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**Assessment of Hypertension-related Knowledge, Attitudes and Life-style Practices
among Hypertensive Patients at Primary Health Care Centers in Jeddah in 2015, KSA**

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Abstract

Background Hypertension is one of the most common non-communicable diseases; it is a modifiable risk factor for stroke, ischemic heart diseases, peripheral vascular diseases and chronic kidney disease.

Objective To assesses hypertension-related knowledge, attitudes, and lifestyle practices among hypertensive patients attending primary health care centers in Jeddah, Saudi Arabia.

Subjects and Methods A cross-sectional study was conducted in 220 hypertensive patients randomly selected from five primary health care centers in Jeddah in July 2015. Participants were interviewed one-on-one in Arabic using an adapted structured questionnaire on hypertension-related knowledge, attitudes and lifestyle practices. Response rate was 100%.

Results Males constituted 53.2% of the sample and females 46.8%. The majority of the participants were married (81.4%) and aged above 40 years old (66.8%). More than half of the participants were diabetic (52.3%) or had a positive family history of hypertension (74.5%); 46.8% were overweight; and 44.1% were smokers. Of the respondent, 98% knew that hypertension was a disease, 90% knew high salt intake is a risk factor for hypertension and that 88.6% knew that exercise reduces blood pressure level. Almost all of the participants scored high on attitude level: 97.3% believed that adherence to hypertension medication was important. However, a low level of lifestyle practices was observed among participants; only 10% reported that they did a urine analysis or checked their lipid profile in the last month. Gender differences were observed in lifestyle practices with more men reporting having exercised in the last month than women (42% men, 33% women; $P = 0.03$).

Conclusion A high proportion of participants had a good level of knowledge and right attitudes related to hypertension; however, a small proportion had good lifestyle practices. These findings emphasize the need to develop national strategies with positive reinforcement to improve hypertension-related practices.

Keywords Hypertension, Knowledge, Attitudes, Practices, Saudi Arabia

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Chapter 1. Introduction

Overview on Hypertension

Hypertension is a condition that affects the blood vessels with persistently increased blood pressure.

Normal systolic blood pressure level in adults is 120 mmHg and normal diastolic blood pressure is 80 mmHg. Systolic blood pressure is considered high when it is greater than or equal to 140 mmHg, and diastolic blood pressure is considered high when it is greater than or equal to 90 mmHg.³

The majority of hypertensive patients are symptomless, which is the reason behind describing hypertension as a “silent killer”. Some patients may experience symptoms such as dizziness, headache, heart palpitations and blurring of vision³.

Hypertension is a major public health challenge worldwide because it has a high prevalence and is considered a strong risk factor for cardiovascular disease and premature death^{4,5}. Approximately 29.8% of the world’s adults’ population were estimated to have hypertension in 2010, 30.7% in men and 28.8% in women. In 2010, 346 million individuals in developed countries were hypertensive, compared to 985 million in developing countries⁶. In 2015, The World Health Organization (WHO) revealed that 40% of adults over 25 years of age are currently affected by high blood pressure³. Globally, hypertension leads to 7.5 million deaths per year, accounting for 12% of all-cause mortality³.

The higher the blood pressure, the more harmful its effects are on the heart and major organs such as the kidney and the brain. Uncontrolled hypertension contributes to a heart attack and congestive heart failure. High blood pressure can lead to a stroke after leakage of the blood from the vessels. In addition, renal failure and blindness are complications of hypertension. The hypertension complications are facilitated by different risk factors that accelerate the heart attack, renal failure and stroke. These risk factors incorporate obesity, tobacco smoking, physical inactivity and high cholesterol level ³

Hypertension is classified as the third leading cause of disability-adjusted life-years a ^{7,8}. Hypertension is a modifiable risk factor for leading causes of mortality including, stroke, ischemic heart diseases, peripheral vascular diseases, and chronic kidney disease ^{1,2}. There is a strong positive relation between hypertension and the incidence of vascular disease, which affects individuals with or without a history of cardiovascular disease ⁹. High systolic blood pressure contributes to cardiovascular disease more than high diastolic blood pressure and is considered a strong risk factor for cardiovascular disease ^{10, 11, 12}.

Antihypertensive treatment has revealed its effectiveness in preventing and decreasing the incidence of vascular disease according to randomized controlled trials ³.

Hypertension in Saudi Arabia

In Saudi Arabia, 78% of all deaths were attributed to non-communicable diseases in 2014, and 46% of deaths were due to cardiovascular disease ³.

In 2007, a study conducted in Saudi Arabia on 17,230 individuals showed that the prevalence of hypertension was 26.1%. The prevalence was 28.6% for males and 23.9% for females ¹³. The rural population showed significantly lower prevalence of 22.4% in comparison to the urban population with 27.9%. The prevalence of cardiovascular diseases and obesity rises in relation to the prevalence of hypertension with a positive linear relation ¹³.

Hypertension affects more than one-fourth of individuals over 18 years old and it is increasing in prevalence. According to recent survey on 4,758 individuals in Saudi Arabia, the overall hypertension prevalence was 20.7% with 7.6% prevalence of isolated systolic hypertension. Higher body mass index (BMI) and age had a strong relation with the increase in prevalence of isolated systolic hypertension ¹⁴.

Hypertension is a silent killer; people can have hypertension for years and not know it. The longer a person is hypertensive, the more likely it is that adverse effects can result. Even when people experience symptoms of hypertension, such as headaches, they might not recognize them as such, and so they will address only the symptom and ignore the underlying cause. Still others are under the false impression that they are not prone to hypertension unless they have a positive family history. They are not aware of the other risk factors (e.g., obesity, smoking, diabetes).

The Saudi Ministry of Health (MoH) has implemented a public health campaign to educate the population about hypertension every year. As part of this campaign, booths have been set up at malls and other public spaces that have health workers measuring blood pressure. Physicians also participate by checking people's knowledge and counseling those with hypertension and those at risk of developing it. In addition, the MoH distributes booklets about hypertension. A question arises: how much are hypertensive patients gaining from these and other efforts? It is key that these individuals do and know certain things in order to have better health outcomes, so it would be useful to assess the knowledge, attitudes, and practices of hypertensive patients.

Study Purpose

In the current study, we will focus on discovering the knowledge, attitudes, and lifestyle practices (KAP) of a group of hypertensive patients in order to ultimately improve patient awareness and hypertension control. This study will help the MoH evaluate its efforts and will indicate the effectiveness of messaging directed to hypertensive patients from health professionals (physicians and nurses). This KAP assessment may encourage physicians to use innovative ways to deliver their messages and assist them in choosing the most appropriate tools for health promotion and disease prevention.

Study Questions

Our goal is to assess the knowledge, attitude and lifestyle practices among adult hypertensive patients in Jeddah, Saudi Arabia. Since this study assessed the KAP of hypertensive patients that had been seen in primary health care clinics, we would expect them to have a good level of knowledge and attitude towards hypertension. Our study results will either confirm that assumption or reveal another.

- What is the level of hypertension-related knowledge, attitudes and lifestyle practices among adult hypertensive patients visiting primary health care centers (PHCCs) in Jeddah?
- Are differences in knowledge, attitudes and lifestyle practices among hypertensive patients related to demographic characteristics and other factors such as duration of hypertension?

Study Significance

There are a limited number of studies addressing areas other than hypertension trends and prevalence in Saudi Arabia. Studying hypertension- related knowledge, attitudes, and practices is critical for successful health awareness campaigns and hypertension regulation in Saudi Arabia ¹⁴.

This study will provide information on the level of hypertension-related knowledge, attitudes, and practices among hypertensive patients. Findings will serve as an indicator of how effective clinical counseling and awareness campaigns are at informing patients about hypertension in Jeddah city.

Being aware of the level of knowledge among hypertensive patients will help MoH officials address the weak points of the hypertension campaign efforts and acknowledge the limitations of facilities. In addition, it is also crucial to know if there is an insufficient knowledge about hypertension because this is a strong factor for the development of complications.

Chapter 2. Literature Review

Global Snapshot of Hypertension Prevalence and Control

Hypertension is a common chronic condition that requires lifelong management and control to reduce its adverse effects on vital organs such as the heart and the brain. The overall prevalence of hypertension is increasing in both developed and developing countries ¹⁵. According to a systematic review, the prevalence, awareness, and control of hypertension in developed countries were approximately similar to developing countries with a significant increase in prevalence among males living in developed countries ¹⁵.

Early hypertension detection and widespread cost effective antihypertensive treatment both play an important role in the reduction of high blood pressure and death from cardiovascular disease in the developed countries ³. In the United States, hypertension prevalence was 31% in 1980; by 2014, it had declined to 18%. The highest prevalence of hypertension has been recorded in African countries, where 30% of adults suffer from high blood pressure and where the highest blood pressure average has been recorded in the world ³. The WHO reported that hypertensive populations in developing countries had a lack of hypertension awareness, detection, and access to treatment. This has resulted in increasing the rates of hypertension-related disability and death. Drawing attention to the proper hypertension knowledge, attitude and practice in order to control increased blood pressure is of high priority in the world ³.

Among developed countries, European countries recorded the highest hypertension prevalence (44.2%)¹⁶.

In developing countries, it is predicted that by the year 2025, more than 1.5 billion people will be hypertensive¹⁷. The more that hypertension prevalence increases in developing countries, the more that cardiovascular disease related mortality increases; this will facilitate the epidemiologic transition of disease burden from communicable to non-communicable diseases, affecting significantly people with the lower education level¹⁸. It is predicted that the rate of ischemic heart disease in developing countries will increase by 120% in females and 137% in males¹⁹.

In Arab countries, a recent systematic review indicates that the prevalence of hypertension had reached 29.5%, in comparison to 28% in the United States and 27.6% in Sub-Saharan Africa¹⁶. It is believed that lifestyle changes resulting from industrialization and urbanization, seen in the form of increased prevalence of obesity, higher rates of physical inactivity, and the consumption of highly processed and salty foods, play a pivotal role in high prevalence of hypertension in Arab populations¹⁶.

The same factors are relevant to the Kingdom of Saudi Arabia (KSA). The higher prevalence of obesity resulting from social traditions and the low educational level had a large influence on the prevalence of hypertension. According to Al-Nozha et al., the prevalence of hypertension has markedly increased among those who are less educated compared to those who are more educated¹³. Hypertension is the major risk factor for mortality in Saudi Arabia according to the 2010 Global Burden of Disease study²⁰. Moreover, hypertension causes 24% of cardiovascular diseases. A high prevalence of

hypertension in a country with free access to health care and a place enriched with all needed resources calls for national initiatives to decrease the burden of the disease and facilitate disease awareness, knowledge, early detection, and control ²⁰.

Jeddah is a major city in KSA. A recent study was conducted there on 243 participants to estimate hypertension prevalence and its related risk factors compared to other regions in the Kingdom. Researchers found that the hypertension prevalence there was 22.6%, higher than in all other areas of the Kingdom. The highest incidence of hypertension was recorded among diabetic patients (40%), patients with high cholesterol levels (19%), and smokers (8%) ²¹.

Hypertension-related Knowledge, Attitudes, and Lifestyle Practices in Developed Countries

Many studies discuss the importance of tertiary prevention of hypertension in the form of increasing knowledge, awareness, and attitudes among the hypertensive population in both developed and developing countries. Recent studies have recognized the importance of hypertension-related knowledge in disease control and recommend the assessment of hypertension-related knowledge, attitudes, and practices in hypertensive individuals as a component of designed interventions to promote and control hypertension ²².

A study conducted in the United States on hypertension knowledge, awareness and attitudes found that most of the participants were knowledgeable regarding hypertension, but they were less aware of some risk factors related to hypertension,

even though a portion of the participants had been diagnosed with hypertension for more than 14 years. This result suggests that even though some people have had hypertension for long time, their knowledge is still insufficient ²².

A similar survey in the United States investigated the current knowledge and awareness of hypertensive patients in a group model health maintenance organization (HMO). The results showed that participants had relatively adequate knowledge about stroke and myocardial infarction as complications of hypertension, though some of them were unaware that kidney disease is also a hypertension complication. The majority correctly identified systolic blood pressure and diastolic blood pressure readings as the top and bottom numbers, respectively. Although this survey indicates that participants' knowledge was adequate, their knowledge on self-control of blood pressure was considered suboptimal ²³.

Researchers in European countries investigated the level of knowledge in hypertensive population and in the elderly as well. A recent study was conducted on self-reported hypertension-related knowledge and awareness in Denmark among an elderly population between the ages of 60 and 74. Showed that around 80% of the participants reported that obesity and stress had a great impact on hypertension incidence ²⁴. Generally, there were various degrees of knowledge with regards to hypertension symptoms. Approximately one-third reported that hypertension is an asymptomatic condition. Others reported that hypertension might cause some symptoms like nosebleeds, headache and palpitations. Most of the participants did have good knowledge regarding hypertension complications ²⁴.

In contrast, a similar survey in Canada among a middle aged population (over 40 years old) revealed limited knowledge with regards to hypertension risk factors and its long-term consequences on health ²⁵. Approximately two-thirds of the participants indicated clearly that hypertension is a symptomatic condition and can be recognized by clear signs ²⁵.

Another study done in Canada to assess knowledge, attitudes, and practices regarding sodium consumption among Canadians aged 35 to 50 addressed the importance of lowering sodium intake to decrease the incidence of hypertension ²⁶. The majority of the respondents acknowledged the negative health impact of excessive sodium intake and they were aware that processed food is rich in sodium; half of the participants agreed strongly that a low salt diet was mandatory for maintaining a healthy life and preventing or controlling hypertension; more efforts were required to educate the general public about the benefit of a low sodium diet. Many of the respondents took a step forward towards reducing sodium in their diets ²⁶.

Hypertension-related Knowledge, Attitudes, and Lifestyle Practices in Developing Countries

Although assessment of hypertension-related knowledge, attitudes, and practices is important for prevention of hypertension, there is a lack of studies set in developing countries. In 1997, Aubert et al. found that most of the respondents in a study in Seychelles Islands had an acceptable level of hypertension-related knowledge considering its determinants and complications. However, positive attitudes and healthy lifestyle practices were reported in few respondents, with minimal differences between aware hypertensive and unaware hypertensive respondents ²⁷. Awareness denotes having a general sense of the disease and an intellectual recognition of its aspects, whereas knowledge suggests knowing more deeply about it, as through experience.

Along those lines, another study conducted in India reported good overall hypertension-related knowledge levels but poor scores with regard to positive hypertension attitudes and practices among the general population. The study suggested that the reinforcement of health education about hypertension and its consequences would have a positive impact on the attitudes and practices in this population ²⁸.

In China, a study showed that hypertension awareness, treatment, and control among hypertensive patients had increased slowly at an unacceptable rate over time. National initiatives towards improving hypertension-related knowledge, attitudes and practices were necessary to minimize hypertension's adverse health effects and consequences ²⁹.

In Iran, researchers found a significant relationship between knowledge, attitudes, and practices, but there was found to be little relationship between knowledge and both attitudes and practices. In addition, a significant relationship between the older age of the participants and knowledge level was observed, but the same was not found between old age and attitudes and practices. Moreover, patients with longstanding hypertension and high educational levels had significantly more knowledge and healthy lifestyle practices. Furthermore, females recorded better scores of awareness, knowledge, attitudes, and practices than males ³⁰.

A group of rural hypertensive patients in Iran participated in a cross sectional study that examined their sodium consumption and dietary knowledge based on whether their hypertension is controlled or uncontrolled³¹. The uncontrolled group had suboptimal knowledge regarding the appropriate daily salt intake and showed a lack of dietary knowledge in general, while the controlled group showed an acceptable knowledge level. The fact that the participants had access to free health care in Iran set the expectation that they would have adequate knowledge ³¹. The mean salt consumption in the uncontrolled group was significantly increased, and the higher knowledge scores were recorded in the controlled group ³¹.

In Africa, a study conducted on the knowledge and attitudes of women of childbearing age in Ghana showed that the majority of the respondents had knowledge about hypertension symptoms such as dizziness and headache. They disagreed that hypertension is symptomless ³². Almost half of the respondents had knowledge about the normal level of blood pressure, and 38% of them reported that high blood pressure

would be recorded as more than 120/80³². Similarly, another study in Nigeria on hypertension-related knowledge and practices among 260 hypertensive adults revealed that many of the participants had knowledge of healthy lifestyles practices, 54% knew that smoking was a risk factor for hypertension, and 76% acknowledged the positive effects of exercise and weight loss in reducing blood pressure³³. However, 50% of the participants related the cause of hypertension to stress³³. Results showed that there was a significant relationship between knowledge and education level, but not between knowledge and marital status³³.

In Africa and in the Arab world, hypertension is the most common non-communicable disease. A study conducted among 200 Sudanese participants to examine their awareness and knowledge with regard to hypertension-associated factors discovered that most were unaware and had a lack of knowledge regarding hypertension's consequences and risk factors³⁴. Uncontrolled hypertension was significantly higher in smokers, the highly educated, and those who were employed. There was a strong relationship between obesity and uncontrolled hypertension in almost 50% of the subjects³⁴.

Although assessing patients' knowledge and practices related to hypertension is important, assessing the source of that knowledge (e.g., physicians and nurses) is also necessary. A recent study conducted in Egypt to assess the knowledge and practices of the primary care physicians towards hypertension management and detection showed that hypertension was considered of high priority, and 50% of the physicians included patient's clinical history with regard to hypertension in medical records³⁵.

Overall, hypertension-related knowledge and practice level among the primary health care physicians was unsatisfactory ³⁵. It was strongly suggested that physicians continue their medical education and participate in workshops and seminars on hypertension guidelines in order to improve their performance ³⁵.

Hypertension-related Knowledge, Attitudes, and Lifestyle Practice in KSA

A study was conducted in KSA among health professionals to discover their awareness level and attitudes toward hypertension. The study found a suboptimal level of hypertension awareness and a lack of updated knowledge regarding the recent hypertension guidelines ³⁶. In addition, most of the hypertensive respondents were neglecting their own condition and could not recall their recent blood pressure measurements. Furthermore, the hypertensive physicians were not following up at clinics regularly and had poor compliance to hypertension treatments. Physicians linked this improper attitude to work stress, insufficient time, and lack of trusted physicians ³⁶. The study also revealed that stress, physical inactivity, and obesity were major risk factors for hypertension among health professionals. The author called for motivation and dietitian advice to overcome this problem in physicians ³⁶.

Another cross-sectional study conducted in KSA among 255 hypertensive patients following up in primary health care centers (PHCs) in Riyadh determined hypertension control and co-morbidities. The study recorded a high percentage of participants with uncontrolled hypertension, the majority of whom were overweight or obese ²¹.

In addition, diabetes and kidney disease were the most common hypertension co-morbidities. Updating health care professionals and hypertensive patients with the latest hypertension knowledge was highly recommended in order to improve PHC center quality ²¹.

Two recent national surveys in KSA on hypertension and its related risk factors showed that old age, obesity, diabetes, and high cholesterol level were significant risk factors. In general, hypertension control was poor and most Saudi hypertensive patients were not aware of hypertension risks ^{20, 37}.

Therefore, understanding hypertension and using the ideal preventive measures is the key to controlling and reducing its prevalence in developing countries such as KSA. Strengthening hypertension-related knowledge and encouraging the appropriate attitudes among the Saudi public can accomplish this goal. Use of the appropriate preventive measures has a positive impact in changing the behaviors that contribute to hypertension in adults, and it reinforces healthy life-style. Besides the lower cost of the primary prevention approach as compared to treatment cost, it has been long considered the most effective way to prevent and control non-communicable diseases such as hypertension and diabetes ³⁸. Based on this fact, primary prevention is the most cost effective way of preventing diseases.

In KSA, the Ministry of Health proceeds toward community participation that integrates the people into the process of health care and motivates them to avoid risk factors of chronic disease such as hypertension by embracing the appropriate lifestyle practices ²¹.

The Effect of Patient Education in Hypertensive Patients

Hypertensive patients who had adequate hypertension-related knowledge had better hypertension control and compliance to treatments ³⁹. In fact, those who had fewer years of schooling and fewer literacy skills were at risk of uncontrolled hypertension and had insufficient knowledge related to hypertension ⁴⁰. A study investigated the effect of an educational intervention on the level of hypertension-related knowledge, beliefs, and adherence among hypertensive patients ⁴¹. It revealed a significant increase in the level of knowledge after the educational intervention, and a positive impact on patients' beliefs was observed ⁴¹. However, more time was required before changes in behavior such as adherence to hypertension treatment could be expected ⁴¹. A similar study involved patients who received an educational intervention from pharmacists ⁴². Assessment of their hypertension-related knowledge, treatment compliance, and quality of life showed significantly higher levels of hypertension-related knowledge and medication compliance among the intervention group, and lower blood pressure measurements were observed after the intervention period. Improved quality of life was also reported ⁴².

Researchers found that short-term educational intervention is effective in increasing the level of hypertension knowledge, attitude, control, and lifestyle practice among hypertensive patients ⁴³.

Moreover, evidence has shown that behavioral intervention through phone calls and blood pressure monitoring at home assist in hypertension control ⁴⁴.

Therefore, effective knowledge, attitudes and healthy lifestyle practices should be vital goals for all decision makers such as health policy and health care professionals, as well as all persons at risk of developing hypertension. These goals can be achieved through awareness campaigns, national guidelines and adopting policies that expedite hypertension detection, prevention and treatment ⁴⁴.

Chapter 3. Manuscript

Introduction

Hypertension is a major public health challenge worldwide because it has a high prevalence and is considered a strong risk factor for cardiovascular disease. Globally, hypertension leads to 7.5 million deaths per year, accounting for 12% of all-cause mortality. The World Health Organization (WHO) revealed that 40% of adults over 25 years of age are affected by high blood pressure ³.

In Saudi Arabia, non-communicable diseases accounted for 78% of all deaths in 2014, and 46% of all deaths were estimated to have resulted from cardiovascular disease ³. In 2007, a study conducted in Saudi Arabia on 17,230 subjects showed that the prevalence of hypertension was 26 (29% in men and 24% in women) ¹³. The prevalence of cardiovascular diseases and obesity rises in relation to the prevalence of hypertension with a positive linear relation ¹³.

Assessment of hypertension-related knowledge, attitudes, and lifestyle practices assists in identifying the gaps in knowledge among hypertensive individuals in Saudi Arabia and improves the future planned interventions.

This study will provide significant indicators of hypertension control and show how effective clinical attempts are at informing patients about hypertension in Jeddah city. Being aware of the level of knowledge among hypertensive patients will help MoH officials address the weak points of the hypertension campaign efforts and acknowledge the limitations of facilities. In addition, it is also crucial to know if there is an insufficient

knowledge about hypertension because this is a strong factor for the development of complications.

We conducted a study to assess the level of hypertension-related knowledge, attitudes, and lifestyle practices (KAP) in hypertensive patients attending primary health care centers (PHCCs) in Saudi Arabia, and to determine whether differences in knowledge, attitudes, and practices are related to demographic characteristics and other factors such as disease duration.

Methods

Study Area

Jeddah city is the main seaport and the second-largest city of the Kingdom of Saudi Arabia. For administrative reasons, it is geographically divided into five supervisory sectors, each having around 9 PHCCs, with a total of 45 PHCCs in the city.

Study Design

We conducted a cross-sectional study on a sample of 220 hypertensive patients attending five of Jeddah's PHCCs during July 2015. All hypertension patients visiting these clinics were eligible for inclusion in the study and there were no exclusion criteria. The study included hypertensive patients who had appointments at the chronic disease clinic directly or who walked into the general clinic and then were referred. We informed nurses at the general clinics of the study purpose and asked them to refer eligible patients to the chronic disease clinics.

Sample Selection

A multistage sampling technique was utilized. In the first stage, one primary health care center was selected by simple random sampling from each supervisory sector. In the second stage, from each center, every other patient was selected for participation. Each participant was notified that participation was voluntary. The distribution of recruited patients by geographic location of the PHCC was as follows: 60 patients were recruited from the central PHCC, 50 from the northeastern, 50 from the southwestern, 30 from the southeastern and 30 from the northwestern PHCC.

Before interviewing participants, we received verbal consent to do so. The sample size and power was determined using EPI Info version 0.7. We estimated the population proportion using the sum of each PHCC's average monthly patient attendance (n=59,364), with an expected frequency of hypertension of 25% to achieve the 95% confidence interval. The estimated sample size of the five clusters was 290. The 220 randomly surveyed subjects yielded an approximate power of 92%.

Data Collection Tool

Subjects were interviewed one on one in Arabic using an adapted structured questionnaire²⁸ in paper form on hypertension-related knowledge, attitudes and lifestyle practices. The data was then re-entered into an electronic version of the questionnaire in Google Docs. There were eight questions related to knowledge, five questions related to attitude, and six questions related to practice.

Patient privacy was ensured when conducting the interviews, and anonymity was maintained by not collecting any data on personal identifiers.

Study Variables

Independent variables. The demographic data was collected in categories: age (18-20, 21-30, 31-40, and over 40), gender (male and female), education (illiterate, primary school, secondary school, and graduate), marital status (married, unmarried), and occupation (professional, retired, housewife, unemployed, student, and technical/manual). In addition, the following variables were also divided into categories: the duration of hypertension (less than 5 years, 5–10 years, and more than 10 years), body mass index (BMI; underweight<18, normal 18.5-24.9, overweight 25-29.9, and obese 30 or greater), family history of hypertension (Yes/No), smoking history (Yes/No), and the diet type, for which the patient could select more than one answer (diabetic diet, low carbohydrate, low cholesterol, low salt, renal with low salt/low protein diet, vegetarian, and no special diet).

Dependent variables. Hypertension-related knowledge parameters included five questions that were dichotomous (Yes/No) on (knowing whether hypertension is a disease, knowing the risk of high salt intake, smoking and obesity on hypertension, and knowing the benefits of exercise on hypertension), two questions with multiple correct answers (regarding complications and symptoms), and one question with a single correct answer (regarding blood pressure level). Hypertension-related attitude parameters included five yes or no questions on the importance of (reducing salt intake, regular checking of blood pressure, follow up with the physician, taking medication, and exercise on hypertension). Hypertension-related lifestyle practice parameters included six questions focused on the last time practice of (measuring the blood pressure, clinic visit,

urine examination, lipid profile checked, blood sugar level checked, and doing exercise). If the follow-up period was less than six months, we considered it “not delayed,” but if it was more than 6 months, we considered it “delayed.”

Data Management and Statistical Analysis

Data entry and descriptive data analyses were conducted using Excel statistical software package 2016 (Microsoft, Seattle, WA). Quality control was done at the stages of coding and data entry. Weights were calculated by using a 2-stage approach: the first stage weight was the probability of the health center being randomly chosen in each sector. The second stage weight was the probability of being surveyed in that health center. Weights were normalized according to the sample mean. The weighted data analysis was performed using SAS 9.4 (Cary, NC). Qualitative data were presented using descriptive statistics in the form of frequencies and percentages. Means and standard deviations were used for quantitative variables. Chi-square test was used for the association of demographic characteristics and the duration of hypertension with each parameter of knowledge, attitude, and practice.

Ethical Considerations

Written permission from the Medical Research and Studies Department in Jeddah at the Directorate of Health Affairs was granted in order to facilitate the research. The instruments of the study were approved by the Ministry of Health and the participant data was kept anonymous to ensure confidentiality. The verbal consent of the participants was a prerequisite for inclusion in the study. Data was kept confidential and not disclosed except for study purposes. Data was collected by the Saudi Ministry of Health and was completely de-identified. The Institutional Review Board of Emory University granted exempt review status for this study because the dataset used in this study was de-identified.

Results

Demographic Characteristics and Health Status

This cross-sectional study included 220 hypertensive patients with a response rate of 100%. Males constituted 53.2% of the sample and females 46.8%. The majority of the participants were married (81.4%) and aged above 40 years old (66.8%). The largest proportions had professional jobs (37.3%), or were housewives (25%), and the lowest proportions were either unemployed (4.6%), or retired (10%). Regarding educational level, 31.8% were university graduates, 27.3% had completed secondary school, 23.6% were illiterate, and 17.3% had completed primary school (Table 1).

Table1. Demographic characteristics of hypertensive patients attending five primary health centers in Jeddah, Saudi Arabia, 2015

Demographic Characteristic	N	(%)
Gender		
Female	103	(46.8)
Male	117	(53.2)
Marital status		
Married	179	(81.4)
Unmarried	41	(18.6)
Educational level		
Graduate	70	(31.8)
Illiterate	52	(23.6)
Primary school	38	(17.3)
Secondary school	60	(27.3)
Age (years)		
21-30	15	(6.8)
31-40	58	(26.4)
41 or above	147	(66.8)
Occupation		
Housewife	55	(25)
Professional	82	(37.3)
Retired	22	(10)
Student	7	(3.2)
Unemployed	10	(4.6)

*N (%) number of hypertensive patients & percentage.

More than half of the participants were diabetic (52.3%) and had a positive family history of hypertension (74.5%). Almost half (46.8%) of them were overweight and 44.1% were smokers (Table 2). Respondents with hypertension for more than 10 years constituted 28.6% of the group, and 38.6% had been hypertensive for less than 5 years. Although hypertension was diagnosed early in most of the respondents, many of them (40.5%) were not following a specific diet; only 37.3% were on a low salt diet and 13.6% were on a diabetic diet.

Table 2. Clinical and anthropometric characteristics of hypertensive patients attending five primary health centers in Jeddah, Saudi Arabia, 2015

Variables	N	(%)
BMI		
<18.5	5	(2.3)
18.5-24.9	63	(28.6)
25-29.9	103	(46.8)
>30	49	(22.3)
Diabetes		
Yes	115	(52.3)
No	105	(47.7)
Smoking		
Yes	97	(44.1)
No	123	(55.9)
Positive family history of hypertension		
Yes	164	(74.6)
No	56	(25.5)
Duration of hypertension		
< 5 years	85	(38.6)
5-10 years	72	(32.7)
>10 years	63	(28.6)

*N (%) number of hypertensive patients & percentage

Table 3. Knowledge parameters of hypertensive patients attending five primary health centers in Jeddah, Saudi Arabia, 2015

Knowledge parameters	N	(%)
Do you know whether hypertension is a disease?		
Yes	217	(98.6)
No	3	(1.4)
What are the complications of hypertension?		
Stroke	182	(82.7)
Renal Failure	117	(53.2)
Ischemic heart disease	190	(86.4)
What is the normal level of blood pressure (mmHg)?		
120/80	130	(59.1)
100/90	59	(26.8)
150/90	40	(18.2)
What are the symptoms of hypertension?		
Blurred vision	139	(63.2)
Dizziness	143	(65)
Headache	204	(92.7)
Is a diet rich in salt a risk factor for hypertension?		
Yes	198	(90)
No	22	(10)
Is smoking a major cause of hypertension?		
Yes	139	(63.2)
No	81	(36.8)
Is obesity associated with hypertension?		
Yes	164	(74.5)
No	56	(25.5)
Does exercise have a beneficial role in hypertension?		
Yes	195	(88.6)
No	25	(11.4)

*N (%) number of hypertensive patients & percentage

Knowledge Parameters

Table 3 shows the response of the participants to knowledge questions. Almost every respondent knew that hypertension was a disease (98.6%), and most knew that a diet rich in salt is a risk factor for hypertension (90%) and that exercise had a positive effect on lowering blood pressure (88.6%). Three-quarters of the participants (74.6%) knew that obesity was a risk for hypertension. Fewer than half of the participants correctly chose all three answers related to hypertension complications and symptoms; 25% of the participants chose only one correct answer for both questions. However, over half chose the correct answer for the normal level of blood pressure, which is 120/80 mmHg.

Table 4. Association* of hypertension-related knowledge with age and gender in hypertensive patients attending five primary health centers in Jeddah, 2015

Knowledge parameters (N [%] of correct answer)	Age			P value	Gender		P value
	21- 30	31-40	40 +		Male	Female	
Do you know whether hypertension is a disease? (Yes)	15 (100)	58 (100)	144 (98.33)	--	117 (100)	100 (97.54)	--
What are the complications of hypertension?							
Stroke (Yes)	12 (82.46)	43 (73.40)	127 (87.09)	0.12	96 (82.33)	86 (84.38)	0.82
Renal Failure (Yes)	11 (69.55)	32 (55.05)	74 (49.76)	0.44	65 (54.54)	52 (49.92)	0.20
Ischemic heart disease (Yes)	14 (91.87)	51 (86.96)	125 (83.62)	0.37	101 (85.4)	89 (84.6)	0.74
Is the normal level of blood pressure 120/80? (Yes)	11 (71.61)	32 (54.26)	87 (59.72)	0.58	69 (59.01)	61 (59.20)	0.98
What are the symptoms of hypertension?							
Blurred vision (Yes)	10 (64.76)	35 (58.38)	94 (61.20)	0.97	78 (64.34)	61 (56.45)	0.09
Dizziness (Yes)	9 (59.11)	34 (58.81)	100 (68.52)	0.50	80 (68.01)	63 (62.36)	0.42
Headache (Yes)	14 (91.87)	53 (90.15)	137 (92.60)	0.80	104 (87.72)	100 (96.86)	0.01**
Is a diet rich in salt a risk factor for hypertension? (Yes)	15 (100)	53 (92.12)	130 (88.61)	--	103 (88.34)	95 (92.50)	0.05
Is smoking a major cause of hypertension? (Yes)	14 (91.87)	41 (75.18)	84 (57.86)	<.0001**	85 (74.02)	54 (53.38)	<0001**
Is obesity associated with hypertension? (Yes)	15 (100)	45 (80.37)	104 (73.50)	--	94 (82.01)	70 (71.11)	0.07
Does exercise have a beneficial role in hypertension? (Yes)	15 (100)	50 (88.58)	130 (87.44)	--	109 (93.25)	86 (83.04)	0.0044**

*Table shows number and percentage of hypertensive patients who identified the correct answer by age and gender groups

**Statistically significant result

-- Statistical test cannot be computed because a cell within the table has a null value

Table 5. Association* of hypertension-related knowledge with educational level and hypertension duration in hypertensive patients attending five primary health centers in Jeddah, 2015

Knowledge parameters (N [%] of correct answer)	Education				P value	Hypertension Duration			P value
	Graduate	Primary School	Secondary School	Illiterate		<5 years	5-10 years	>10 years	
Do you know whether hypertension is a disease? (Yes)	70 (100)	36 (95.12)	60 (100)	51 (99.09)	--	85 (100)	72 (100)	60 (96.21)	--
What are the complications of hypertension?									
Stroke (Yes)	63 (89.63)	35 (91.68)	51 (85.80)	33 (65.98)	0.01**	70 (82.52)	61 (83.35)	51 (84.17)	0.98
Renal Failure (Yes)	49 (69.57)	16 (42.06)	34 (54.25)	18 (36.85)	<.0001**	50 (59.46)	37 (48.06)	30 (47.92)	0.12
Ischemic heart disease (Yes)	63 (88.87)	32 (84)	50 (81.12)	45 (35.32)	0.81	79 (91.95)	61 (83.35)	50 (77.85)	0.07
Is the normal level of blood pressure 120/80? (Yes)	47 (66.50)	22 (58.46)	43 (71.49)	18 (36.48)	0.08	53 (62.43)	47 (64.96)	30 (48.61)	0.10
What are the symptoms of hypertension?									
Blurred vision (Yes)	48 (65.96)	25 (64.84)	35 (54.44)	31 (57.92)	0.52	56 (64.26)	42 (54.22)	41 (62.98)	0.68
Dizziness (Yes)	44 (61.57)	27 (71.30)	37 (61.98)	35 (69.51)	0.65	56 (65.77)	45 (62.32)	42 (68.20)	0.64
Headache (Yes)	65 (91.57)	34 (89.34)	56 (92.91)	49 (93.27)	0.78	78 (91.01)	68 (93.68)	58 (91.24)	0.70
Is a diet rich in salt a risk factor for hypertension? (Yes)	68 (97.74)	34 (89.73)	56 (94.63)	40 (76.38)	0.01**	80 (93.92)	66 (92.34)	52 (83.32)	0.10
Is smoking a major cause of hypertension? (Yes)	60 (88.60)	19 (52.08)	40 (67.30)	20 (40.86)	0.0002**	68 (82.39)	41 (57.55)	30 (48.85)	0.0009**
Is obesity associated with hypertension? (Yes)	63 (91.91)	28 (76.65)	44 (74.83)	29 (60.97)	0.01**	68 (83.23)	53 (74.85)	43 (71.22)	0.15
Does exercise have a beneficial role in hypertension? (Yes)	67 (95.89)	34 (91.55)	54 (90.49)	40 (74.85)	0.1037	79 (94.52)	65 (89.76)	51 (79.59)	0.0034**

*Table shows number and percentage of hypertensive patients who identified the correct answer by education and hypertension duration

**Statistically significant p value

-- Statistical test cannot be computed because a cell within the table has a null value

Table 4 and 5 present associations of hypertension-related knowledge with the demographic variables and hypertension duration by presenting the percentage of hypertensive patients who identified the correct answer for knowledge variables within each age, gender, education, and disease duration group. The youngest age group was more likely to correctly identify smoking as a risk factor for hypertension compared to the other age groups; the percentage of correct answers was 92% in the 21-30 age group, 25% in the 31-40, and 58% in the 40+ age groups ($P < 0.001$). No other knowledge variable had statistically significant associations with age (Table 4).

Women were more likely than men to identify headache as a symptom of hypertension (percentages are 97% for women, 88% for men; $P = 0.01$). However, men were more likely than women to correctly identify smoking as a risk factor for hypertension ($P < 0.0001$) and exercise as a beneficial factor for it ($P = 0.004$). All the other knowledge variables were not statistically significantly associated with gender, although an association of borderline significance was shown for salt intake where more women reported it as a risk factor than men ($P = 0.05$) (Table 4).

A higher educational level was statistically significantly associated with more knowledge about the complications of hypertension, particularly renal failure ($P < 0.0001$) and stroke ($P = 0.01$), and its risk factors (p-values are 0.01 for salt intake, 0.0002 for smoking, and 0.01 for obesity). All remaining knowledge variables did not vary significantly by educational level (Table 5).

A shorter duration of hypertension was related to more knowledge about smoking as a risk factor ($P= 0.0009$) and exercise as a beneficial factor ($P= 0.003$) for hypertension. All other knowledge variables did not show a variation by disease duration (Table 5).

Table6. Attitude parameters of hypertensive patients attending five primary health centers in Jeddah, Saudi Arabia, 2015

Attitude parameters	N	(%)
Should we reduce salt intake to prevent hypertension?		
Yes	206	(93.6)
No	14	(6.4)
Do you think regular checking of your blood pressure is important?		
Yes	211	(96)
No	9	(4.1)
Should we follow up with our physician regularly?		
Yes	211	(96)
No	9	(4)
Do you think taking our medication is important in hypertension?		
Yes	214	(97.3)
No	6	(2.7)
Should we exercise regularly for a healthy life?		
Yes	193	(87.7)
No	27	(12.3)

*N (%) number of hypertensive patients & percentage

Attitude Parameters

Table 6 shows that almost all of the participants scored high on attitude level: 97.3% believed that adherence to hypertension medication was important, 96% believed that regular measuring of their blood pressure was important, 96% believed that keeping in touch with the physician regularly was important, and 93.6% believed that decreasing daily salt intake was important for preventing hypertension. However, a lower proportion of respondents (87.7%) acknowledged the effect of regular exercise for a healthy life.

Table 7. Association* of hypertension-related Attitude with age and gender in hypertensive patients attending five primary health centers in Jeddah, 2015

Attitude parameters (N [%] of correct answer)	Age			P value	Gender		P value
	21- 30	31-40	40 +		Male	Female	
Should we reduce salt intake to prevent hypertension? (Yes)	15 (100)	53 (92.12)	138 (94.16)	--	108 (92.79)	98 (95.46)	0.10
Do you think regular checking of your blood pressure is important? (Yes)	15 (100)	57 (99.14)	139 (94.71)	--	112 (96.09)	99 (96.32)	0.92
Should we follow up with our physician regularly? (Yes)	15 (100)	56 (96.17)	140 (95.66)	--	114 (97.48)	97 (94.43)	0.0002**
Do you think taking our medication is important in hypertension? (Yes)	15 (100)	57 (98.18)	142 (97.54)	--	115 (98.73)	99 (96.86)	0.31
Should we exercise regularly for a healthy life? (Yes)	15 (100)	51 (90.06)	127 (85.85)	--	109 (93.41)	84 (81.35)	<.0001**

*Table shows number and percentage of hypertensive patients who identified the correct answer by age and gender groups

**Statistically significant p value

-- Statistical test cannot be computed because a cell within the table has a null value

Table 8. Association* of hypertension-related attitude with educational level and hypertension duration in hypertensive patients attending five primary health centers in Jeddah, 2015

Attitude parameters (N [%] of correct answer)	Education				P value	Hypertension Duration			P value
	Graduate	Primary School	Secondary School	Illiterate		<5 years	5-10 Years	>10 years	
Should we reduce salt intake to prevent hypertension? (Yes)	68 (97.74)	36 (94.01)	57 (96.29)	45 (86.82)	0.07	81 (95.96)	68 (95.45)	57 (90.01)	0.50
Do you think regular checking of your blood pressure is important? (Yes)	69 (99.27)	34 (90.24)	60 (100)	48 (92.71)	--	84 (99.43)	69 (95.12)	58 (93.16)	0.18
Should we follow up with our physician regularly? (Yes)	70 (100)	33 (87.84)	56 (93.88)	52 (100)	--	85 (100)	67 (93.35)	59 (93.90)	--
Do you think taking our medication is important in hypertension? (Yes)	69 (99.27)	38 (100)	59 (98.27)	48 (94.01)	--	84 (98.61)	70 (98.61)	60 (95.90)	0.40
Should we exercise regularly for a healthy life? (Yes)	65 (92.66)	34 (90.96)	56 (93.88)	38 (72.72)	0.01**	79 (94.52)	62 (85.87)	52 (81.36)	0.0065**

*Table shows number and percentage of hypertensive patients who identified the correct answer by education and hypertension duration

**Statistically significant p value

-- Statistical test cannot be computed because a cell within the table has a null value

Tables 7 and 8 both present associations of hypertension-related attitudes with demographic variables and hypertension duration. Men acknowledged more frequently than women the importance of follow up with the physician regularly ($P = .0002$) and doing regular exercise for a healthy life ($P < 0.001$). All other variables had similar distribution by gender (Table 8).

Table 8 shows that there was a statistically significant association between educational level and attitude related to the importance of regular exercise ($P = 0.01$). Moreover, participants with shorter duration of hypertension had a higher agreement with the importance of regular exercise ($P < 0.001$), but no other statistically significant associations were observed between hypertension duration and attitude parameters ($P > 0.05$).

Table 9. Practice parameters of hypertensive patients attending five primary health centers in Jeddah, Saudi Arabia, 2015

Practice parameters	N	(%)
When was your blood pressure checked last?		
One week to one month ago	156	(71)
2 to 6 months ago	53	(24.1)
More than 6 months ago	11	(5)
When was your last visit with your physician?		
One week to one month ago	67	(30.5)
2 months to 6 months ago	129	(58.6)
More than 6 months ago	24	(11)
When was your last urine examination done?		
One week to one month ago	22	(10)
2months to 6 months ago	118	(53.6)
For more than 6 months ago	80	(36.4)
When was your lipid profile checked last?		
One week to one month ago	22	(10)
2 months to 6 months ago	103	(46.8)
More than 6 months ago	95	(43.2)
When was your blood sugar level last checked?		
One week to one month ago	102	(46.4)
2 months to 6 months ago	93	(42.3)
More than 6 months ago	25	(11.4)
When did you exercise last?		
One week to one month ago	80	(36.4)
2 months to 6 months ago	66	(30)
More than 6 months ago	74	(33.6)

*N (%) number of hypertensive patients & percentage

Lifestyle Practice Parameters

In Table 9, the majority of the participants (71%) reported that their blood pressure had been measured within the last month; this measurement included clinic and home measurements. More than 50% of the participants had their last visit to the clinic and last urine investigation done within the previous two to six-month period. However, less than 50% of the participants had checked their blood lipid profile in the same period. Almost half of the participants (46.4%) had checked their blood glucose level in the last month.

In terms of the last time they exercised, the respondents were divided fairly evenly among the three groups: 36.4% had exercised from a week to one month before 30% had exercised from two to six months before; and 33.6% had exercised over 6 months before.

Table10. Association of hypertension-related practice with age and gender in hypertensive patients attending five primary health centers in Jeddah, 2015)

Practice parameters	Age			P value	Gender		P value
	21- 30	31-40	40 +		Male	Female	
When was your blood pressure checked last? One week to one month ago	12 (78.71)	33 (56.90)	111 (74.54)	0.26	85 (73.77)	71 (66.20)	0.69
2 months to 6 months ago	1 (7.09)	19 (31.96)	23 (23.20)		25 (20.20)	28 (29.32)	
More than 6 months ago	2 (14.19)	6 (11.12)	3 (2.25)		7 (6.01)	4 (14.47)	
When was your last visit with your physician? One week to one month ago	6 (43.89)	18 (32.63)	43 (30.59)	0.82	32 (27.75)	35 (36.95)	0.51
2 months to 6 months ago	7 (41.91)	33 (55.39)	89 (60.13)		72 (61.18)	57 (53.67)	
More than 6 months ago	2 (14.19)	7 (11.97)	15 (9.26)		13 (11.06)	11 (9.36)	
When was your last urine examination done? One week to one month ago	1 (8.12)	6 (11.65)	15 (10.62)	0.99	11 (9.88)	11 (11.71)	0.64
2 months to 6 months ago	9 (52.87)	31 (55.17)	78 (54.43)		64 (55.52)	54 (53.34)	
More than 6 months ago	5 (38.99)	21 (33.17)	54 (34.94)		42 (34.59)	38 (34.94)	
When was your lipid profile checked last? One week to one month ago	1 (8.12)	6 (11.91)	15 (10.62)	0.86	12 (10.74)	10 (10.84)	0.16
2 months to 6 months ago	7 (37.90)	30 (54.05)	66 (45.81)		61 (45.81)	42 (39.84)	
More than 6 months ago	7 (53.96)	22 (34.02)	66 (43.56)		44 (35.46)	51 (49.30)	
When was your blood sugar level last checked? One week to one month ago	5 (38.07)	15 (28.13)	82 (85.04)	0.0045**	60 (54.68)	42 (42.48)	0.28
2 months to 6 months ago	6 (31.05)	36 (58.99)	51 (33.27)		44 (34.35)	49 (46.03)	
More than 6 months ago	4 (30.86)	7 (12.87)	14 (8.67)		13 (10.96)	12 (11.48)	
When did you exercise last? One week to one month ago	6 (40.38)	24 (44.37)	50 (34.70)	0.80	48 (41.64)	32 (32.75)	0.03**
2 months to 6 months ago	5 (29.10)	19 (31.33)	42 (28.11)		39 (33.16)	27 (24.13)	
More than 6 months ago	4 (30.44)	15 (24.29)	55 (37.18)		30 (25.19)	44 (43.11)	

**Statistically significant p value

Table11. Association of hypertension-related attitude with educational level and hypertension duration in hypertensive patients attending five primary health centers in Jeddah, 2015)

Practice parameters	Education				P value	Hypertension Duration			P value
	Graduate	Primary School	Secondary School	Illiterate		<5	5-10	>10	
When was your blood pressure checked last?									
One week to one month ago	54 (78.31)	25 (66.46)	41 (66.67)	36 (67.22)	0.30	53 (62.33)	59 (80.71)	44 (69.56)	0.34
2 months to 6 months ago	12 (15.32)	12 (31.05)	14 (24.44)	15 (30.56)		24 (27.85)	12 (17.60)	17 (27.10)	
More than 6 months ago	4 (6.35)	1 (2.48)	5 (8.87)	1 (2.20)		8 (9.80)	1 (1.68)	2 (3.32)	
When was your last visit with your physician?									
One week to one month ago	23 (34.98)	8 (21.12)	19 (32.87)	17 (35.65)	0.66	20 (24.62)	26 (38.51)	21 (34.59)	0.09
2 months to 6 months ago	42 (56.90)	25 (67.95)	35 (57.43)	27 (51.23)		55 (64.43)	43 (57.63)	31 (49.18)	
More than 6 months ago	5 (8.11)	5 (11.01)	6 (9.68)	8 (13.1)		10 (10.93)	3 (3.85)	11 (16.22)	
When was your last urine examination done?									
One week to one month ago	9 (14.28)	4 (11.01)	4 (7.15)	5 (10.01)	0.47	8 (10.28)	5 (7.66)	9 (14.51)	0.07
2 months to 6 months ago	41 (57.82)	22 (59.18)	28 (47.22)	27 (54.90)		40 (48.04)	50 (70.51)	28 (46.00)	
More than 6 months ago	20 (27.88)	12 (29.80)	28 (45.62)	20 (35.07)		37 (41.66)	17 (21.82)	20 (34.48)	
When was your lipid profile checked last?									
One week to one month ago	9 (14.28)	4 (11.01)	4 (7.40)	5 (10.01)	0.02**	9 (11.49)	5 (7.87)	8 (12.96)	0.38
2 months to 6 months ago	39 (55.34)	23 (61.51)	22 (35.99)	19 (39.24)		39 (46.88)	40 (56.03)	24 (38.98)	
More than 6 months ago	22 (30.36)	11 (27.47)	34 (56.60)	28 (50.73)		37 (41.62)	27 (36.08)	31 (48.04)	
When was your blood sugar level last checked?									
One week to one month ago	32 (50.25)	20 (53.41)	19 (33.00)	31 (62.14)	0.02**	33 (42.69)	37 (54.01)	32 (52.08)	0.45
2 months to 6 months ago	32 (40.14)	13 (34.34)	31 (49.07)	17 (32.93)		40 (42.94)	31 (39.77)	22 (35.52)	
More than 6 months ago	6 (9.59)	5 (12.23)	10 (17.92)	4 (4.92)		12 (14.36)	4 (6.21)	9 (12.38)	
When did you exercise last?									
One week to one month ago	29 (42.37)	21 (58.04)	20 (34.30)	10 (19.25)	0.0016**	35 (44.50)	29 (39.73)	16 (26.30)	0.0041**
2 months to 6 months ago	23 (32.41)	9 (23.39)	24 (38.36)	10 (18.63)		27 (29.90)	26 (36.49)	13 (19.94)	
More than 6 months ago	18 (25.20)	8 (18.55)	16 (27.32)	32 (62.11)		23 (25.58)	17 (23.76)	34 (53.75)	

**Statistically significant p value

Tables 10 and 11 demonstrate the association of hypertension-related lifestyle practices with demographic variables and hypertension duration. Table 10 shows that gender difference in lifestyle practices was only statistically significant with regard to the last time participants exercised, with more men reporting having exercised in the last month than women (42% men, 33% women; $P = 0.03$). The difference between age groups in lifestyle practices was only statistically significant with regard to the last time participants checked their blood sugar level, with the older age group (40+) reporting having their blood sugar level checked in the last month compared to other groups (85% for the 40+ age group, 28% for 31-40, and 38% for the 21-30 age group; $P = 0.004$).

In table 11, a higher educational level was statistically significantly associated with higher practices of checking lipid profile ($P=0.02$) performing exercise in the last month ($P=0.001$). However, illiterate participants were more likely to report checking blood sugar level in the last month ($P = 0.02$).

In addition, participants with shorter duration of hypertension had the highest proportion of exercising in the last month ($P = 0.004$) (Table 11).

Discussion

The results of this study showed that a high proportion of the participants had good basic knowledge and right attitudes related to hypertension, but low level of hypertension-related practices.

Our demographic characteristics results showed that 52.3% of the participants were diabetic, 74.5% had a positive family history of hypertension, 46.8% of them were overweight, and 44.1% were smokers. These findings were consistent with a national study in Saudi Arabia found that the incidence of hypertension had increased threefold among diabetic, obese, and smoking participants ⁴⁵.

Our study assessed the baseline level of hypertension-related knowledge attitudes, and practices among hypertensive patients in PHCCs in Jeddah.

Our finding shows that participants had a good level of basic hypertension-related knowledge. Almost all participants knew that hypertension was a disease (98.6%), most knew that a diet rich in salt caused hypertension (90%), 74.6% knew that obesity was a risk for hypertension, 63% knew that smoking was a major cause of hypertension, and 88% knew the benefits of exercise on hypertension. This finding is consistent with Parmer et al. ²⁸, Kusuma et al. ⁴⁶, and Aubert et al. ²⁷ In the latter study, more than 96% of the participants reported knowing the risk associated with high salt intake and obesity on hypertension incidence ²⁷. More than three-quarters of the participants knew that ischemic heart disease and stroke were hypertension-related complications, which is similar to data in the study conducted in India by Kusuma et al., which found that more than half of the participants knew that hypertension led to cardiovascular disease and stroke ⁴⁶. More than half of the participants knew hypertension's symptoms and

knew what normal blood pressure measurements were, in contrast to the results of the study conducted by Parmer et al., in which only 40% of all participants knew hypertension symptoms and only 24% could identify a normal blood pressure measurement ²⁸.

We found a statistically significant association between the level of education and knowledge related to hypertension complications, salt intake, smoking, and obesity ($p < 0.05$). This result contrasts the one found in the national survey conducted in Riyadh in which there was no association reported between the level of education and knowledge about hypertension risk factors ²⁰. This result might be due to the large percentage of our participants who had a high level of education (30% were university graduates and 27% were high school graduates). This result is similar to the one reported in Ike et al.'s study in Nigeria ³³.

Our results show that although participants did not receive an educational intervention almost all of them scored high in the area of hypertension-related attitudes, with 97.3% believing that adherence to hypertension medication was important. This finding is consistent with that of Magadza et al.; in their study, participants had a high level of adherence to medication after they had been exposed to an educational intervention ⁴¹.

Engaging in certain lifestyle practices is vital for hypertension control and reduction in complications such as ischemic heart disease, stroke, and renal failure ²¹. Our study reveals that the level of hypertension-related practice is low compared to the levels of knowledge and attitude.

A total of 71% of the participants had measured their blood pressure level within the last month. This percentage could be improved with more directed awareness towards this practice.

However, illiterate and old age group participants had a statistically significant association with the last time their blood sugar level checked in the last month ($P < 0.05$). This finding indicates that illiterate, and old age participants had a good practice level with regard to their last time blood sugar level checked maybe because they are more likely to have diabetes.

According to the published literature, different lifestyle practices have a positive influence on lowering blood pressure; we should consider Saudi Arabia's religious and cultural values when it comes to physical exercise engagement.

Our study results showed that there were gender differences in lifestyle practices, and that males had statistically significantly associated with the last exercise time for less than one month previously compared to women (42% men, 33% women; $P = 0.03$). This is in agreement with national survey were gender differences in reporting regular physical exercise constituted 24% in women compared to 31.4% in men and this could be related to the cultural believes and values within the community ⁴⁵.

Also, the higher educational level was statistically significantly associated with the practice of last time exercised in the last month ($P = 0.001$). These finding in contrast to Ike et al, were educational level had no statistically significantly associated with physical exercise ³³.

Interestingly, shorter hypertension duration showed a significant association with hypertension-related knowledge about smoking as a risk factor ($P= 0.0009$) and exercise as a beneficial factor ($P= 0.003$) for hypertension, with attitude parameter related to the importance of regular exercise ($P<0.001$), and with lifestyle practice of the last time exercise within the last month ($P= 0.004$). This could be related to strict adherence to follow-ups with physicians and the positive influence of simple advice given by health care providers on patients' awareness and motivation to practice a healthy lifestyle.

This study focused on knowledge, attitude, and lifestyle practice assessment because these play a vital part in patients' daily lives as well as in the improvement of the public's wellbeing. By developing and evaluating proper health education, the population will come to better understand and deal with the most common non-communicable diseases including hypertension.

The main limitations for our study are the small sample size, the cross-sectional study design, and the generalizability of findings generalized to the general population or to other hypertensive patients due to the study's focus on patients attending PHCCs in one city.

There are a limited number of studies addressing hypertension-related knowledge, attitudes, and practices in KSA. This information is critical for effective patient education and successful health awareness campaigns, which would ultimately translate into hypertension regulation in Saudi Arabia.

In conclusion our study revealed that a high proportion of participants had an overall good level of hypertension-related knowledge and attitudes but low level of hypertension-related practices. The low practice level was related to the last time blood lipid and sugar checked, urine examination and physician follow up. This could be related to lack of awareness on the importance of these aspects. Therefore, an urgent attention and efforts from health care providers are required to improve the level of hypertension-related knowledge, attitudes, and practices among hypertensive individuals in our society. In addition, suitable and acceptable strategies should be formulated and implemented to overcome the gap between these parameters.

Chapter 4. Conclusion and Recommendations

Hypertension is one of the most common chronic conditions worldwide, with a higher than average prevalence in Saudi Arabia. Our study revealed that there was a good level of hypertension-related knowledge and attitude among a high proportion of hypertensive patients, but that the level of engagement in lifestyle practices was lower with regard to physician follow up and physical exercise.

There seems to be a gap between knowledge, attitudes, and practices, and to overcome this gap strategy should be formulated and adopted so that knowledge and attitudes are applied to adopt healthy lifestyle practices.

We highly recommend the development of a suitable and culturally acceptable environment with adequate facilities for physical exercise to reinforce hypertension-related practice in the Saudi community

In addition, these findings should be considered by health care authorities so they can ensure messages from health care providers are being delivered to patients appropriately and strengthen any weak points related to hypertension activities (such as campaigns).

Cooperation and communication should occur among physicians, patients, health care administrators and policymakers to find innovative approaches to increasing and maintaining high levels of knowledge, attitudes, and practices regarding hypertension.

To increase the level of knowledge among health care providers, the national hypertension guidelines should be updated.

Laboratory services are not as accessible to patients as they could be. To improve hypertension-related practices, patients should have better access to laboratory services such as urinalysis, lipid blood tests, and glucose tests. For people to have these tests more often, labs need to be more widespread and convenient. In addition, healthcare providers should coordinate with hospitals so that patients can be sure to receive a comprehensive annual check-up in order to improve their health.

To this end, a periodic assessment of hypertension-related knowledge, attitudes, and practices should be incorporated into PHCCs and supported with recurring positive reinforcements and health education.

Similar studies with larger samples and wider coverage of regions in the Kingdom of Saudi Arabia are worth being conducted.

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Appendix

Assessment of Hypertension- Related KAP among Hypertensive Patients' Questionnaire

Questionnaire will take about 5 minutes to finish. Thank you for your time.

Demographic questions

1. Gender	<input type="checkbox"/> Male	<input type="checkbox"/> Female		
2. Marital Status	<input type="checkbox"/> Married	<input type="checkbox"/> Unmarried		
3. Educational Status	<input type="checkbox"/> Illiterate	<input type="checkbox"/> Primary school	<input type="checkbox"/> Secondary school	<input type="checkbox"/> Graduate
4. Age	<input type="checkbox"/> 18-20	<input type="checkbox"/> 21-30	<input type="checkbox"/> 31-40	<input type="checkbox"/> 41 or above
5. Smoking	<input type="checkbox"/> Non smokers	<input type="checkbox"/> Smokers		
6. Diabetic	<input type="checkbox"/> Yes	<input type="checkbox"/> No		
7. Occupation				
8. Duration of Hypertension	<input type="checkbox"/> < 5 years	<input type="checkbox"/> 5-6 years	<input type="checkbox"/> >10 years	
9. Family History of Hypertension	<input type="checkbox"/> Present	<input type="checkbox"/> Absent		
10. BMI Level	<input type="checkbox"/> Underweight <18.5	<input type="checkbox"/> Normal weight 18.5-24.9	<input type="checkbox"/> Overweight 25-29.9	<input type="checkbox"/> Obesity 30 or greater
11. Type of Diet	<input type="checkbox"/> Diabetic	<input type="checkbox"/> Low Carbohydrate	<input type="checkbox"/> Low Cholesterol	<input type="checkbox"/> Low Salt
	<input type="checkbox"/> Renal (Low Protein/Low Salt)	<input type="checkbox"/> Weight Reduction	<input type="checkbox"/> Vegetarian	<input type="checkbox"/> No Special Diet
Knowledge questions				
12. What are the complications of hypertension?		<input type="checkbox"/> Stroke	<input type="checkbox"/> Renal failure	<input type="checkbox"/> Ischemic heart disease
13. What is the normal level of blood pressure?		<input type="checkbox"/> 120/80	<input type="checkbox"/> 100/90	<input type="checkbox"/> 150/90
14. What are the symptoms of hypertension?		<input type="checkbox"/> Blurry Vision	<input type="checkbox"/> Dizziness	<input type="checkbox"/> Headache

Knowledge questions - Response with Yes or No

15. Do you know whether hypertension is a disease?	<input type="checkbox"/> Yes	<input type="checkbox"/> No
16. Is a diet rich in salt a risk factor for hypertension?	<input type="checkbox"/> Yes	<input type="checkbox"/> No
17. Is smoking a major cause of hypertension?	<input type="checkbox"/> Yes	<input type="checkbox"/> No
18. Is obesity associated with hypertension?	<input type="checkbox"/> Yes	<input type="checkbox"/> No
19. Does exercise have a beneficial role in hypertension?	<input type="checkbox"/> Yes	<input type="checkbox"/> No

Attitude questions

20. Should we reduce the salt intake to prevent hypertension?	<input type="checkbox"/> Yes	<input type="checkbox"/> No
21. Do you think regular checking of your blood pressure is important?	<input type="checkbox"/> Yes	<input type="checkbox"/> No
22. Should we follow up with our physician regularly?	<input type="checkbox"/> Yes	<input type="checkbox"/> No
23. Do you think taking our medication is important in hypertension?	<input type="checkbox"/> Yes	<input type="checkbox"/> No
24. Should we exercise regularly for a healthy life?	<input type="checkbox"/> Yes	<input type="checkbox"/> No

Practice questions

25. When was your blood pressure checked last?	<input type="checkbox"/> Week - Month	<input type="checkbox"/> 2-6 Months	<input type="checkbox"/> More than 6 Months
26. When was your last visit with your physician?	<input type="checkbox"/> Week - Month	<input type="checkbox"/> 2-6 Months	<input type="checkbox"/> More than 6 Months
27. When was your last urine examination done?	<input type="checkbox"/> Week - Month	<input type="checkbox"/> 2-6 Months	<input type="checkbox"/> More than 6 Months
28. When did you have your lipid profile checked last?	<input type="checkbox"/> Week - Month	<input type="checkbox"/> 2-6 Months	<input type="checkbox"/> More than 6 Months
29. When was your blood sugar level last checked?	<input type="checkbox"/> Week - Month	<input type="checkbox"/> 2-6 Months	<input type="checkbox"/> More than 6 Months
30. When did you exercise last?	<input type="checkbox"/> Week - Month	<input type="checkbox"/> 2-6 Months	<input type="checkbox"/> More than 6 Months