Hypertension in Saudi Arabia

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ABSTRACT

Objectives: To determine the prevalence of hypertension among Saudis of both gender, between the ages of 30-70 years in rural as well as urban communities. This work is part of a major national study on Coronary Artery Disease in Saudis Study (CADISS).

Methods: This is a community-based study conducted by examining subjects in the age group of 30-70 years of selected households during a 5-year period between 1995 and 2000 in Saudi Arabia. Data were obtained from history using a validated questionnaire, and examination including measurement of blood pressure. The data were analyzed to provide prevalence of hypertension. Logistic regression was used to develop a risk assessment model for prevalence of hypertension.

Results: The total number of subjects included in the study was 17,230. The prevalence of hypertension was 26.1% in crude terms. For males, the prevalence of hypertension was 28.6%, while for females; the prevalence was significantly lower at 23.9% (p<0.001). The urban population showed significantly higher prevalence of hypertension of 27.9%, compared to rural population's prevalence of 22.4% (p<0.001). The prevalence of CAD among hypertensive patients was 8.2%, and 4.5% among normotensive subjects (p<0.001). Increasing weight showed significant increase in prevalence of hypertension in a linear relationship.

Conclusions: Hypertension is increasing in prevalence in KSA affecting more than one fourth of the adult Saudi population. We recommend aggressive management of hypertension as well as screening of adults for hypertension early to prevent its damaging consequences if left untreated. Public health awareness of simple measures, such as low salt diet, exercise, and avoiding obesity, to maintain normal arterial blood pressure need to be implemented by health care providers.

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The prevalence of risk factors for cardiovascular diseases (CVD) is increasing worldwide. Obviously, this increase has been translated into mortality from CVD being the leading cause of death. Hypertension is a strong risk factor for cardiovascular as well as renal and neurological disorders. Recently, hypertension was identified as the most common risk factor for coronary heart disease events.[1] One important feature of hypertension is being asymptomatic until target organ damage has ensued, at which time intervention is already too late.

Ironically, despite the increased prevalence of hypertension and its associated complications, studies have shown that control of the disease is far from adequate.[2,3] It is important for health care providers to know that adequate control of hypertension is a target that is likely to be difficult to achieve. Enforcing compliance with dietary restrictions and pharmacological therapy is a pivotal step in the management of hypertension. However, our knowledge of hypertension is derived mainly from studies conducted outside the Kingdom of Saudi Arabia (KSA), hence, the need for local data is vital in evaluating hypertension as a health problem in KSA.

Previous studies on the prevalence of hypertension in KSA have demonstrated persistently increasing figures.[4-8] We attributed this increase to several reasons such as lifestyle change in KSA towards urbanization, adopting dietary eating habits that are likely to result in hypertension, increasing prevalence of obesity, as well as changing the definition of hypertension to lower systolic normal level.

The Seventh Report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure (JNC VII) identifies hypertension if blood pressure (BP) is ≥140/90 mmHg.[9] Furthermore, individuals with a systolic blood pressure (SBP) of 120-139 mmHg

or a diastolic blood pressure (DBP) of 80-89 mmHg should be considered as prehypertensive and require health-promoting lifestyle modifications to prevent CVD as indicated by JNC VII. Therefore, we designed this study with the objective to obtain the prevalence of hypertension in KSA among adult Saudi subjects living in rural and urban areas. Furthermore, this study will enhance our insight towards other factors that may play a role in the development of hypertension in KSA.

Methods. Saudi Arabia encompasses approximately four-fifth of the Arabian Peninsula, has inhabitants of 22.7 million people with 16.5 million of local population (Saudis).[10] A 5-year National Epidemiological Health Survey to study hypertension as a risk factor for coronary artery disease (CAD) was conducted between 1995 and 2000. Male and female Saudi subjects aged (30 - 70 years), in rural and urban areas of the Kingdom formed the target population for this study. For the purpose of the study, a Saudi is identified as a person holding (or a dependent of a holder) of a Saudi Nationality Identification Card (SNIC). Most previous studies on hypertension from other parts of the world focused on similar population that allows for inter-countries comparison.

A sample size of 20,000 participants was the target of the study to ensure a high reliability of our estimates of the prevalence of hypertension. The subjects were selected using a 2 stage stratified cluster sampling procedure, urban and rural being the strata. For practical and logistic reasons, the study population was drawn from the local primary health care centers' catchment's areas. The catchment's population of each primary health care center (PHCC) was taken as a cluster. The Kingdom of Saudi Arabia is subdivided into 14 administrative regions and samples were selected from each region. The first stage-sampling frame has 1,623 PHCCs uniformly distributed in the Kingdom. Since the establishment of the PHCCs was dictated by the population in each region, the allocation of the required number of PHCCs were made proportional to be the number of PHCCs in each region. Then, each region was stratified into urban and rural communities and a simple random sample of PHCCs was selected. The number of PHCCs selected from each community was based on the total number of PHCCs in each rural and urban community. A total of 66 PHCCs were selected from urban and 58 from rural areas. Then block (blocks) was randomly selected from the catchments areas of each selected PHCCs and used as cluster. One hundred households from urban PHCCs and 50 households from rural PHCCs were selected from these blocks.

All subjects of age group of 30 - 70 years of selected households were interviewed at their houses and examined at PHCCs. The questionnaire was developed, pre-tested, and validated in a pilot study. The questionnaire included basic demographic and socioeconomic data as well as detailed medical history including intake of medications. A clinical examination was conducted, included height, weight, waist circumference, BP, followed by obtaining 12 hours fasting blood samples [for measurement of fasting plasma glucose, fasting triglycerides, and fasting high density lipoprotein (HDL)] as well as performing an electrocardiogram (ECG).

Well-trained primary care physicians obtained detailed history and conducted a clinical examination including measurement of BP using mercury sphygmomanometers to the nearest 2 mm for all subjects. Participants were seated and the right arm was placed on the tabletop, the appropriate cuff size was used. For SBP, the first Korotkoff sound (K1) was used; defined as appearance of 2 consecutive beats. For DBP the fifth Korotkoff sound (K5) was used; defined as the last beat before disappearance of the sound. Two BP measurements were taken with 30 seconds rest in between. The 2 readings were averaged and entered in data collection form.

Weight was measured with ordinary scales (non-electronic portable balance) with indoor clothing on without shoes on to the nearest 0.1 kg. Height measurement was carried out in the standing position, without footwear, to the nearest mm by using measuring tape that is part of the weighing scale. Weight and height were measured using standardized techniques and equipment (to be precise, healthcare workers were trained, for the purpose of this study, to use the same technique of weight and height measurements for all subjects of the study population, using the same type of equipment such as BP apparatus, weighing scale and ECG machine).

Hypertension is present if SBP is equal to or more than 140 mmHg or DBP is equal to or more than 90 mmHg. Isolated systolic hypertension (IS) is defined as SBP ≥140 mmHg and DBP ≤89 mmHg, while isolated diastolic hypertension (IDP) is defined as SBP ≤139 mmHg and DBP ≥90 mmHg, and combined systolic and diastolic hypertension (CSD) is defined as SBP ≥140 mmHg and DBP ≥90 mmHg.

The data were analyzed using the Statistical Package for Social Sciences (version 10.0) on personal computers. The estimate prevalence rate of hypertension was calculated for the total sample, and sub-groups of gender, area of residence, income, marital status, educational level, occupation and age groups. Logistic regression was used to develop a risk assessment model for prevalence of hypertension.

Results. The total number of subjects included in the study was 17,230. Eight thousand and two hundred

twenty-four (47.7%) of the total subjects were males (**Table 1**). The mean age of male and female subjects was 49.06 ± 11.81 years and 43.71 ± 10.63, respectively. The prevalence of hypertension, IS, IDP, and CSD hypertension categorized by gender, age groups, residence (urban/rural) and regions are shown in **Table 1**.

The prevalence of IS, ID and CSD hypertension was 5.3%, 8.3% and 12.5% respectively, in crude terms, while after age adjustment, it was 4.9% 7.9% and 11.2% respectively. The prevalence of hypertension defined as either IS, ID, or CSD was 26.1% in crude terms and 24% after age adjustment. For male subjects, the prevalence of IS, ID and CSD hypertension was 5.7%, 9.6% and 13.4%, respectively. For females, these values were 5.0%, 7.1% and 11.8%, respectively, which were significantly lower than males (p<0.001). However, after age adjustment the prevalence of IS, ID and CSD for male subjects was decreased to 4.5%, 9.2% and 10.7% respectively, while female adjusted figures remain almost unchanged (**Table 1**).

The prevalence of IS hypertension doubled for each 10 years of increment in age for both gender. The prevalence of ID hypertension increased for younger age groups (30-39, 40-49 years) and decreased for the eldest age group (60-70 years). The prevalence of CSD hypertension showed a progressive increase corresponding with increase in age (**Table 1**).

The urban population showed significantly higher prevalence of hypertension of 27.9%, compared with rural population's prevalence of 22.4% (p<0.001). Eastern region's subjects showed significantly higher level of hypertension prevalence (34.6%) compared with other regions. Furthermore, subjects from the southern region showed the lowest level of hypertension prevalence (20.3%) as shown in **Table 1**.

The prevalence of IS, ID, CSD, and hypertension categorized by marital status, income and educational level and housing condition are shown in **Table 2a & 2b**. Forty-three percent of widows were having hypertension, while approximately 25% of married subjects were hypertensive. However, after splitting the data into age groups, widows had significantly

Table 1 - Prevalence of hypertension categorized by gender, age groups, residence and regions.

Factor	Response	Number (%)	Isolated systolic ≤89 & ≥140	Isolated diastolic ≥90 & ≤139	Combined ≥90 & ≥140	Hypertension ≥90 or ≥140	*p*-value
Gender	Male	8224 (47.7)	468 (5.7)	786 (9.6)	1100 (13.4)	2354 (28.6)	<0.001
	Female	9006 (52.3)	453 (5)	636 (7.1)	1059 (11.8)	2148 (23.9)	
Gender (adjusted*)	Male	8224 (47.7)	4.5	9.2	10.7	24.4	
	Female	9006 (52.3)	5.4	7	11.9	24.3	
Age - group							
Male	30 - 39	2141 (26)	30 (1.4)	167 (7.8)	105 (4.9)	302 (14.1)	<0.001
	40 – 49	2173 (26.4)	69 (3.2)	246 (11.3)	184 (8.5)	499 (23)	
	50 – 59	1962 (23.9)	125 (6.4)	206 (10.5)	353 (18)	684 (34.9)	
	60 – 70	1948 (23.7)	244 (12.5)	167 (8.6)	458 (23.5)	869 (44.6)	
Female	30 - 39	3773 (41.9)	63 (1.7)	187 (5)	141 (3.7)	391 (10.4)	<0.001
	40 – 49	2713 (30.1)	103 (3.8)	223 (8.2)	327 (12.1)	653 (24.1)	
	50 – 59	1528 (17)	128 (8.4)	147 (9.6)	329 (21.5)	604 (39.5)	
	60 - 70	992 (11)	159 (16)	79 (8)	262 (26.4)	500 (50.4)	
Residence	Urban	11738 (68.1)	658 (5.6)	1017 (8.7)	1599 (13.6)	3274 (27.9)	<0.001
	Rural	5492 (31.9)	263 (4.8)	405 (7.4)	560 (10.2)	1228 (22.4)	
Region	Central	4018 (23.3)	237 (5.9)	416 (10.4)	552 (13.7)	1205 (30)	<0.001
	Northern	1533 (8.9)	81 (5.3)	120 (7.8)	181 (11.8)	382 (24.9)	
	Southern	3579 (20.8)	163 (4.6)	225 (6.3)	337 (9.4)	725 (20.3)	
	Western	5460 (31.7)	289 (5.3)	401 (7.3)	586 (10.7)	1276 (23.4)	
	Eastern	2640 (15.3)	151 (5.7)	260 (9.8)	503 (19.1)	914 (34.6)	
Total		**17230**	**921 (5.3)**	**1422 (8.3)**	**2159 (12.5)**	**4502 (26.1)**	
Total (adjusted*) %			**(4.88)**	**(7.93)**	**(11.22)**	**(24.03)**	

*Adjusted with the census data of 2000 (1421 H) of the Kingdom of Saudi Arabia,
Total number of subjects involved = 17230.

higher prevalence (p<0.001) in only 60-70 years cohort. Clearly, the age played an important factor in the prevalence of hypertension rather than marital status alone, particularly, most of widows were at older age group (number = 206 at age group 60-70 versus number = 8 at age group 30-39) as shown in **Table 2a**. Furthermore, the diverse group showed significantly higher prevalence in the eldest group (60-70 years), and this was statistically significant (p<0.001).

Twenty-nine percent of low income (<SR 2,500) group showed significantly higher prevalence of hypertension reaching 29%. Whereas, income level (SR 5,000 – 7,499) group showed the lowest prevalence of hypertension (22.1%). These differences were statistically significant (p<0.001).

Table 2a - Prevalence of hypertension categorized by marital status and age.

Factor	Response	Number (%)		Isolated systolic ≤89 & ≥140		Isolated diastolic ≥90 & ≤139		Combined ≥90 & ≥140		Hypertension		*p*-value
Marital status	Single	397	(2.3)	15	(3.8)	37	(9.3)	26	(6.5)	2907	(19.6)	<0.001
	Married	15740	(91.4)	789	(5)	1306	(8.3)	1889	(12)	3984	(25.3)	
	Divorced	224	(1.3)	14	(6.3)	14	(6.3)	43	(19.2)	71	(31.7)	
	Widowed	869	(5)	103	(11.9)	65	(7.5)	201	(23.1)	369	(42.5)	
30-39	Single	254	(4.3)	7	(2.8)	22	(8.7)	4	(1.6)	33	(13)	0.892
	Married	5503	(97.3)	84	(1.5)	328	(6)	229	(4.2)	641	(11.6)	
	Divorced	84	(1.4)	1	(1.4)	2	(2.4)	8	(9.5)	11	(13.1)	
	Widowed	73	(1.2)	1	(1.2)	2	(2.7)	5	(6.8)	8	(11)	
40-49	Single	63	(1.3)	0	(0)	6	(9.5)	6	(9.5)	12	(19)	0.466
	Married	4607	(94.3)	160	(3.5)	445	(9.7)	478	(10.4)	1083	(23.5)	
	Divorced	62	(1.3)	2	(3.2)	6	(9.7)	11	(17.7)	19	(30.6)	
	Widowed	154	(3.2)	10	(6.5)	12	(7.8)	16	(10.4)	38	(24.7)	
50-59	Single	44	(1.3)	2	(4.5)	4	(9.1)	5	(11.4)	11	(25)	<0.001
	Married	3155	(90.4)	218	(6.9)	319	(10.1)	600	(19)	1137	(36)	
	Divorced	52	(1.5)	7	(13.5)	2	(3.8)	14	(26.9)	23	(44.2)	
	Widowed	239	(6.8)	26	(10.9)	28	(11.7)	63	(26.4)	117	(49)	
60-70	Single	36	(1.2)	6	(16.7)	5	(13.9)	11	(30.6)	22	(61.1)	<0.001
	Married	2475	(84.2)	327	(13.2)	214	(8.6)	582	(23.5)	1123	(45.4)	
	Divorced	26	(0.9)	4	(15.4)	4	(15.4)	10	(38.5)	18	(69.2)	
	Widowed	403	(13.7)	66	(16.4)	23	(5.7)	117	(29)	206	(51.1)	

Table 2b - Prevalence of hypertension categorized by income, educational levels and housing condition.

Factor	Response	Number		Isolated systolic ≤89 & ≥140		Isolated diastolic ≥90 & ≤139		Combined ≥90 & ≥140		Hypertension		*p*-value
Income level	<2,500	4756	(28)	326	(6.9)	381	(8)	673	(14.2)	1380	(29)	<0.001
	2,500 – 4,999	5691	(33.5)	302	(5.3)	471	(8.3)	741	(13)	1514	(26.6)	
	5,000 – 7,499	3530	(20.8)	151	(4.3)	268	(7.6)	362	(10.3)	781	(22.1)	
	7,500 – 9,999	1474	(8.7)	67	(4.5)	140	(9.5)	157	(10.7)	364	(24.7)	
	0,000 – 14,999	1185	(7)	50	(4.2)	116	(9.8)	131	(11.1)	297	(25.1)	
	≥15,000	375	(2.2)	16	(4.3)	27	(7.2)	58	(15.5)	101	(26.9)	
Educational level	Illiterate	8885	(51.7)	620	(7)	670	(7.5)	1381	(15.5)	2671	(30.1)	<0.001
	Read and write only	2000	(11.7)	95	(4.8)	164	(8.2)	248	(12.4)	507	(25.4)	
	School	4928	(28.7)	152	(3.1)	449	(9.1)	421	(8.5)	1022	(20.7)	
	College and University	1357	(7.9)	49	(3.6)	127	(9.4)	104	(7.7)	280	(20.6)	
Housing Condition	Villa/palace	4986	(29)	303	(6.1)	469	(9.4)	688	(13.8)	1460	(29.3)	<0.001
	Small house	6120	(35.6)	336	(5.5)	469	(7.7)	755	(12.3)	1560	(25.5)	
	Flat	4631	(26.9)	199	(4.3)	367	(7.9)	518	(11.2)	1084	(23.4)	
	Wooden house/tent	381	(2.2)	16	(4.2)	34	(8.9)	47	(12.3)	97	(25.5)	
	Mud house	514	(3)	25	(4.9)	36	(7)	46	(8.9)	107	(20.8)	
	Others	576	(3.3)	41	(7.1)	47	(8.2)	101	(17.5)	189	(32.8)	

With respect to educational level, the highest prevalence of hypertension (30%) was found among illiterate subjects, while among subjects with higher educational level, the prevalence of hypertension was significantly lower at 20% (p<0.001). Subjects living in villa/palaces had the highest prevalence of hypertension (29.3%), while subjects living in mud houses had prevalence of 20.8%; the difference was statistically significant (p<0.001).

Seventy-five percent of subjects who gave history of hypertension and on regular treatment were found to have BP ≥140/90 during data acquisition, this indicates that only 25% were having controlled hypertension. However, 66.9% of hypertensive patients who denied history of having hypertension were actually found to have hypertension. Therefore, 66.9% of hypertensive patients in our study were unaware of having hypertension.

Thirty-nine percent of CAD patients had hypertension, while 25.3% of subjects without CAD were hypertensive (p<0.001). Moreover, 45% of subjects with metabolic syndrome (MS) had hypertension compared with 12.8% without MS. Among patients with diabetes mellitus (DM), 34% were found to have hypertension compared with 21.4% without DM. The observed differences were statistically significant (p<0.001).

Figure 1 shows the prevalence of CAD, MS and DM among hypertensive patients. The prevalence of CAD

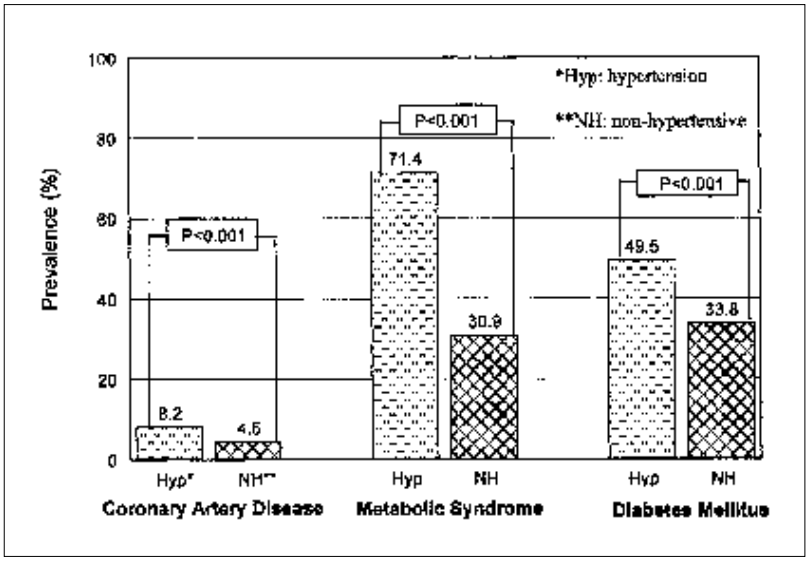

Figure 1 - Prevalence of coronary artery disease, metabolic syndrome and diabetes mellitus among hypertensive patients and normotensive subjects.

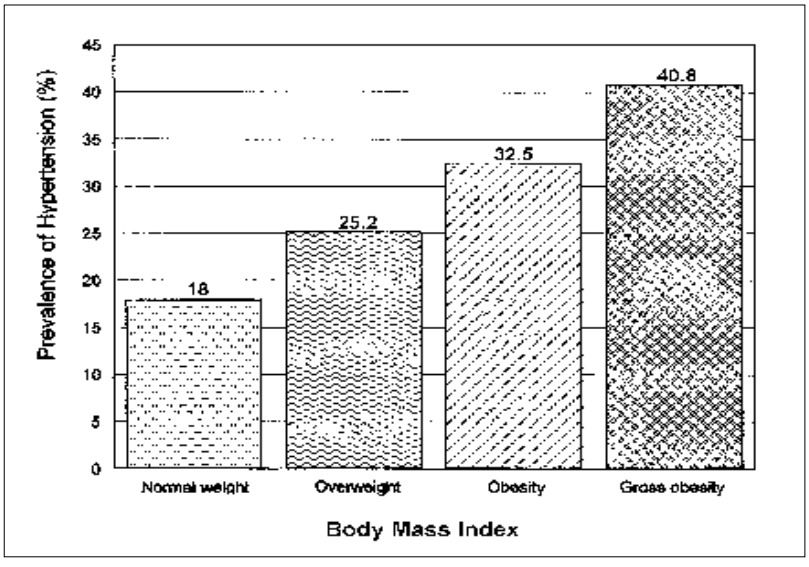

Figure 2 - Prevalence of hypertension with respect to body mass index.

among hypertensive patients was 8.2%, MS 71.4% and DM 49.5%. There was significantly higher prevalence of these diseases among hypertensive patients than normotensive subjects (p<0.001).

Figure 2 illustrates the prevalence of hypertension for different categories of body mass index (BMI). The prevalence of hypertension was more than double (40.8% versus 18%) for grossly obese (BMI >40.0) subjects compared with subjects with normal weight (BMI >18.5 - <25). The linear regressions of systolic and diastolic BP on weight were obtained and they are as follows:

Systolic BP = 106.0 + 0.209 (weight); R= 0.183
Diastolic BP = 67.1 + 0.154 (weight); R=0.228,

This linear regression indicates that for every increase of 5 kg of weight there will be an increase of one mmHg of SBP and 0.77 mmHg increase of DBP, these regression coefficients were statistically significant (p<0.001).

The risk assessment model obtained by logistic regression method of having hypertension showed independent variables of age group, residence, educational level, housing condition, CAD and marital status as significant factors (**Table 3**). The result showed that the age group of 60-70 years had more than 8 times of odds of having hypertension than young respondents of age group 30-39 years. Illiterate respondents showed 1.6 (1/0.607) times more odds of having hypertension than the university and college graduates.

Moreover, housing conditions results revealed that subjects who were living in villa/palaces showed 1.7% (1/0.563) higher odds of having hypertension than people living in mud houses. Additionally, subjects who had CAD showed 1.7 times more odds of having hypertension than subjects without CAD. Divorced respondents showed 2.5 times more odds of having hypertension than married respondents.

Discussion. The data presented in this study report overall higher prevalence of hypertension among adult Saudi population. Clearly, hypertension is a major risk factor affecting large portion of the Saudi community and make them vulnerable of acquiring CVD, PVD, as well as renal and cerebrovascular diseases.

The reported prevalence of hypertension in Saudi Arabia is in keeping with increasing prevalence of hypertension worldwide. Studies from various parts of the world showed that hypertension is affecting 26.6 - 28.5% of adults in Kuwait, 16.1 - 16.3% of adults in Jordan (according to old definition of hypertension ≥160/90), and 24% of adults in Haiti.[11-15] Among studied population (number = 314, age 40 - 60 years) in India the reported overall figure on the prevalence of hypertension of 54.5% is rather striking (56.3% among men and 52.3% among women) demonstrating the increasing prevalence of hypertension worldwide.[16] Another study from Hungary (number of studied population = 21,800 aged 30-65 years) reported an overall prevalence of hypertension of 37%.[17] In nearby country of Qatar, the overall prevalence of hypertension was reported to affect 32.1% of studied population (aged 25-65 years).[18]

Overall, 26.4% of the world's adult population in 2000 had hypertension (26.6% of men and 26.1% of women), and it is expected that by the year 2025, approximately 1 in 3 adults aged over 20 years will have hypertension (based on data from 30 surveys that reported the prevalence of hypertension between the years 1980 and 2002).[19] Moreover, Egyptian National Hypertension Project reported 26.3% estimated prevalence of hypertension in Egypt.[20] A more recent survey from China (number of studied population = 15540, age 35 - 74 years) revealed 27.2% hypertension prevalence of the Chinese adult population.[21]

Further analysis of our data in the present study, clearly demonstrate an increasing prevalence of hypertension with increasing age and this increase is due to mainly to the increase in systolic hypertension. We also found that the prevalence of hypertension at younger ages was higher in men than in women, but among older people (>60 years) it was higher in women.

The eastern region of Saudi Arabia showed the highest prevalence of hypertension compared with other regions. Furthermore, hypertension is more prevalent among urban population that is probably explained by lifestyle and eating habits compared with rural population. It is likely that urbanization carries with it sedentary lifestyle with less physical activity that leads to an increase in prevalence of obesity as well as hypertension prevalence in a linear relationship. Several studies strongly support the concept that multiple dietary factors affect BP and adopting healthier eating habits can substantially reduce hypertension.[22-28] Moreover, it has been shown that comprehensive lifestyle modification is feasible and has beneficial effects on BP reduction.[29,30]

Educational level was found to be significantly affecting the prevalence of hypertension in Saudi Arabia as demonstrated by the results of the current study. Illiterate subjects were more likely to be hypertensive compared with educated subjects. This is likely to be explained by less awareness of the dietary habits that reduce the incidence of hypertension, particularly, the amount of salt intake that was found to play an important role in the development and control of hypertension.[31] Furthermore, other explanations are related to poor adherence to medical care and poor compliance as it has been shown in a study from the

United States of America, looking at racial differences in BP control.[32]

A large number of the hypertensive patients (66.9%) were unaware of having hypertension enforcing the fact that hypertension is a silent killer. Moreover, possible explanation may be partly due to lack of clear explanation of healthcare provider to hypertensive patients of having hypertension, particularly, when lifestyle modification is used as initial therapy rather than medications. Hence, we recommend hypertensive patients to be well informed regarding their BP measurements and to be actively involved in management. The data from the United States of America National Health and Nutrition Examination Survey III (NHANES III) reported 37.9% of studied populations were unaware of having hypertension (68.9% were aware of their hypertension).[33] Another study from Germany looking at a population over the age of 65 years found that 34% of patients with hypertension were unaware of the diagnosis.[34] However, a Japanese study reported 54% of the studied population were unaware of having hypertension (N=11,302 and mean age=55 years), that is similar to our finding.[35] A more recent study from Japan reported 32.8% unawareness rate among studied population (N=11.726, age 25 – 64 years).[36] The awareness of hypertension in China was shown to be similar to our results as it was reported that 55.3% of studied population (N=15,838, age 35-74 years) were unaware of having hypertension.[37] Among Korean population, a rather higher rate of unawareness of hypertension was reported reaching 75.4% of the studied population (N=4,226, age 18-92 years).[38] It is obvious that as the prevalence of hypertension is increasing, the unawareness rate remains to be steady that dictate more aggressive screening of hypertension at a younger age group. Other parts of the world reported different figures on the lack of awareness of having hypertension among studied populations, as the unawareness was 53.9% in Portugal, 57.4% in China, and 35% in Spain.[39-41]

Moreover, it is clearly shown from our data the relationship between hypertension and CAD, as significant correlation was established in keeping with the well known fact that hypertension is an important risk factor for CAD. Furthermore, we found an important association between hypertension and DM as well as MS. The vulnerability of an individual to MS clearly increases the risk of other well-known risk factors to CAD. Probably, the common denominator here is obesity that was definitely shown to be correlated to the development of hypertension in a direct linear relation. Ironically, we found that large number of our studied population, who reported hypertension that is under medical care by history, to remain hypertensive by BP measurement during data acquisition, indicating poor control of their BP. Clearly, this poor control of hypertension put them at increased risk of developing complications as a result of hypertension.

In conclusion, it is obvious that hypertension is a prevalent risk factor in Saudi Arabia that needs intervention to be controlled. We recommend implementation of management guidelines suggested by JNC VII in-order to halt the progression of hypertension. This may include dietary measures as well as lifestyle modifications, particularly, weight reduction to achieve normal BMI. Additionally, screening for hypertension should be initiated at early adulthood age so that management can be started before complications of hypertension have taken place.

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