree, 95 (32.5%) were private employee, 62 (21.2%) were retired, and 42 (14.4%) were housewives. The mean score of BMI was  $31.62 \pm 4.72$ , where 157 (66.2%) were obese, and 71 (30.3%) were overweight. The median of DM duration was 7.0 years, 124 (42.5%) had HTN, 102 of HTN patients were diagnosed (>5 years). 111 (76.0%) reported "feeling better comparing to last 12 months", 131 patients had a Family history of DM & HTN, 4 (1.4%) cases hospitalized due to HTN. 70 (23.9%) stated smoking, with a mean age of smoking  $21.56 \pm 5.36$ , 37 (52.9%) attend the tabaco cessation program, 220 (75.3%) reported "walking" as physical activity type, 198 (67.8%) reported "diet counseling." A significantly higher rate of HTN was among older, male, obese, heavy smokers, those who did not attend any cessation program, and had DM for a longer time ( $p < 0.05$ ).**Conclusion:** Reliable information about the incidence of hypertension is essential to develop national health policies to prevent and control the burden of such comorbid conditions. The prevalence of HTN was at a moderate level, where less than half had HTN.**Recommendation:** To present the most key points in this study to PHCC doctors and to write brochures. Further nation-wide studies on assessment of the prevalence and risk factors of HTN among DM patients need to be conducted in larger sample sizes and regions other than Makkah Al-Mukarramah.**Corresponding author:****Osama Mohammed Noor,**

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Please cite this article in press Osama Mohammed Noor et al., *Essential Hypertension, Prevalence, And Determinants Among Adult Type Ii Diabetic's Patients In Al Adel Primary Health Care Center, Makkah, 2018.*, Indo Am. J. P. Sci, 2019; 06(12).

## 1. INTRODUCTION:

### 1.1 Background

Both essential hypertension and diabetes mellitus are widespread diseases, and therefore it is not surprising that their co-existence is extremely prevalent<sup>(1)</sup>. Type 2 diabetes is considered to affect over 150 million people worldwide. This prevalence is increasing rapidly, partly through changes in case ascertainment and diagnostic criteria, but mainly through lifestyle changes in developing countries. Both diseases are linked with a raised risk of premature death due to cardiovascular disease (CVD), stroke, and renal disease<sup>(2)</sup>. The majority of developing countries in the Middle East countries are experiencing a significant change in lifestyle patterns regarding nutritional habits, physical activity, and personal habits (smoking). In Saudi Arabia, there is limited information about the influence of changes in lifestyle, such as the reduction of physical activity and dietary habits on the prevalence of diabetes mellitus, hypertension, and hypercholesterolemia<sup>(3)</sup>.

Hypertension in diabetes is a common and significant problem, which aggravates diabetic macro- and microvascular problems. Due to the fact that both are common diseases, their follow up in primary health care centers should insist on the early detection. Hypertension in diabetes is also associated with all behavioral problems encountered with essential hypertension, such as unawareness, and non-compliance with drugs and non-drug management. Since both diabetes and hypertension are common issues in Saudi Arabia, it is essential to shedding some light on the problem of hypertension in diabetes. Both conditions are being mostly managed in the primary health care (PHCC) centers.

### 1.2 Rationale

Hypertension is known contributor to the development of long-term complications of type 2 diabetes mellitus. Knowing the prevalence of this comorbidity in type 2 diabetic patients is essential for establishing the magnitude of the population that may benefit from strategies that decrease blood pressure while controlling blood glucose.

### 1.3 Aim of the study

To studying the magnitude of hypertension in diabetic patients registered in Al-Adel primary health care center and risk factors associated.

### 1.4 Objectives

- 1- To calculate the prevalence of hypertension among adults, diabetic type 2 patients in Al Adel PHCC, Makkah, 2018.
- 2- To determine associated risk factors of having hypertension among adult type 2 diabetics in Al Adel PHCC, Makkah, 2018.

## 2. Literature review

### 2.1 National studies

Elzubier in his study published in the Journal of Family and Community Medicine in 2000 discussed the results of a survey where all patients registered in the diabetic registries of the PHCC centers in Makkah City, and in rural Makkah district during the year 1420H (1999G). The majority of subjects (93.7%) were of Saudi nationality age +15 years completed a structural interview questionnaire — data such as demographic and diabetes-related variables. The prevalence of Diabetic subjects who had high blood pressure reading among 1039 diabetic subjects (66.7% Males and 33.3% females) respondents was 560 (54.9%), of whom with stage 1, 2, and 3 hypertension formed 25.5%, 7.0%, and 2.5%, respectively. Subjects with undetected high blood pressure amounted to 225 (22.1%). There was significant growth in the rate of patients at all stages of high blood pressure, with increasing age ( $P < 0.0001$ ), male gender ( $P < 0.0001$ ), and low educational level ( $P < 0.0001$ ). However, there was a significantly greater incidence of all stages of high blood pressure ( $P < 0.0001$ , and  $P < 0.0001$ , respectively) in subjects with type 2 diabetes mellitus, and those with a high BMI. As regards the duration of diabetes, significantly more patients who had high blood pressure for less than ten years at all stages of hypertension were observed. Many patients may remain undetected. There was a significant association of high blood pressure with age, male gender, body mass index, and low education<sup>(4)</sup>.

### 2.2 International studies

Berraho et al. in their study published in The Pan African Medical Journal in 2012 conducted a national cross-sectional survey between Feb 2006 and Jul 2006. A sample from the citizens of Morocco was obtained using a structural interview questionnaire. It revealed that the overall prevalence of hypertension among 525 diabetics participants was 70.4%. The prevalence among men was similar to that among women ( $P=0.31$ ). The rate of hypertension increased with age ( $P=0.001$ ). Illiterate people were found to be at higher risk of hypertension compared to those with a higher school or college education ( $P<0.001$ ). Obese and overweight subjects had significantly ( $P=0.01$ ) got a higher rate of hypertension (77.4% and 80.0% respectively) than underweight (70.9%) and average weight (60.6%) groups. In contrast to the expectations, non-smokers in this study had a higher rate of hypertension than smokers ( $P<0.01$ ). Patients without physical activity were found to be at higher risk of hypertension compared to those with physical activity. In the multivariate analysis, there was a positively and statistically significant association between hypertension and the variables

of age, BMI, and duration of diabetes. But no significant association was found with the level of education or physical activity. Compared to the age group < 50 years, the risk of hypertension increased by 3.98 times among the 50-59 age group ( $P < 0.0001$ ) and by 7.26 times among the age group 60 years old and up ( $P < 0.0001$ ). Compared to the standard BMI group, the risk of hypertension increased by 3.09 among the obese group<sup>(2)</sup>.

Venugopal K et al., Department of General Medicine Vijayanagara Institute of Medical Sciences, Bellary, Karnataka in India, published an article in the CHRISMED Journal of Health and Research in 2014 as a national cross-sectional study. A sample from the citizen of India who visited medicine outpatient department Vijayanagara Institute of Medical Sciences and hospital, Bellary was obtained using stratified random cluster sampling. Through a face to face interview, a detailed history of all the patients regarding diabetes duration, mode of diagnosis were asked. Detailed history regarding personal habits like smoking, alcoholism, and 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. There was no cut-off age or body mass index (BMI). The Prevalence of hypertension among 250 diabetic patients noted in 64 (25.6%) patients. BP was normal in 55 (22%), 131 (52.4%) patients were prehypertensive, 45 (18%) patients were in stage-1 hypertension, and 19 (7.6%) had stage-2 hypertension. Macrovascular complications noted in 120 (48%). While microvascular complications noted in 60 (24%) patients<sup>(5)</sup>.

Zhao et al. in their study published by Wolters Kluwer Health conducted a cross-sectional study to assess the prevalence, risk factors, and prognostic significance of masked hypertension in diabetic patients. They included 266 patients with documented type 2 diabetes mellitus and clinic blood pressure (BP) <140/90mm Hg without antihypertension treatment. 24-hour ambulatory BP monitoring was applied to evaluate mean 24-hour systolic/diastolic BP. Demographics, medical histories, and medication usage were gathered using the questionnaire. Fasting venous blood was drawn for biochemical analysis. Approximately 26.5% of participants were diagnosed as masked hypertension with mean 24-hour systolic BP >140mmHg and/or mean 24-hour diastolic BP >90mm Hg. In respect to significantly higher mean 24-hour systolic/ diastolic BP, patients with masked hypertension were more elderly, had more elevated serum glycated hemoglobin (HbA1c) and

C-reactive protein (CRP) levels and higher prevalence of coronary heart disease (CHD) than those without masked hypertension. Multivariate regression analysis revealed that aging, increased HbA1c and CRP levels, and prevalent CHD was independently associated with masked hypertension. Logistic regression analysis revealed that after adjusting for traditional risk factors including age, male sex, smoking status, low-density lipoprotein-cholesterol, CRP, clinic systolic BP, and HbA1c. Still, masked hypertension remained independently associated with prevalent cardiovascular disease (CVD), with odds ratio of 1.31 and 95% confidence interval of 1.11 to 1.85. They concluded that in diabetic patients, concurrent masked hypertension increases the odds of having CVD. Future randomized controlled trials are warranted to investigate whether screening and managing masked hypertension could reduce cardiovascular events in diabetic patients<sup>(6)</sup>.

In the review article 'Prevalence of hypertension and obesity in patients with type 2 diabetes mellitus in observational studies': a systematic literature review carried out by Colosia et al. (2013) published in Dove Medical Press Ltd, and licensed discussed the link between Diabetes Mellitus and Hypertension. It was showed that patients of diabetes mellitus are very much likely to have hypertension as well. It was determined that diabetes and hypertension are correlated with each other, which means that their main cause is obesity. Through searching for studies and researches, the correlation of hypertension and obesity with type 2 diabetes has been investigated<sup>(7)</sup>.

### 3. METHODOLOGY:

#### 3.1 Study design:

Cross-sectional study.

#### 3.2 Study area:

Makkah city is the holy capital of the Kingdom of Saudi Arabia, located in the western region. Almasjid Alharam (the holy mosque) there contains Alka'aba representing The Qibla, the guidance for all Muslims in their prayers. The city is divided into four inner and three outer sectors of primary health care. They include 85 primary health care centers supervised by the Directorate of Health Affairs of Makkah. The researcher selected Al Adel sector, where is one of 4 inner sectors by simple randomization. Underneath Al Adel sector 12 PHCCs. The researcher chose the Al-Adel PHCC because of large numbers of diabetic's patients

#### 3.3 Study population:

All diabetic type 2 patients registered in Al Adel PHCC in Makkah, including males and females, constitute the target population of the present study during September 2018.

### 3.4 Sample size:

By using Roasoft sample size calculator, the sample size was 292 under the following conditions:

- The total number of diabetic type 2 patients attended Al Adel primary health care center at Makkah, is 1230
- The Prevalence: 50%
- A confidence level: 95%
- A Margin of error: 5%

### 3.5 Selection criteria:

#### Inclusion criteria:

- All diabetic type 2 Patients
- All nationality
- Age >20 years

#### Exclusion criteria

- HTN caused by secondary causes
- All diabetic type 1 patients

### 3.6 Sampling technique:

The researcher chose Al Adel PHCC due to a large number of diabetic patients attending to it. The sample of diabetic subjects was selected by choosing the medical records; then by Roasoft sample size calculator, the sample size was 292; then by systemic random sampling, choosing the sample. The sampling interval was 4 which was obtained by total number of population (1230) divided by the sample size (292); then by simple random technique using the website "<https://www.dcode.fr/random-sampling>" to generate one random number from 1 to 4 medical records, the result was 2. The number 2 was starting point then after every 4 medical records choosing one (2,6,10,14,18..ect). the researcher collected 292 medical records out of 1230 medical records. Each file of medical records of the participants, who constitute the total population, was labeled with a serial number (1,2,3,4,...etc.). Accordingly, the face to face questionnaire was done, by interviewed the patients and gathered the information from them when they came to the clinic and filled out the checklist also from patient's medical records. In the cases where patients did not come to the regular visit. The researcher took the phone numbers from the medical records and contacted them and asked them to come for their regular appointment. If the patient refused to come, the researcher gathered the information through directed questions of the questionnaire after taken the verbal consent, if the patient still refused, the researcher excluded him/her from the study and chose another one.

### 3.7 Data collection tools:

Face to face questionnaires was distributed to all chosen medical records involving in the study. It consisted of two main sections. The first section was concerned with sociodemographic variables gender, age, nationality, level of education as low

(primary and intermediate schooling), average (secondary schooling), and high (university and postgraduate) and Employment status. The second section was concerned with smoking status, diet, history of hypertension, use of antihypertensive medications, duration of diabetes, whether the patient was being treated with insulin or oral hypoglycemic drugs, and compliance of medications. The first page contains brief information about the study, participant rights, informed consent, and keeps all the information confidential. The checklist was utilized to retrieve data from the medical record like height, weight, BMI, last BP reading, last Hba1c, HDL, and LDL. If the weight and height were not available in the medical records, informed the nurse to measure them. Body mass index (BMI) was calculated through the following equation "dividing the weight in kilograms by the square of the height in meters." BMI was categorized as underweight < 18.5 kg/m, normal if 18.5-24.9 kg/m, overweight if 25-29.9 kg/m<sup>2</sup>, and obesity if = or more 30 kg/m<sup>2</sup>. Blood pressure was measured using electronic BP machines with suitable cuff size with specific collaboration and standardization. A trained nurse performed the procedures while the subject in a sitting position with the arm at the level of the heart and after 5 minutes rest. Two blood pressure readings were taken from each patient, and the average reading of both was used in this study. The patients were labeled as having hypertension if the diagnosis was made before a period. Where, systolic blood pressure more than or =140 mm Hg or diastolic blood pressure more than or =90 mm Hg according to JNC8), as well as the patients were on either lifestyle modifications or medications.

### 3.8 Data collection technique:

The data was collected by filling out the checklist from medical records and face to face questionnaire was done. In extreme cases, if the patients did not come during the collection data period, the researcher used the contact telephone numbers to contact the patients and collecting the data after took the verbal permission or consent from them.

#### Checklist:

The researcher visited the medical records department and took all the medical records numbers of diabetic patients registered in PHCC. They were 1320 medical records and by a simple random technique using the website "<https://www.dcode.fr/random-sampling>" to generate the random numbers of the sample size, which is 292 medical records. Then each chosen medical record, the researcher put the sticker on it to be well known by health work providers that the patient involved in the study. The researcher used the checklist for every medical record out of 292 to gather the information from it.

The questionnaires:

The researcher visited the family medicine clinics, male section every working day throughout the study period, which is three weeks. The researcher informed all primary health care providers, chose the patients by showing specific sticker in the medical records of the patients, and accordingly, the questionnaire was done by face to face interview with the patients. In the female section, the researcher contacted the female doctors who responsible for the family medicine clinics. Then described to them how to select the patients by showing specific sticker in the medical records and accordingly interviewing the patients.

The BMI:

The weight and height were retrieved from the medical records, and the BMI was calculated using the equation described above in the part of data collection tools. If the values were not present, then the nurse measured them, and the researcher calculated the BMI. In the female section, the researcher informed the female doctors to retrieve the values of weight and height from the medical records and plotted in the checklist. If the values were not present, then the female's nurse measured them, and the researcher calculated the BMI. The researcher divided the patients according to values normal, overweight, or obese.

The Blood pressure

For diabetic patients who not known to have hypertension, the last BP reading was retrieved from medical records and plotted in the checklist. Then the trained nurse measured the new one by measuring two readings, 5 minutes apart, then the research took the mean of them. The researcher divided the patients either having high blood pressure or not according to the JNC8 guideline. In the female section, the researcher informed the female doctors to do the same action. For diabetic's patients who well known to have hypertension and on antihypertensive medications, the researcher included them directly to sample size.

**3.9 Study variables:**Dependent variables:

- Hypertension among diabetic type 2 patients

Independent variables:

- Demographic information (age, gender, level of education and nationality)

- Duration of diabetes, smoking status, diet, and Body mass index (BMI), LDL and HDL and total cholesterol

**3.10 Reliability and validity:**

The researcher tested the reliability by retesting 10% of participants to compare the answers. The questionnaire was revised by two consultants to get the validity.

**3.11 Pilot study:**

A pilot study was conducted in the Al Azizya primary health care center underneath Al Adel sector due to similarity to the target group using the same questionnaire. The deficit was identified and modified accordingly.

**3.12 Data entry and analysis:**

The Statistical Package for Social Sciences (SPSS) software version 20.0 was used for data entry and analysis. Descriptive statistics (e.g., number, percentage) or (mean±SD) or median were used and analytic statistics using Chi-Square test ( $\chi^2$ ) was applied for the association between two categorical variables or independent t-test was applied to test the differences between categorical and numerical variables. A p-value equal to or less than 0.05 was considered statistically significant.

**3.13 Ethical considerations:**

- Permission from the research committee in Makkah was obtained.
- Permission from the Directorate of Health Affairs of Makkah was obtained.
- All information kept confidential, and results were submitted to the department as feedback.

**3.14 Budget:**

Self-funded

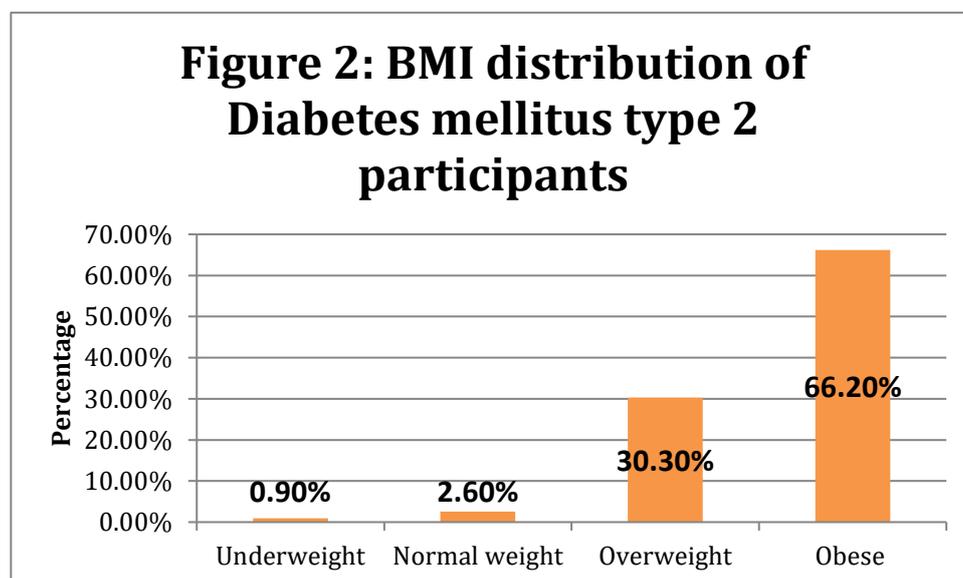
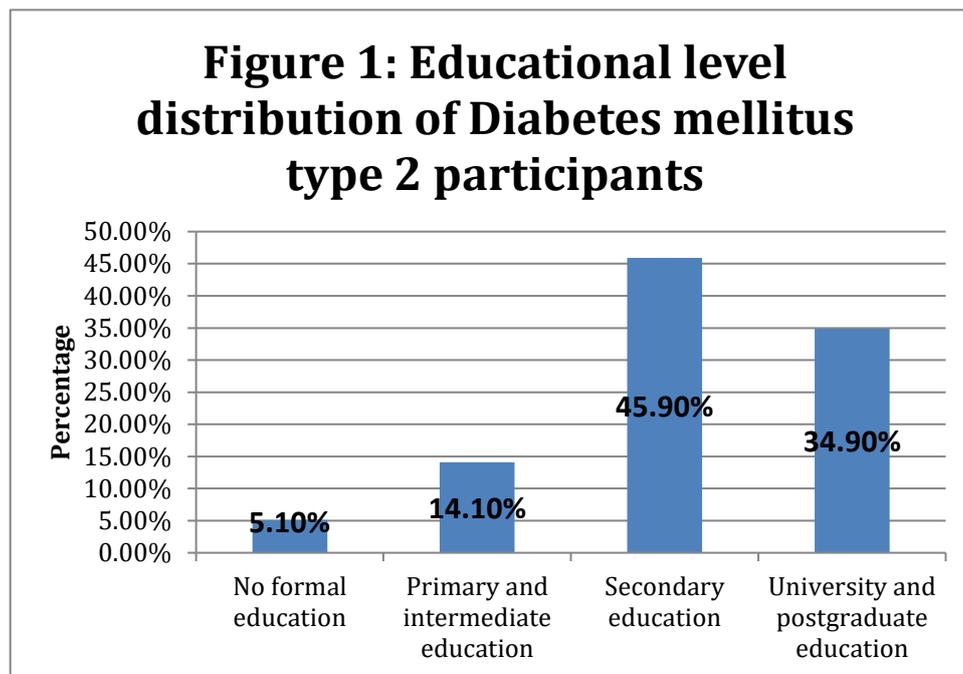
**4. RESULTS:**

Out of 292 diabetics patients, 172 (58.9%) were male, and 120 (41.1%) were female, with mean age  $52.82 \pm 7.05$ , 281 (96.2%) were Saudi. Third of participants 102 (34.9%) had a university degree, and 134 (45.9%) attend secondary school. Almost the third, 95 (32.5%) were private employees, 62 (21.2%) were retired, and 42 (14.4%) were housewives. The mean score of BMI was  $31.62 \pm 4.72$ , where two-third 157 (66.2%) were obese, and 71 (30.3%) were overweight. (**Table 1 & Figures 1,2**)

**Table (1) Demographic data of Diabetes mellitus type 2 participants:**

Variable	N	%
<b>Gender</b>		
Male	172	58.9
Female	120	41.1
<b>Nationality</b>		
Non-Saudi	8	3.8
Saudi	281	96.2
<b>Education</b>		
No formal education	15	5.1
Primary and intermediate school	41	14.1
Secondary education	134	45.9
University and postgraduate education	102	34.9
<b>Occupation</b>		
Driver	1	.3
Government Employee	58	19.9
Housewife	42	14.4
Military	33	11.3
Private Employee	95	32.5
Retired	62	21.2
Student	1	.3
<b>BMI category</b>		
Underweight	2	.9
Normal weight	6	2.6
Overweight	71	30.3
Obese	157	66.2
<b>Variable</b>		
	<b>Mean±SD</b>	<b>Rang (min-max)</b>
Age	52.82±7.05	(39.0-95.0)
High	162.74±7.72	(120.0-180.0)
Weight	84.74±9.30	(54.0-121.0)
BMI	31.62±4.72	(3.0-46.70)

Data are presented as number and percentage or as Mean± SD



The median of DM duration was 7.0 years, while the median of HbA1c was 8.0. Otherwise, the mean score of HDL and LDL were  $40.85 \pm 7.35$  and  $122.02 \pm 15.05$ . (**Table 2**)

**Table (2) Medical information of Diabetes mellitus type 2 participants**

Variable	Mean $\pm$ SD	Rang (min-max)
HDL	$40.85 \pm 7.35$	(21.70-125.0)
LDL	$122.02 \pm 15.05$	(40.0-158.0)
Variable	Median	Quartile (25,75)
Duration of DM	7.0	(5,11)
HbA1c	8.0	(7,8)

Data are presented as Mean $\pm$  SD or as median (quartile 25,75)

Out of the 292 patients, 124 (42.5%) have HTN, and 168 (57.5%) do not have HTN, 102 of HTN patients were diagnosed (>5 years), and the rest 24 (8.2%) diagnosed (<5 years). Third of the patients reported "Nearby

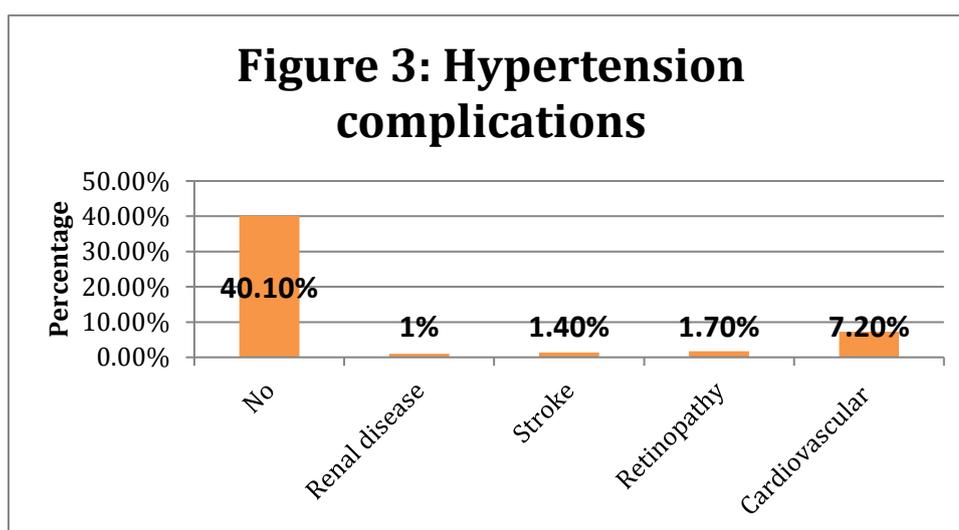
hospital (secondary facility)" as the place of follow up, and 108 reported that they come for follow up for both reasons "following the advice of doctor " and " feeling bad." Third fourth 111 (76.0%) reported "feeling better comparing to last 12 months". A family history of DM & HTN was reported among 131 patients. Only 4 (1.4%) cases admitted to the hospital, and the reason was HTN, wherein 3 of them the HTN was controlled. Regarding receiving HTN medications, 124 reported it, where the median of HTN medication number 2.0 drugs. (Table 3 & Figure 3 )

**Table (3) Blood pressure information on Diabetes mellitus type 2 participants:**

Variable	N	%
<b>HTN</b>		
Yes	124	42.5
No	168	57.5
<b>Diagnosis</b>		
Not applicable	166	56.8
< 5 years	24	8.2
>5 years	102	34.9
<b>Routine follow up the place</b>		
Not applicable	147	50.3
Diagnosis of this visit	1	.3
This health center	50	17.1
Nearby primary health care clinic	1	.3
Nearby hospital (secondary facility)	92	31.5
I do not do any routine follow up	1	.3
<b>Routine follow up duration</b>		
Diagnosis of this visit	1	.7
As advised by the doctor	36	24.7
When I do not feel well	1	.7
Both	108	74.0
<b>Control of blood pressure, compared to 12 months ago</b>		
Better	111	76.0
Same	28	19.2
Worse	1	.7
Do not know	6	4.1
<b>Family history of diabetes and Hypertension</b>		
Yes	131	87.3
No	16	10.7
Do not know	3	2.0
<b>Hospitalization during last years</b>		
Yes	4	1.4
No	288	98.6
<b>Know the reason for admitting</b>		
Not applicable	288	98.6
Yes	4	1.4
<b>The reason for admitting is HTN</b>		
Not applicable	288	98.6
Yes	4	1.4
<b>HTN was controlled during hospitalization</b>		
Not applicable	288	98.6
Yes	3	1.0
No	1	.3
<b>HTN complications</b>		
No	117	40.1
Renal disease	3	1.0
Stroke	4	1.4
Retinopathy	5	1.7
Cardiovascular	21	7.2
<b>HTN medication prescription</b>		
Yes	124	84.4

No	23	15.6
<b>Taking medication</b>		
Yes	138	95.8
No	6	4.2
<b>Reason for not using the medication</b>		
Medication is not easily available	1	.8
Do not like to take medications	1	.8
Do not like the side effects of the medication	38	30.9
Forgetting	11	8.9
Don't know	72	58.5
<b>Variable</b>		
	<b>Median</b>	<b>Quartile (25,75)</b>
HTN medication number	2.0	(1.0,2.0)

Data are presented as number and percentage or as median and quartile (25,75)



Only 70 (23.9%) stated smoking, with a mean age of smoking  $21.56 \pm 5.36$ , where 52 of them reported 10-19 cigarettes daily, 37 (52.9%) attend Tabaco cessation program. Less than fifth 41 (16.1%) reported a family history of smoking. Third fourth 220 (75.3%) reported "walking" as physical activity type, and 131 (44.1%) reported, "Inconsistently of physical activity." Two thirds 198 (67.8%) reported "diet counselling", where 128 (43.8%) following "diabetics diet" and 164 (56.2%) reported "no specific diet". (Table 4 & Figures 4 & 5)

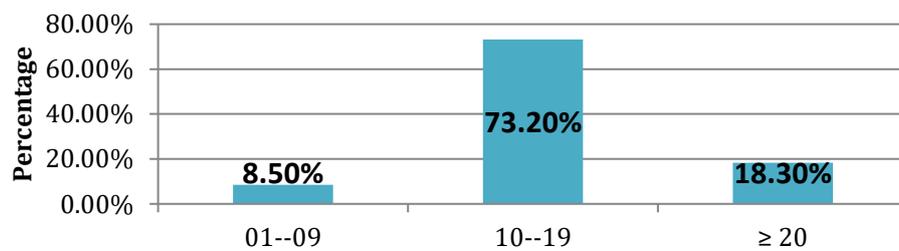
**Table (4) Risk factors related to hypertension among Diabetes mellitus type 2 participants:**

Variable	N	%
<b>Smoking, and from them 37</b>		
Yes	70	23.9
No	222	76.1
<b>Number of cigarettes daily</b>		
1-9	5	8.5
10-19	52	73.2
$\geq 20$	13	18.3
<b>Tabaco cessation program</b>		
Yes	37	52.9
No	33	47.1
<b>Family History of smoking</b>		
Yes	41	16.1
No	213	83.5
Don't know	1	.4
<b>Physical activity type</b>		
Aerobic Workout	2	.7

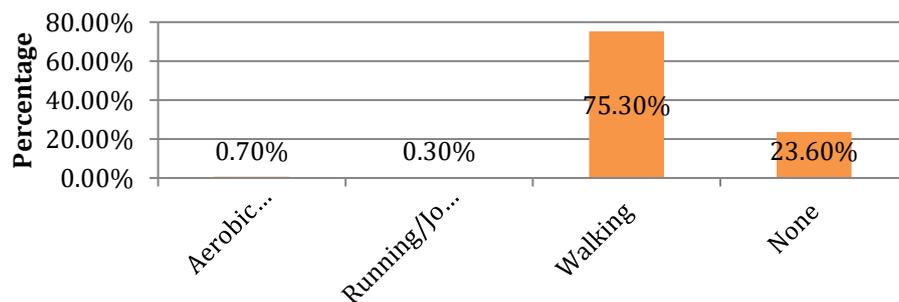
Running/Jogging	1	.3
Walking	220	75.3
None	69	23.6
<b>Physical activity periodic</b>		
1-3 times a week	55	18.8
3-5 times a week	15	5.1
5-7 times a week	10	3.4
Inconsistently	131	44.9
None	81	27.7
<b>Diet counseling</b>		
Yes	198	67.8
No	94	32.2
<b>Diet type</b>		
Diabetic	128	43.8
No specific diet	164	56.2
<b>Variable</b>		
	<b>Mean± SD</b>	<b>Rang (min-max)</b>
<b>Smoking age</b>	21.56±5.36	(3.0-30.0)

Data are presented as number and percentage or as Mean± SD

**Figure4: Number of cigarette smoking per day as a risk factor of hypertension among Diabetes mellitus type 2 participants**



**Figure5: Physical activity type among Diabetes mellitus type 2 participants**



The result revealed a significant difference in HTN prevalence regarding age and duration of DM. Where those who were older and had DM for a long time had a higher rate of HTN than others ( $p < 0.0001$ , and  $p = 0.004$ ). On the other hand, there was no significant difference in the rate of HTN regarding (HDL, LDL, HbA1c, and smoking age). (Table 5)

**Table (5) The relation between hypertension and demographic data and measurements among Diabetes mellitus type 2 participants:**

Variable		Mean	SD	T-test	P-value
Duration	Yes	10.1855	3.93725	50.869	.000*
	No	6.6845	4.29335		
Age	Yes	54.4318	8.20400	8.499	.004*
	No	51.5455	5.69667		
High	Yes	135.4435	61.97132	.793	.374
	No	128.6369	66.42987		
Weight	Yes	100.4563	120.25553	2.259	.134
	No	84.7368	9.06533		
HbA1c	Yes	7.9706	1.12422	.833	.362
	No	8.5754	6.61601		
HDL	Yes	39.8311	5.01664	3.596	.059
	No	41.6485	8.67304		
LDL	Yes	102.8387	48.54742	1.246	.265
	No	96.2738	50.47685		
Smoking age	Yes	21.6757	5.01140	.033	.856
	No	21.4412	5.80069		

Data are presented as Mean  $\pm$  SD

The comparison was made using an independent t-test

\*Statistically significance at the 0.05 level

The study revealed a significant association between HTN prevalence and gender, BMI, smoking, Tabaco cessation and number of cigarettes, where male, obese, those who were heavy smokers, and those who didn't attend any cessation program had the higher rate of HTN than others ( $p = 0.031$ ,  $p = 0.032$ ,  $p = 0.41$ ,  $p = 0.043$  and  $p = 0.032$ ). On the other hand, there was no significant association between HTN and (education, occupation, physical activity, and diet). (Table 6)

**Table (6) The relation between hypertension and demographic data and risk factors among Diabetes mellitus type 2 participants:**

Variable		HTN		P-value
		Yes	No	
Gender	Male	64	108	0.031*
		51.6%	64.3%	
	Female	60	60	
		48.4%	35.7%	
Nationality	Non-Saudi	3	8	0.671
		2.4%	4.8%	
	Saudi	121	160	
		97.6%	95.2%	
Education	No formal education	7	8	.050
		5.7%	4.8%	
	Primary and intermediate education	23	18	
		18.7%	10.7%	
	Secondary education	57	77	
		46.3%	45.8%	
	University and postgraduate education	36	65	
		29.3%	38.7%	
BMI	Underweight	1	1	0.032*
		1.0%	0.8%	
	Normal weight	4	2	
		3.9%	1.5%	
Overweight	36	35		

		35.3%	26.5%	
	Obese	62	95	
		59.8%	71.2%	
Smoking	Yes	35	35	0.041*
		28.2%	20.5%	
	No	89	133	
		71.8%	79.5%	
Number of cigarettes	1-9	0	6	0.043*
		0.0%	17.6%	
	10-19	29	23	
		78.4%	67.6%	
≥ 20	8	5		
	21.6%	14.7%		
Tabaco cessation	Yes	18	19	.032*
		14.5%	11.3%	
	No	19	14	
		15.3%	8.3%	
Physical activity type	Aerobic Workout	0	2	.911
		0.0%	1.2%	
	Running/Jogging	0	1	
		0.0%	.6%	
Walking	95	125		
	76.6%	74.4%		
None	29	40		
	23.4%	23.8%		
Physical activity periodic	1-3 times a week	26	29	.846
		21.0%	17.3%	
	3-5 times a week	4	11	
		3.2%	6.5%	
	5-7 times a week	3	7	
		2.4%	4.2%	
Inconsistently	57	74		
	46.0%	44.0%		
None	34	47		
	27.4%	28.0%		
Diet counseling	Yes	86	112	.360
		69.4%	66.7%	
	No	38	56	
		30.6%	33.3%	
Diet type	Diabetics	53	75	.419
		42.7%	44.6%	
	No specific type	71	93	
57.3%		55.4%		

Data are presented as number and percentage

The comparison was made using the Chi-square test

\*Statistically significance at the 0.05 level

### 5.DISCUSSION:

During the last few decades, the environment becomes rapidly changing. One of the most remarkable examples of these changes is that non-communicable diseases such as diabetes, cardiovascular disease, cancer, and chronic lung diseases have passed infectious diseases as the world's leading cause of mortality. Where, up to 80% of people with diabetes will die of

cardiovascular disease, particularly hypertension (HTN) and stroke since most patients with diabetes develop hypertension. HTN is one of the main risk factors for cardiovascular disease, and it exists in all communities in the world. (8-11) Worldwide, Cardio-vascular diseases (CVDs) are responsible for roughly 17 million deaths a year, and from these complications of HTN are responsible for 9.4 million deaths yearly. <sup>(8)</sup>

HTN is responsible for at least 45% of deaths due to heart disease, and 51% of deaths due to stroke. In the past, HTN has been considered as a disease of wealth or economically higher-class society. However, in the last two decades, this consideration was changed, where higher blood pressure presents in Africa more than in Europe and the USA. Where the prevalence of HTN is growing among poor sections of society. It is stated to be the fourth(4th) responsible for premature death in developed countries and the seventh in developing countries. (8,12-16)

The present study aimed to study the magnitude of hypertension in diabetic subjects registered in primary health care centers and risk factors associated.

The results of this study showed that less than half of diabetic patients attending the diabetes clinic in Al-Adel PHCC had hypertension (HTN) (42.5%) (moderate HTN rate).

Hypertension is a common problem for people with diabetes. The result of the current study is inconsistent with Tadesse et al., study, who reported 55% of DM patients had HTN. (8) Also, 53% in Saudi diabetics (17), and 44% in Omani diabetics. (18)

Otherwise, it is lower than Berraho et al., study who reported HTN among (70.4%) patients with type 2 diabetes, 64.5% rate reported in Qatari diabetics (19) and 72.4% rate reported in Jordanian diabetics. (20)

While it is higher than a study of Zhao et al., in China, reported that (26.5%) of diabetics patients had HTN. (6) Venugopal and Mohammed, India stated 25.6%. (5) As well as the 32 %, 38% and 39% rates reported among diabetics in the Turkish (21), Bahraini (22) and Taiwanese (23) diabetics populations, respectively. (2)

This result showed that the high rate of HTN among diabetic patients is a common problem and has been reported by several studies. This difference could be due to the variety of socio-economic factors, sample size, studies nature, and geographic areas. Therefore, primary health care providers should be advised to focusing more on providing health education about HTN and its associated risk factors to all diabetic patients through their regular visits.

Findings of the present study showed that the rate of HTN was significantly higher among older age, male, obese, heavy smokers, and those who didn't attend any cessation program and had DM for a longer time.

According to gender, this can be explained by the fact that females tend for sedentary life more than males (24). While males tend to be smokers and obese. (2)

Regarding the duration of DM, hypertension in insulin resistance states is usually attributed to hyperinsulinemia, which causes increases in renal sodium retention and/or sympathetic nervous system activity. Hyperinsulinemia induces hypertension through increased renal tubular reabsorption of sodium and water, raised sympathetic nervous system activity, the proliferation of vascular smooth muscle cells, and alterations of transmembrane cation transport. At physiological concentrations, insulin reduces urinary sodium excretion, an action mediated by binding to specific high-affinity receptors. (5) Other studies suggest that cellular insulin resistance, rather than hyperinsulinemia per se, may lead to hypertension. Where observations suggest that impaired cellular response to insulin predisposes to raised vascular smooth muscle (VSM) tone (the most noted mark of hypertension in diabetic patients). (5)

The study of Venugopal and Mohammed India found that females and those with a long duration of DM had a higher rate of hypertension. (5)

Elzubier, in Saudi Arabia, reported a significantly higher proportion of HTN among older, male, those with low educational level, high BMI and those with shorter duration of DM ( $p < 0.0001$ ). (4)

Berraho et al., in Morocco, reported a significantly higher rate of HTN among DM patients in older, obese male patients, and those with a long duration of DM. (2)

In the current study, there was a significant association between HTN and both smoking and obesity. It could be elucidated by the fact that most of the participants were male, and obesity and smoking tend to be more among males than females.

These findings indicate the importance of receiving the correct education messages about the prevalence of HTN and its risk factors among DM patients.

#### Limitations of the study

Time constraints, the researcher collected the data within three weeks only, and this study was conducted at only one PHCC at Makkah Al-Mukaramah.

## 6. CONCLUSIONS:

Based on the findings of the researcher study, the following can be concluded:

- T2DM and HTN are two of the most common diseases affecting a large proportion of adults all over the world.
- Reliable information about the prevalence of hypertension is essential to the development of national health policies to prevent and control of burden of such comorbid conditions.
- The prevalence of HTN was at a moderate level, where less than half had HTN.
- A higher rate of HTN was among older, male, those who were heavy smokers, and those who didn't attend any cessation program, and had DM for a longer time.
- There is a significant association between the higher rate of HTN and both smoking and BMI.

## 7. RECOMMENDATIONS

Based on the findings of the researcher study, the following can be recommended:

- Primary health care providers are requested to provide the necessary health education of the prevalence and risk factors of HTN among DM patients for all DM patients through periodic visits and must be repeated at every visit.
- Health education messages of the prevalence and risk factors of HTN among DM patients should be enforced for those who are old, smokers, obese, longer duration of DM or HTN, and those who never try to cease smoking.
- The administrators in MOH should try to organize and conduct health education programs of "the prevalence and risk factors of HTN among DM patients" in simple and familiar language among the community through mass media to raise public awareness and knowledge regarding HTN and DM.
- Encourage diabetic patients to talk about HTN with their doctors.
- Further nation-wide studies on assessment of the prevalence and risk factors of HTN among DM patients need to be conducted in larger sample size and regions other than Makkah Al-Mukarramah to identify the level and distribution of different knowledge grades as well as the areas and topics of knowledge deficits.
- To present the most key points in this study to PHCC doctors in training centers and to write a brochure of the prevalence and risk factors of HTN among DM patients to be distributed to DM patients.

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## 9. Annex

### 1. Official Documents



- 3) Secondary education
- 4) University and postgraduate education

#### Diabetes Mellitus information

5. When were you diagnosed to have Diabetes Mellitus? \_\_\_\_\_
6. List different medications a day are you taking for Diabetes (an approximate number)?
  - 1) .
  - 2) .

#### Blood Pressure Information

7. Has your doctor told you that you have High Blood Pressure?
  - 1) Yes GO to Q 8
  - 2) No
  - 3) Don't know
8. When were you diagnosed as a hypertensive patient?
  - 1) First time
  - 2) < 5 years
  - 3) > 5 years
9. Where do you regularly go for routine follow up to check your blood pressure?
  - 1) Diagnosis of this visit
  - 2) This health center
  - 3) Nearby primary health care clinic
  - 4) Nearby hospital (secondary facility)
  - 5) Tertiary hospital
  - 6) I do not do any routine follow up
  - 7) Why? \_\_\_\_\_
10. When do you go for your routine blood pressure check?
  - 1) Diagnosis of this visit
  - 2) As advised by the doctor
  - 3) When I do not feel well
  - 4) Both
  - 5) Other (specify) \_\_\_\_\_
11. Compared to 12 months ago, is your blood pressure:
  - 1) Better
  - 2) Same
  - 3) Worse
  - 4) Do not know
  - 5) I didn't get my blood pressure measurement 12 months ago
12. Do you have blood relatives with a history of diabetes and Hypertension?
  - 1) Yes
  - 2) No
  - 3) Don't know
13. Over the last year have you been admitted to the hospital?
  - 1) Yes
  - 2) No, GO to Q 17
14. Do you know why?
  - 1) No
  - 2) Yes
  - 3) (specify) \_\_\_\_\_
15. Was it related to hypertension?
  - 1) Yes
  - 2) No
  - 3) Don't know
16. Was your blood pressure controlled at your admission to the hospital?
  - 1) Yes
  - 2) No
  - 3) Don't know
17. Have you had any complications from your hypertension?
  - 1) No
  - 2) Renal disease

- 3) Stroke
  - 4) Retinopathy
  - 5) Cardiovascular
  - 6) Other \_\_\_\_\_
- Don't know
18. Have you been prescribed any medication to lower your blood pressure?
    - 1) Yes
    - 2) No
    - 3) Don't know
  19. Do you take all your prescribed medications?
    - 1) Yes
    - 2) No
    - 3) Don't know
  20. How many different medicines a day are you taking (approximate number)?  
\_\_\_\_\_
  21. If you don't take your medication regularly, why don't you take them as directed?
    - 1) I cannot afford the cost
    - 2) Medication is not easily available
    - 3) I do not like to take medications
    - 4) I only take them when I feel that I need them
    - 5) I do not like the side effects of the medication
    - 6) I prefer alternative medicine
    - 7) I forget
    - 8) Don't know
    - 9) Other \_\_\_\_\_

#### Risk Factors information

22. Do you smoke cigarettes? If yes, how many cigarettes a day? \_\_\_\_\_
  - 1) Yes
  - 2) No
  - 3) Don't know
23. If the answer is yes, tell us at what age did you start smoking?  
\_\_\_\_\_ years
24. On average, how many cigarettes are you have you been taking in a day?
  - 1) 1-9
  - 2) 10-19
  - 3) 20 or >
25. Have you ever been enrolled in a tobacco cessation program?
  - 1) Yes
  - 2) No
  - 3) Don't know
26. Does anyone in your house smoke?
  - 1) Yes
  - 2) No
  - 3) Don't know
27. What type of physical activity do you currently do?
  - 1) Aerobic Workout
  - 2) Running/Jogging
  - 3) Walking
  - 4) Bicycling
  - 5) Swimming
  - 6) None
28. How often do you do physical activity?
  - 1) 1-3 times a week
  - 2) 3-5 times a week
  - 3) 5-7 times a week
  - 4) Inconsistently
  - 5) None
29. Have you had diet counseling before?
  - 1) Yes

- 2) No
  - 3) Don't know
30. Select the type of diet you are following
- 1) Diabetic
  - 2) Low Carbohydrates / Sugar
  - 3) Low cholesterol
  - 4) Low salt
  - 5) Renal (Low protein/Low salt)
  - 6) Weight reduction
  - 7) Vegetarian
  - 8) No Special Diet