



Hypertension and Prehypertension among Undergraduate Students in Sohag University

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ABSTRACT

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Background: Many people with high blood pressure are not aware they have the disease until it has progressed. Awareness and provision of information on the risk factors for hypertension are essential for prevention. **Objective:** To estimate the prevalence and risk factors of hypertension and prehypertension among undergraduate students. **Method:** Analytic cross-sectional study was conducted at Sohag University during academic year 2021-2022 among five hundred undergraduate students. Data were collected by questionnaire and physical and biochemical measurements. **Results:** Five hundred students were included in the current analysis. The mean age was 21.57 ± 1.96 years and 52.6% were females. The prevalence of prehypertension was 35.8% and hypertension was 4.2%. Older students and those who had low socio-economic status had higher prevalence of prehypertensive (59.1 and 45.5%, respectively) and hypertensive (20.5% and 9.1%, respectively). Students from practical faculties had higher prevalence of prehypertensive (52.2%) and hypertensive (6.2%). Students who were physically inactive and those who consumed less than five servings of fruits-vegetables/day had higher prevalence of prehypertension (67.0% and 52.9%, respectively) and hypertension (17.4% and 6.7%, respectively). Most of these factors remained significant in multivariate analysis. **Conclusions:** There is considerable prevalence rates of prehypertension and hypertension among undergraduate students. Unhealthy lifestyle including physical inactivity and low consumption of fruits and vegetables per day increase the risk of high blood pressure in these students. The identified association between these modifiable risk factors and elevated blood pressure emphasizes the importance of primary prevention interventions for young adults.

INTRODUCTION

Hypertension is the most important risk factor for CVDs in most studies. Hypertension can be defined as a condition in which the blood pressure, the strength of blood flow through blood vessels is persistently high, (140/90 mmHg or higher) is considered hypertension.¹ Prevalence of

hypertension is a major health issue in Egypt affecting 26.5% (~15 million people) of Egyptian population.² Prehypertension the intermediate stage between hypertension and normal blood pressure, it is associated with subclinical atherosclerosis and target organ damage.³ In line with the global trend,

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In Egypt a survey of chronic disease and their risk factors using the WHO STEPwise was conducted in 2017, the survey revealed that 29.5 % of surveyed population (total of 6680 adult population) had hypertension. Significant risk factors to hypertension included smoking (23% were current tobacco users), physical inactivity (one in every four Egyptians was physically inactive).⁴ Several studies were done among university students in Egypt which found that prehypertension prevalence is 47.4%⁵, prevalence of hypertension is 6.1%.⁶ Study among university students in Saudi Arabia revealed that 14.6% were hypertensive and 29.2% were prehypertensive.⁷ Based on survey involved 4649 undergraduate university students from seven ASEAN countries., 19% of undergraduate university students had prehypertension, 6.7% hypertension.⁸ Since preventing hypertension is the most effective way to reduce the burden of this condition, identifying its risk factors is essential for primary prevention. Both controllable and non-modifiable risk factors exist for hypertension. People can't change a number of risk factors that increase their chance of having hypertension, such as age and hereditary variables from their family history.⁹ It is well known that the older people get the more likely to develop high blood pressure as getting older blood vessels lose some of their elasticity which can contribute to high blood pressure.¹⁰ However, over the last few decades there has been a noticeable change in the attitude towards hypertension in young adults the as prevalence of hypertension has risen to epidemic proportions among the young (defined as adults <30 years old). This rapid increase is concerning because it foreshadows an increase in cardiovascular disease and cerebrovascular disease in the coming years.¹¹ Family history of hypertension established before the age of 55 years old is the biggest risk factor for high blood pressure in the offspring independently of measurable environmental factors.¹² Excessive salt intake, poor potassium intake, obesity and overweight, physical inactivity, smoking, and psychosocial stresses are modifiable risk factors for hypertension. Dietary practices and adjustments are crucial for managing and preventing hypertension. The Dietary Approaches to Stop Hypertension trial (DASH) findings, which advocate a diet high in fruits,

vegetables, low-fat dairy products, and low in salt and saturated fats, are generally the basis for dietary recommendations to lower the risk of hypertension.¹³ Higher sedentary behavior is associated with elevated blood pressure and breaking up prolonged periods of sedentary time help to maintain normal blood pressure level.¹⁴ It has been discovered that smoking cigarettes increases the risk of hypertension through a number of different mechanisms. Smoking tobacco raises inflammation, alters metabolism, and increases sympathetic activity in the central nervous system. These many pathways interact to produce mitochondrial oxidase oxidative stress, which in turn causes hypertension.¹⁵ Stress has become a part of students' academic lives. Academic stress is defined as unpleasant situations that arise as a result of many demands placed on students' shoulders.¹⁶ Obesity and hypertension have a well-established relationship. Cross-sectional survey of 398 students from Pharos University, Alexandria showed that 28.9% of the students were overweight, 11.8 % were obese.¹⁷ Although the pathogenesis of diabetes mellitus and hypertension differs, they have many characteristics. Both are classified as non-communicable illnesses that are brought on by comparable unhealthy lifestyles. Additionally, because both diseases affect entire body circulation, their implications are also comparable.¹⁸

METHOD

A cross-sectional study was conducted among 500 university students involved in the at Sohag University during academic year 2021-2022 among undergraduate students

Sample size was calculated using the formula $N = \frac{Z^2 p (1-p)}{d^2}$ where N = sample size, Z = 1.96 and d=0.05 precision. The expected prevalence of problem was set at 47% according to Soliman et al, 2014.⁵ So according to this equation N=383. To compensate for the dropouts/incomplete questionnaires, the sample size increased to 500.

In order to have a representative sample from both theoretical and practical faculties, a multi-stage sampling approach was done, the first phase: all faculties were stratified in two groups theoretical and practical then three theoretical (faculty of education, Arts, and Commerce) and three practical

Table 1: Socio-demographic characteristics of the study participants

Variables	No	%
Age (years)		
Mean ± SD	21.57 ± 1.96	
median (Range)	21.0 (18-27)	
18 - 21	258	51.6%
22 - 24	198	39.6%
25 - 27	44	8.8%
Gender		
Male	237	47.4%
Female	263	52.6%
College		
Practical	291	58.2%
Theoretical	209	41.8%
Grade		
First	88	17.6%
Second	138	27.6%
Third	143	28.6%
Fourth	94	18.8%
Fifth	19	3.8%
Sixth	18	3.6%
Residence		
Urban	260	52.0%
Rural	139	27.8%
Semi urban	101	20.2%
Marital status		
Single	471	94.2%
Married	29	5.8%
Socioeconomic level		
Low	11	2.2%
Medium	314	62.8%
High	175	35.0%

SD: standard deviation

(Faculty of Medicine, Science. and Veterinary Medicine) were chosen randomly, then the second stage: Students were then split into strata reflecting the grades in each faculty and on the basis of the ratio of students in each grade to the faculties overall enrollment, 1 or 2 classes were randomly chosen from a list that includes all classes in each grade then the last third stage: simple random sample was taken from each section.

Population: Inclusion criteria included undergraduate students > 18 years old who agree to participate in the study. Exclusion criteria included

Table 2: Prevalence of prehypertension and hypertension among the study participants

Characteristics	Mean ± SD
Blood pressure (mmHg)	
Systolic	115.82 ± 11.52
Diastolic	75.58 ± 7.01
Systolic blood pressure groups (%)	
Normal (<120)	300 (60%)
Prehypertension (120-139)	179 (35.8%)
Stage 1 hypertension (140-159)	21 (4.2%)
Diastolic blood pressure groups (%)	
Normal (<80)	314 (62.8%)
Prehypertension (80-89)	173 (34.6%)
Stage 1 hypertension (90-99)	13 (2.6%)
Systolic / diastolic blood pressure groups (%)	
Normotensive (<120/<80)	300 (60%)
Prehypertension (120-139/80-89)	179 (35.8%)
Hypertension (140-159/90-99)	21 (4.2%)

students who refuse to participate in the study, pregnant female students, students who have communication barriers, comorbidities other than diabetes mellitus and obesity. The Scientific Research Ethical Committee of the Faculty of Medicine at Sohag University approved the study protocol. University students gave their informed written consent to participate in the study after being made aware of its purpose. The participants were assured of the confidentiality and privacy of their contribution. Data were collected through personal interview with students.

The questionnaire included three sections. First section: socio-demographic information. Second section: Behavioral habits related to risk factors of hypertension. Third section: Perception of Academic Stress Scale. Socio-demographic information (including: gender, age, faculty, grade, marital status and socioeconomic status (SES). Utilizing a validated instrument, the socioeconomic status was scaled.¹⁹ The appendix contains the cut-off points to be utilized for SES categorization once the overall SES score was determined. After that, the discrete scores for each case were added together to create a single index, which yielded the total score, which ranged from 0 to 48, where a high level was indicated as

Table 3: Socio-demographic characteristics of the study participants by blood pressure groups

	Normal (N=300, 60%)	Pre- hypertension (N=179, 35.8%)	Hypertension (N=21, 4.2%)	P-value*
Gender				
Males	152 (64.1%)	80 (33.8%)	5 (2.1%)	0.039
Females	148 (56.3%)	99 (37.6%)	16 (6.1%)	
Age (years)				
18 - 21	208 (80.6%)	43 (16.7%)	7 (2.7%)	<0 .001
22 - 24	83 (41.9%)	110 (55.6%)	5 (2.5%)	
25 - 27	9 (20.5%)	26 (59.1%)	9 (20.5%)	
College				
Practical	121 (41.6%)	152 (52.2%)	18 (6.2%)	<0 .001
Theoretical	179 (85.6%)	27 (12.9%)	3 (1.4%)	
Grade				
First	84 (95.5%)	4 (4.5%)	0 (0.0%)	<0.001
Second	99 (71.7%)	39 (28.3%)	0 (0.0%)	
Third	79 (55.2%)	62 (43.4%)	2 (1.4%)	
Fourth	34 (36.2%)	49 (52.1%)	11 (11.7%)	
Fifth	2 (10.5%)	13 (68.4%)	4 (21.1%)	
Sixth	2 (11.1%)	12 (66.7%)	4 (22.2%)	
Marital status				
Single	281 (59.7%)	170 (36.1%)	20 (4.2%)	0.883 [#]
Married	19 (65.5%)	9 (31.0%)	1 (3.4%)	
Residence				
Urban	165 (63.5%)	86 (33.1%)	9 (3.5%)	0.530
Rural	80 (57.6%)	52 (37.4%)	7 (5.0%)	
Semi urban	55 (54.5%)	41 (40.6%)	5 (5.0%)	
Socioeconomic level				
Low	5 (45.5%)	5 (45.5%)	1 (9.1%)	< 0.001
Medium	155 (49.4%)	140 (44.6%)	19 (6.1%)	
High	140 (80.0%)	34 (19.4%)	1 (0.6%)	

P value was calculated by *Chi-Square Test or # Fisher's Exact Test wherever suitable

33.6–48, a medium level as 19.2 to < 33.6 and a low level as less than <19.2. Second section: questions derived from (WHO STEPS) instrument STEP1 (WHO Stepwise approach to NCD risk factors, 2018) .²⁰These included questions about (Behavioral habits) risk factors of hypertension. Tobacco use, Physical activity, and dietary habits (such as food frequency questionnaire of usual day for fruit and vegetable consumption). Third section: The academic stress: Perception of Academic Stress Scale (PAS) was used²¹Academic stress was assessed using the 18 items representing different sources of academic stress. Responded on a 5-point Likert

scale: strongly disagree (1) to strongly agree (5). Five items scoring were reversed (1= strongly disagree to 5=strongly agree).

Measurements: To measure blood pressure a calibrated digital automatic blood pressure monitor was used after preparing the participant using the standard WHO criteria. Ask the participant to sit quietly and had rest for 5 minutes, three measurements had been taken within 5-min interval. The average of three readings recorded as individual's blood pressure. If systolic BP was ≥ 140 and/or diastolic BP was ≥ 90 two other readings in different occasions were taken to confirm sustained

Table 4: Relation between risk factors and blood pressure status among participants

	Normal (N=300, 60%)	Pre- hypertension (N=179, 35.8%)	Hypertension (N=21, 4.2%)	P-value
Smoking				
Smoker	47 (51.6%)	42 (46.2%)	2 (2.2%)	0.058*
Nonsmoker	253 (61.9%)	137 (33.5%)	19 (4.6%)	
Diet				
<5 servings of fruits and vegetables/ day	85 (40.5%)	111 (52.9%)	14 (6.7%)	< 0 .001*
≥5 servings of fruits and vegetables/ day	215 (74.1%)	68 (23.4%)	7 (2.4%)	
Physical activity				
Physically active	282 (73.2%)	102 (26.5%)	1 (0.3%)	< 0.001*
Physically inactive	18 (15.7%)	77 (67.0%)	20 (17.4%)	
Total academic stress score				
Mean ± SD	3.30 ±.454	2.47±.423	2.11 ± .32	< 0.001**
Median (range)	3.34 (1.93-4.54)	2.41 (1.29-3.75)	2.10 (1.28-2.74)	

*P value was calculated by *Chi-Square test or **Kruskal –Wallis test wherever suitable*

elevation of blood pressure. Measurement of weight and height were taken according to WHO STEPS instructions. To measure weight a portable mechanical weighting scale was used. To measure height, a portable height measuring device was used. Blood glucose tests were taken to measure for blood glucose levels. To obtain accurate results, participants fast for at least 8 hours before fasting blood glucose level (FPG) was taken . Blood was collected from small prick on the finger. Record the result for fasting blood glucose in mg/dL by using digital blood glucose level measuring device. Data collection was done in 2-3 settings. In the first setting completing the questionnaire, measurement of blood pressure, weight, and height and in the second setting measurement of fasting blood glucose level. If blood pressure level is ≥ 140 and/or 90 third setting was needed to record third reading of blood pressure. Coordination was made with students to avoid interfering with their schedule. All instruments were checked before taking measurements in each day. Calibration of digital automatic blood pressure monitor was done by using mercury sphygmomanometer at the beginning of each day.

Definition of outcomes and exposures: Hypertension and pre-hypertension are both defined and classified

according to the Seventh Report of the Joint National Committee on Prevention, Detection, Evaluation and Treatment of High Blood Pressure” or JNC-7. ²² Normal: systolic less than 120 mm Hg/ diastolic less than 80 mm Hg. Pre-hypertension: systolic 120–139 mm Hg and/or diastolic 80–89 mm Hg. Hypertension stage I: Sustained high blood pressure (Systolic 140-159 and/or Diastolic 90-99 mmHg) or reported use of anti-Hypertensive medication(s). Hypertension stage II: systolic ≥ 160 mm Hg or greater and/or diastolic ≥ 100 mm Hg. Diabetes mellitus: Normal (FPG): less than 100 mg/dl. Pre-diabetes (FPG): 100 mg/dl to 125 mg/dl. Diabetes mellitus is diagnosed at fasting blood sugar of greater than or equal to 126 mg/dl or reported regular use of medications for diabetes.²³ BMI = weight in kilograms divided by the height in square meters. The World Health Organization (WHO) defines the following cut-points for BMI; <18.5 kg/m² as underweight, 18.5-24.9 kg/m² as healthy weight, 25.0-29.9 kg/m² as overweight, and ≥ 30 kg/m² as obese. Sufficiently active participants were engaged in at least (1) 30-minute of moderate-intensity activity or walking per day on at least five days of a typical week; or (2) 20-minute of vigorous-intensity activity per day on at least three days of a typical week; or (3) 5 days of any combination of

Table 5: Logistic regression analysis for risk factors of pre-hypertension compared to normal blood pressure

Variable	Univariate		Multivariate	
	UOR (95%CI)	p-value	AOR (95%CI)	p-value
Gender				
Female vs male	1.27 (0.88 - 1.84)	0.206	0.84 (0.31-2.28)	0.738
Age				
18 – 21 vs 25-27	0.07 (0.03-0.163)	< 0.001	0.10 (0.02-0.50)	0.005
22 – 24 vs 25-27	0.46 (0.20 - 1.03)	0.059	0.67 (0.15- 3.07)	0.606
College				
Practical vs theoretical	8.33 (5.21-13.3)	< 0.001	3.07 (1.24- 10.86)	0.018
Year of study				
≤third vs ≥ fourth	0.21 (0.13-.32)	< 0 .001	0.94 (0.35 -2.51)	0.904
Socioeconomic status				
High vs low	0.24 (0.07-0.89)	0.032	0.11 (0.01 - 1.15)	0.065
Medium vs low	0.90 (0.26-3.19)	0.874	0.54 (0.06 - 4.91)	0.580
BMI				
Normal vs obese	0.02 (0.01-0.06)	< 0.001	0.04 (0.01 - 0.22)	< 0.001
Overweight vs obese	0.50 (0.21 -1.20)	0.122	0.54 (0.13 - 2.24)	0.393
No family history of hypertension				
	0.05 (0.03- 0.09)	< 0 .001	0.10 (0.04- 0.25)	< 0.001
Smoking				
<5 servings of fruits and vegetables/ day	4.13 (2.79-6.11)	< 0 .001	2.83 (1.13- 7.11)	0.027
Physically activity				
Normal glycemic status	0.09 (0.05-0.15)	< 0 .001	0.25 (0.09-0.70)	0.008
Total Stress score				
	0.61 (0.39- 0.96)	0.032	0.68 (0.23- 2.02)	0.484
	0.02 (0.01- 0.05)	< 0.001	0.10 (0.03 - 0.30)	< 0 .001

walking and moderate or vigorous-intensity activities achieving 600 -1500 MET-minute per UOR, Unadjusted odds ratio; AOR, adjusted odds ratio. CI, Confidence Interval at 95%. Some categories are combined to avoid zero observation in some categories

week. Inactive participants were those who did not meet one the above-mentioned criteria <600 MET minute per week. Adequate diet was a diet including consumption of 5 servings of fruits and vegetables per day. Inadequate diet was a diet including consumption of less than 5 servings of fruits and vegetables per day. Standard serving of fruit or vegetable: One standard serving of fruits and vegetables is equivalent to 80 grams, translated into different units of cups depending on type of vegetables and fruits. For vegetables this refers to one cup of raw, one-half cup of cooked vegetables.

For fruits, this refers to one medium-sized piece of fruit (banana, apple, etc.) or a half cup of raw fruit.

Statistical analysis: SPSS version 25 was used for data analysis and tabulation. The mean and standard deviation were used to describe quantitative data. Numbers and percentages were used to convey qualitative data. Before conducting any statistical analysis, the Kolmogorov-Smirnov test was used to verify that the data were normal. Fisher's Exact Test and the Pearson Chi-Square Test were the statistical tests used to get the P-value. Mann Whitney and Kruksal Wallis are two statistical tests used to compare two or more independent samples with non-parametric data. A P value equal to or less than 0.05 was taken to be statistically significant. Odds ratio was calculated by Univariate & multivariate multinomial logistic regression to determine factors affecting blood pressure status of students. The

Table 6: Logistic regression analysis for risk factors of hypertension compared to normal blood pressure

Variable	Univariate		Multivariate	
	UOR (95%CI)	p-value	AOR (95%CI)	p-value
Gender				
Female vs male	3.28 (1.17 - 9.20)	0.023	0.48 (.02 - 11.42)	.649
Age				
18 - 21 vs 25-27	0.04 (0.01-0.14)	< 0.001	0.11 (0.01 -1.19)	0.069
22 - 24 vs 25-27	0.07 (0.02 -0.25)	< 0.001	0.05 (0.01- 0.57)	0.016
College				
Practical vs theoretical	8.88 (2.55-30.79)	0.001	0.63 (0.05 - 7.97)	0.722
Year of study				
≤third vs ≥ fourth	0.02 (0.00-0.07)	< 0.001	0.03 (0.00 - 0.30)	0.004
Socioeconomic status				
High vs low	0.04 (0.00-0.66)	0.025	0.02 (0.00- 2.85)	0.118
Medium vs low	0.61 (0.07-5.52)	0.663	0.08 (0.00- 9.31)	0.293
BMI				
Normal vs obese	0.02 (0.01- 0.07)	< 0.001	0.23 (0.02 - 3.20)	0.274
Overweight vs obese	0.08 (0.02- 0.31)	< 0.001	0.05 (0.01 -0.97)	0.047
No family history of hypertension				
	0.06 (0.02-0.15)	< 0.001	0.05 (0.01 - 0.32)	0.002
Smoking				
<5 servings of fruits and vegetables/ day	5.06 (1.97-12.97)	0.001	10.5 (1.42 - 78.02)	0.021
Physically activity	0.00 (0.00 - 0.03)	< 0.001	0.01 (0.00 - 0.10)	< 0.001
Normal glycemic status	0.87 (0.28- 2.69)	0.810	0.76 (0.06 - 9.00)	0.825
Total Stress score	0.00 (0.00- 0.01)	< 0.001	0.00 (0.00- 0.15)	0.001

results were presented to fulfill the objectives of the study.

RESULTS

UOR, Unadjusted odds ratio; AOR, adjusted odds ratio. CI, Confidence Interval at 95%. Some categories are combined to avoid zero observation in; some categories. Table (1) shows the socio-demographic characteristics of the studied university students, including (500) students from different faculties. More than half (52.6%) of the studied students were females. The mean age of the studied students was 21.57 ± 1.96 years with a range of (18-27) years. As regards faculties, the studied students were from practical and theoretical faculties (58.2% and 41.8%, respectively). The studied students were from different grades from first to sixth grades (17.6%, 27.6 %, 28.6%, 18.8%, 3.8%, 3.6%) respectively. Most participants were

singles (94.2%). More than half of the studied students were from urban areas (52%). The largest percentage of studied students had Medium socioeconomic level (62.8%). Table (2) shows blood pressure status among participants. Mean systolic blood pressure was 115.82 ± 11.52 mm Hg. The mean of diastolic blood pressure was 75.58 ± 7.01 mm Hg. Most students (60%) were normotensive. The prevalence of prehypertension was (35.8%) and hypertension was (4.2%). Table (3) shows the relation between blood pressure status and socio-demographic characteristics among participants. Older students and those who had low socioeconomic status had higher prevalence of prehypertensive (59.1 and 45.5%, respectively) and hypertensive (20.5% and 9.1%, respectively). Students from practical faculties had higher prevalence of pre-hypertensive (52.2%) and

hypertensive (6.2%). Table (4) shows relation between risk factors that affect blood pressure status among participants. Students who were physically inactive and those who consumed less than five servings of fruits-vegetables/day had higher prevalence of prehypertension (67.0% and 52.9%, respectively) and hypertension (17.4% and 6.7%, respectively). Table (5) shows logistic regression analysis for risk factors of prehypertension (vs. normal blood pressure). According to Univariate regression Age group (18 - 21) was less likely to be prehypertension (OR=.072). Students in practical faculties were (8.32) more likely to be prehypertension. Students of high socioeconomic level were less likely to be prehypertension (OR=.243). Smoker students were (1.65) times more likely to be prehypertension. The probability of having prehypertension increased among students who consumed < 5servings of fruits and vegetables/day (OR= 4.129). Students with normal BMI was less likely (OR= .023) and having normal glycemic status was less likely to be prehypertension (.610). Multivariate logistic regression revealed that students in practical faculties (OR= 3.068) were more likely to be prehypertension. While Students in age group (18 - 21) (OR=.101), Students with no family history of hypertension (OR=.098), physically active students (OR=.251), having higher score in academic stress scale (OR= .097) were less likely to be prehypertension. These findings are statistically significant. Table (6) shows logistic regression analysis for risk factors hypertension (vs. normal blood pressure). Using Univariate analysis, the current findings revealed that females (OR = 3.28), Students in practical college (OR= 8.87), Consumption of less than five servings of fruits and vegetable/day (OR=5.059) were associated with a higher prevalence of hypertension. While high socioeconomic status (OR=.036), Students with no family history of hypertension (OR= .058), Physically active students (OR=0.003), Students with normal body weight (OR=.020) , Having higher score in academic stress scale (OR= .002) were less likely to be hypertensive. Multivariate regression shows that risk of hypertension increased among students who consumed < 5servings of fruits and vegetables/ day (OR= 10.52). While Students with no family history of hypertension (OR= .048), physically active students (OR= .007), having higher

score in academic stress scale (OR= .008) were less likely to be hypertensive. These findings are statistically significant.

DISCUSSION

This current study included 500 students, 35.8% of the participants were pre-hypertensive and 4.2% were hypertensive. Family history of hypertension was positive in 33.4% among students. Regarding lifestyle related risk factors, 18.2% were smokers, 23% were physically inactive and 42% of students reported inadequate daily consumption of fruits and vegetables according to WHO recommendation. Study conducted in Al-Azhar Cairo University in Egypt among 1500 male students which reported that the prevalence of hypertension was 6.1%.⁶ Dissimilarities in sampling methods and target studied population as the previous mentioned study in Cairo university was carried among male students only with larger sample size might posed effect which might have generated such differences. Another study used a comparative cross-sectional design in the Egyptian cities of Damietta and Port-Said. There were 2,029 undergraduates in the sample. In Damietta University, the rate of cases of hypertension was 26.5%, whereas in Port-Said University, it was 18.1%.²⁴ Study was conducted in university in Chennai among 403 students showed that the prevalence of pre-hypertension and hypertension was 49.6% and 19.1% among students.²⁵ The study in Chennai was conducted among students of practical faculties only who might be exposed to additional stressors linked to their academic work which may account for the higher prevalence of prehypertension and hypertension. Cross sectional study was carried out among young adults in three universities in Morocco using WHO STEP wise approach, The results reported that 9.09% of the students were hypertensive.²⁶ According to Alhawari et al, who assessed blood pressure status among 505 university students in Jordan , results showed that 13.5% out of total number were hypertensive.²⁷ The prevalence of prehypertension and hypertension documented in previous mentioned studies was higher than the prevalence in the present study. These regional variations in prevalence may also be related to variation in socioeconomic, demographic and geographic characteristics. According to

observational study among 2895 students from 10 public universities that represent different geographic areas in Egypt reported that 2% of students were shown to be hypertensive and 15% were pre-hypertensive.²⁸ Previous study conducted on 506 undergraduates in three universities in Lagos State, Nigeria where 2.8% of the study subjects were hypertensive.²⁹ Similarly, another study in India among 1,933 students showed that 1.6% of students were diagnosed as hypertensive.³⁰ So prevalence of hypertension in these mentioned studies are lower than the present study. It has been demonstrated that a circumstantial lifestyle is linked to the prevalence of both pre- and hypertension. Consequently, variations in context were most likely the cause of the variations in prevalence. In our study regarding gender, hypertension was higher in females compared to males. This was in contrast with a study done in Nigeria which reported that prevalence of hypertension was 5.4% among the studied university students being higher proportion (10%) among males.³¹ We postulated that the observed disparities may have been influenced by the disproportionate gender participations across studies. Also, it had been noticed that females are exposed to other stressors not studied in the current study. This may contribute to blood pressure elevation. In Malaysia 410 undergraduates participated in study. Results showed that 10% had hypertension and there was no significant association between smoking and hypertension. In our findings prevalence of hypertension was lower, however our results agreed with such study as there is no significant association between smoking and hypertension.³² Study at Ajman University in United Arab Emirates shown that hypertension prevalence was 13.2%. Prehypertension prevalence was 41.6 %. This was higher than findings in our study.³³ The difference may be due to difference in lifestyle, dietary patterns, and physical activity between the two populations as there was high smoking percentage 76.4 % and lack of physical activity 78.8 % among students in Ajman University. Several risk factors have been reported to have a significant effect on the development of pre-hypertension. The results in the current study is in line with study in East Malaysia which reported that family history of hypertension OR= 2.30, reduced physical activity OR= 3.43 and cigarette smoking OR=1.78 are

significantly associated with the development of prehypertension.³⁴ Cross sectional study was conducted on 1142 students in Cairo. It stated that smoking was significant covariate associated with hypertension (OR= 7.213). Physical activity levels were insignificant associated with hypertension.³⁵ The current study results disagreed with such study as smoking was not significantly associated with hypertension whereas being physical active was associated with decreased risk to develop hypertension. We assume that there is another details regarding smoking status that may affect blood pressure status these factors like (Age at smoking initiation ,Duration of smoking , Regularity and Quantity or heaviness of smoking) and not only to be smoker is necessarily have to cause elevation of blood pressure. Effect of these factors on blood pressure status could be point for further work and research.

CONCLUSIONS

The study found that among undergraduate students, prehypertension and hypertension were highly prevalent. It is an alarming finding which highlights the need of monitoring young people's blood pressure. Also, the results showed significant relation between different lifestyle patterns and elevated blood pressure. Students whose lifestyle is associated physical inactivity, eating less than five servings of fruits and vegetables per day, tobacco consumption, increase body mass index are several times more prone to the risk of high blood pressure than other students. The identified association between these modifiable risk factors and elevated blood pressure emphasizes the importance of primary prevention interventions for young adults. The university's health services should include periodic blood pressure testing and tracking in the physical examination required for all students, particularly those who pose a danger. Policy makers and program managers need to develop targeted and cost-effective intervention programs and campaigns to increase awareness among university students especially in practical faculties about hypertension and its associated factors to strength the capacity for making healthier choices and follow healthy lifestyle.

Ethical Consideration: The study obtained all required approvals from the Institutional Review Board (or other appropriate ethics committee) of Sohag University. IRB (Soh-med-20 -12-21)

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