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Isolated Systolic Hypertension among Adults in Saudi Arabia: Prevalence, Risk Factors, Predictors and Treatment - Results of a National Survey

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Abstract

Background: Isolated systolic hypertension (ISH) is associated with many complications quantifying the magnitude and risk factor of ISH in the community is essential for all intervention strategies.

Objectives: To determine the prevalence, risk factors, predictors, treatment modalities and lifestyle practices of ISH adult patients in Kingdom of Saudi Arabia (KSA).

Subjects and Methods: A community-based cross-sectional study using STEPwise approach among adults using a multistage, stratified, cluster random sample. Data was collected using a questionnaire which included sociodemographic, blood pressure, biochemical, anthropometric measurements and lifestyle practices. Statistical analysis included calculating means and standard deviations, proportions, univariate and multiple logistic regression analysis.

Results: Of a total 4551 subjects, 358 (7.9%) suffered from ISH, which was significantly related to sociodemographic, geographic, anthropometric and morbidity characteristics. 46.7% of ISH patients were using some form of treatment, 84.5% on prescribed drugs, 69.1% on diet, 25% on exercise. Significant predictors of ISH were education, retirement, obesity, diabetes mellitus, and dyslipidaemia.

Conclusions: ISH is associated with some sociodemographic and lifestyle characteristics. Given the risk of cardiovascular disease associated with ISH, the findings of this study emphasize the need for a comprehensive strategy focusing on the modifiable risk factors of ISH.

Keywords: Isolated systolic hypertension; STEP wise; Saudi Arabia; Risk factors

Introduction

Hypertension is a worldwide significant risk factor and predictor of cardiovascular disease morbidity and mortality in all countries including Saudi Arabia [1-4]. Diastolic pressure was mostly the basis of clinical decisions [5] but studies later showed that systolic blood pressure is more important, particularly among elderly [6]. Systolic blood pressure is easier to determine [7] but is largely responsible for the unacceptable low rates of overall blood pressure control [8,9] Isolated systolic pressure was estimated as affecting 5.3% of the adult population in a previous survey conducted in 1995 [4]. To the best of our knowledge further details and characterization of its correlates were not done. The present study attempts to estimate the current prevalence of ISH, characteristics, treatment modalities, patient' practices, risk factors and significant predictors. It is hoped that such data can be helpful in the overall strategy for prevention and control of hypertension and CVD.

Subjects and Methods

This was a cross-sectional community-based study covering whole of Kingdom of Saudi Arabia in 2005. The WHO STEPwise approach Surveillance (STEPS) of Non-Communicable Diseases (NCD) risk factors was the basis for conducting the survey and collecting data [10,11].

Study population

The study population was all Saudi population of all the 20 health regions of the country aged 15-64 years.

Sampling

A multistage stratified cluster random sampling technique was used to recruit the study subjects. Stratification was based on age (Five 10 year age groups), gender (2 groups) and health regions of country. Based upon proposed methodology of the WHO STEPS sample size of 196 was calculated for each of these ten strata. A list of all Primary Health Care Centres (PHCCs) in each region was prepared and 10% of these PHCCs were randomly chosen, and allocated regional sample to them proportionate to the size of their catchment population in sampled PHCCs. To identify the households a map of the health centre coverage area was used to choose the houses. Each house was assigned a number and a simple random draw was made.

Data collection

Tool used: Data was collected using the WHO STEPS which includes a questionnaire, physical measurements plus biochemical measurements covering hypertension and other chronic diseases and risk factors. The questionnaire was translated into Arabic by a team of physicians and was back translated to ensure the accuracy of translation. Arabic instrument was pre-tested on 51 eligible respondents for wording and understanding of the questions, and necessary adjustments were made in the instrument in light of the pre-test. The questionnaire includes socio-demographic data, history of blood pressure and blood pressure measurement in addition to other diseases and risk factors.

Data collectors

Data was collected by 54 males and 54 female collectors who work in teams. Each field team was made up of four persons a male data collector, a female data collector, a driver and a female assistant. Data collection teams were supervised by a hierarchy of local supervisor, regional coordinators and national coordinator.

Training of data collectors

All individuals involved in data collection attended comprehensive training workshops that included interview techniques, data collection tools, practical applications and field guidelines.

Blood pressure (BP) measurement

The BP measurements were taken using a digital sphygmomanometer. Before taking the measurements the respondent was advised to sit quietly and rest for 5 min with the legs uncrossed and the right arm free of clothing. Then, the right arm was placed on the table with the palm facing upwards. The appropriate cuff size was selected. The artery position mark (ART) was aligned with the brachial artery. The cuff was wrapped snugly and fastened securely. The cuff was kept at the same level as the heart during measurement. Taking measurement involved the following steps: Pushing the 'START' button enabled automatic inflation of the cuff and display of the reading of systolic blood pressure (SBP) and diastolic blood pressure (DBP) readings, which were recorded. A second reading was taken after five minutes from the first and a third reading was taken after five minutes of the second.

Definition of hypertension

The subject is labeled hypertensive if the average of the 3 blood pressure measurements was 140 mmHg or above for systolic and/or 90 mmHg or above for diastolic blood pressure. Those were categorized as both systolic and diastolic hypertensive if systolic pressure is 140 mmHg or above and diastolic pressure is 90 mmHg or above. Isolated systolic hypertension is when systolic pressure is 140 mmHg or above and diastolic pressure is below 90 mmHg. Isolated diastolic is when diastolic pressure is 90 mmHg or above and systolic pressure is below 140 mmHg. This communication deals only with isolated systolic hypertension.

Data management and analysis

Questionnaires collected from the field were reviewed by team leaders assigned to each team before submitting them to the headquarters for data entry. Double entry of the questionnaires was performed using EPI-INFO 2000 software and EpiData software developed by the Menzes centre for validation. After data entry, data cleaning was conducted. New variables were defined by adopting the Standard Steps variables (STEPS Data Management Manual, Draft version v1.5, October 2003). Data analysis was conducted using SPSS software.

Statistical analysis

Continuous variables are presented as mean ± standard deviation. Categorical variables are reported as percentages. Univariate analysis was performed for significant associations and multiple logistic regression analysis was performed to detect significant predictors for isolated systolic hypertension. A p value of ≤0.05 was taken for statistical significance. The data were processed in SPSS version.

The number of participants' responses used in the discrete statistical analyses varied due to missing data for certain variables.

Ethical clearance and confidentiality

The protocol and the instrument of the surveillance were approved by the Ministry of Health, Center of Biomedical Ethics and the concerned authorities in the Kingdom. Informed consent of all subjects was obtained. Confidentiality of data was assured and that data will be used only for the stated purpose of the survey. Further details of the method used and sampling procedures can be found in STEPwise documents [10,11].

Results

A total of 4758 subjects participated in the study, 4719 were included in the final analysis giving an overall 99.2% response rate. Males constituted about 49% of the study population. Females in age group 25-44 years were more than males (53.3% compared to 43.1%), while males were more than females in the age group 45-64 years (33.5% compared to 24.8%). The overall prevalence of hypertension was 20.7% (976 patients). The prevalence of ISH was 7.6% (358 patients) constituting about 37% of all hypertensives and almost half of them, 49.7% (178) were not aware of their disease. They were discovered first time during the survey. ISH prevalence increased with increase in age and BMI as shown in Figures 1 and 2.

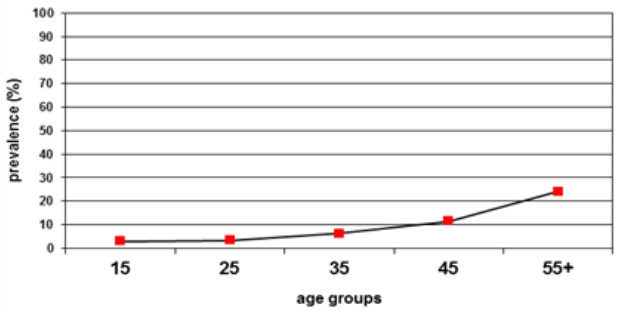

Figure 1: Prevalence in percentage of isolated systolic hypertension by age in Saudi Arabia.

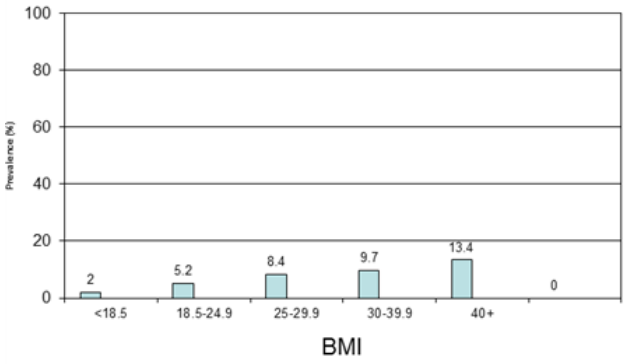

Figure 2: Prevalence in percentage of isolated systolic htpertension by BMI in Saudi Arabia.

ISH was significantly related to geographical and sociodemographic characteristics. Prevalence of ISH was less than 6% in Eastern Region compared 11.5% in Central Region. It increased from 3.0% in age group 15-24 to over 24% in elderly 55-64 years.

The prevalence ranged from less than 5% in patients with secondary education or more compared to 14.4% among illiterates. It was less than 3% among students compared to over 19% among retired patients.

It was also significantly more in patients with monthly income less than 3000 Saudi Riyals. It was more in males but with no significant gender differences as shown in Table 1.

Variable	Total No. (%)	Hypertensive		P Value
		Number	Percentage	
Gender				
Male	2223 (48.8)	183	8.2	0.371
Female	2328 (51.2)	175	7.5	
Age (Years)				
15-24	1009 (22.0)	30	3	<0.001
25-34	1072 (23.2)	36	3.4	
35-44	1132 (24.9)	71	6.3	
45-54	819 (18.0)	94	11.5	
55+	526 (11.6)	127	24.1	
Education				
Non	1228 (27.0)	164	14.4	<0.001
Primary	1158 (25.5)	79	6.8	
Intermediate	711 (15.7)	44	6.2	
Secondary	739 (16.3)	33	4.5	
University	592 (13.0)	28	4.7	
Vocational	114 (2.5)	9	7.9	
Occupation				
Government employee	1323 (29.1)	68	5.1	<0.001
Non-government employee	431 (9.5)	53	12.3	
Student	603 (13.3)	17	2.8	
Housekeeping	1696 (37.3)	150	8.8	
Retired	295 (6.5)	57	19.3	
Unemployed	197 (4.3)	13	8.6	
Region				
Central	1096 (24.1)	126	11.5	<0.001
Eastern	666 (14.6)	39	5.9	
Northern	400 (8.8)	39	9.8	
Western	966 (21.2)	63	6.5	
Southern	1423 (31.3)	91	6.4	
Family Income (Saudi Riyals)				
<3000	1444(33.5)	136	9.4	0.032
3000-6999	966 (22.4)	68	7	
7000-9999	1261 (29.2)	83	8.6	
10000-14999	425 (9.9)	26	6.1	
15000+	216 (95.0)	15	6.9	

Table 1: Prevalence of ISH according to the sociodemographic characteristics.

ISH was significantly higher with increasing BMI, central obesity, diabetics and hypercholesteremic subjects. It was significantly lower with high physical activity.

It was not significantly related to smoking habit as shown in Table 2. Of the 180 known patients 48.9% (88) were not under treatment.

Variable	Number	Percentage	P Value
Physical Activity: (No.)	n=334		0.028
High(730)	38	5.2	
Medium(734)	61	8.3	
Low(2941)	235	8	
Smoking:	n=348		0.636
Yes(556)	41	7.4	
No(3860)	307	8	
Diabetes Mellitus:	n=351		<0.001
Diabetic(691)	118	17.1	
Not diabetic(3774)	233	6.2	
Body Mass Index:	n=353		<0.001
< 18.5(253)	5	2	

18.5-24.9(1177)	61	5.2	
25.0-29.5(1455)	122	8.4	
30.0-39.9(1387)	134	9.7	
40.0+(231)	31	13.4	
Central Obesity:	n=349		
Yes(953)	98	10.3	0.004
No(2375)	251	7.4	
Total cholesterol level:	n=340		
Elevated(855)	87	10.2	0.003
Not elevated(3553)	253	7.1	

Table 2: Prevalence of ISH according to some lifestyle practices, obesity and diabetes.

Characteristic	Number	Percentage
Isolated Systolic Hypertension (n=358)		
Aware of disease	180	50.3
Under any form treatment	84	46.7
Treatment prescribed by physicians	71	84.5
Dietary modifications	58	69.1
Weight loss	31	36.9
Exercise	21	25
Traditional healers	6	7.1
Herbs	4	4.8

Table 3: ISH Patients awareness of disease and treatment modalities.

Of the patients who were under treatment (92), about 93% were under some form of treatment suggested by physicians.

As shown in Table 3, there were no significant differences in these practices according sociodemographics except for quitting smoking which was practiced significantly more by males.

All significant variables in the univariate analysis were analysed again using multiple logistic regression for significant ISH predictors after controlling for age.

Significant predictors for ISH included obesity, diabetes mellitus, lower educational level and retirement from work as depicted in Table 4.

Predictors	B	S.E	Wald	DF	P value	Odds Ratio	95% C.I. for odds ratio	
							Lower	Upper
Riyadh Region	0.763	0.18	17.936	1	0	2.145	1.507	3.054
Full time schooling	-0.075	0.014	30.088	1	0	0.927	0.903	0.953
Occupation	0.123	0.03	16.282	1	0	1.131	1.065	1.2
Not Diabetic	-0.714	0.147	23.55	1	0	0.49	0.367	0.653
BMI	0.341	0.072	22.391	1	0	1.406	1.221	1.619
Total cholesterol level	0.09	0.053	2.858	1	0.091	1.095	0.986	1.215
Constant	-1.249	0.575	4.714	1	0.03	0.287		

Table 4: Multiple Logistic Regression for Significant predictors of ISH. Variables entered: Region, education, occupation, income, smoking, physical activity, diabetes, BMI, total cholesterol level.

Discussion

The results of this study showed that the prevalence of ISH was 7.6% and significantly increased with advancing age in both genders The previous survey in the country in 1995 showed that crude prevalence of ISH was 5.3% and doubled for each 10 years increment in age for both genders.4 This age relation is consistent with findings of other studies worldwide. Without exception, there is a progressive rise in SBP throughout life, with a difference of 20-30 mm Hg between early and late adulthood in almost all communities [12-16]. The overall prevalence of ISH in KSA as revealed by this study and previous studies is within the range of overall prevalence of 3-30% of ISH in other communities. These variations are dependent on the adopted definition, and methodology of blood pressure measurement, as well as the study population and its age and sex distribution [12-16].

In KSA, ISH is lower in women as shown by this and the previous study [4], but the differences were not significant. Women have a lower ISH in most communities although few communities have females with higher ISH [16,17], while other studies revealed no significant gender differences [14]. So ISH is strongly significantly associated with advancing age while the gender differences appear to show no consistent pattern. This may need to be considered in any intervention strategy. ISH was also significantly associated with lower socioeconomic status as revealed by higher prevalence rates among illiterates and patients with the lowest monthly income. This is in agreement with similar finding as reported by other studies [18,19]. ISH was more common among retired patients in this study and in neighbouring Oman [15] Retirement and lower income may be associated with psychological tension which is associated with higher blood pressure. There were also significant geographical variation in ISH in this study where ISH was significantly more in the Central

Region which is the capital of the country and the most urbanized and industrialized region. Geographical variations in the prevalence of hypertension were reported in many studies in different regions of the world [15,20]. These regional variations in blood pressure may also be related to variations in socioeconomic, demographic and dietary in addition to the geographic characteristics [20]. ISH was significantly associated with diabetes, high BMI, central obesity, physical inactivity and dyslipidemia. Significant predictors for ISH as revealed by logistic regression analysis, after controlling for age, were high BMI, Diabetes mellitus, lower educational level and retirement. Studies have consistently revealed the association of BMI with ISH [12,14,16,21] Diabetes mellitus was a strong predictor of ISH in this study in agreement with findings of other studies [21].

The most prevalent lifestyle modality used by patients was dietary modifications in the form of low salt, physical exercise, weight reduction and few quitted smoking. Such lifestyle modifications and others also known as non-pharmacological or non-drug therapies are practiced by many hypertensive and normotensives worldwide. They are uniformly recommended by KSA and international agencies for hypertension as treatment guidelines [22-24]. The European Society of Hypertension and the European Society of Cardiology recently developed an evidence-based update of their Guidelines on the Management of Hypertension for health professionals involved in hypertension treatment, control and prevention [25]. Some points needs further clarification as pointed by some authors such as: Blood pressure values at treatment starts and target BP values in elderly patients. The authors think that new randomized controlled trials can resolve these issues [26] and we do support and encourage such efforts. Physical activity and exercise were practiced by less than 23% of the patients with no significant differences according to the sociodemographic characteristics. All persons particularly those suffering from chronic morbidity such as hypertension need to be encouraged to perform regular physical exercise. Studies have shown that exercise plays an important role in prevention and treatment of hypertension. The antihypertensive effect of exercise is immediate, elicited by low-intensity, short-duration exercise and can be individually tailored [27]. All community members' hypertensive or not need to be encouraged to perform physical exercise on regular basis. The concerned authorities need to plan for all community members to be able to perform physical activities in suitable premises respecting the traditional habits particularly for females. The national guidelines in KSA call for regular physical activity (30-45 min, 3-4 times per week) [22]. Physicians particularly in PHCCs need to advocate these recommendations. It is a welcome finding that few patients consulted traditional healers or use herbs in the treatment of hypertension. Many of these traditional advices are unproven to be effective and could even have harmful effects. It is of serious concern that almost half of the patients were not aware of their condition. Also almost half of the known patients were not under treatment. Intensive effort is needed to diagnose all patients as early as possible by screening programs. Detected patients need to be encouraged to adhere to their treatment modalities.

Study Limitations

The study is a cross-sectional design, reflecting mostly associations between ISH and its risk factors, and causation cannot be properly evaluated.

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