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Lifestyle Factors Associated With Body Mass Index, Waist To Hip Ratio And Blood Pressure Among Undergraduates

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Abstract: Obesity and hypertension are major risk factors of morbidity and mortality in modern world. Numerous studies have been performed to assess the lifestyle factors associated with obesity and hypertension among western population. There is a lack of studies conducted on this area among south Asian population. A cross sectional descriptive study was conducted to examine the lifestyle factors associated with Body Mass Index(BMI), Waist Hip Ratio(WHR) and Blood Pressure(BP) among undergraduates of university of Peradeniya, Sri Lanka in 2017. Lifestyle factors such as nutrition, smoking, alcoholism, physical activity and sleep were assessed using a validated self-administered questionnaire. Body weight, height, waist circumference, Hip circumference and systolic and diastolic blood pressure were measured and the statistical associations were assessed. Nutritional factors, smoking, physical activity sleep and stress were significantly associated with anthropometric measures and/or blood pressure values. These associations were gender dependent.

Keywords: Body Mass Index, Waist Circumference, Waist to Hip Ratio, Systolic Blood Pressure, Diastolic Blood Pressure

1. Introduction

Obesity is a significant global issue of public health. It has been defined as abnormal or excessive fat accumulations that may impair health. The key cause of obesity is an energy imbalance between calorie consumption and calorie expenditure [1]. It has serious consequences for morbidity, disability and quality of life. Frequency and prevalence rates of obesity are increasing in both developed and developing countries. Worldwide, obesity has increased above two folds since 1980[1]. Although under nutrition and infectious diseases were considered as major health concerns in developing countries, As the growing trend of the obesity worldwide and specially in south Asian countries, burden of the obesity has been doubled among developing South Asian countries. [2] Sri Lanka is a developing country in South Asia with lower middle-income status. According to a national survey conducted in 2005-2006, Prevalence of overweight and obesity among adults in Sri Lanka were 25.2% and 9.2% respectively [3]. Obesity is found to be coexisting with hypertension. According to the literature linear relationship is reported between blood pressure values and body weight [4]. Hypertension is reported as a significant and modifiable risk factor of cardiovascular disease. [5] Studies suggest that lifestyle factors of individuals are associated with the epidemic of obesity [6] Lifestyle factors like physical inactivity, food habits, alcoholism and smoking have led to the increase prevalence of obesity and hypertension among young adults [7]. In contrast to western population, limited numbers of studies have been investigated the associated lifestyle factors of obesity and hypertension of the South Asians. Lifestyle modifications for prevention and management of obesity and hypertension in western population may not be appropriate for South Asian population as their dietary habits and physical activity patterns are clearly different from western population [8]. Previous Sri Lankan studies have found that the level of education is positively correlated with the obesity [3]. According to a previous study done by author 18.8% of university students were either overweight or obesity (9). The aim of the present study to investigate the lifestyle associated factors of obesity and hypertension of the undergraduates of university of Peradeniya.

2. Methods and Materials

Cross sectional descriptive study was conducted among undergraduates of the university of Peradeniya, Sri Lanka in 2017 to assess the lifestyle factors associated with obesity and hypertension. Stratified randomization was used for the sampling of the population. Male and Female genders were used as strata. Subjects diagnosed with physical disabilities, diagnosed with chronic illnesses which alter the body mass index, waist hip ratio and blood pressure, used medications for hypertension and pregnancy were considered as exclusion criteria. 646 undergraduates of the University of Peradeniya was investigated for the study. Ethical approval for the study was obtained from the ethics review committee of the Ethics Review Committee of the Faculty of Allied Health Sciences, University of Peradeniya. Informed written consent was obtained from the participant after the explanation of the purpose, procedures, and rights of the participants. Participants' age, gender, fast food habits, dietary preferences, smoking, alcoholism, sleep and mental stresses were assessed using a validated self-administered questionnaire. Smoking at least a once a day ware classified as regular smoker. Exercise routines and hours of weekly participation in any sports were assessed as physical activities. Average sleeping hours and sleeping difficulties of participants were assessed under sleep. How frequently get

stresses and any coping strategies used were assessed under mental stresses. Participants who had a first degree relative with obesity or hypertension were considered as participants with positive family history. **Body weight** was measured to the nearest 0.1 kg, using calibrated standard electronic weighing scale. **Body height** was measured to the nearest 0.5cm without footwear using a stadiometer. **Waist circumference** was measured at the approximate midpoint between the top edge of the iliac crest and the lower margin of the last palpable rib at the end of a normal expiration using a K – E anthropometric tape to the nearest 0.5cm. **Hip circumference** was taken in erect position and around the broadest part of the buttocks (level of the greater trochanter).**Blood pressure** was measured in seated position to the nearest 2 mmHg using mercury in glass sphygmomanometer calibrated in millimeters of mercury from 0-300mmHg with the aid of a Littman stethoscope. Asian cutoff points (10) were used to classify BMI categories. Waist to Hip Ratio norms proposed by Bray, Bouchard and James in 1998(11) were used as WHR cutoff points. American heart association's criteria for adult blood pressure classification (12) were used to classify blood pressure. Data analysis were done using spss version 22.0. Independent t test and chi-square test were utilized to determine statistical relationships with variables.

3. Results

Out of the 705 first year students studied 59 were excluded according to exclusion criteria.424 subjects (65.6%) of the sample were female participants and 222 (34.3%) were male participants. Mean age of the female subjects was 21.22 (±0.83) years and it was 21.5(±0.839) years for males. Mean BMI of male subjects was 20.922 Kgm-2 which was significantly ($p<0.01$) higher than the BMI for females (19.808 Kgm-2). 112(50.4%) of the male subjects were in normal weight range, 62(27.9) were in underweight category (according to the BMI).178 (41.9%) of females were in normal weight range and 172 (40.6%) were in underweight range.48 (21.62%) male subjects were either overweight or obese while 74 (17.45%) female subjects were either overweight or obese. Prevalence of Overweight was not significantly different ($p>0.05$) between male participants and female participants.4.95% of male participants was obese while only 2.59% of females were obese. Prevalence of obesity among male subjects was significantly ($p<0.05$) higher than the female subjects. Mean SBP in all subjects was 108.57(±11.93) mmHg and the mean DBP was 68.61(±11.3) mmHg. The mean SBP of male participants (118.21±10.02 mmHg) was significantly higher than in females (103.52±9.5 mmHg) ($p<0.01$). The mean DBP of male participants (72.94±8.03 mmHg) was significantly higher than in females (67.01±7.71 mmHg) ($p<0.01$). Both mean SBP and DBP were relatively high for overweight and obese categories while normal weight and underweight categories had lower values for both males and female subjects. 21(9.5%) male participants were regular smokers. No female subjects were regular smokers. Smoking was found to be associated with SBP and DBP among male subjects. Mean SBP for regular smokers (122.66 mmHg) was significantly higher than the rest of male subjects (117.74mmHg). Mean DBP for regular smokers (75.56 mmHg) was higher than non-smokers (72.67) but was not significant ($p>0.05$)

Table 1:*Variations of blood pressure with smoking*

Sex	Smoking	Number of subjects	BP	Mean BP (mmHg)
Male	No	201	diastolic BP	72.677
			systolic BP	117.748
	Yes	21	diastolic BP	75.556
			systolic BP	122.667
Female	No	424	diastolic BP	67.017
			systolic BP	103.525

3(1.4%) male subjects and 7(1.7%) female subjects didn't have fast foods at all.52 (23.4) male participants and 83(19.6%) female participants usually had fast foods more than 4 times a week while 61(27.5%) male and 54(12.7%) females regularly had fast foods. Mean SBP and DBP showed a graded response with frequency of fast foods for male participants. However, it was not evident with female participants.

Table 02: *Fast food taking frequency and variations of systolic and diastolic blood pressure*

Sex	Frequency of fast foods consumption		Mean/mmHg
Male	no	systolic BP	114.889
		diastolic BP	68.111
	once per week	systolic BP	117.036
		diastolic BP	72.095
	2-4 times a week	systolic BP	118.940
		diastolic BP	73.068
	more than 4 times	systolic BP	119.098
		diastolic BP	73.410
	regularly	systolic BP	119.859
		diastolic BP	73.885
Female	no	systolic BP	102.571
		diastolic BP	65.286
	once per week	systolic BP	102.664
		diastolic BP	66.620
	2-4 times a week	systolic BP	103.806
		diastolic BP	67.671
	more than 4 times	systolic BP	104.044
		diastolic BP	66.659
	regularly	systolic BP	103.975
		diastolic BP	66.772

117 male subjects and 391 female subjects were not engage in any sport activities.22 male subjects and 5 female subjects were engaged in sport activities more than 10 hours a week. BMI category and number of hours engaged in physical activities were significantly associated (Pearson chi-square=35.5).

Table 03: *Variations of blood pressure with the regular physical activities engaged per week*

Sex	Number of hours engaged in regular physical activities	Number of Subjects	Mean BMI/mmHg
Male	no	117	20.964
	0-1hr	11	20.070
	1-2hr	17	19.674
	2-5hr	29	19.985
	5-10hr	26	22.610
	10-12hr	12	20.737
	>12hr	10	22.034
Female	no	391	19.806
	0-1hr	12	18.608
	1-2hr	10	19.808
	2-5hr	3	19.133
	5-10hr	3	22.576
	10-12hr	2	20.178
	>12hr	3	22.582

32 male participants were regular alcoholics and their mean SBP and DBP were relatively higher but not significantly different from the rest. However, blood pressure category and alcoholism were significantly associated (Pearson Chi-Square=21.22).

Table 05: *Variations of systolic and diastolic blood pressure with positive and negative alcohol consumption in male and female subjects*

Sex	Regular alcohol users	Number of subjects	BP	Mean BP /mmHg
Male	No	190	diastolic BP	72.721
			systolic BP	117.865
	Yes	32	diastolic BP	74.302
			systolic BP	120.281
Female	No	424	diastolic BP	67.017
			systolic BP	103.525

23 Male participants and 8 female participants usually had a sleep of less than 4 hours.15 males and 61 females and a sleep of more than 7 hours. Mean SBP didn't show any significant variation with number of sleeping hours while mean DBP of female subjects who had number of sleeping hours less than 4 was significantly higher than female subjects who had more number of sleeping hours.

Table 04: *Variations of blood pressure with sleeping hours for male and female subjects*

Sex	Sleep hours	BP	Mean BP /mmHg
Male	<4hrs	systolic BP	116.449
		diastolic BP	70.464
	4-6hrs	systolic BP	118.478
		diastolic BP	73.042
	7hrs	systolic BP	119.171
		diastolic BP	73.870
	>7hrs	systolic BP	115.778
		diastolic BP	73.356
Female	<4hrs	systolic BP	97.000
		diastolic BP	70.333
	4-6hrs	systolic BP	103.399
		diastolic BP	66.934
	7hrs	systolic BP	104.156
		diastolic BP	67.743
	>7hrs	systolic BP	103.628
		diastolic BP	66.989

6 male participants and 13 female participants were frequently stressed. Mean DBP of subjects with frequent stress was significantly high compared to other male subjects (p=0.05).93% of the sample was non-vegetarian. No significant differences of mean SBP, DBP and BMI were shown between vegetarians and non-vegetarians

4. Discussion

According to the findings of the study, participants who were regular smokers had statistically significant ($p<0.05$) relationship with increased systolic and diastolic blood pressure as shown in Table 01. 9.5% male subjects of the sample were regular smokers. This finding was congruent with the study conducted by Sundar et al, (2013), the research which was done among urban school children in the age group of 13-17 years in Chennai, Thamilnadu reported that increased risk of hypertension was directly associated with an increase of daily cigarette smoking [13]. Furthermore, previous study which was done among youth in Helwan University reported that the smoking and hypertension were known to accelerate the process of atherosclerosis and increase the risk of all other coronary lesions [14]. Furthermore, mean DBP for regular smokers (75.56 mmHg) was higher than non-smokers (72.67 mmHg) but was not significant ($p>0.05$) in this present study. This connive that regular smokers have an increased risk of hypertension. 32 male participants were regular alcoholics. Mean SBP and DBP were relatively higher but not significantly different from the rest. This finding agreed with Friedman et al, (1982) the research which was done to over 5000 middle-aged men and women in Oakland, California

said that alcohol use shows a positive relation to some squeal of hypertension. Coronary heart disease is an outstanding exception, which inversely related to alcohol intake, probably through various mechanisms [15]. According to the findings of this study, the mean SBP and DBP showed a graded response with frequency of fast foods (Table 02) for males but it was not evident among female participants. A similar result was observed in a study conducted in Iran among children and adolescents regarding the relationship of the consumption of junk food with high BP and obesity. This study reported that the sweets intake was significantly correlated with anthropometric indices and BP level. Moreover, a statistically significant ($p>0.05$) association has been reported among fast food consumption, anthropometric measures (except for WHR) and blood pressure levels [16]. However, according to another study, no significant association of junk foods (fast foods and salty snacks) with obesity and hypertension among children in Europe was reported; despite the fact that many studies have shown a statistically significant relationship between abdominal obesity and junk foods among general population [17]. According to the study most of the undergraduates were not engaged in an exercise routine or in a sport activity. Only 53 (23.8%) male subjects and 23(5.4%) female subjects were engaged in an exercise routine. There were only few male (22) and female subjects (05) were engaged in sport activities more than 10 hours a week. According to statistical analysis, the mean SBP didn't show any significant($p>0.05$) association with exercise routine for both male participants and female participants while mean DBP of female subjects engaged in exercise routine was relatively less than other female subjects and mean DBP displayed a inversely graded relationship with number of hours of regular physical activity. However, a previous study has done to evaluate the response of the BP after 6 months of exercise routine followed by a 2 week detraining period in same group, among sedentary, middle-aged men and women in United States of America. The BP response after 6 months of exercise training was negatively correlated with the BP response. In this study, SBP and DBP decreased in exercise trainers and SBP and DBP were increased during detraining among the majority of both male participants and female participants [18]. The possible reason for that deviation of results from other similar studies may be the inadequate proper knowledge and engagement in aerobic exercise training which reduces the DBP and SBP. According to the findings of a previous study, specific type of nutrition (dietary pattern) that is associated in greater extent and in a direct way to body mass index, as well as central obesity ratio. In addition, both BMI and WHR are positively correlated with the age. Consequently young adult men seem to underestimate their actual body weight, and to be oblivious to optimal (desirable) body weight [19]. Another previous study indicates that waist to hip ratio was the strongest predictor of myocardial infarction irrespective of age, sex, smoking status, diabetes, lipid levels and blood pressure [20]. As per the findings of the current study, participants who have suffered from frequent psychological stress is less common (13 female participants, 5male participants). Among female participants, there is no association of SBP and DBP with the frequency of stress. Previous review study has reported a relationship between oxidative stress and psychological stress [21]. Females appear to be less susceptible to oxidative stress this may due to anti-oxidative properties of estrogen [22]. As per study findings, there is an association with DBP and stress among male participants. A previous study has showed that men with psychological stress were more likely to reported hypertension [23] which is congruent with this study results.

5. Conclusion

- Nutrition, smoking and physical activeness, sleep and stress had significant associations with blood pressure values.
- Nutrition, physical activeness had significant associations with BMI and WHR.
- Associations of lifestyle factors with blood pressure, BMI and WHR are gender dependent.

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