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Prevalence and Determinants of Pre-hypertension among Undergraduate Nursing Students of Private Health Sciences College

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Abstract: Hypertension is a major public health concern worldwide; while most studies describe hypertension in older adults, there is scarce data on prehypertension in young**.** The aim of highlighting this new category of "prehypertension" is to raise public awareness about the cardiovascular risk associated with blood pressure in this range and the importance of taking preventive action. Also, it is to determine the frequency of prehypertension among undergraduate nursing students and the association between demographic factors and psychological factors with prehypertension. A cross-sectional study was conducted in 2018 among undergraduate nursing students of private health colleges. A convenience sample of 282 students participated in this study. The Arabic version of Depression, Anxiety, and Stress Scale-21 elicited depression, anxiety, and stress levels. Blood pressures were measured twice using a sphygmomanometer, and the averages were taken. Data analyses used descriptive and inferential statistics. Out of the total number of 282 participants included in this study, 7.5% (19.6% male; 5.1% female) have a systolic pressure of ≥130 mmHg, and 6.7% (10.9% male; 5.9% female) have a diastolic pressure of ≥85 mmHg. Significant gender differences were detected regarding employment status, smoking, study year, depression, stress, and systolic pressure ($p<.05$). Results showed significant anthropometric differences in systolic and diastolic pressure ($p<.001$), higher in elevated than normal. The level of depression was significantly associated with systolic prehypertension, while the level of stress was significantly different for diastolic prehypertension ($p<.05$). The prevalence rate of prehypertension and hypertension was quite high in the present study. Early identification of pre-hypertensive individuals and early intervention by implementing a healthier lifestyle have been discovered to slow the development of hypertension.

Keywords: prehypertension, hypertension, body mass index, depression, anxiety, stress.

私立健康科学学院护理专业本科生高血压前期患病率及影响因素

摘要：高血压是全球主要的公共卫生问题，而大多数研究描述了老年人的高血压，但关于年轻人高血压前期的数据很少。强调这一新类别的“高血压前期”的目的是提高公众对与此范围内的血压相关的心血管风险以及采取预防措施的重要性的认识。确定本科护生高血压前期的频率，以及人口统计学因素和心理因素与高血压前期的关系。2018年对私立卫生学院的本科护理专业学生进行了一项横断面研究。282名学生的便利样本参与了这项研究。阿拉伯语版本的抑郁、焦虑和压力量表21用于引出抑郁、焦虑和压力的水平。使用血压计测量血压两次并取平均值。数据分析使用描述性和推论性统计。在本研究的282名参与者中，7.5%（19.6%男性；5.1%女性）的收缩压≥130毫米汞柱，6.7%（10.9%男性；5.9%女性）的舒张压为≥85毫米汞柱。在就业状况、吸烟、学习年份、抑郁、压力和收缩压方面发现了显着的性别差异(可能性<.05)。结果显示收缩压和舒张压的人体测量学差异显着(可能性<.001)，升高时高于正常值。抑郁水平与收缩期高血压前期显着相关，而压力水平与舒张期高血压前期显着不同（可能性<.05）。在本研究中，高血压前期和高血压的患病率相当高。已经发现早期识别高血压前期个体以及通过实施更健康的生活方式进行早期干预可以减缓高血压的发展。

关键词：高血压前期、高血压、体重指数、抑郁、焦虑、压力。

1. Introduction

Hypertension (HTN), a major public health concern worldwide, is related to premature death, cardiovascular disease, and stroke [1]. Strokes,

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aneurysms, hypertensive heart disease, coronary artery disease, renal disease, and peripheral artery disease can occur if prehypertension is left untreated [2]. According to the Global Burden of Disease 2010 report, hypertension is the most common cause of death in the Kingdom of Saudi Arabia (KSA) [3]. According to a national survey conducted in Saudi Arabia, 15.2 % and 40.6 % of Saudis were hypertensive or borderline hypertensive. Male's hypertension risk has increased due to their age, obesity, diabetes, and hypercholesterolemia. [4]. While most studies described hypertension in older adults, there is scarce data on prehypertension in young adults.

Prehypertension patients have a two- to three-fold higher risk of developing hypertension than people with normal blood pressure [5]. Furthermore, it was discovered that hypertension is 'getting younger,' meaning that younger people are being diagnosed with the condition. Pre-hypertension was more common than hypertension in young people [6]. Pre-hypertension was found to be prevalent in 37.45 – 45.0 % of Indian undergraduate medical students [7, 8] and 13.5 - 47.4% in the Middle East [9].

The Kingdom of Saudi Arabia has seen substantial socio-economic growth over the last two decades, resulting in significant changes in its lifestyle and standard of living. Furthermore, these changes have resulted in many social behaviors and eating preferences, not necessarily healthy ones. The lack of exercise and widespread sedentary behavior among large population segments has complicated this public health issue [10]. These and other investigated risk factors in the public health literature have aided the development of adult-onset degenerative diseases such as hypertension, obesity, and diabetes mellitus. Body mass index (BMI) was linked to a higher prevalence of high blood pressure in people between 18 and 44. The relationship between BMI and prehypertension and hypertension varies by age and gender [11].

Biological, social, and psychological factors are frequently cited as key hypertension risk factors. The psychological state of an individual has a significant impact on the physical state of the human body. Several authors have looked into other risk variables, such as psychosocial ones and mental disorders, although the relationship with hypertension is less apparent and, at times, contentious [12-14]. In terms of psychological variables, a prior survey found that 47.2 %, 56.0 %, and 39.1 % of Saudi university students had mild to severe depression, anxiety, and stress, respectively [15]. In Malaysia, a study of undergraduate students from four universities found that moderate and severe or extremely severe depression was prevalent at 27.5 % and 9.7 %, respectively; moderate and severe or extremely severe anxiety was 34.0 %, and 29.0 percent; and moderate and severe or extremely severe stress was 18.6 % and 5.1 %. [16]. A recent study conducted by Mamoona and Najma (2014) revealed that hypertension has a significant positive relationship with depression, anxiety, stress, and demographic variables [17].

However, in the Southern province, data are scarce on prehypertension in young adult undergraduate nursing students. This study aimed to determine how common prehypertension is and what risk factors are associated with it among young adult undergraduate nursing students of private Health Sciences College in the southern region of Kingdom Saudi Arabia (KSA).

Research Questions:

1. What is the prevalence rate of prehypertension and hypertension among undergraduate nursing students of private health sciences colleges in the southern region of KSA?
2. What are the gender significant predictors of prehypertension?
3. Does undergraduate's prehypertension status differ significantly concerning socio-demographics, BMI, and psychological factors?

2. Methods

2.1. Design

This study utilized a descriptive correlation design to fit the study purpose. The data were collected from undergraduate nursing students during the second semester of the 2018/2019 academic year.

2.2. Sampling and Setting

The study was conducted at a private Health Sciences College located in the south part of Saudi Arabia. A total number of 282 undergraduate nursing students were recruited by using convenience sampling from the available students during the data collection period. In addition, Quota sampling was used in the current research to ensure students from all levels of bachelor degrees in nursing science were included.

2.3. Ethical Consideration

Before the data collection, ethical approvals were obtained from Alghad International College of Applied Medical Sciences (Approval GIC-ECM #03 15-12-2018). The students were fully informed about the nature of the study by using the student datasheet. Before data collection, each student gave their verbal and written agreement to participate. The anonymity of all participants was retained as the questionnaire did not mention any names.

2.4. Instruments and Data Collection Procedure

In this study, data were collected via a self-administered questionnaire. There were three sections to the instrument: 1) socio-demographic factors as age group, gender, study year, marital status, and employment status; 2) Students' backgrounds and

current conditions: family history of HTN, diagnosed as HTN, smoking status, systolic and diastolic pressure recordings, anthropometric measurements and BMI; and 3) DASS-21-the Depression, Anxiety, and Stress Scale: is a tool that measures depression, anxiety, and stress (Arabic DASS-21). The Arabic DASS-21 is made up of 21 items on three scales: depression (DASS-D), anxiety (DASS-A), and stress (DASS-S), all of which are rated on a four-point Likert scale from 0 to 3. The possible range for each scale is 0 to 21, with higher values indicating more sadness, anxiety, and stress. The Arabic version of DASS-21 was used in the current study after authorization was obtained from the developer.

The clinical nursing instructor gathered the information. A questionnaire was employed by the clinical nursing instructor, which contained demographic information, blood pressure measurements, and anthropometric measurements. For 10-15 minutes, each participant was interviewed. A non-stretch tape was mounted to a level vertical wall, and body weight and height were measured using a digital scale sensitive to 0.1 kg and 0.5 cm, respectively. The BMI was computed by dividing the weight by the square of the height (kg/m^2). The BMI values that were considered to be < 18.5 kg/m^2, underweight; 18.5 to 24.9 kg/m^2, normal weight; 25.0 to 29.9 kg/m^2, overweight; and ≥30 kg/m^2, obesity; all the participants wore light clothes without shoes. Waist circumference (WC) measurements were taken twice by a non-stretchable tape with no pressure on the skin at the level of the umbilicus. In contrast, hip circumference (HC) was measured at the maximum width of the buttocks in a standing position with the participants' feet together.

In a local faculty clinic, blood pressure was measured using WHO-defined criteria by a clinical nursing teacher. Participants sat in a chair with their backs supported and their right arm bared at heart level. After a 5-minute rest period, systolic blood pressure (SBP) was recorded twice from the right upper arm, with a 2-minute gap between each measurement. The blood pressure was measured to the nearest 2 mmHg. The cuff was inflated until the radial pulse could no longer be heard from the antecubital area, and then it was deflated at a rate of 2-3 mm Hg per second while the pulse was auscultated. When the cuff pressure was reduced, the onset of the sound was recorded as the subject's SBP, and the disappearance of the sound was recorded as the subject's Diastolic Blood Pressure (DBP).

2.5. Data Analysis Procedures

The Statistical Package for the Social Sciences (SPSS) –version 24 was used for data entry and analysis. Descriptive statistical measures including frequency and percentages were used to describe the participants' demographics. The Chi-square test inferential statistic was used to test associations between prehypertension and associated risk factors. A p-value of less than .05 was deemed significant.

3. Results

3.1. Students' Characteristics

The study was composed of 282 undergraduate nursing students from a private college for health sciences in south Saudi Arabia who satisfied the criteria for inclusion in the study. The majority of the participants were female (n = 236; 83.7 %). More than half (n= 170; 60.3 %) of the participants were < 22 years old. The mean of students' age (M±SD) was (21.85±2.26) year for males and (22.67±3.82) year for females with a range of 18-42years. About 8.9 % (n=25) of the sample were smokers, with more significance among male than female participants (37.0 % vs. 3.4 %; p=.003). The majority of the participants (n= 251; 89.0 %) were single.

Out of total 282 students (n=48; 17.0 %) were obese BMI equal or more 30, obesity was higher in male compared to female (21.7 % vs 16.2 %, while (n=72; 25.5 %) of students were overweight BMI between 24.9-29.9 kg/m^2 and higher in male compared to female (28.3 % vs 25.2 %). Results show the prevalence of normal depression, anxiety, and stress levels were 57.7 %, 42.3 %, and 64.0 %, respectively, with significant differences in abnormal depression and stress between the two genders (p=.001; .045) respectively out of the total of 282 students (n=49; 17.4 %) with either hypertensive or pre-hypertensive systolic, more significant in males than females (29.6 % vs. 14.4 %; p=.008). Regarding diastolic blood pressure, results also showed that 12.1 % (n=34) were either pre-hypertensive or hypertensive diastolic and not significant (13.1 % vs. 11.9 %; p>.05). Table 1 shows the socio-demographic characteristics of participants.

Table 1 Association between socio-demographic characteristics, DAS (Depression, Anxiety, and Stress), pre-hypertension with gender (N=282); * = significant (p <0.05)

Variables		Gender		χ2 test	*p* value
		Male N=46	Female N=236		
Age Group	< 22 years	32 (69.6)	138 (58.5)	1.978	.160
	≥ 22 years	14 (30.4)	98 (41.5)		

Continuation of Table 1

Employment Status	Yes	20 (43.5)	196 (83.1)	33.629	.003*
	No	26 (56.5)	40 (16.9)		
Smoking Status	Yes	17 (37.0)	8 (3.4)	53.686	.003*
	No	29 (63.0)	228 (96.6)		
Study Year	≤ 2nd Year	20 (43.5)	108 (45.8)	10.751	.005*
	3rd Year	18 (39.1)	45 (19.1)		
	≥ 4th Year	8 (17.4)	83 (35.2)		
Body Mass Index (BMI)	Underweight (<18.5 kg/m^2)	5 (10.9)	28 (12.0)	1.437	.697
	Normal (18.5-24.9 kg/m^2)	18 (39.1)	109 (46.6)		
	Overweight (25.0-29.9 kg/m^2)	13 (28.3)	59 (25.2)		
	Obesity (≥ 30 kg/m^2)	10 (21.7)	38 (16.2)		
Depression	Normal (0-4)	16 (34.8)	143 (60.6)	13.248	.001*
	Mild – Moderate (5-10)	17 (37.0)	66 (28.0)		
	Severe- Extremely Severe (≥11)	13 (28.3)	27 (11.4)		
Anxiety	Normal (0-3)	17 (37.0)	114 (48.3)	2.463	.292
	Mild – Moderate (4-7)	10 (21.7)	50 (21.2)		
	Severe- Extremely Severe (≥8)	19 (41.3)	72 (30.5)		
Stress	Normal (0-7)	24 (52.2)	161 (68.2)	6.190	.045
	Mild – Moderate (8-12)	11 (23.9)	48 (20.3)		
	Severe- Extremely Severe (≥13	11 (23.9)	27 (11.4)		
Systolic Blood Pressure (SBP)	Normotensive (<130 mmHg)	37 (80.4)	224 (94.9)	11.712	.001*
	Elevated (≥ 130 mmHg)	9 (19.6)	12 (5.1)		
Diastolic Blood Pressure (DBP)	Normotensive (<85 mmHg)	41 (89.1)	222 (94.1)	1.493	.222
	Elevated (≥ 85 mmHg)	5 (10.9)	14 (5.9)		

3.2 Prevalence of Hypertension

This study's overall prevalence of systolic prehypertension and hypertension was 15.2 % and 2.5 respectively (Fig. 1).

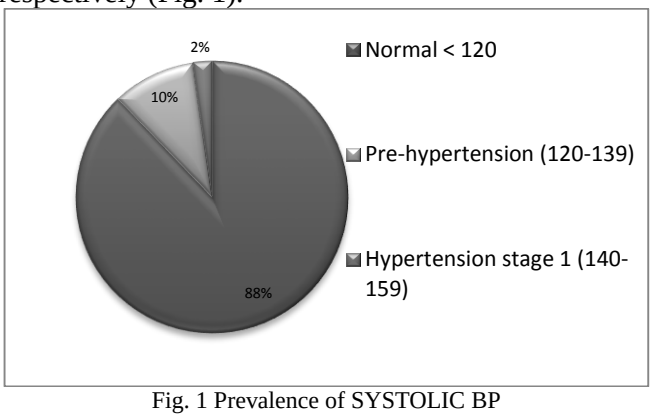

Fig. 1 Prevalence of SYSTOLIC BP

Regarding the prevalence of diastolic hypertension, fig. 2 showed that the overall prevalence of diastolic prehypertension was 9.2 %, while diastolic hypertension was 2.8 %.

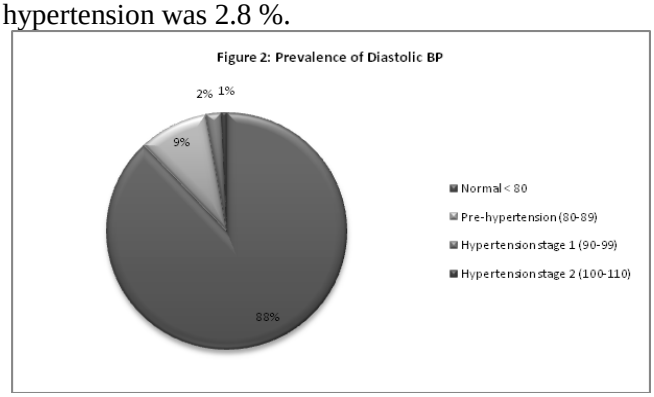

Fig. 2 Prevalence of diastolic BP

3.3 Age, Anthropometric Measurements, DAS, and Total DAS Stratified by either Systolic or Diastolic Pre-Hypertension

The results of mean age, anthropometric measurements, and psychological factors (depression, anxiety, stress, and total DAS) are illustrated in Table 2.

The overall mean of age was (22.38±2.97) in elevated systolic, while the overall mean of age was (22.79 ±3.34) in elevated diastolic and was not significantly different (p=.752).

The mean weight was higher in elevated SBP compared to normal (91.55±32.67 vs. 63.82±14.83) mmHg, which is highly significant (p<.001). Also, the mean weight was higher in elevated DBP compared to normal (86.76±34.21 vs. 64.38±15.58) and significantly different (p<.001). The mean BMI was higher in elevated SBP and DBP (32.36±9.51; 31.02±9.79) kg/m² compared to normal (24.23±5.02; 24.39±5.22) kg/m² respectively and was statistically significant different p<.001.).

A significant difference in waist circumference, hip circumference, and waist to height ratio was detected for elevated and normal systolic and diastolic pressure (p<.001). In contrast, waist to height ratio was not significant in both SBP and DBP. Among these psychological factors studied, depression and stress were significantly associated with diastolic prehypertension (p<.05). Whereas total DAS had a significant association with diastolic prehypertension (p=.021).

Table 2 Dependent predictors of age, anthropometric measurements, DAS, and Total DAS stratified by either Systolic Blood Pressure (SBP) or Diastolic Blood Pressure (DBP (N=282); * = Significant (p <0.05)

Dependent predictors	SBP		t test p value	DBP		t test p value
	Normal N=261	Elevated N=21		Normal N=263	Elevated N=19	
Age	22.55±3.67	22.38±2.97	.203 .839	22.52±3.64	22.79±3.34	.316 .752
Height	1.62±.08	1.67±.09	2.503 .013*	1.62±.08	1.66±.10	1.725 .086
Weight	63.82±14.83	91.55±32.67	7.299 <.001*	64.38±15.58	86.76±34.21	5.419 <.001*
Body Mass Index (BMI)	24.23±5.02	32.36±9.51	6.557 <.001*	24.39±5.22	31.02±9.79	4.961 <.001*
Waist circumference	77.14±12.84	95.14±24.21	5.682 <.001*	77.5±13.1	92.16±25.1	4.322 <.001*
Hip circumference	97.5±12.52	113.42±18.5	5.386 <.001*	97.84±12.64	110.37±20.93	3.956 <.001*
Waist Hip Ratio (WHR)	.80±.13	.83±.11	1.226 .221	.8±.13	.83±.1	.976 .330
Waist to Height ratio	.48±.08	.57±.12	4.992 <.001*	.48±.08	.55±.13	3.899 <.001*
Depression	4.84±4.81	6.9±5.43	1.874 .062	4.83±4.72	7.32±6.47	2.162 .031*
Anxiety	5.30±4.97	7.48±5.56	1.911 .057	5.33±5.02	7.32±5.07	1.664 .097
Stress	5.92±5.15	7.86±6.30	1.633 .104	5.85±5.11	9.0±6.48	2.549 .011*
Total DAS	16.06±13.64	22.24±16.29	6.181 .05*	16.00±13.54	23.63±17.21	2.326 .021*

3.4. Association between Socio-Demographic Characteristics, BMI, and Related Risk Factors by Considering Prehypertension Categories

The association between prehypertension of SBP, DBP, participants' characteristics, and related risk factors are shown in Table 3. National Cholesterol Education Program (US) criteria classified participants as either normal or elevated. Systolic blood pressure ≥ 130 mmHg or diastolic blood pressure ≥ 85 mmHg were considered elevated, while other readings of SBP and DBP < 130 mmHg and or /< 85 mmHg were normal. Female students (57.1 %) were more likely to get elevated systolic hypertension compared to males (42.9%) (p<0.001). There were significant differences existed between SBP prehypertension and other students' characteristics as employment status and BMI ($p < 0.05$), while DBP prehypertension was associated only with BMI (p=.017). Among these psychological factors studied, depression was significantly associated with SBP prehypertension (p=.027), and stress was significantly associated with prehypertension of DBP (p=0.26).

Table 3 Association between socio-demographic characteristics and related risk factors with hypertension (N=282); * = Significant (p <0.05)

Variable	Systolic Blood Pressure			Diastolic Blood Pressure		
	Normal N=261	Elevated N=21	χ2 test *p* value	Normal N=263	Elevated N= 19	χ2 test *p* value
Age						
<22	155 (59.4)	9 (42.9)	.093	155 (58.9)	9 (47.4)	1.419
≥22	106 (40.6)	12 (57.1)	.760	108 (41.1)	10 (52.6)	.234
Gender						
Male	37 (14.2)	9 (42.9)	11.712	41 (15.6)	5 (26.3)	1.493
Female	224 (85.8)	12 (57.1)	.001*	222 (84.4)	14 (73.7)	.222
Employment Status						
Yes	56 (21.5)	10 (47.6)	7.421	62 (23.6)	4 (21.1)	.063
No	205 (78.5)	11 (52.4)	.006*	201 (76.4)	15 (78.9)	.802
Smoking Status						
Yes	21 (8.0)	4 (19.0)	2.912	24 (9.1)	1 (5.3)	.327
No	240 (92.0)	17 (81.0)	.088	239 (90.9)	18 (94.7)	.567
Study Year						
≤ 2nd Year	120 (46.0)	8 (38.1)	.668	122 (46.4)	6 (31.6)	1.611
3rd Year	57 (21.8)	6 (28.6)	.716	58 (22.1)	5 (26.3)	.447
≥ 4th Year	84 (32.2)	7 (33.3)		83 (31.6)	8 (42.1)	
BMI						
Normal (BMI <29.9)	225 (86.2)	9 (42.9)	25.860	222 (84.4)	12 (63.2)	5.667
Obese (BMI ≥ 30)	36 (13.8)	12 (57.1)	<.001*	41 (15.6)	7 (36.8)	.017*
Depression						

Continuation of Table 3

Normal (0-4)	152 (58.2)	7 (33.3)	4.902	151 (57.4)	8 (42.1)	1.689
Abnormal (≥5)	109 (41.8)	14 (66.7)	.027*	112 (42.6)	11 (57.9)	.194
Anxiety						
Normal (0-3)	124 (47.5)	7 (33.3)	1.570	125 (47.5)	6 (31.6)	1.812
Abnormal (≥4)	137 (52.5)	14 (66.7)	.21	138 (52.5)	13 (68.4)	.178
Stress						
Normal (0-7)	174 (66.7)	11 (52.4)	1.758	177 (67.3)	8 (42.1)	4.985
Abnormal (≥8)	87 (33.3)	10 (47.6)	.185	86 (32.7)	11 (57.9)	.026*

3.5. Predictors of Pre-Hypertension

Table 4 shows the multivariate binary logistic regression results for the predictors of prehypertension. In this final logistic model, Negelkerke's R square showed that about 25.6% and 9.0 % of the variation in systolic and diastolic prehypertension is explained by the variables in the model. There was multicollinearity, and there was a significant interaction between the independent variables in the model. The results indicated that obesity was more than 9 times higher in getting elevated systolic prehypertension than normal (Adj. OR: 8.573; 95% CI: 1.59 - 3.84). Also, obesity was more than 4 times higher in getting elevated diastolic prehypertension than normal (Adj. OR: 3.536; 95% CI: 1.282 - 9.757). The respondents with abnormal depression had almost twice elevated systolic prehypertension than normal (Adj. OR: 2.084; 95% CI: .723 – 6.002). In addition, respondents with abnormal stress also had almost 3 times in developing elevated diastolic prehypertension compared to normal (Adj. OR: 3.115; 95% CI: 1.185 - 8.191).

Table 4 Multivariate Logistic Regression analysis showing the predictors of pre-hypertension (n=282) ; * = Significant (p <0.05)

Variables	Odds Ratio	P-value	95% CI
SBP-Predictors			
Gender			
Male	Ref		
Female	2.811	.081	.879-8.986
Employment Status			
Yes	Ref		
No	.527	.263	.172-1.617
BMI			
Normal (BMI <29.9)	Ref		
Obese (BMI ≥ 30)	.117	.001*	.043-.313
Depression			
Normal (0-4)	Ref		
Abnormal (≥5)	.480	.174	.167-1.383
DBP-Predictors			
Marital Status			
Single	Ref		
Married	.036	.008*	.003-.421
BMI			
Normal (BMI <29.9)	Ref		
Obese (BMI ≥ 30)	.283	.015*	.102-.780
Stress			
Normal (0-7)	Ref		
Abnormal (≥8)	.321	.021*	.122-.844

4. Discussion

The present study reports the prevalence of prehypertension and related risk factors among undergraduate nursing students. Many diagnostic criteria were used to define systolic and diastolic prehypertension to improve the relations between the study findings and the findings of others. When the most recent threshold for the diagnosis of hypertension was applied [18], 17.1 % of students were diagnosed with systolic prehypertension (i.e., blood pressure > 130mmHg), and 16.0 % of the students were diagnosed with diastolic prehypertension (i.e., blood pressure > 80mmHg). The prevalence of prehypertension in the present study is lower than the prevalence reported in previous studies [7, 8, 19, 20]. These results seem to be in line with current works of literature [21]. The difference might be as this study is the first of its kind, focusing on a sample of young students (average age 23.18±4.31 years old) and the higher proportion of females (83.7 % vs. 16.3 %). In Arab countries, the prevalence of prehypertension varies greatly. The prevalence of prehypertension in the present study was similar to the findings of Alhawari and colleagues [21]. Differences in prevalence rates between countries could be due to differences in the age groups constituting the study populations investigated, different cut-off points in determining the level of hypertension, socio-cultural differences, sampling methods, study settings, and timeframes of the studies.

The prevalence of prehypertension is gender-related and significantly higher among males than in females, consistent with previous studies' study findings [22, 23]. However, the results of the present study were in contradiction with other studies that found that elevated blood pressure is more common in females [24, 25]. Studies on hypertension from developed and developing countries showed a higher prevalence in males than females in both countries. This variation may be explained by the high prevalence of overweight, the sedentary lifestyle, and unhealthy diet in our region.

Although this study was demonstrated higher SBP and DBP in obese patients, the BMI of elevated systolic and diastolic hypertension were (32.36±9.51; 31.02±9.79) respectively and statistically significant. Early detection of high blood pressure is usually difficult in young adults, mostly due to underestimating the long-term effect of high blood pressure and BMI and the relatively minor effect of these diseases on the well-being of young compared to old.

These findings highlight the significance of students' body weight and the relevance of alerting students about this association. All physicians, particularly those in primary care settings, should be aware of students' BMI and encourage them to lose weight.

In this study, the prevalence of elevated systolic and diastolic pressure with age is not statistically significant. The prevalence of elevated systolic and diastolic hypertension in age groups (≥ 22 years) is 42.9% and 52.6%, respectively. More than half of the students in this study were under 22, with the average age being 22.38±2.97, and the maximum age reported was 42 years. An increase in age-related hypertension is seen in almost every population [26]. Due to the relatively young age group of students in this study compared to other studies in the general population, the increased likelihood of prehypertension with increasing age could not be noticed. According to a previous study conducted in India, the prevalence of prehypertension remained steady until the fifth decade of life [27].

The present study reveals that the risk of developing prehypertension is not significantly associated with students' smoking status. However, other studies state that smoking is a risk factor for hypertension by accelerating arterial aging (loss of elasticity) [28] because of the small number of smoker students: 25 of 282 in total (8.9 %) and four of them were only pre-hypertensive. Thus, this phenomenon of "smoking" is not common in Saudi Arabia because it is prohibited in our religion.

The link between depression, anxiety, stress, and elevated blood pressure has been documented in the literature [17]. Depression and stress levels were both predictive of systolic and diastolic prehypertension. Compared to students who did not have depression, depressive students were more than twice as likely to develop prehypertension. The link between prehypertension and depression could be explained indirectly by low chemical dopamine levels in depressed people. In both bivariate and multivariate analyses, stress was linked with diastolic prehypertension. Compared to normal, stressed students were approximately three times more likely to develop prehypertension. Students in pursuit of higher professional education in a highly competitive environment such as that found in applied medical science programs are more overloaded with their curriculum, personal issues, and family life issues as causes of stress which influence their blood pressure. The current findings are consistent with previous studies [12, 17]. The finding of this study is also consistent with Balami et al. (2014), which showed levels of anxiety were not significantly associated with prehypertension [29].

4.1. Limitations

This study has a few limitations. Firstly, as in many population-based studies on hypertension, blood pressure was based on the average of two measurements at a single visit. More accurate measurement is needed, such as 24-hour ambulatory measurements. Secondly, the sample is not representative of the undergraduate nursing students of the private college. Our sample consisted of students from one college only. Finally, it could not exclude the effects of nutritional habits on blood pressure while conducting the study.

5. Conclusion

The findings of this study can be considered both valuable and relevant because they added baseline data on the prevalence of prehypertension and relevant risk factors. Prehypertension prevalence is higher in males, and the incidence increases with BMI. It was also observed that systolic prehypertension is more common than diastolic prehypertension. In this study, depression and stress were changeable psychological factors of prehypertension. Awareness of the diagnosis of prehypertension and early detection and treatment, and adherence to a healthy lifestyle are important to decrease hypertension incidence.

According to the predictors that have been studied and reviewed above, it is believed that factors like obesity, gender, and others have a significant effect on determining prehypertension. The author recommends following many procedures to minimize the effect of having prehypertension. Firstly, encouraging people at risk to or diagnosed with prehypertension to adopt healthy lifestyle modifications, including regular physical activities, quitting smoking, a healthy diet, and stress reduction measures. Evidence showed that healthy lifestyles help to control and reduce

hypertension. Secondly, increasing community awareness toward blood pressure goals and how to deal with them. Thirdly, continuous blood pressure monitoring, using a systematic follow-up, adopting effective guidelines, and utilizing the revolution in technology. Future studies are warranted to focus on implementation strategies for hypertension prevention and control.

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