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Prevalence of Prehypertension among Saudi Female University Students – A Pilot Study

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Abstract: Background and Aim: The term ''prehypertension'' is defined as a blood pressure (BP) levels of 120-139/80-89 mmHg. Prehypertension is widespread especially in young people who suffer from obesity, and in most studies, is more prevalent than hypertension. Therefore, the aim of this study was to determine the prevalence of prehypertension in Saudi female students at King Abdul Aziz University, Jeddah, Saudi Arabia. **Method:** This cross-sectional study was conducted at the Faculty of Science, King Abdul Aziz University, Jeddah, Saudi Arabia. One hundred Saudi female students, 20-30 years old were recruited. Demographic data was collected through a self-administered questionnaire. Weight and height were measured and body mass index (BMI) was calculated. BP was recorded using a standardized technique. **Result**: Mean age of the study group was 22.1±1.6 years. Prehypertension was prevalent in 7% of the study group. The prevalence of prehypertension was higher in overweight and obese subjects (10%) compared to normal weight subjects (6%), however, this difference was not statistically significant. **Conclusion:** Prehypertension was observered in a group of young and otherwise healthy women and was more common in obese subjects. Since prehypertension is a predictor to future hypertension and subsequent cardiovascular events, early intervention to reduceweight maybe an effective preventive measure. Large scale studies are needed to confirm these findings in both sexes and different age groups. Moreover, clinical trials to assess the effectiveness of weight reduction in lowering the prevalence of prehypertension are warrented.

Keywords: Prehypertension, hypertension, blood pressure, Saudi females, obesity, body mass index, female students

1. Introduction

Prehypertension, a term coined by the "Seventh Report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure", is defined as a blood pressure ranging between 120-139 mmHg (systolic) and /or 80-89 mmHg (diastolic) (1). "Prehypertension" was previously known as "high normal BP (2). BP levels that were above normal, yet did not reach the hypertension level were proposed to have more progression to hypertension (2). Progression of prehypertension to hypertension and eventually to cardiovascular disease, may lead to increased cardio vascular events. Moreover, evidence is accumulating that there is an association between prehypertension and cardiovascular disease mortality (3).

Many studies reported a high prevalence of pre-hypertension among the general population including young age groups (4-7).

Prehypertension is considered as a risk factor and a signal to initiate lifestyle modifications in order to prevent its progression to hypertension (1). The risk of developing hypertension was found to be 3 times more in prehypertensive than normotensive people (8).

Prehypertension is widespread in young people who suffer from obesity, and in most studies, is more prevalent than hypertension. Saudi national health survey found that obesity occur in 28.7 % aged 15 years old and above, with the occurrence of 24.1% and 33.5% among men and women respectively.

In the United States, it was found that age and BMI were highly associated with prehypertension. Elliott & Black conducted a study in 2007 and stated that prehypertension was found to be significantly associated with the risk of cardiovascular disease (9). Meanwhile, Leibowitz and Grossman in 2009 reviewed that aging, high BMI and high blood cholesterol level were found to be significantly associated with prehypertension and there was a noticeable high prevalence of hypertension among those who suffer from metabolic syndrome (10). Similarly, Hu *et al* also found that high BMI was significantly associated with hypertension and prehypertension (11).

According to the World Health Organization statistic in 2008, the prevalence of hypertension in

Eastern Mediterranean Region was above 40% for males and 40% for females (12). A large national study in Saudi Arabia reported the prevalence of hypertension to be 15.2% and that of prehypertension to be 40.6% (4). However, data on the prevalence of prehypertension among young Saudi females is sparse. Only one study was found reporting the prevalence of prehypertension among female students from Eastern province to be 13.5% (13). Therefore, the aim of this study is to determine the prevalence of prehypertension among Saudi females' students at King Abdul Aziz University in the Western Region of Saudi Arabia (Jeddah).

2. Material and Methods

Subject selection and recruitment

This cross-sectional study was conducted at the Faculty of Science, King Abdulaziz University, Jeddah, Saudi Arabia (Western Region). One hundred female Saudi students, 20-30 years old were recruited over the period of (February – May 2016). Pregnant subjects, those with a history of cardiac diseases, diabetes or subjects taking antiepileptic drugs were excluded from the study. The students were asked to sign an informed consent at the outset of the study.

Anthropometric measurements

Weight in kilograms (kg) and standing height in centimeters (cm) were measured while wearing light clothes and barefooted using ACTEST medical 160-200 kg body weight -height scale (China). BMI was calculated as weight (kg) / height (m^2). Normal weight is defined as a BMI between 18.5-24.99 kg/m^2, overweight as BMI ≥ 25-<30 kg/m^2, and obese as BMI ≥ 30kg/m^2 on the basis of International Obesity Classification (14).

Socio-demographics information such as age, marital status, educational level and other lifestyle data were collected using a self administered questionnaire.

BP was measured in the seated position using a British Hypertension Society validated BP monitor, with interface (OMRON, Japan). All subjects were instructed not to talk, use their cell phones, or cross their legs during the measurement. After resting for 3-5 minutes, the BP was measured with the left arm supported at heart level, with an adult sized cuff.

Statistical analysis:

Data are presented as mean (SD) for continuous data and frequency (percentage) for categorical variables. Chi-square test or Fischer's exact test were used to determine the difference in prehypertension frequency among different BMI groups as appropriate. *P*-value <0.05 was considered as statistically significant. All statistical analyses were carried out using the SPSS for Windows V22.0 (SPSS Inc., Chicago, IL, USA).

3. Results

The total number of the study group was 100 female students. The participants' characteristics are presented in Table 1.

Table 1 Characteristic of the study group (n=100)

Variables	Mean± SD
Age (years)	22.1±1.622
Weight (kg)	57.0±13.4
Height (cm)	158.1±5.3
BMI (kg/m^2)	22.8±4.9
SBP (mmHg)	108.5±10.4
DBP (mmHg)	68.8±7.7

SD: Standard Deviation, BMI: body mass index, SBP: systolic blood pressure, DBP: diastolic blood pressure.

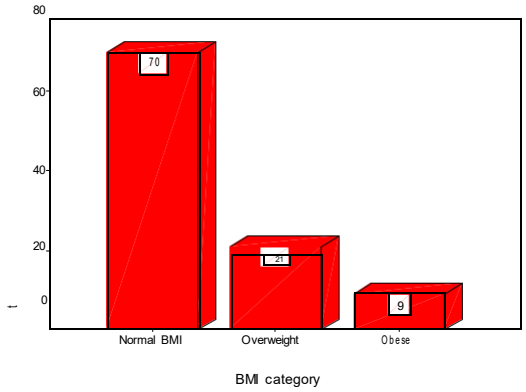

Figure 1. Prevalence of overweight and obesity among the study group.

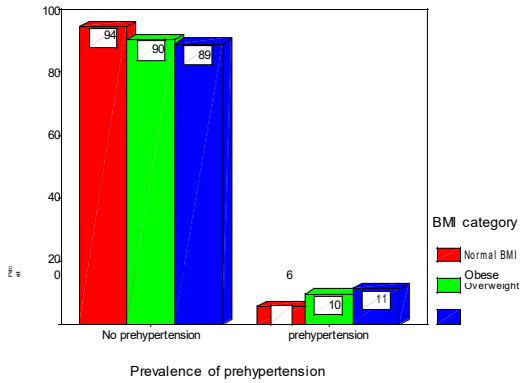

Figure 2. Prevalence of prehypertension according to BMI category.

According to BMI, 21% of the studied subjects were overweight and 9% were obese (Figure 1).

The prevalence of prehypertension (BP 120-139/80-89 mmHg) among the whole group was 7%. Systolic prehypertension (SBP 120-139 mmHg) was

prevalent in 13% of the subjects, while diastolic prehypertension (DBP 80-89 mmHg) was prevalent in 10% only. None of the subjects had undiagnosed hypertension apart from a subject with systolic hypertension (SBP>140mmHg).

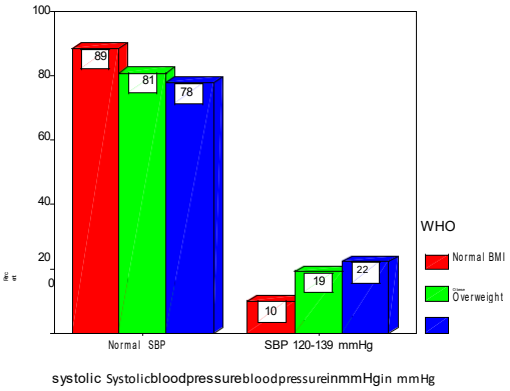

Figure 3. Prevalence of systolic prehypertension according to BMI category.

Prehypertension was more common among overweight and obese subjects (Figure 2). The same pattern was seen for both systolic and diastolic prehypertension (Figures 3 & 4).

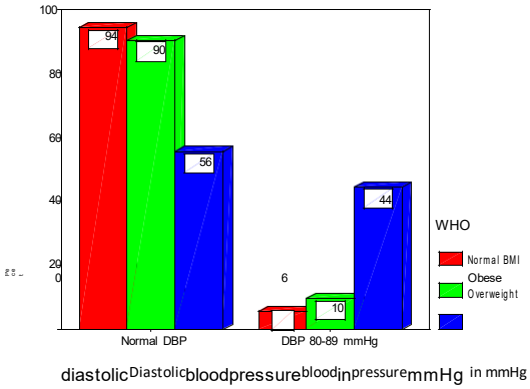

Figure 4. Prevalence of diastolic prehypertension according to BMI category.

Because of the small number of subjects with prehypertension, overweight and obese subjects were grouped together. Prehypertension (whether systolic, diastolic or both) was more prevalent among overweight and obese subjects (Table 2), however this difference was only significant for the diastolic prehypertension (P=0.039).

Table 2. Prevalence of pre hypertension among the normal and overweight/obese groups.

	Normal (n=70) N (%)	**Overweight/ Obese (n=30) N (%)**	**P-value***
Pre hypertension	4 (6 %)	3 (10 %)	0.350
Systolic prehypertension	7 (10%)	6 (20%)	0.156
Diastolic prehypertension	4 (6%)	6 (20%)	0.039

BMI: body mass index, *Fisher exact test

4. Discussions

This pilot study determined the prevalence of prehypertension in a group of apparently healthy female Saudi students at the faculty of science, King Abdul Aziz University, Jeddah, Saudi Arabia. Prehypertension was only observed in 7% of the study group, which is a much lower prevalence rate than that reported in previous national and international studies (13-16). Few Saudi studies were found reporting the prevalence of prehypertension among Saudi population. In a similar Saudi study conducted on female university students in the Eastern province, a prevalence of 13.5% was reported (13), while a national Saudi study reported a higher prevalence of prehypertension (25%) among females aged between 15-24 years (n=295) (3). Other international studies report higher prevalences of prehypertension ranging from12.6%-43.1% (Table 3).

Table 3 The prevalences of prehypertension in females in some international studies

	Population	**Sample size**	**Age**	**Prevalence of prehypertension**
Widjaj *et al*., 2013	Indonesian	111	18 to 25	36%
Hu *et al*., 2017	Chinese	15296	15 and over	27.6%
Xu *et al*., 2016	Chinese	47495	43.9 ± 16.8	33.2 %
Ortiz-Galeano *et al*.,2012	Spain	545	20.36±3.9	13%
Allal-Elasmi *et al*.,2012	Tunis	2712	35 to 69	43.1%
Erem *et al*., 2008	Turkish	4809	20 to*70* +	12.6%

Prehypertension was more prevalent among overweight and obese subjects, which was consistent with most reported literature (4, 13, 21-23). Koura *et al* stated that the most prevailing risk factor for cardiovascular diseases was physical inactivity followed by overweight/obesity, and that overweight/obesity was the strongest predictor of prehypertension (13).

The reason behind the variable prevalences of prehypertension reported in different studies could possibly be related to methodological difference in blood pressure measurement among these studies. However, we can speculate on the lower prevalence of prehypertension found in our study. Since higher blood pressure levels are related to BMI, it is possible that the studies with higher prevalence rates recruited subjects with higher BMIs. The mean BMI of the subjects in the present study was 22 kg/m^2 and the number of obese subjects was low (9%). Another possible explanation is related to the well documented effect of hot climate on lowering blood pressure (24). Since Jeddah has a warm climate with an average of 31 degrees C for almost 8 months per year, lower blood pressure levels can be expected in acclimatized residents.

The main limitation in our study was the use of an adult cuff for the measurement of blood pressure in all subjects. Cuff hypertension is a well known phenomenon when using a regular cuff in obese subjects (25), however in such a case we expect to see a higher prevalence of prehypertension rather than lower as reported in the present study. Another limitation is the small sample size on female students only, which is not representative of the whole population of Jeddah. However, this was a pilot study and we suggest that future studies with a larger sample size should be conducted on both sexes and different age groups. We also recommend that a scoring system should be created to assess the collective effects of several cardiovascular risk factors in apparently healthy female and male subjects in different sets of populations. In addition, measuring the association between prehypertension, diet and life style among young adults should also be studied.

Conclusion:

Prevalence of prehypertension was found to be lower than that reported in previous studies. Obesity was found to be associated with prehypertension Further larger studies are needed to confirm these findings and evaluate the effect of weight reduction and other life style modifications on the prevalence of prehypertension.

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Conflict of interest

Conflict of interest statement: The authors have no conflicts of interest relevant to this article to disclose.

Disclosure Summary:

The authors have nothing to disclose.

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