A STUDY ON THE DISTRIBUTION OF BLOOD PRESSURE MEASUREMENTS AMONG UNIVERSITY STUDENTS

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ABSTRACT

Objective: **The aim of the study was to measure the blood pressure of University students and relate variation to specific risk factors (age, sex, family history of hypertension, body mass index and smoking).**

Patients & Methods: **This study is a cross sectional study based on a random sample drawn from 5 of the 14 colleges in the University of Basrah. Field part of the study extended from first of March to middle of May 2010 and involved 330 students.**

Results: **The results showed that with respect to systolic blood pressure, 17% were in the prehypertension and 1.8% hypertensive. For diastolic blood pressure, 31.8% were in the prehypertension and 3.6% hypertensive. Using multiple logistic regression analysis sex, family history and body mass index predict significantly 9% of the systolic pressure measurements variability. Also body mass index, sex and family history of hypertension could significantly predict 10% of variability. Also body mass index, sex and family history of hypertension could variability predict 10% of variability. Other variables (age, smoking and father education) could not predict significant variability of blood pressure measurements.**

Conclusions: **Monitoring blood pressure in young adults is worth doing as a high percent of students were either hypertensive or in the prehypertension stage.**

INTRODUCTION

In the year 2000 it was estimated that nearly one billion people or 26% of the adult population have hypertension worldwide.[1] It was common in both developed (333 million) and developing (639 million) countries.[1] However, rates vary markedly in different regions with rates as low as 3.4% in men and 6.8% in women in rural India and as high as 68.9% in men and 72.5% in women in Poland.[2] In 1995, it was estimated that 43 million people in the United States had hypertension or were taking antihypertensive medication, almost 24% of the adult population, but the prevalence was increasing and reached 29% in 2004.[3] Hypertension is more prevalent in men (though menopause tends to decrease this difference between sexes) and those of low socioeconomic status.[4] The prevalence of high blood pressure in the young is increasing.[5] Most childhood hypertension, particularly in preadolescents, is secondary to an underlying disorder. Kidney disease is the most common responsible for 60–70% of secondary causes of hypertension in children. Adolescents usually have primary or essential hypertension, which accounts for 85–95% of cases.[6] In older persons, the mix is variable but most of the cases are of the primary or essential type. Over the past two decades, more and more interest is being devoted to study blood pressure in children and young adults. The assumption is that the risk of hypertension and hence the complications of hypertension might start very early in life and their discovery and modification could help in future prevention of these events. Studies have shown that essential hypertension can be found among children and adolescents. These particular blood pressure (BP) patterns show a strong correlation to adulthood hypertension with all the risk of cardiovascular complications.[7-8] Although the risk of hypertension during childhood is lower than that seen in adulthood, this condition is not rare in children. The prevalence of hypertension, by definition, among children reported by various studies to lie within a range from 5.4% to 19.4%.[9] It is highly recommended that in children and adolescents, blood pressure measurements should be incorporated into the routine pediatric examination of children three years of age and older.[7] Information on the population distribution of BP is therefore useful for describing blood pressure related health burden as well as for planning prevention strategy whether at population level or at least at high risk group level. In various epidemiological studies, a strong positive relationship between cardiovascular disease and blood pressure has been reported.[10-11] Both systolic blood pressure (SBP) and diastolic blood pressure (DBP) have been shown to be associated with cardiovascular risk. In the 1970s and early 1980s, most international medical authorities view concentrated on diastolic blood

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pressure as the main determinant of cardiovascular risk. More recently, however, the importance of SBP has also been pointed out, especially in older subjects.[12] Autopsy studies such as the Bogalusa Heart Study and the Pathobiologic Determinants of Atherosclerosis in Youth (PDA) Study have demonstrated increased atherosclerosis at higher BP levels in youth.[13] An epidemic of cardiovascular disease (CVD) is taking place in developing countries, this means that the risk of cardiovascular disease is going to be enormous in the future.[14,15] Signals have already been identified in some countries. In an Iranian study conducted between 1999-2000, the prevalence of hypertension in people aged between 20-29 years was 6.6% in males and 3.3% in females.[16] In Canada, the results of Ontario survey showed that the prevalence of hypertension was 3.4% among participants aged between 20–39 years.[17] In the Kingdom of Saudi Arabia the prevalence of hypertension varies between 4% to 17% among males and 3% to 13% among females.[18] A recent study in Basrah-Southern Iraq, indicated that the cause specific mortality rate from cardiovascular disease has increased during the last four decades. Such increase is likely to be associated with a number of risk factors including hypertension.[19] So Information on the distribution of blood pressure (BP) in young population as a step towards wide scale screening of high risk groups is thought necessary. Only few studies could be traced to have been done on young people in Basrah. For example Al-Asadi et al. in their study on cardiovascular risk profile among college students,[20] found that the prevalence of blood pressure was 5.6% for SBP and 8.6% for DBP in addition to a package of other risk factors. The present study is a small-scale study, on a representative sample of Basrah university students considered of epidemiological interest, and is also useful in public health practice. We present here the distribution of systolic and diastolic BP for such young population and in relation to a few selected possible determinants. An assumption is made that early identification of people at risk could assist in promoting preventive measures as early as possible.

SUBJECTS AND METHODS

This study is a cross sectional study based on a random sample drawn from 5 of the 14 colleges in the University of Basrah. Field part of the study extended from First of March to middle of May 2010. The study or reference population was the entire population of the undergraduate students at the University of Basrah as on January 2010. The sampling was a multi-stage sampling as follows**:** First a list of Colleges and random selection of four out of fourteen at the time of initiation of the study. Then, one division was selected from each college. College of Medicine and Dentistry were treated as one division each. From each division, group B from each class was selected**.** The final sample was as follows: 108 students from College of Medicine, 88 students from College of Arts, 53 students from College of Dentistry, and 81 students from College of Agriculture. The final sample was 330 with a response rate of 82.5%.

Variables and measurements

Variables included were: Name, completed age last birth day, sex, education and occupation of parents, family history of hypertension, diabetes, and history of smoking.

Measurements taken were: Height in centimeters to the nearest 1 cm, it was measured on a solid surface with the participant in the erect position with heel and back against the rod. Weight was measured in kilograms (kg) to the nearest 100gms, using Secca model electronic scale. Body mass index (BMI) was calculated as weight divided by height squared (kg/m^2). Blood pressure was measured in millimeters of mercury (mmHg). It was obtained by mercurial sphygmomanometer. The measurements were taken by placing the appropriately sized cuff at a point half way between the olecranon and the acromion. The cuff bladder covered 80-100% of the circumference of the arm. The participants were seated and restful for 3-5 minutes prior to measurement. The students were seated in a comfortable chair with their backs supported and arms bared and supported at heart level. Blood pressure was measured twice at two minute intervals. The systolic BP was defined as the appearance of the first sound (Korotkoff phase 1), and the diastolic BP was defined as

the disappearance of the sound (Korotkoff phase 5). Hypertension' was defined as BP≥140/90 mmHg on two occasions or self-reported use of anti-hypertensive medication. Data were collected in the colleges. For each preselected class an appointment was arranged for interview and measurements. In most instances the time was between 9.00-11.00am. The nominated group gathered in one lecture hall with the help of responsible faculty from the division in each college. The questionnaire forms were distributed and the questions were answered, then measurements were taken for each participant. Data were fed into a computer using SPSS (Statistical Package for Social Sciences version 15). Results were presented as simple tables with suitable statistical tests when appropriate.

RESULTS

Of the 330 students studied, 162 were males (49.1%) and 168 (50.9%) were females. The age distribution ranged from 18–35 with nearly 97% aged 18-25 years. The prevalence rate of systolic hypertension was 1.8% and of diastolic hypertension 3.6%.

Systolic blood pressure among the studied students.

Table-1, shows that 81.2% of the studied students had normal systolic blood pressure, 17% had elevated blood pressure in the extent they can be considered in pre hypertension stage. Only 1.8% had elevated blood pressure to be described as having hypertension stage 1.

Table 1. Distribution of systolic blood pressure among studied students

State of blood pressure	Level in mmhg	No. of students	%
Normal	<120	268	81.2
Pre hypertension	120-139	56	17.0
Hypertension stage1	140-159	6	1.8
Hypertension stage2	160+	None	None
Total	**----**	**330**	**100.0**

Diastolic blood pressure among the studied students.

Table-2 shows that 64.5% of studied students had normal diastolic blood pressure, 31.8% had elevated blood pressure in the extent they can be considered in pre hypertension stage. Only 3.3% had elevated blood pressure stage 1 and 0.3% in hypertension stage 2.

Table 2. Distribution of diastolic blood pressure among the studied students

State of blood pressure	Level in mmHg	No.	%
Normal	< 80	213	64.5
Pre hypertension	80-89	105	31.8
Hypertension Stage 1	90-99	11	3.3
Hypertension Stage 2	100 & above	1	0.3
Total		**330**	**100.0**

Distribution of systolic blood pressure with selected variables:

Age and sex: Table-3 shows the distribution of systolic blood pressure among different age groups. No statistically significant difference could be detected among various age groups (P>0.05) despite some variations in various levels of systolic blood pressure across age groups.

Table 3. Distribution of systolic blood pressure by age.

Age (years)	Level in mmhg			Total
	120 mmHg	120-139 mmHg	140-159 mmHg	
18-19	**36(72.0%)**	**11(22.0%)**	**3(6.0%)**	**50(100%)**
20-21	**106(81.5%)**	**23(17.7%)**	**1(0.8%)**	**130(100%)**
22-23	**95(83.3%)**	**17(14.9%)**	**2(1.8%)**	**114(100%)**
24-25	**23(88.5%)**	**3(11.5%)**	**0(0.0%)**	**26(100%)**
>=26	**8(80.0%)**	**2(20.0%)**	**0(0.0%)**	**10(100%)**
Total	**268(81.2%)**	**56(17.0%)**	**6(1.8%)**	**330(100%)**

Fisher Exact Test = 0.446 df=8 P>0.05

Table-4 shows that 75.3% of males had normal blood pressure, 21% were pre hypertensive and 3.7% had hypertension stage 1 compared to 86.9%, 13.1% and 0.0% in the same order in females but the difference was not significant (P>0.05).

Table 4. Distribution of systolic blood pressure with sex.

Sex	Level in mmHg			Total
	<120 mmHg	120-139 mmHg	140-159 mmHg	
Male	122 (75.3%)	34 (21.0%)	6 (3.7%)	162 (100.%)
Female	146 (86.9%)	22 (13.1%)	0 (0.0%)	168 (100.%)
Total	268(81.2%)	56 (17.0%)	6 (1.8%)	330 (100.%)

Fisher Exact Test = 0.003 df=2 P>0.05

Body mass index: Table-5 shows that 76.9% of underweight students had normal systolic blood pressure, 23.1% had prehypertesion and no one was hypertensive, whereas in normal body weight students, 83.8% had normal systolic blood pressure, 14.9% were pre hypertensive and 1.3% hypertensive stage 1. In overweight students, 79.3% had normal systolic blood pressure, 19% were pre hypertensive and 1.7% were hypertensive stage 1. In obese students, 36.4% had normal systolic blood pressure, 45.5% were prehypertensive, and 18.1% were hypertensive stage 1.

Table 5. Distribution of systolic blood pressure with body mass index.

Body mass index		Level in mmHg			
		<120 mmHg	120-139 mmHg	140-159 mmHg	Total
Underweight	<18.5	20(76.9%)	6(23.1%)	0(0.0%)	26(100%)
Normal	18.5-24.9	197(83.8%)	35(14.9%)	3(1.3%)	235(100%)
Overweight	25-29.9	46(79.3%)	11(19.0%)	1(1.7%)	58(100%)
Obese	>=30	4(36.4%)	5(45.5%)	2(18.1%)	11(100%)
Total		267(81.2%)	56(17.0%)	6(1.8%)	330(100%)

Fisher Exact Test = 0.017 df=6 P>0.05

Family history of hypertension: of the students with no family history of hypertension 82.5% had normal systolic blood pressure, 15.7% were pre hypertensive and 1.8% were hypertensive compared to 79.9%, 18.3% and 1.8% in the same order for students with no family history of hypertension. The difference was insignificant (P>0.05).

Smoking: of students who were non smokers, 81.6% had normal systolic blood pressure, 16.7% were pre hypertensive, and 1.7% were hypertensive, in comparison with 77,8%, 19.4%, and 2.8% among smokers.

Distribution of diastolic Blood pressure with selected variables

Age and sex: Table-6 shows the distribution of diastolic blood pressure among different age groups in university students. No clear pattern can be described apart from a tendency of increased pre hypertension (50%) and hypertension (20%) in those aged 26 years and above in comparison with other ages.

Table 6. Distribution of diastolic blood pressure with age

Age in Years	Level in mmhg				Total
	<80 mmHg	80-89 mmHg	90-99 mmHg	>=100mmmHg	
18-19	31(62.0%)	16(32.0%)	2(4.0%)	1(2.0%)	50(100%)
20-21	91(70.0%	38(29.2%)	1(0.8%)	0(0%)	130(100%)
22-23	73(64.0%)	35(30.7%)	4(3.5%)	2(1.8%)	114(100%)
24-25	15(57.7%)	11(42.3%)	0(0%)	0(0%)	26(100%)
>=26	3(30.0%)	5(50.0%)	2(20.0%)	0(0%)	10(100%)
Total	213(64.5%)	105(31.8%)	9(2.7%)	3(0.9%)	330(100%)

Fisher Exact Test = 0.059, df=8, P>0.05

Table-7 shows that 58.6% of males had normal diastolic blood pressure, 35.8% had pre hypertension, 3.7% were hypertensive stage1and 1.9% were hypertensive stage2, whereas in females 70.2% had normal diastolic blood pressure, 28% were pre hypertensive and 1.8% were hypertensive stage 1. The percentages of pre hypertension (35.8%) and hypertension (5.6%) in males are higher than in females 28% and 1.8% respectively.

Table7. Distribution of diastolic Blood pressure with sex

Sex	Level in mmhg				Total
	<80 MmHg	80-89 mmHg	90-99 mmHg	>=100 mmHg	
Male	95(58.6%)	58(35.8%)	6(3.7%)	3(1.9%)	162(100%)
Female	118(70.2%)	47(28.0%)	3(1.8%)	0(0.0%)	168(100%)
Total	213(64.5%)	105(31.8%)	9(2.7%)	3(0.9%)	330(100%)

Fisher Exact Test = 0.049, df=3, P>0.05

Body mass index: Table-8 shows that 76.9% of underweight students had normal diastolic blood pressure, 23.1% were prehypertensive and no one was hypertensive. Whereas in normal body weight students, 68.1% had normal diastolic blood pressure, 30.2% were pre hypertensive, 0.9% were hypertensive stage1 and 0.9% were hypertensive stage 2. In overweight students, 55.2% had normal diastolic blood pressure, 37.9% were pre hypertensive, 5.2% were hypertensive stage1 and 1.7% were hypertensive stage2. In obese students, 9.1% had normal diastolic blood pressure, 54.5% were prehypertensive, and 36.4% were hypertensive stage 1.

Table 8. Distribution of diastolic blood pressure with body mass index.

BMI	Level in mmhg				Total
	<80mmhg	80-89mmhg	90-99mmhg	>=100mmhg	
<18.5	20(76.9%)	6(23.1%)	0(0.0%)	0(0.0%)	26(100%)
18.5-24.9	160(68.1%)	71(30.2%)	2(0.9%)	2(0.9%)	235(100%)
25-29.9	32(55.2%)	22(37.9%)	3(5.2%)	1(1.7%)	58(100%)
30 & above	1(9.1%)	6(54.5%)	4(36.4%)	0(0.0%)	11(100%)
Total	213(64.5%)	105(31.8%)	9(2.7%)	3(0.9%)	330(100%)

Fisher Exact Test = 0.000 , df=9, P>0.05

Smoking: among non-smokers 64.6% had normal diastolic blood pressure, 31.6% were pre hypertensive, 2.7% were hypertensive stage1 and 1% were hypertensive stage 2. whereas students who were smoking, 63.9% had normal diastolic blood pressure, 33,3% were pre hypertensive, and 2.8% had hypertension stage1.

Family history of hypertension: of students with no family history of hypertension 67.5% had normal diastolic blood pressure, 31.3% were Pre hypertensive, 1.2% had hypertension stage1 while students who had family history of hypertension, 61.6% had normal diastolic blood pressure, 32.3% were pre hypertensive, 4.3% had hypertension stage1 and 1.8% had hypertension stage2.

DISCUSSION

Hypertension affects somewhat 20-30% of the world population.[21] The prevalence rate is lower among young people. In this study, the prevalence rate of hypertension among university students aged between 18-35 years was 1.8% for systolic hypertension and 3.6% for diastolic hypertension. This prevalence is lower than figures reported in the United States, where the prevalence was 7% in individuals aged 18 - 39 years, in 2000.[22] The results are also lower than figures reported in a study conducted in Korea, in 2001.[23] In the latter study, the general prevalence was 33%, but progressively increasing with age, from 14% between 18 and 24 years of age to 71% for people aged 75 years or older. In Portugal, in 2003, prevalence in adults aged 20-90 years was 42%, being 26% among those aged between 20-35 years.[24] The prevalence of pre-hypertension in this study was 17% for systolic pre-hypertension and 31.8% for diastolic pre-hypertension, an indication that in few years, many of these young persons might have overt hypertension. The variation in prevalence figures among various studies is a reflection of methodological issues as well as true variation in risk of high blood pressure.

Age and Sex distribution with blood pressure

In this study, it was evident that a significant association of both systolic and diastolic blood pressure with sex with a relatively higher prevalence rates in males compared to females ($P<0.05$). This result is consistent with other studies worldwide. [24] The age pattern does not reveal any clear relationship with blood pressure and no significant relation of age with both systolic or diastolic blood pressure and this result apparently contrasts studies over the world. This contradiction is not totally real as the age span covered in the present study is narrow. More than 90% of the sample actually lies within the age of 18-24 years. A larger sample size may allow some variation to be detected with age.

Distribution of blood pressure with body mass index

Body weight was another relevant factor in relation to arterial hypertension. The choice of BMI to classify overweight and obesity was due to the fact that it is an index that has an important explanatory power concerning the occurrence of arterial hypertension**.** [25] In this study, it was possible to demonstrate a significant positive association of both systolic

and diastolic blood pressure with body mass index. A lot of research has been carried out to determine this association and reported similar results. For example in a Turkish cohort study, they found that both age and body mass index were predictors for hypertension.[26] Another teenagers study also found that current weight was strongly associated with systolic and diastolic blood pressure.[27] In young Swiss men, body weight was strongly correlated with elevated blood pressure.[28] The implication of relationship of body mass index to blood pressure is clear; prevention of overweight and obesity could reduce the risk of hypertension. Also reduction of excess weight in hypertensives could contribute to the control efforts.

Distribution of blood pressure with smoking

The association between smoking and blood pressure was not significant. Cigarette smoking causes systolic blood pressure elevation,[29] although some studies found similar or lower blood pressures in smokers compared with non smokers.[30] A cross sectional data from 3 years of annual health survey for England showed that any independent chronic effect of smoking on blood pressure was small. [31] Another study in Iran on military personnel showed no significant relationship between smoking and both prehypertension and hypertension.[32] This result might be because being a young population, it is possible that the harmful effects of smoking on health, which manifest themselves in the long term, are still not present in these individuals.

Distribution of blood pressure with family history of hypertension

A positive family history seems to predict diastolic hypertension more than systolic blood pressure in the bivariate analysis. In Northern Mexico, a cross sectional study showed that there was a significant association between the family history of hypertension and cardiovascular risk factors including hypertension.[33] When multivariate analysis was done, 9-10% of variation in blood pressure could be predicted by male sex, body mass index and family history of hypertension. It is highly recommended that the study of blood pressure in young persons is justified on the basis of the fact that even young university students have some risk of hypertension and that some of the preventable risk factors are operating in this population.

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