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Prevalence of Obesity in Adult Hypertensive Patients and its Effect on Antihypertension Drugs Polypharmacy in Primary Health Care Clinics in Benghazi

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ABSTRACT

Obesity is one of the most common cardiovascular risk factors that affects blood pressure (BP) control, but there is a lack of data regarding the prevalence of overweight and obesity in hypertensive patients and their relationship in the Libyan population. The aim of this study is to determine the prevalence of obesity and its impact on BP control among hypertensive patients in a primary health care (PHC) unit in Benghazi, Libya. This is a cross-sectional, PHC unit-based study carried out in hypertension clinic of Al-Kish Polyclinic, Benghazi, Libya, between July and December 2017.

A total number of 207 adult patients with systemic hypertension (HTN), comprising 71 males and 136 females with age range from 27-70 years, were studied. The office BP readings along with weight and height were measured and used to calculate the body mass index (BMI) and to classify the participants into obese and nonobese. Abdominal obesity was found through waist-to-hip ratio (WHR) and waist circumference (WC) according to the cut-off points recommended by the World Health Organization (WHO). Data results were coded, entered, and analysed using SPSS version 24.

The mean age of the patients was 51.7 ± 09.0 years. Out of the 207 participants, obesity was found in 136 (65.7%) of the participants. Out of those, 66 (31.9%) had class I obesity, 45 (21.7%) had class II obesity, and class III obesity was found in 25 (12.1%) of patients. BP control was poor in 131 (63.3%) patients, of whom 70% were obese. The BMI correlated positively with each of systolic BP (SBP) with r = 0.24 and p=0.005; diastolic BP (DBP) with r=0.18 and p= 0.035; and the number of anti-HTN drugs with r=0.228 and p=0.008.

The prevalence of abdominal obesity determined by WHR and WC was 92.6% and 98.5%, respectively, and it was 88.7% in females and 54.9% in males.

The prevalence of obesity is high in hypertensive patients in Al-Kish Polyclinic and their BP control is poor including those who are obese. Public health measures aimed at reducing obesity should be incorporated into the overall management of systemic hypertensive patients.

KEYWORDS: hypertension, obesity, abdominal obesity, body mass index, blood pressure control, waist circumference, waist-to-hip ratio.

1. INTRODUCTION

Hypertension (HTN) is characterized by a systolic blood pressure (SBP) equal to or exceeding 140mmHg, a diastolic blood pressure (DBP) equal to or exceeding 90mmHg, or the use of antihypertensive medication [1].

Worldwide, about 17 million people die from cardiovascular diseases (CVDs) each year. HTN, a major risk factor for CVDs, is estimated to be responsible for at least 45% of heart disease deaths and 51% of stroke deaths [2].

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According to the Seventh Report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure (JNC 7), a patient has stage I hypertension if his/her SBP is between 140 and 159 mmHg, or DBP is between 90 and 99 mmHg. Stage II hypertension is defined as SBP of 160 mmHg or higher, or DBP of 100 mmHg or higher [3].

Most patients with HTN are advised to lose weight, increase physical activity, and reduce their salt intake [4]. The 2014 Eighth Joint National Committee (JNC-8) guidelines on HTN recommend starting blood pressure medication for people under 60 years old if their SBP is at least 140 mmHg, or if their DBP is at least 90 mmHg, despite lifestyle modification. For people 60 years and older, blood pressure medication should be started if their SBP is at least 150 mmHg, or their DBP is at least 90

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mmHg [5]. In stage I hypertension, a single agent is generally enough to control BP, whereas in stage II, combined anti-hypertension medications may be required [3].

Hypertension frequently coexists with obesity, diabetes, or hyperlipidemia; their association with CVD is well established. Because such patients are more prone to end-organ damage, they need their BP to be under control as recommended in the clinical guidelines [6].

The WHO defines overweight as BMI of 25-29.9kg/m^2, grade I (mild) obesity as BMI of 30-34.9 kg/m^2, grade II (moderate) obesity as BMI of 35-39.9kg/m^2, grade III (severe) obesity as BMI of ≥ 40kg/m^2 [7]. Abdominal obesity, on the other hand, is defined by a WHR ≥ 0.90 for men and ≥ 0.85 for women, or WC ≥ 102 cm for men and ≥ 88 cm for women [8].

The obesity-related risks for coronary artery disease and stroke are mediated by its metabolic consequences (i.e. hypertension, dyslipidemia, and diabetes). Among these factors, hypertension appears to have the greatest impact, accounting for 31% of the excess risk of coronary heart disease and 65% of the excess risk of stroke [9].

In Libya, the prevalence of HTN is 25.5%, and 67%of Libyan adults have BMI > 25 while those with BMI > 30 are 31.9% [10].

Lifestyle modification, including weight loss, exercise, limited salt intake, and a Mediterranean diet, is usually recommended when managing patients with obesity and hypertension irrespective of BP lowering treatment [11]. The effect of physical activity on BP is crucial, too, independently of the weight loss achievement. Aerobic exercise has the highest impact, lowering BP up to 5-8 mmHg [12]. Recent data highlight the importance of a multicomponent exercise approach to improve cardiometabolic health [13].

However, following successful weight loss, weight regain over few months is common and can lead to a so-called weight cycling phenomenon. Similarly, adherence to exercise training tends to decline over time [14]. Hence, weighting patients at every visit and self-monitoring need to be encouraged [15].

The effectiveness of the currently available weight loss monotherapies is still modest, with the exception of GLP-1 RA mainly semaglutide, which in combination with behavioural modification therapy, may achieve more than 15% weight loss [16].

The shortage of large, prospective, comparative trials in obesity and HTN explains the lack of clear guidelines on how to treat obese hypertensive patients. There is some evidence that managing HTN in obese patients is challenging and that this population received suboptimal treatment in real practice [17, 18].

Feldstein, et al. [19] evaluated BMI, WC, and WHR to examine the relationship between 24-hour ambulatory blood pressure monitoring in hypertensive patients who are aged 18-86 years in Buenos Aires. The prevalence of overweight and obesity was 56.76% in women and 75.86% in men [19].

Mufunda, et al. [20] reported a positive association between BMI and SBP, DBP and mean arterial pressure. It was also found that the effect of BMI on BP was higher in males in comparison to females [20].

Girotto, et al. [21] investigated the prevalence of abdominal obesity in hypertensive patients in a family health unit in Brazil and found that WHR was 87.9% in females and 30.2% in males [21].

Adamu, et al. [22] conducted a study in Bida, Nigeria, and reported that obesity was found in 44.2% of the participants. The BP control was reasonable in 56%, and the BMI correlated with age, SBP, and DBP [22].

Whether or not obesity is more prevalent in adult hypertensive patients in Benghazi is still understudied, as there was only one unpublished study conducted in a private clinic. Also, whether a better control of systemic HTN in such patients requires single or multiple antihypertensive drugs still needs further clinical studies.

Faced with the need for more studies to investigate the prevalence of abdominal obesity in patients who already have a risk factor for metabolic syndrome, hypertension, and the importance of determining and preventing the risk factors associated with this condition, this study is designed to investigate the prevalence of obesity and other associated risk factors in patients with systemic HTN.

This study will serve as a base for information and strategies implementation that may reduce such risk factors. It will also encourage the primary health care personnel and physicians to diagnose high-risk patients for appropriate counselling, timely intervention, and proper referral when necessary, aiming to prevent serious complications of systemic hypertension and sudden death.

2. OBJECTIVE

This study aims to investigate the prevalence rate of obesity and its correlation with obesity measurements. It also aims to investigate the number of antihypertensive drugs needed for the best control of blood pressure in adult hypertensive patients attending the hypertension clinic at Al-Kish Polyclinic in the City of Benghazi, Libya.

3. METHODOLOGY

3.1 Design of the Study

This study is a cross-sectional study conducted between June and December 2017 in Al-Kish Polyclinic, a primary health care unit in Benghazi, eastern Libya.

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Al-Kish Polyclinic is a primary health care clinic located in Al-Kish neighbourhood. It receives cases from all over Benghazi, the second largest city in Libya which has an estimated population of 800,000 persons. The hypertension clinic is run four days per week. The total cases of adult hypertensive patients registered in the clinic are approximately 402, with an average number of daily attendees of 15 patients.

The study population includes adult hypertensive patients aged 18 to 70 who are registered at Al-Kish Polyclinic in Benghazi. Two hundred and seven adult hypertensive patients were involved and agreed to participate in this study.

Inclusion criteria

- The study participants are those who are known to have hypertension or were diagnosed with hypertension on the first visit to the HTN Clinic. Participants were divided according to age into an 18 to 50-year-old group and a 51 to 70- year-old group.
- Only patients who gave consent to participate in the study were included.

Exclusion criteria

- Patients who refused to participate in the study.
- Patients with secondary causes of obesity (e.g., Cushing syndrome), pregnant women, end-stage renal disease, decompensated heart failure or decompensated liver cirrhosis.
- Patients above 70 years old.

3.2 Data Collection and Statistical Analysis

Structured interviews and clinical/biochemical measurements were used for data collection. The structured interview was conducted using an interviewer-administered questionnaire that included demographic characteristics of the subjects, lifestyles, chronic diseases, drugs taken, and risk factors for high blood pressure. Following the interview, the clinical measurements were taken. The BP was measured by the auscultatory method using a mercury sphygmomanometer with an appropriately sized cuff and a 3M Littmann stethoscope. A special thigh cuff was used for BP measurements in obese individuals with a cuff length of 33 cm and cuff width of 20 cm. After resting for about five minutes, the subjects had their blood pressure (BP) measured on either the right or left arm at heart level. The first and fifth Korotkoff sounds marked the systolic and diastolic blood pressures, respectively. Two readings were obtained with five-minute intervals, and the average was calculated and recorded.

Next, the height and weight of each subject were measured using a stadiometer to which an electronic weighing scale was attached. Measurements were taken while the patients stood erect, wearing light clothing, and with no footwear. Height was measured to the nearest centimetre and weight to the nearest 0.1kg. The BMI was then calculated using the formula: BMI = weight (kg)/ height $(m)^2$.

Waist and hip measurements were obtained with an inextensible measuring tape having a width of 1.0 cm and a minimum unit of 0.1 cm. To take waist and hip measures, the individual remained standing upright, with as little clothing as possible. WC was obtained by positioning the measuring tape on an imaginary median line between the iliac crest and the last rib and was taken at the end of the expiration. Hip circumference was measured at the largest diameter of the buttocks. In both measures, the tape was positioned horizontally without pressing the soft tissues; two measurements were obtained for each, and the average was recorded. The dependent variables analyzed were WC and WHR which the latter was calculated from WC divided by hip circumference.

Serum lipid profile, total cholesterol (TC), triglycerides, low-density lipoprotein cholesterol (LDL-C), and HDL-C, were obtained following an overnight (10-12 hours) fast.

Data were analyzed using SPSS Statistics software for Windows, version 24 (SPSS Inc, Chicago, IL, USA). Descriptive statistics were generated for all variables. Numerical data were expressed as the mean and standard deviation (mean ± SD), and categorical data were expressed as percentages. The t-test was used to examine differences in the means of variables (age, BMI, WC, WHR, SBP, and DBP) between study groups, and the $\chi 2$ test was used to compare the prevalence of general obesity and abdominal obesity between males and females.

Pearson's correlation and linear regression analysis were used to determine the effect of grades of obesity on BP control and the number of drugs needed to control blood pressure. Also, p-values less than 0.05 were considered significant.

3.3 Ethical Considerations

Informed consent was taken from respondents before administering the questionnaire or anthropometry. Names and addresses were excluded to maintain the confidentiality of the respondents. Participants had a brief one-to-one discussion on the health implications of risk behaviours and measures to reduce the risk of noncommunicable diseases. Patients with borderline high BP (i.e., measurements of 140/90mmHg) were counselled on needing further review and follow-up. Those with marked elevations ≥ 180/110mmHg were referred to the nearest hospitals for urgent medical treatment and management.

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4. RESULTS AND DISCUSSION

4.1 General Characteristics of Study Subjects

During the study period from July 1st, 2017 to December 31st, 2017, there were 207 patients with hypertension enrolled in the study, 34.3% (71) of whom were males and 65.7% (136) were females, See Table **1**

The female predominance in this study was reported in other studies: 53.7% from Tunisia [23]; 56.5% from Egypt [24] and 60% from Nigeria [25]. Similarly, multiple studies from different regions of Saudi Arabia showed a similar female predominance: 67% in Jeddah [26]; 52.5% in Riyadh [27]; 56% in Abha [28] and more than 50% in the Aseer region [29]. Moreover, a study from South Africa reported a similar female predominance of 63.8% [30]. However, a different study from the Aseer region found that hypertensive males were more prevalent than females (54% vs 46%) [31].

Table 1: Age group distribution among male and female hypertensive patients

			Gender		Total
			Males	Females	
Age group	18-50 years	Count/percentage	39 (54.9%)	60 (44.1%)	99 (47.8%)
	51-70 years	Count/percentage	32 (45.1%)	76 (55.9%)	108 (52.2%)
Total		Count/percentage	71 (34.3%)	136 (65.7%)	207 (100%)

The mean age for patients was 51.7 years and the age range was from 27 to 70 years. This was higher than the mean age of 45.6 years reported by Ibrahim [24] from Egypt and a mean age of 49.6 years reported from Tunisia [23]. However, the mean age was lower than 60 years reported by Al-Khaldi [31], 57.2 years reported by Al-Tuwijri and Al-Rukban [27] and 57.8 years reported by Ba-Saikh, et al. [26], all from Saudi Arabia. The latter had found that the age of their sample ranged from 21 to 84 years. In a study from South Africa, the mean age of the study sample was higher; 60.1 years and the range was from 35 to 90 years [30]. However, in another study from Lagos State Hospital in Nigeria, the mean age was 57 years [25]. More than half of the patients (52.2%) were in the 51 years and above age group, a similar figure shown by Boujnah, et al. [23] and Ba-Saikh, et al. [26].

The prevalence of current smokers in this study was 46.5%, which is nearly double that (24.3%) reported by Batubenga, et al. [30] from South Africa and it is two times higher than that (20.8%) reported by Boujnah, et al. [23] from Tunisia. A much lower number was reported from Aseer [31] and Riyadh [27] as 3% and 8.3%, respectively. There was a statistically significant difference in smoking status among both males and females' hypertensive patients (p=0.000), where none of the females were current smokers nor had a previous history of smoking, while in males 53.6% were either current or ex-smokers.

The highest co-morbid conditions in this study were dyslipidemia followed by diabetes mellitus (32.9% versus 31.9%). Hyperlipidemia was further subcategorized into high levels of LDL-C in 26.1%, TG in 42%, TC in 32.4% and suboptimal HDL-C level in 43.7% of males and 57.4% of females, see Figure 1.

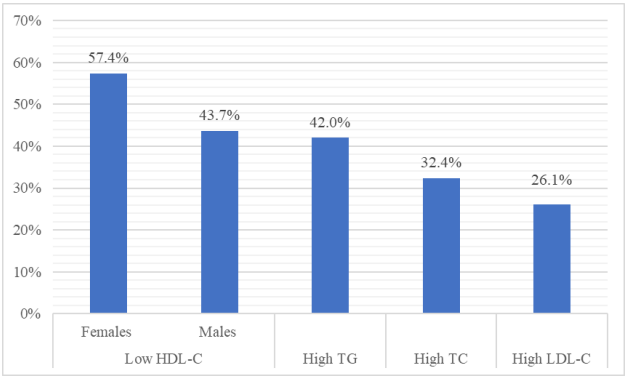


Figure 1: Pattern of dyslipidemia among the hypertensive patients

Dyslipidemia is 13.3% higher than that reported by Al-Tuwijri and Al-Rukban [27], and more than three times that reported by Al-Saleem, et al. [29]. However, it was lower than the prevalence rate found by Al-Khaldi [31] in Saudi hypertensive patients in Aseer region (34-51%). In the latter study, it was shown that 34% of the study sample size have total cholesterol level ≥ 200mg/dl and 51% have TG levels ≥ 150 mg/dl. These rates were higher than the results of this study, which showed that abnormal levels of total cholesterol and triglycerides were 32.4% and 42%, respectively. On the other hand, a study from Tunisia has shown that hypercholesterolemia was found in 20.7% of the hypertensive patients [23].

In a similar fashion, 31.9% of hypertensive patients in this study were diabetics; a prevalence that is similar to what was reported by Al-Saleem, et al. [29]. In addition, such prevalence was lower than results observed in Qatar at 68.9% [32], in Aseer at 46%[31], in Riyadh at 38.4% [27], but it

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was more than those reported by another national Saudi study at 22.2% [33], by Batubenga, et al. [30] from South Africa at 29.5% and by Boujnah, et al. [23] from Tunisia at 19.2%.

The study also shows low frequency of regular physical activity among hypertensive patients under study at 12.1%; this was higher among males (21.1%) than females (7.4 %), p=0.004. The level of regular physical activity reported by Girotto, et al. [21] was 20% and in a similar fashion it was higher among males than females (26.6% versus 16.3%). This low level of physical activity should not be a surprise considering that sedentary lifestyle is highly prevalent in the Libyan society, where nearly 44% of Libyan adults do not exercise regularly, (51.7% of women and 36% of men) [34].

4.2 BMI Distribution of the Hypertensive Patients

The overall prevalence of obesity was 136 (65.7%), made up of 31 males (22.8%) and 105 females (77.2 %). There was a significant difference in obesity among both genders, p-value 0.000. This prevalence is higher than the 39% reported from South Africa [30] and lower than the78.2% reported by Fadupin and Olayiwola [25] among adult hypertensive patients attending the Lagos state hospital, Nigeria. Similarly, it was lower than a study from Saudi Arabia by Barrimah, et al. [35] which showed obesity rate of 81%. However, some other Saudi studies showed lower rates of 59% and 58% reported by Alzahrani, et al. [36] and Al-Homrany, et al. [28], respectively. Studies from Tunisia [23] and Egypt [24] showed lower rates in comparison to this study; 26% and 39.8%, respectively.

A study from Aseer region revealed that 47% of the hypertensive patients had obesity of different grades [31]. Another study from Riyadh focused on hypertension control and co-morbidities in primary health care centres [27] showed that 50.4% are obese including a morbid obesity prevalence of 9.2%, which is 3% lower than rate in this study.

The mean BMI of the study subjects was 32.8 ± 6.0 kg/m^2 with a range of 20.4 to 52.8 kg/m^2. It is worth noting that this mean BMI is higher than that of the general Libyan adult population namely 27.7 kg/m^2 [37]. The mean BMI of the nonobese patients was 26.94 ± 2.14 kg/m^2 and that of the obese patients was 35.89 ± 5.05 kg/m^2, p value 0.000. They also differed significantly in their SBP (137.5 ± 16.5 mmHg versus 142.3 ± 17.7 mmHg), p < 0.05 but there was not such difference in their DBP (86.6 ± 12.5 mmHg versus 88.4 ± 11.4 mmHg) p value = 0.3, see Table 2.

Table 2: Clinical and demographic characteristics among obese and non-obese hypertensive patients

	All (n=207)	Obese (n=136)	Non-obese (n=71)	*p*
Mean age (years)	51.7±9	51.7±8.4	51.7±10.3	0.9
Gender Male/Female	71/136 (34.3%/65.7%)	31/105 (22.8%/77.2%)	40/31 (56.3%/43.7%)	0.000
Mean BMI (kg/m^2)	32.8±6	35.9±5	26.9±2.1	0.000
SBP mmHg	140.7±17.4	142.3±17.7	137.5±16.5	< 0.05
DBP mmHg	87.8±11.8	88.4±11.4	86.6±12.5	0.3

Data are shown as mean ± SD or percentage; p values refer to comparison of obese and non-obese; BMI=body mass index; SBP=systolic blood pressure; DBP=diastolic blood pressure

Normal BMI was found in 7.7 % of the study subjects. Prevalence of overweight people was 26.6% and most of them were males at 52.7%, a trend being observed worldwide [38]. This rate is similar to that of 26% that was reported by Al-Khaldi [31] but lower than the 35.3% reported by Al-Tuwijri and Al-Rukban [27] and the 29% reported by Al-Homrany, et al. [28]. The different classes of obesity were distributed as follows: 66 (31.9%) with class I obesity, 45 (21.7%) with class II obesity, and class III obesity was found in 25 (12.1%) of the study subjects. Figure 2 shows distribution of hypertensive patients according to their BMI.

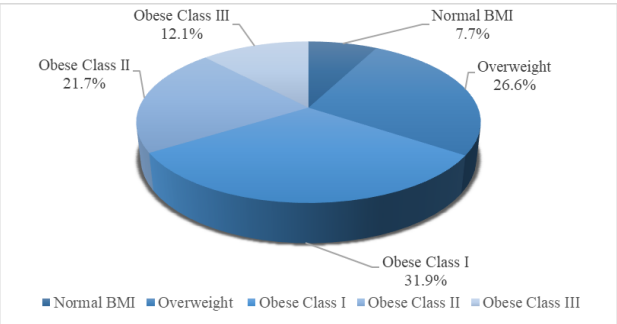


Figure 2: Distribution of hypertensive patients according to their BMI

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Obesity in this study showed female preponderance. This finding is concurrent with studies in the general Libyan population, which showed that obesity was almost two times more common among Libyan women than men, 21.4% versus 40.1%, respectively [34]. This may be because women tend to have more sedentary lifestyle than men and women in Libya spend much time at home and social events, which are usually associated with consumption of abundant food. In addition, hormonal factors might play a more vital role in accumulation of fat in women than in men [37]. A similar pattern was noted in a study from Egypt that showed obesity was present in 50.3% of hypertensive women [24].

Considering the age range of obese people in this study, obesity was noted to be more in the age group between 51 and 70 years. The higher BMI for this age group might be due to that elderly people have a higher risk of cardiovascular co-morbidities and less ability to perform regular physical activities because of age-related joint and bone problems. There was no statistical difference in prevalence of obesity or overweight between both age groups, p value > 0.05.

The present study revealed a high association exists between hypertension and obesity. A similar finding was reported in multiple other studies [32, 39-42]. Such association should make physicians working in primary healthcare centres aware of the importance of lifestyle changes (exercise and diet therapy) in the management of HTN through intensive health education programs.

4.3 Blood Pressure of Hypertensive Patients and its Correlation with Obesity Measurements

The mean SBP of study subjects was 140.7 ± 17.4 mmHg, whilst the mean DBP was 87.85 ± 11.8 mmHg. The different readings of SBP and DBP of the study sample are shown in Table 3. The mean SBP and DBP for controlled and uncontrolled hypertensive patients are 125.5 and 78.1 mmHg versus 149.6 and 93.6 mmHg, respectively. The overall BP control in all hypertensive patients was "good control" in 36.7%, and 63.3% had poor BP control as can be seen from Figure 3. The prevalence of BP control according to BMI class is illustrated in Figure 4.

Table 3: Systolic and diastolic blood pressure readings of the hypertensive patients

		BP level	N	%
Systolic (mmHg)	Controlled	<140	89	43
	Uncontrolled ≥140	140-159	72	34.8
		≥160	46	22.2
Diastolic (mmHg)	Controlled	<90	101	48.8
	Uncontrolled ≥90	90-99	48	23.2
		≥100	58	28

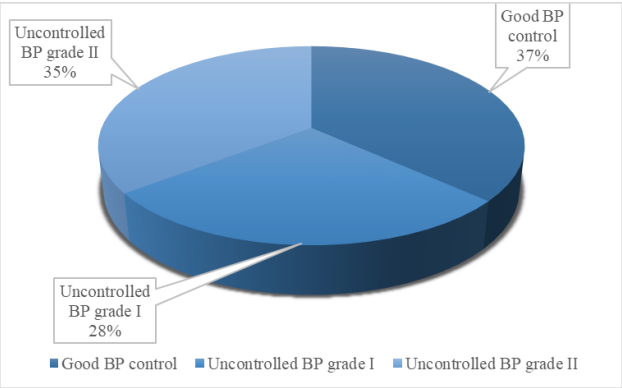


Figure 3: Prevalence of different BP grades among the hypertensive patients.

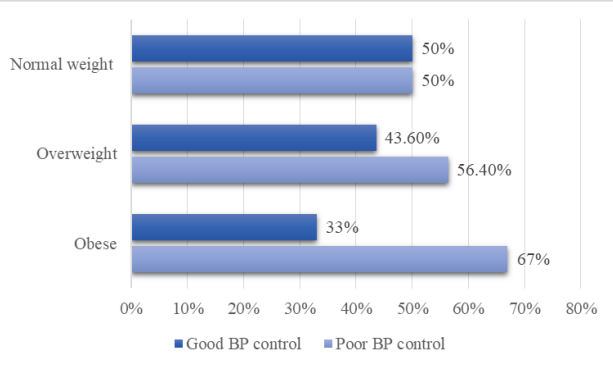


Figure 4: Blood pressure control in hypertensive patients according to their BMI class

The good BP control reported in this study is close to the 37.1% reported from Tunisia [23] and 37% from Riyadh in Saudi Arabia [43]; however, it was slightly higher than the 36% found by AL-Shahrani and Al-Khaldi [44] and 35% that was reported from Aseer region [31]. Other studies have shown higher rates of "good control": 66.5% by Ba-Saikh, et al. [26] from Jeddah, 63% by Al-Homrany, et al. [28] from Abha, 57% by Onwukwe and Omole [45] from South Africa, 56% by Adamu, et al. [22] from Nigeria and 55% by Al-Shidhani, et al. [46] from Oman. Similarly, a study conducted in a specialized healthcare setting in North-western Nigeria showed that good BP control was noted in 42.7% [47] and Al-Saleem, et al. [29] from Aseer showed good BP control in 40% of the study population. On the other hand, other studies had lower control rates as follows: 31.5% by Batubenga, et al. [30] from South Africa, 24.2% by Akpa, et al. [48] from Port Harcourt Nigeria and 15% in Cairo, Egypt [24] and 31% by Hajjar and Kotchen [49] from the USA.

These large differences could be explained by variation of sample sizes, different methods used and definition of cut point of HTN control, along with many other factors that are related to patients, physicians, diseases, and drug efficacy. Regardless of the real reasons for such variations, it is mandatory to reach optimal target of good BP control to prevent long-term serious complications of HTN through intensive health education of patients and

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compliance with practical guidelines of HTN care. The need, therefore, for physicians to screen individuals with systemic hypertension for obesity cannot be overemphasized.

It should be also noted that 93.8% of those patients with poorly controlled BP were either overweight or obese as can be seen from Figure 5. This is 15.8% higher than that reported by Adamu, et al. [22] from Nigeria. The relationship between the degree of obesity and BP control should be taken into consideration during management of HTN through raising awareness of healthy lifestyle and weight reduction programs for high-risk hypertension groups.

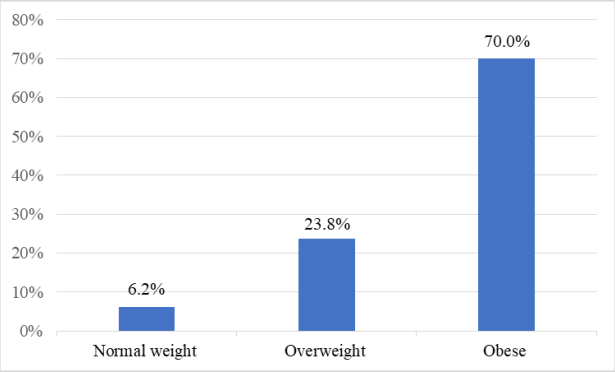


Figure 5: Distribution of BMI classes among patients with poorly controlled blood pressure.

Regarding medications prescribed for hypertensive patients, it was found that 61.8% of the patients were on two or more drugs, and more than 70% of them were obese, p- value=0.13. This is in contrast to a study from Oman that reported that about one quarter of the patients (27%) were using two drugs [50]. Al-Rukban, et al. [51] reported that single drug, two drugs and three or more drugs were respectively prescribed for 57%, 26.6% and 10% of hypertensive patients in the capital of Saudi Arabia, Riyadh. These figures were much lower than those reported by Batubenga, et al. [30] who showed that the vast majority of participants (93.6%) in their study in South Africa were on three or more antihypertensive drugs.

Similarly, in a study from Jeddah in Saudi Arabia by Ba-Saikh, et al. [26], 52.8% of patients were using two or more drugs and the most frequently used drugs were ACEIs (41.9%) and calcium antagonists (38.8%). In this study, calcium antagonists were the most used antihypertensive drugs with 46.3% of patients were using them. Thiazide diuretics and ACEIs were the next most used, at 42% and 37.6%, respectively.

Considering the relationship between BP and obesity measurement, this study showed a positive and statistically significant correlation between BMI and each of SBP (Pearson correlation =0.225, p value= 0.001), DBP (Pearson correlation =0.145, p value= 0.037) and number of antihypertensive medications used by the patients to control their BP (Pearson correlation =0.216, p value= 0.002). Accordingly, linear regression analysis was studied and confirmed the positive correlation between BMI and each of DBP (Figure 6), SBP (Figure 7) and number of anti-HTN drugs (Figure 8). Similar positive correlation had been shown between WC and SBP (R=.141, p=0.04, B=.209).

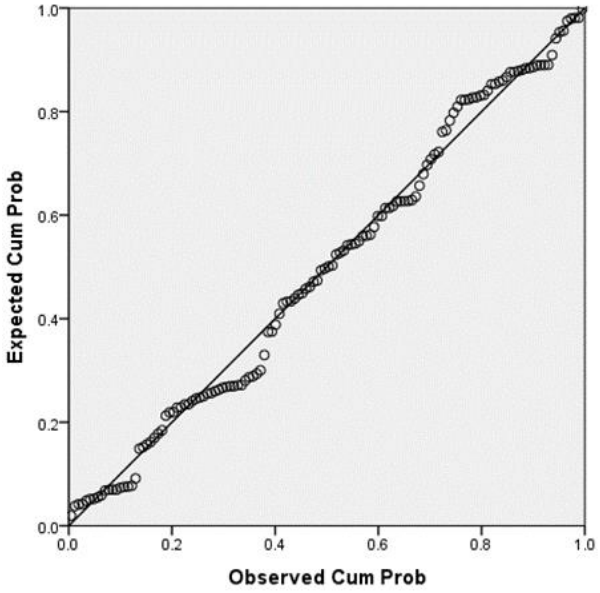


Figure 6: Linear regression between BMI and DBP among the hypertensive patients (R=0.145, p= 0.037, B=.285).

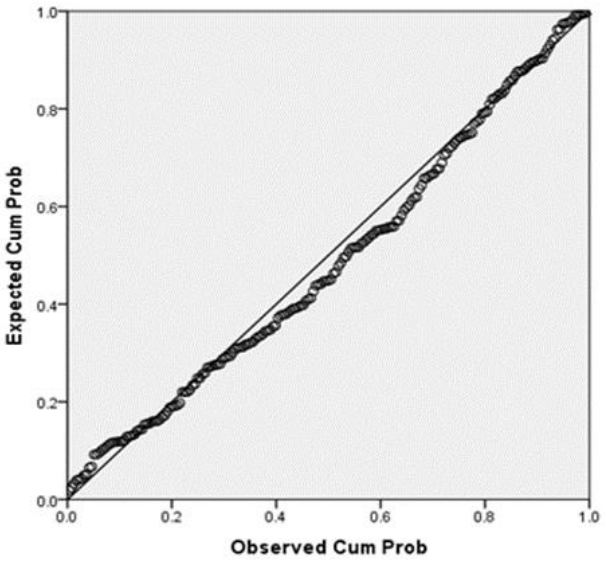


Figure 7: Linear regression between BMI and SBP among the hypertensive patients (R= 0.225, p=0.001, B=.650).

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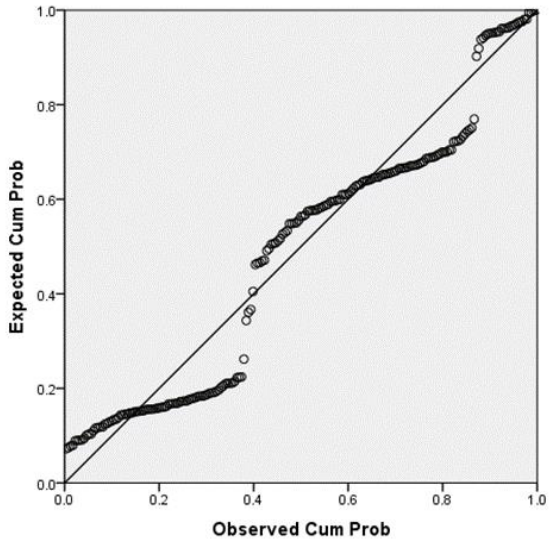


Figure 8: Linear regression between BMI and the number of used antihypertensive drugs (R=0.216, p=0.002, B=.026).

4.4Prevalence of Abdominal Obesity using WC and WHR

The average WHR was 0.97 ± 0.05 for males and 0.92 ± 0.06 for females, whereas WC averaged 103.1 cm ± 10.6 and 108.8 cm ± 11.86 for men and women, respectively. Importantly, the mean WC for men and women was above the values found in other studies (52-55). As for WHR, Girotto, et al. [21] found close values for men and women, 0.96 and 0.94 respectively, compared to those reported in this study 0.97 and 0.92 respectively. Similarly, Picon, et al. [56] found a mean WHR of 0.93 and 0.98 for women and men, respectively. Such similarities may relate to the fact that the latter study and our study looked at individuals already with a risk factor for the metabolic syndrome such that Picon, et al. [56] considered diabetes, whereas our study considered hypertension. Fadupin and Olayiwola [25] from Nigeria found a higher mean of WHR for both genders; 1.01 for males and 0.97 for females.

This study found high prevalence of abdominal obesity in this population of hypertensive patients measured by both WHR and WC. The prevalence of high WC was higher than that (41%) found by a study from Tunisia [23].

The prevalence of abdominal obesity determined by WC was higher in females than males (98.5% vs 54.9%, p = 0.000). Using WHR, the prevalence was also higher in females (92.6%) than males (88.7%) and p > 0.05. These results are different from reports from Egypt, which showed that high WHR was more prevalent in males than females [24].

Comparing both age groups, the prevalence of high WC was higher in the "18-50 years" age group (90.7%) than in the "51-70 years" age group (75.8%), p = 0.004. Similarly, the prevalence of high WHR was 92.6% and 89.9% for "18-50" and "51-70" age groups, respectively, (p> 0.05).

By examining the prevalence of abdominal obesity in both genders, the study found an association between high WHR and each of diabetes mellitus and HDL-C levels, as well as between high WC and uncontrolled blood pressure, p=0.03. Additionally, High WHR was associated with higher levels of TG and LDL cholesterol in females, p=0.03.

5. CONCLUSION

- This study revealed that general and abdominal obesity is prevalent among hypertensive patients in Al-Kish Polyclinic in Benghazi, Libya.
- More than 75% of the obese hypertensive patients were females, whereas males represented more than 50% of the overweight hypertensive patients.
- The prevalence of co-morbid conditions, namely DM and dyslipidemia, was found in nearly one-third of the hypertensive patients.
- Poor blood pressure control was observed in 63.3% of all hypertensive patients of whom 70% were obese.
- More than 60% of the hypertensive patients were on combined antihypertensive drugs, and more than 70% of them were obese.
- There was a significant positive correlation between BMI and each of SBP, DBP, and the number of antihypertensive drugs used by the patients. A similar correlation was observed between WC and each of SBP and the number of antihypertensive drugs.

6. RECOMMENDATIONS

Based on the findings of this study, the authors of this study recommend several actions to be taken by local health authorities, officials, and physicians by:

- Improving the knowledge and the attitude of primary health care physicians towards the importance of achieving the target blood pressure levels according to JNC-8 guidelines and recommendations.
- Identifying obesity through these simple and low-cost measures, which should be part of the routine tasks of primary health care for all hypertensive patients.
- Integrating comprehensive health education regarding lifestyle and behavioural changes into national health policies to avoid obesity comorbidities and to ensure better blood pressure control.

Although the findings of this study suggest a predictive relationship between obesity measurements and BP control, the sample was not nationally representative, and the presence of potential confounders makes it challenging

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to suggest meaningful explanations for these relationships. Therefore, similar future research in the field is to be done at larger and better-designed studies aiming to examine and explain the relationships between these variable factors.

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