

PREVALENCE OF PREHYPERTENSION AND THE NEAR TERM RISK OF DEVELOPING HYPERTENSION AMONG ARABIAN GULF UNIVERSITY MEDICAL STUDENTS IN THE KINGDOM OF BAHRAIN FOR THE YEAR 2011-2012.

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ABSTRACT

This research mainly aims to estimate the prevalence of prehypertension among medical students in the Arabian Gulf University (AGU) in the Kingdom of Bahrain for the year 2011-2012. It also provides a baseline data of the blood pressure status among medical students above 20 years in the University. This includes identifying the factors contributing to the blood pressure variation. Also acknowledging the near-term risk of developing hypertension in the upcoming first, second and fourth years by using the risk score.^[1] The method used in this research was

multistage stratified sampling from the population. The procedure included going to the administration and registration unit of the university, which supplied a table of information regarding the number, the gender and date of birth of the students in each academic year. Before the actual study took place, a pilot study was done and the research data was entered and analyzed by SPSS 16. As for the principle results, we concluded that the prevalence of prehypertension among AGU medical students in the Kingdom of Bahrain, who aged 20 years and above was found to be 37.35%, with a gradual increase of the mean risk of developing hypertension as a student moved from one academic year to the next. According to our study, there is a significant positive association between blood pressure status with BMI and with gender.

BACKGROUND

Prehypertension in adolescents and young adults is a significant cause of developing hypertension in later years of life.^[2] Identification of prehypertension - defined as blood pressure ranging from 120 to 139 mmHg systolic or 80 to 89 mmHg diastolic according to the Joint National Committee on Prevention, Detection, Evaluation and Treatment of high blood pressure seventh report (JNC-7).^[3] **table (1)** - is crucial and is of great value in avoiding the forthcoming calamity, hypertension. Proven to be a silent killer, it accounts for 6% of deaths worldwide.^[4] Fortunately, systemic hypertension is recognized worldwide as the greatest preventable risk factor for cardiovascular diseases^[5] that can be easily detected ahead of time before its unwanted effects and complications begin to take effect.

The main objective of this study is to prevent hypertension by detecting prehypertensive adolescents and young adults, mainly among medical students of Arabian Gulf University (AGU) in the kingdom of Bahrain. Similar studies have been conducted in other countries, such as China^[6] and India.^[2] The former found that 30% of adolescents were prehypertensive, while the latter showed that 67% of medical students are prehypertensive.

The aim of this study is to estimate the prevalence of prehypertension among medical students in AGU in the Kingdom of Bahrain.

Table (1): JNC-7 classification of hypertension.^[3]

Systolic Bp mmHg			Diastolic Bp mmHg
Normal	<120	&	<80
Prehypertension	120-139	or	80-89
Hypertension –stage 1	140-159	or	90-99
Hypertension-stage 2	>160	or	>100

AIM

To find the prevalence of prehypertension among Arabian Gulf University medical students who are 20 years or above, registered for the year 2011-2012.

Research Questions

- What is the prevalence of prehypertension among medical students in the AGU?
- What are the risk factors contributing to the variation in blood pressure?
- What is the near term risk of developing hypertension in the upcoming first, second

and fourth years?

OBJECTIVES

- To provide a baseline data of blood pressure status among medical students above 20 years in the AGU.
- To identify the factors contributing to blood pressure variations.
- To predict the near-term risk of developing hypertension in the upcoming first, second and fourth years by using the risk score.^[1]

METHODOLOGY

Study Design

- Analytical cross-sectional study involving medical students in the AGU in the academic year 2011-2012.

Setting

- AGU in the Kingdom of Bahrain.

Study Population

- All medical students who are 20 years and above admitted to the AGU in the academic year 2011-2012.
- Population size was given by the Administration Registration Unit (**table 2**).

Table 2: Population size of AGU medical students.

Medical school	Population	%	Sample
AGU	587	100%	340

Sample Size

To calculate the prevalence of prehypertension among medical students in the AGU in the kingdom of Bahrain. The following equation was used to find out the sample size:

$$n = \frac{(Z_{1-\alpha/2})^2 \cdot P \cdot (1-P)}{E^2}$$

n= sample size, p= prevalence of prehypertension among medical students, E= error

Considering that

Confidence interval (CI): 95%, so $(Z_{1-\alpha/2}) = 1.96$

Prevalence of prehypertension among medical student in a previous study was 67%.^[7]

- E = 0.05

After calculation, the sample size equaled **340 medical students**.

Exclusion Criteria^[1]

- Diabetes mellitus.
- Hypertension.
- Age < 20 years.

Case Definition

Any medical student 20 years and above registered to AGU in the year 2011-2012.

Sample Technique (Method)

Multistage stratified sampling from the sample population (table 3).

Table 3: AGU population and sample classified by gender and academic year.

Medical Year	Total population	Gender	Population		Sample	
			Number	%	Number	%
2	100 (17%)	M	47	47%	31	47%
		F	53	53%	27	53%
3	132 (23%)	M	55	42%	46	42%
		F	77	58%	33	58%
4	139 (24%)	M	40	36%	53	36%
		F	89	64%	29	64%
5	103 (18%)	M	30	29%	43	29%
		F	73	71%	18	71%
6	113 (18%)	M	29	20%	44	20%
		F	84	74%	16	74%
Total	587(100%)		587	100%	340	100%

Study Instruments and Variables

Study Instruments

Done by the students

A written questionnaire that contains information to be filled by the students.

A copy of the questionnaire is attached to the appendix.

Done by the researchers

- Blood pressure measurement for a seated student using electronic sphygmomanometer placed around the arm at the level of the heart. The device

recorded the systolic and diastolic blood pressure.

- For accuracy, some of the readings using the manual mercury sphygmomanometer were recorded.
- Height and weight measurements were recorded using electronic scale from the physiology department of the university.

Study Variables

Qualitative

- Gender
- Smoking history
- Physical history
- Psychological history
- Familial history of hypertension
- Academic year

Quantitative

- Age
- Blood pressure
- Height, weight & BMI

Procedures of Data Collection

The administration and registration unit of the university provided a table of information regarding the number, the gender and date of birth of the students in each academic year. Students were chosen randomly.

Pilot Study

A pilot study was done on 33 medical students after their lab session that ensured that the research is feasible. Some modifications were done to the questionnaire after the pilot study.

Data Entry, Validation and Data Analysis

- The questionnaire was numbered serially.
- Coding was done for the study variables.
- Data was entered and analyzed by SPSS 16.
- Calculations done:

BMI from the data measured (height and weight), $BMI = \text{weight (kg)} / (\text{height (m)})^2$.

Risk score, to find out the near term risk of developing hypertension in upcoming first, second and fourth year ahead of conducting the research. That was achieved by a technique proved by a research conducted by the Framingham Heart Study which used the systolic and diastolic blood pressure, gender, BMI, smoking status and parental hypertension as the required variables^[1] see figure 1.

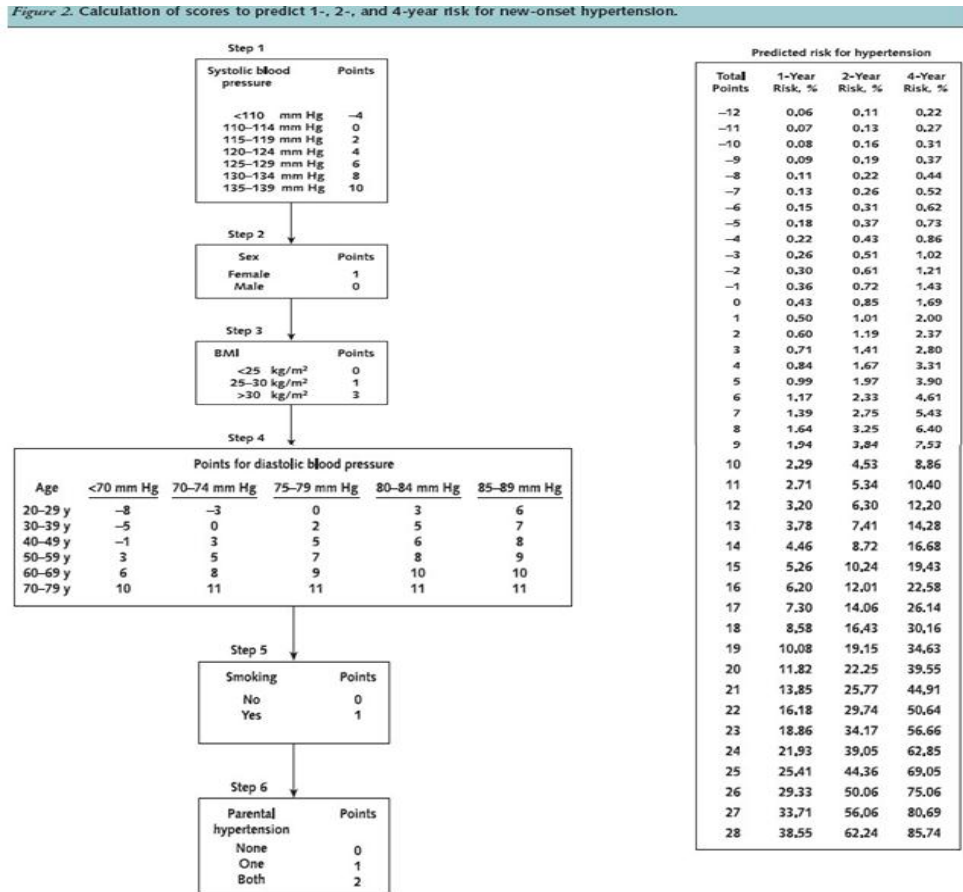


Figure 1: Near- term risk of developing hypertension using risk score 1.

Statistical Methods

Graphic representation of

- Prevalence of prehypertension.
- Risk score among academic years.
- Near term risk of developing hypertension in the upcoming first, second and fourth years.

To check for the statistical significance between BP (systolic & diastolic) and individual risk factors using

Pearson correlation: for quantitative risk factors with systolic & diastolic BP.

Independent one sample t-test / one way ANOVA test: for qualitative risk factors with systolic & diastolic BP.

Graphic representation to show the effect of BP and the different risk factors (including Regression).

Permission and Ethical Approval

- To collect data properly, booths in the university lobby were provided to take measurements. The permission was taken from *Dr. Abdurrahman Yusuf* – chairman of student affairs at the AGU (a copy of the permission is attached to the appendix).
- The ethical approval was given by *Prof.Faisal Abdul Latif Al-Nasir* – Chairman of department of Family and Community Medicine at the AGU – after submitting the protocol.

Important Notes

- Exclusion criteria (below age 20, diabetes mellitus and hypertension) were based on the Risk Score Calculation by a method approved by the Framingham Heart Study^[1], that is not applicable to be used with these criteria.
- First year students were excluded in AGU who are almost < 20 year old.
- To avoid the personal variation in blood pressure measurement using the manual mercury sphygmomanometer, electronic sphygmomanometer was used as well. To ensure accuracy, some of the readings using the manual mercury sphygmomanometer were recorded.

RESULTS

Prevalence of Prehypertension

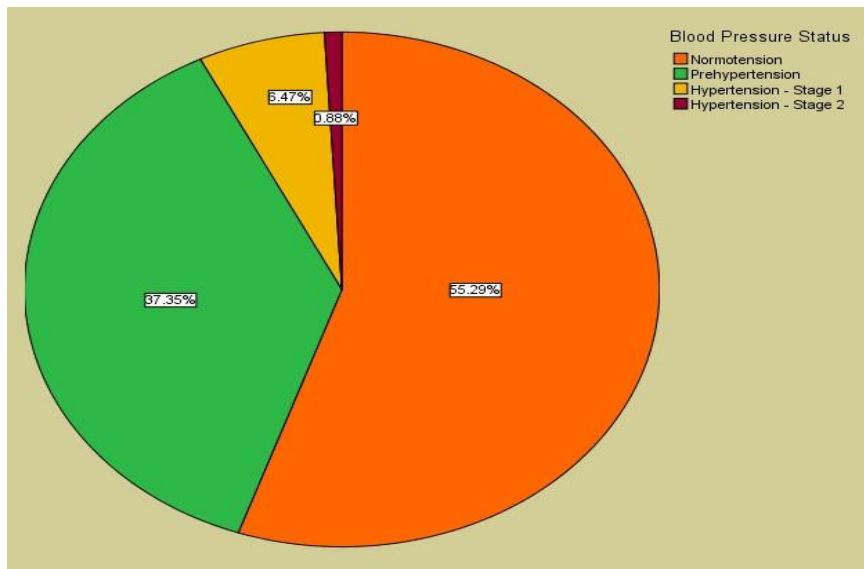


Figure 2: prevalence of prehypertension among AGU medical students.

The majority of AGU students are normotensive accounting for **55.29%** while the second most common are prehypertensive which was found to be **37.35%** among AGU medical students in the Kingdom of Bahrain.

Risk Score Interpretation

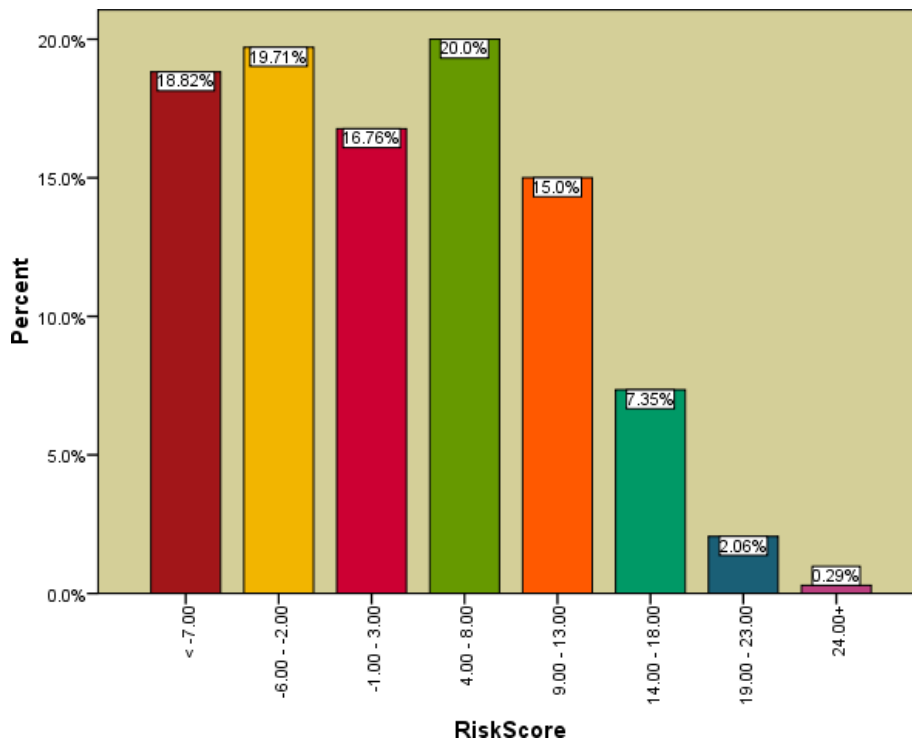


Figure 3: Risk score among academic years in AGU medical students.

Risk score in the X-axis was taken from figure(1) which is a method approved by Framingham Heart Study(1) to calculate the risk score with the lowest score of (-12) and the highest is (28) which are then divided into intervals using the visual binning.

About 20% of AGU medical students risk score was between 4 and 8, interpreted from figure (1), having a risk between (0.84%, 0.1.67% and 3.31%) and (1.64%, 3.25% and 6.40%) of developing hypertension in the upcoming first, second and fourth year, respectively.^[1]

Mean Risk of Developing Hypertension from the second to sixth academic years in the upcoming first, second and fourth year

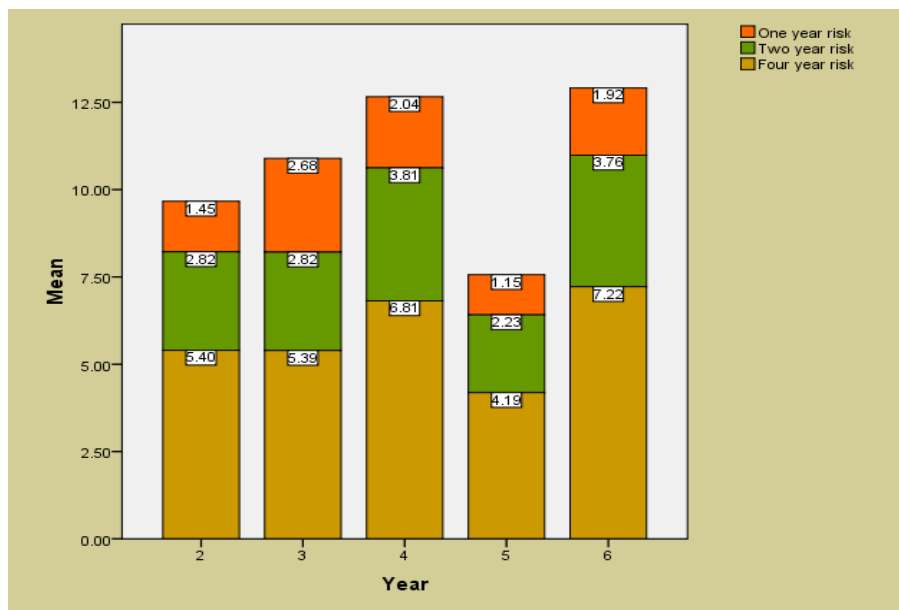


Figure 4: Risk of developing hypertension in the coming first, second and fourth years.

- Generally medical students at AGU in the Kingdom of Bahrain, regardless their academic year, have a higher risk of developing hypertension in fourth year ahead of conducting the study.
- The mean risk of developing hypertension in second and fourth years (yellow and green) increases gradually through academic year 2 to 4, but decreases among year 5 medical students. It then increases again among year 6 medical students.
- Surprisingly, mean risk of developing hypertension in the coming first year increases till year 3 but decreases among year 4 and 5 students then rises again in year 6.

Statistical significance between systolic & diastolic BP and some of the Risk Factors

Table 4: Tests of significance between systolic & diastolic Bp and some risk factors.

Risk factor	Test	Systolic Bp (p-value)	Diastolic Bp(p-value)
Gender	Independent one sample t- test	0	0
BMI	Pearson correlation	0	0.001
Stress level	One way ANOVA	0.191	0.222
Academic year	One way ANOVA	0.009	0.093
Duration of average exercise	One way ANOVA	0	0.520
Smoking	Independent one sample t- test	0.008	0.184
Adding extra salt	Independent One sample t-test	0.041	0.511

See the appendix Systolic BP

- There is significance between systolic BP with gender, BMI, academic year, duration of average exercise, smoking and addition of extra salt to the diet.
- Whereas no apparent significance between systolic BP and stress level.

Diastolic BP

- There is significance between diastolic BP and gender & BMI.
- Whereas no significance between diastolic BP and the other risk factors.

Graphic representation of the Risk Factors with the BP

Gender

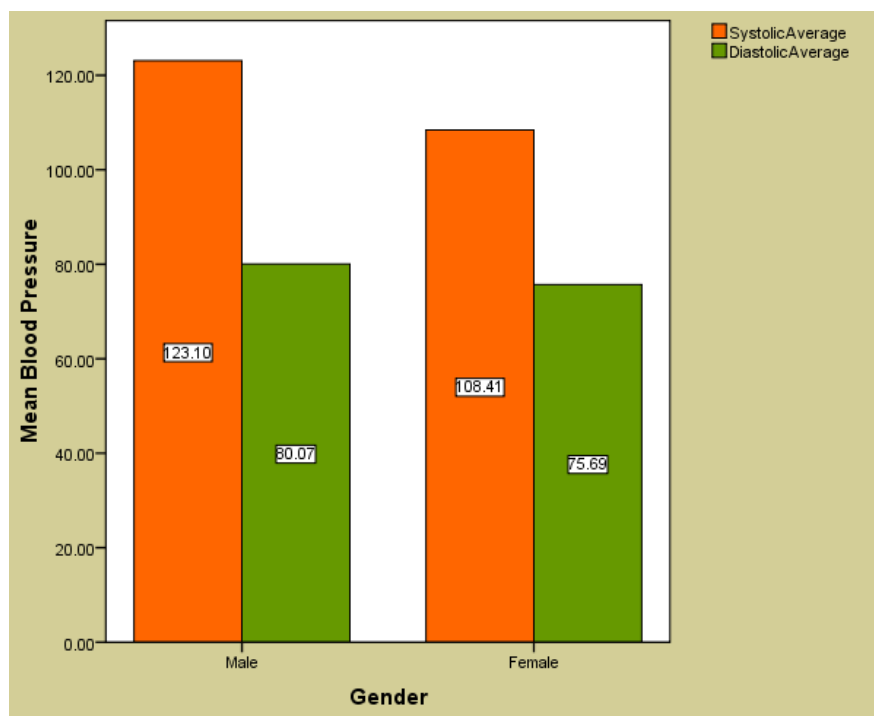


Figure 5: Mean systolic & diastolic BP of males & females.

Generally, males have a higher blood pressure than females in both systolic and diastolic, since the mean of the male systolic and diastolic BP is higher than of the female (see appendix 4).

In addition, gender has a stronger effect on systolic rather than diastolic BP, since the difference between the mean of systolic BP is more significant than of the mean Diastolic (see appendix 4).

BMI

Regression between blood pressure and BMI

Regression of systolic Bp and BMI

$$\text{Systolic BP} = 99.623 + 0.600 (\text{BMI}) \text{ (see Appendix 4)}$$

Systolic blood pressure in medical students increases on average by 0.600 when BMI increases by one kg per m².

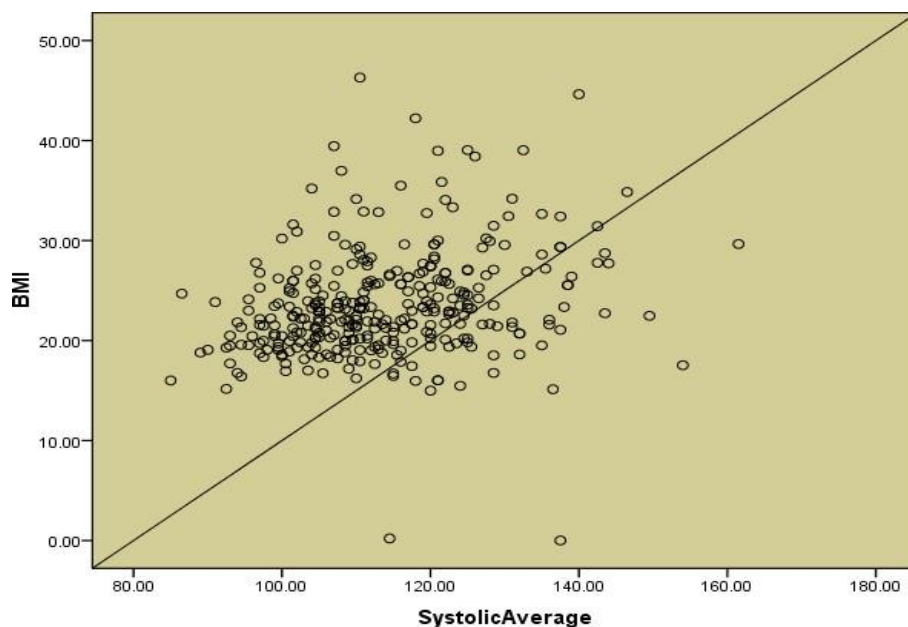


Figure 6: Regression line of the systolic BP and BMI.

Regression of diastolic Bp and BMI

$$\text{Diastolic Bp} = 70.893 + 0.272 (\text{BMI}) \text{ (see Appendix 4)}$$

Diastolic blood pressure in medical students increases on average by 0.272 when BMI increases by one kg per m².

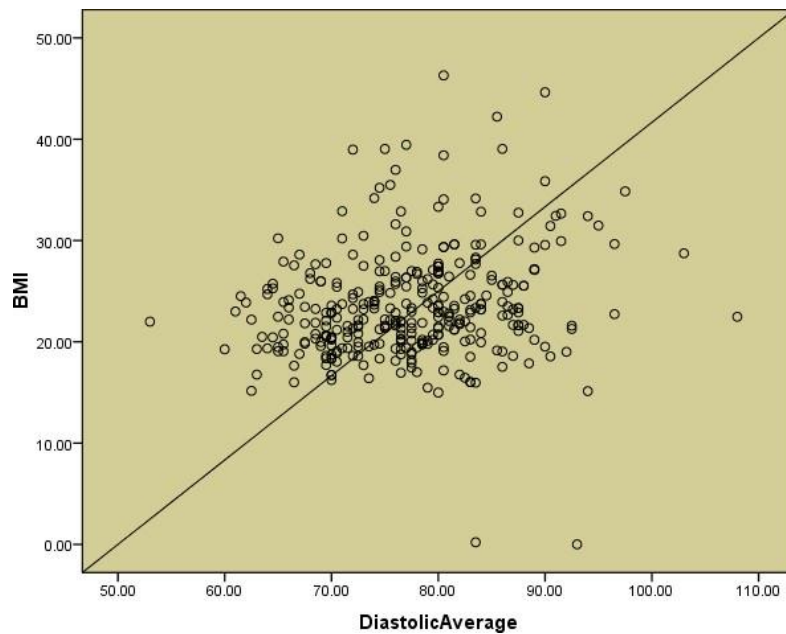


Figure 7: Regression line of the diastolic BP and BMI.

From the above two figures, the relationship between BMI and systolic BP is stronger than with the diastolic BP. So an increase in the BMI would lead to the increase in the systolic BP $>$ increase in the diastolic BP, since $0.600 > 0.272$.

Stress Level

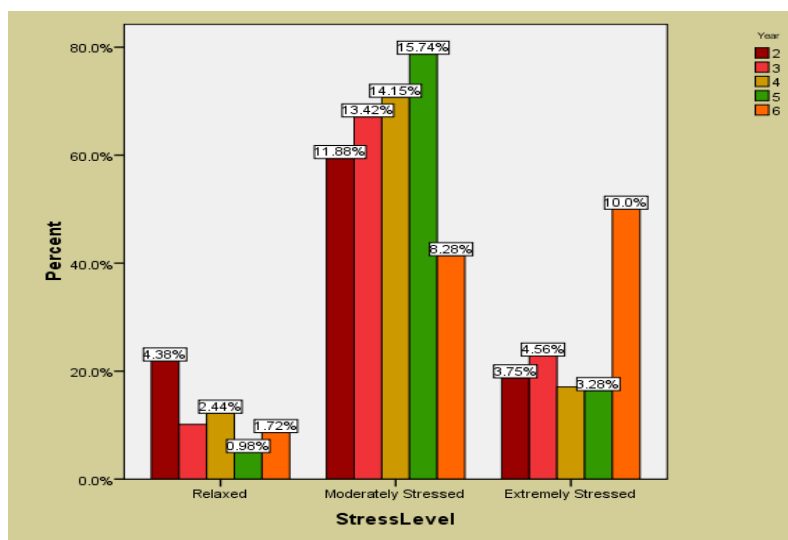


Figure 8: Stress level among academic year.

Although from the previously done one way ANOVA test no significance is apparent between stress level and both systolic & diastolic BP, in the figure above, the majority of students from year 2 to year 5 are moderately stressed, while most year 6 students are extremely stressed.

According to the figure majority of the student in the relaxed category are year 2, in moderately stressed are year 5 and in severely stressed are year 6.

Academic Year

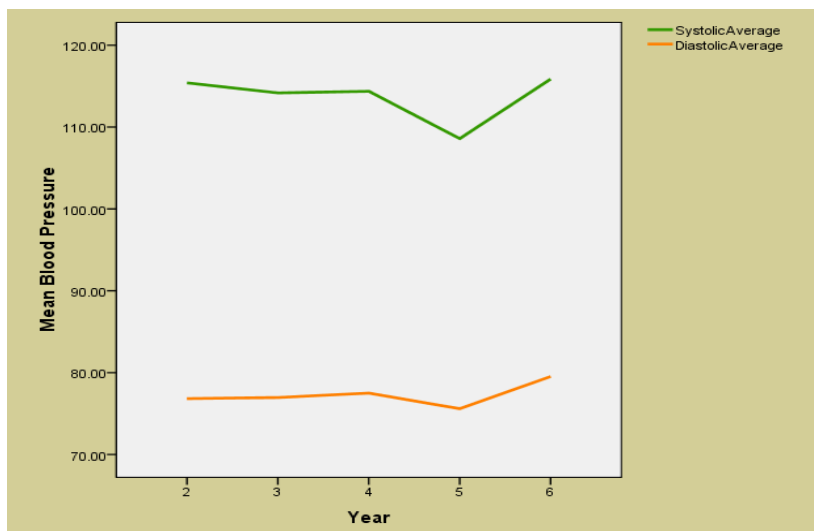


Figure 9: Mean systolic & diastolic BP among academic years.

Blood pressure increases through year 2 to year 4 students, while it decreases among year 5 then increases again in year 6 with a marked increase in the systolic BP in comparison with the diastolic BP, because there is significance between systolic BP & academic year but not with diastolic BP.

Duration of Average Exercise

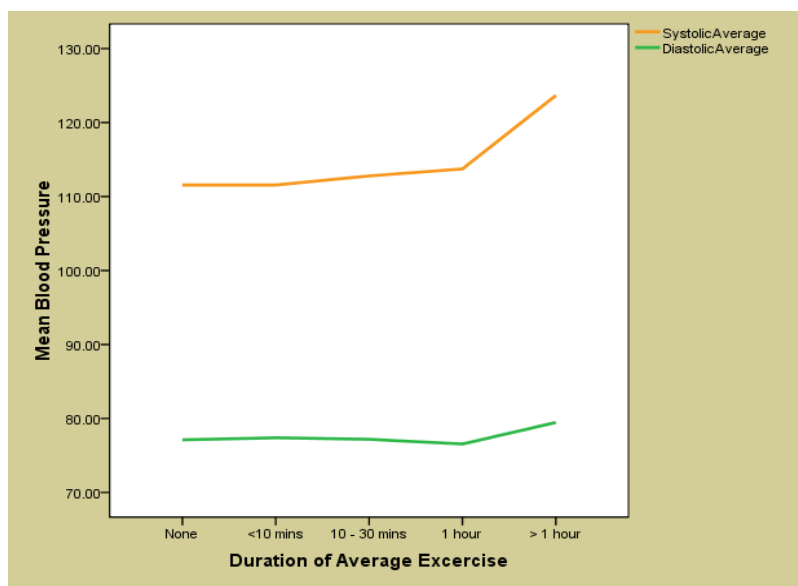


Figure 10: Mean systolic and diastolic BP among different duration of exercise.

As supported previously by one way ANOVA test, there is significant correlation between systolic BP and the duration of average exercise but not with the diastolic BP.

As noticed, the systolic BP increases with a gradual minimal amount when the duration of exercise increases to one hour duration but with a marked increase in the systolic BP when the duration of average exercise exceeds 1 hour Smoking: -approved by PostHoc table –see appendix 4).

Smoking

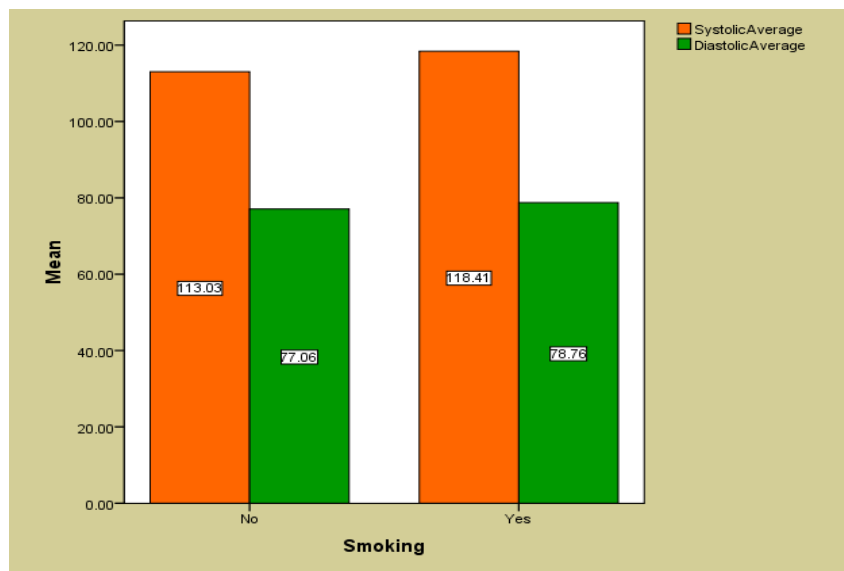


Figure 11: Mean systolic & diastolic Bp of smokers & non-smokers.

It's apparent from the figure above and from the tests done, that Smoking has a significant effect on systolic blood pressure, since that the mean systolic BP of smokers (118.41mmHg) > mean systolic BP of nonsmokers(113.03mmHg).

There is no significant relationship with diastolic BP and smoking since mean diastolic BP in smokers and nonsmokers are almost similar (See appendix 4).

Adding Extra Salt



Figure 13: Mean systolic & diastolic BP of cases who add salt in comparison to who do not add salt.

It is noticed that those who add salt to their diet have lower systolic BP compared to that of the other group who do not add salt to food since the mean systolic BP of cases who add salt is 111.49 mmHg while those who do not add salt is 114.59 mmHg.

However, there is no marked difference between the mean diastolic BP for both salt adders & non-adders.

DISCUSSION

The prevalence of prehypertension among Arabian Gulf University medical students in Kingdom of Bahrain, who aged 20 years and above was found to be 37.35%. This finding supported previous studies conducted on adolescents in Jamaica, which showed that 30% of them were prehypertensive.^[6] It was also found that the mean risk of developing hypertension in the upcoming second and fourth years increased gradually as the students moved from the academic years 2 to 4, but decreased among year 5 medical students and increased again in year 6. Another significant correlation was between blood pressure and BMI and between blood pressure and gender for both systolic and diastolic BP, while it was found that a significant relationship is between academic year, duration of average exercise, smoking, and adding extra salt and the systolic BP but not the diastolic BP. This supported a previously conducted studies carried out in China that

showed the likelihood of developing a prehypertensive state in the presence of a high BMI.^[6] Having stated these results, some of the possible practical applications should be kept in mind. Increasing the awareness of the obvious correlations with a prehypertensive state and also modifying a person's life style are some of these practical applications.

CONCLUSION AND RECOMMENDATION

The prevalence of prehypertension among Arabian Gulf University medical students in the Kingdom of Bahrain should not be taken lightly. It is a growing problem that needs a great deal of care before its effects become irreversible. Special attention should be given to the first and second year students, as prevention is always better than treatment.

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