The Relationship between Body Composition with Blood Pressure and Sleep Quality in Male Dormitory Student at Allameh Tabataba'i University

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Abstract

Background and Pupose: Hypertension and poor sleep quality can increase the risk of cardiovascular diseases, diabetes, stroke, etc. Therefore, the purpose of this study was to investigate the relationship between body compositions with hypertension and sleep quality in male students living in Allameh Tabataba'i University dormitory. **Material and Method:** The present study was descriptivecorrelational. The statistical population consisted of 170 male dormitory students of Allameh Tabataba'i University who were randomly selected. First, body composition indices and blood pressure of subjects were measured and recorded. Then, the Pittsburgh Questionnaire were completed by students (PSQI) to assess their sleep quality. Data were analyzed using SPSS 21 software at a significant level (P <0.05). **Results:** The results showed that there was a positive and significant correlation between systolic (r= 0.281, p<0.01) and diastolic (r=0.357, p<0.01) blood pressure with fat percentage. Also, body mass index was significantly correlated with systolic (r=0.297, p<0.01) and diastolic blood pressure (r=0.322, p<0.01) while there was an inverse and significant correlation between muscle mass with systolic (r=-0.252, p<0.01) and diastolic (r=-0.356, p<0.01) blood pressure. Also, there was no significant relationship between students' sleep quality with fat mass (r=-0.023, p=0.76) and muscle mass (r=-0.015, p<0.84). **Conclusions:** In conclusion, according to the direct relationship between fat percentage and hypertension among students living in the dormitory, it can be concluded that the use of exercise in leisure time and recreational programs to improve body composition can play an important role in the prevention and treatment of hypertension in their future.

Keywords: Blood pressure, Sleep Quality, Muscle mass, Body fat percentage, Exercise

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INTRODUCTION

High blood pressure is the most important risk factor for premature mortality in all around the world (Kishi et al., 2015). In recent years, the prevalence of hypertension has increased remarkably in different societies. According to the World Health Organization report, the number of people with hypertension has reached 1.13 billion worldwide in 2019, who's more than 66% of them living in low-income countries (Hypertension retrieved from WHO, 2019). In a meta-analysis study conducted in 2019 in Iran, the prevalence of hypertension has been reported 25%, which had a 3% increase in comparison to 2012 (Oori et al., 2019).

Also, numerous studies have examined the relationship between hypertension and various diseases. To clear more, the relationship between high blood pressure with cardiovascular diseases (Ettehad et al., 2016; Wells et al., 2015) kidney diseases (Patel et al., 2015), cerebrovascular syndrome (Patel et al., 2015), stroke (Nyombi et al., 2016), metabolic syndrome, diabetes, and dementia have been well proven (Bloch, 2016).

On the other hand, graduation from high school and entering University and living in dormitories is associated with many changes in students' lifestyle. In this period, factors such as being away from family, having new roommate, lack of welfare, social and economic pressures along with educational problems (Cleary, Walter, & Jackson, 2011) lead to unhealthy behaviors and changes in lifestyle, which consequently potentiate various diseases such as hypertension, sleep disorders, cardiovascular disease, diabetes, and many other chronic diseases.

Commonly, sleep quality has decreased considerably due to changes in human society's lifestyle, which is along with academic failure and lower students' health quality (Kronholm et al., 2008). Previous studies in this area have been shown that about 73 percent of students living in a dormitory experience insufficient sleep, sleep disorders, or difficulty falling asleep (Buboltz et al., 2009).

The results of different studies indicate that the decrease in sleep quality and the increase in sleep disorders are being prevalent among students and since the sleep disorder is one of the risk factors of cardiovascular and metabolic diseases, addressing this issue, as well as providing a medical strategy is an important action (Sin, Ho, & Chung,

2009; Suen, Ellis Hon, & Tam, 2008); because, it has been proven that sleep disorders influence on human health by changing the rhythm of hormone release, developing cardiovascular dysfunction, dyslipidemia, metabolic syndrome, and a poor blood glucose regulation (Bixler, 2009).

Control and identification of factors influencing high blood pressure and lower sleep quality are of great importance to improve the health status of the community. Assessment of body composition and anthropometric indices are of the simplest and most accessible methods that do not need expensive laboratory equipment. Several studies have examined the relationship between body composition and various disease-risk factors. Moreover, studies have reported that there is a positive correlation between hypertension with body mass index and fat percentage (Deng et al., 2012). while there is a negative correlation between hypertension and muscle mass (Ye et al., 2018). Furthermore, researchers have examined the relationship between BMI and sleep quality. In fact, there is a significant negative correlation between BMI and sleep quality (Vargas, Flores, & Robles, 2014). Also, many studies have reported that there is a significant negative correlation between subcutaneous fat percentage and visceral fat with sleep quality while there is a positive correlation between muscle mass and sleep quality (Rahe, Czira, Teismann, & Berger, 2015). (Kahlhöfer, Karschin, Breusing, & Bosy‑Westphal, 2016).

Given the different lifestyles of dorm students and their vulnerability to peers, as well as the necessity for a healthy lifestyle to prevent different diseases throughout life, assessing risk factors such as body composition, sleep quality and blood pressure are of great importance. Over the past years, less research has examined the relationship between body composition with high blood pressure and sleep quality in students to prevent the development of cardiovascular diseases and early death. Therefore, the purpose of this study was to investigate the relationship between body compositions and hypertension and sleep quality of male students living at the dormitory of Allameh Tabataba'i University.

METHOD

Subjects

This was a descriptive correlational study conducted during August 2018 in a Hemmat male's dormitory of Allameh Tabataba'i University. Hemmat dormitory out of all dormitories belong to Allamah Tabatabai was selected randomly. The sample size 168 with a 95% confidence interval and 5% error was determined by the Cochran formula. A total of 190 out of 300 subjects from all grades and disciplines randomly participated in this study. Then the research aims were presented precisely and all subjects signed the consent form. Also, the researcher assured that subjects' identity and what they say or do during the research would be maintained confidential. The subjects' characteristics were collected and recorded by a demographic questionnaire.

The inclusion criteria included: students aged more than 18 years who had given their consent for participation, and experience of living at least 3 months in Allameh Tabataba'i University dormitory. Subjects excluded if they reported any food consumption for at least 2 hours before sampling, drinking alcohol or a large amount of water, consumption of caffeine-containing substances such as coffee, doing vigorous exercise on sampling day, and aged more than 40-year-old (because of data normalization).

Six subjects were excluded from the study due to the incomplete sleep quality questionnaire and 7 subjects due to the BMI lower than 15kg/m2 and measurement error by body composition analysis device 4 subjects due to the constant caffeine consumption and 3 other subjects due to the doing vagarious exercise on the day of sampling. Figure 1 indicates the flow charts of the sampling procedure.
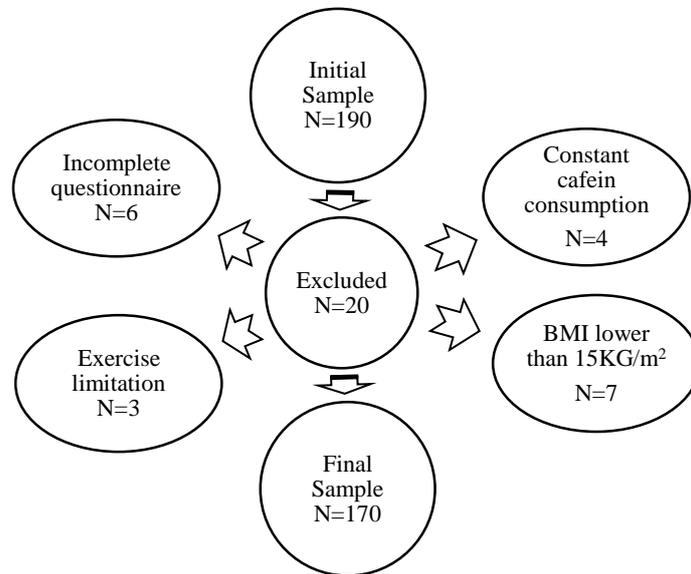
Figure 1

Anthropometric, body composition measurement

The height and weight of subjects were measured and recorded by wallsticker tape meter and the OMRON digital scanner with 0.01 g sensitivity respectively, with minimal clothing and no shoes. Waist circumference was measured with non-stretching tape at mid-way between the anterior superior iliac crest and the lowest rib. Hip circumference was measured from the side at the greatest point of the buttocks to the nearest 0.1 cm. Waist to hip ratio (WHR) was determined by the corresponding value of waist and hip circumferences and classified into low and high-risk groups according to cutoff point WHR>0.9 in men. Then, body composition indices of subjects were measured and recorded by OMRON (BF511, china) body composition analysis device in a 3-hour fasting state with minimal clothing. Body mass index (BMI) was classified according to the World Health Organization as <18.5 kg/m2 is underweight, 18.5– 24.9 kg/m2 is normal, 25–29.9 kg/m2 is overweight, and >30 kg/m2 is obese. Classification of body fat percentage (BFP) for male aged 18-39 was divided based on manual operation of OMRON Healthcare with ranges of <8% low, 8-19.9% normal, 20-24.9% high and >25% very high("BF511 body composition monitor," 2015). Also, skeletal muscle mass percentage (SMMP) was classified as <33.3% low, 33.3-39.3%

normal, 39.4-44% high and >44.1% very high ("BF511 body composition monitor," 2015).

Sleep quality assessment

To evaluate the students' sleep quality, the Pittsburgh 18 items questionnaire (PSQI) was used. The scoring of this questionnaire is in the form of 3-point Likert scale. The total index of sleep quality measuring by sum of the seven sub-scales. Gaining a score of over 5 in the entire questionnaire means poor sleep quality (Buysse, Reynolds III, Monk, Berman, & Kupfer, 1989).

Blood pressure assessment

Subjects' blood pressure was measured after 10 minutes of rest at the upper left arm in seated position by the OMRON (M2, Vietnam) pressure gauge with an accuracy of 3 mmHg. Hypotension was considered as systolic below 90 mmHg and diastolic below 60 mmHg. Normal blood pressure was defined as 90-119 mmHg (SBP) and 60-79 mmHg (DBP). Subjects with SBP of 120-139 mmHg and DBP of 80-89 mmHg were classified as prehypertensive. Stage-I hypertension was considered as SBP between 140-159 mmHg and DBP between 90-99 mmHg, whereas systolic blood pressure of 160-179 mmHg and diastolic of 100-109 mmHg were classified as stage II hypertension. Hypertensive crisis was determined systolic and diastolic blood over 180 mmHg and 110 mmHg respectively.

Statistical analysis

Data were checked for normality before proceeding to statistics analysis. Descriptive statistics including mean ±standard deviation, frequencies and percentages were used. Pearson correlation coefficient was used at the significance level of ($P<0.05$) to find a correlation between anthropometric measures with sleep quality and blood pressure. Data were analyzed using the SPSS software 21 version.

RESULTS

A total of 170 individuals participated in this study, 60 (36%) of whom were overweight. The mean ±SD age of students was 25.94±3.6 years. Also, 95 (55.88%) of subjects had high or very high body fat. Detailed characteristics of the students are presented in Table 1.

Table 1: demographic, anthropometric and blood pressure measurements

Variables	Status	Mean±SD	N (%)
Age (years)		25.94±3.60	
Height (cm)		177.55±6.51	
Weight (kg)		75.46±11.38	
BMI (kg/m^2)		23.94±3.26	
	Normal		104 (61.19%)
	Overweight		60 (35.29%)
	Obese		6 (3.52%)
Fat percentage (%)		20.45±6.73	
	Low		6 (3.53%)
	Normal		69 (40.59%)
	High		45 (26.47%)
	Very high		50 (29.41%)
Muscle mass (%)		39.21±3.91	
	Low		5 (2.94%)
	Normal		89 (52.35%)
	High		53 (31.18%)
	Very High		23 (13.53%)
WHR		0.84±0.06	
	Low risk		151 (88.82%)
	High risk		19 (11.18%)
SBP (mmHg)		119.97±11.35	
	Normal blood Pressure		85 (50%)
	Prehypertension		78 (45.88%)
	High blood pressure stage1		7 (4.12%)
DBP (mmHg)		75.94±8.89	
	Hypotension		5 (2.94%)
	Normal blood pressure		109 (64.12%)
	Prehypertension		45 (26.47%)
	High blood pressure stage 1		11 (6.47%)
BMI: Body mass index, CV: cardiovascular, BP: Blood Pressure			

The mean±SD systolic and diastolic blood pressure of subjects was 119.97±11.35 mmHg and 75.94±8.89 mmHg, respectively; however, a total of 78 (45.88%) of the subjects were found to be systolic prehypertensive, and 45(26.47%) of total participants were found to have diastolic prehypertension.

The results of Pearson correlation coefficient indicated a significant positive correlation between BFP and BMI with both systolic and diastolic blood pressures. In addition, the increase in diastolic blood pressure was associated with an increase in WHR. On the other side, there was a significant and negative correlation between muscle mass and both systolic and diastolic pressure in the students. Also, body composition indices did not show any significant correlation with student's sleep quality (Table 2).

Table 1: The correlation between anthropometric and body composition indices with blood pressure and sleep quality

Variables		Fat percentage	Muscle mass	BMI	WHR
Systolic BP	P	+0.000**	-0.001**	+0.000**	0. 147
	r	0.281	0.252	0.297	0.112
Diastolic BP	P	+0.000**	-0.000**	+0.000**	0.011*
	r	0.357	0.356	0.322	0.195
Sleep quality	P	0.764	0.846	0.933	0.906
	r	-0.023	0.015	0.006	0.009

* indicates p-value <0.05 ** indicating p-value <0.01

DISCUSSION

Since blood pressure is one of the most important risk factors for the metabolic and cardiovascular diseases, the identification and control of factors influencing students' blood pressure can be included as an essential part of health programs. One of the simple and valid methods to tackle this problem is body composition and anthropometric indices assessment. Despite significant progress in health and medicine in recent years, less research has evaluated the relationship between body composition with high blood pressure and sleep quality. The lack of research in this area can endanger the students' health as an important stratum in the community.

In the present study, there was a positive and significant correlation between fat percentage and blood pressure in dormitory students. On the other hand, in comparison to systolic blood pressure, the association

between body fat percentage and diastolic blood pressure was higher, which was consistent with past findings(Moser et al., 2013; Mushengezi & Chillo, 2014). It has been well established that high systolic blood pressure has a significant effect on the incident and development of cardiovascular and metabolic diseases. It has also been reported that an increase in systolic blood pressure leads to an increased risk of intracerebral hemorrhage (stroke caused by bleeding within brain tissue), subarachnoid hemorrhage (the deadliest form of stroke), and stable angina while high diastolic blood pressure is associated with increased risk of Abdominal aortic aneurysm (Rapsomaniki et al., 2014). In addition, it has been reported that high diastolic blood pressure also increases the risk of high systolic blood pressure (Rapsomaniki et al., 2014), so according to our findings (the potent association of body fat percentage with diastolic blood pressure), it can be noted that our subjects with high-fat percentages are at risk of many cardiovascular diseases. Also, our findings indicated that 26.47% of students classified in the high-fat percentage group and 29.41% in the very high-fat percentage group. In fact, 55.88% of the students had fat percentage more than the normal range, which is a very high rate and it can be stated that the risk of hypertension, cardiovascular and metabolic diseases is high in the students of Allameh Tabataba'i University. Our findings are in line with (Wang et al., 2015). An increase in body fat percentage leads to a rise in inflammatory adipokines secretion, which consequently leads to disturbances in secretion and function of nitric oxide (it is very important in regulating blood pressure and vascular function) and decreases its serum levels (Kotsis, Stabouli, Papakatsika, Rizos, & Parati, 2010). Reduction of nitric oxide disturbs endothelial function, resulting in increased stiffness and arterial stenosis, which eventually increases the arterial pressure (Chiolero, Cachat, Burnier, Paccaud, & Bovet, 2007).

In the present study, there was a positive and significant correlation between BMI and students' blood pressure. Also, 38.81% of students were overweight and obese (35.29% overweight and 3.52% obese), which make them susceptible to various diseases such as type 2 diabetes and cardiovascular disease. Our findings in this regard are in line with Deng et al. (2012), Jayedi et al. (Deng et al., 2012; Jayedi, Rashidy-Pour, Khorshidi, & Shab-Bidar, 2018). Regarding the strong and positive relationship between BMI and body fat, it can be expected that

BMI may also increase blood pressure through mentioned direct and indirect mechanisms. It has been reported that high BMI and obesity lead to the adipokines release that is associated with a reduction in efficiency and production of nitric oxide (Kotsis et al., 2010). Nitric oxide is important in vascular dilatation and improvement of blood circulation, and its reduction results in impaired endothelial function which leads to high blood pressure (Chiolero et al., 2007; Kotsis et al., 2010)

In the present study, there was a negative and significant correlation between muscle mass and students' blood pressure. Our finding in this regard, is consistent with studies by Butcher et al. and Benjamin et al. (Benjamin et al., 2017; Butcher et al., 2018). Possible mechanisms of muscle mass effect on blood pressure include reduction of inflammatory factors, improvement of antioxidant enzyme activity and renal function (Butcher et al., 2018). It has also been reported that an increase in muscle mass is often associated with a decrease in body fat percentage, leading to an increase in myostatin (muscle growth inhibitor) inhibition, and consequently results in cardiovascular health, glucose tolerance and endothelial function which ultimately improves blood pressure.

There is a possible mechanism linking muscle mass with blood pressure; to explain more, with an increase in muscle mass, Myostatin, an inhibition factor of muscle growth is blocked, and consequently, it enhances cardiovascular health, glucose tolerance and endothelial function which ultimately leads to blood pressure improvement (Bergen et al., 2015; Ruas et al., 2012).

In the present study, there was a significant positive relationship between waist to hip ratio and diastolic blood pressure. Our findings are in line with the study of Abbaszadeh et al. Factors such as impairment in the renin-angiotensin system, increased stiffness of the arteries, and high activity of sympathetic nervous system have been reported as the most important factors in central obesity-related hypertension (Abbaszadeh et al., 2017).

In the present study, there was no significant relationship between the body composition and sleep quality of dormitory students. Our findings are contradictory to Zhou et al. and Jurado-Fasoli et al. (JuradoFasoli et al., 2018; Zhou, Lalani, Banda, & Robinson, 2018). The contradiction reason can be attributed to various factors. In the

most studies, the focus had been on the one or two subcategories of sleep quality such as sleep satisfaction or sleep depth (Harvey, Stinson, Whitaker, Moskovitz, & Virk, 2008), thus the difference in outcome can be due to the different classification and assessing every single factor of sleep quality. On the other hand, in most studies, the sample size were more than 500 subjects, and this may be contributing to the different results (Vargas et al., 2014). Also, the subjects' health status may have a significant impact on the results. In the studies on the overweight, high BMI and high-fat percentage subjects, there was a reverse correlation between these factors and sleep quality (Ye et al., 2018; Zhou et al.,

2018). The differences in the subjects' age may be another reason for different results. Therefore, regarding the lack of correlation between obesity and the sleep quality of students, ignoring this could endanger individuals' health in adulthood (Jurado-Fasoli et al., 2018).

CONCLUSIONS

Regarding the wide range of effective factors on sleep quality of young people, indices such as stress, physical activity level, nutritional status and tobacco consumption would be more important indicators than the body composition among dormitory students. The positive role of physical activity to control blood pressure has been proven in many studies, in which most of these studies have reported moderate-intensity aerobic training is the best exercise to modify and control blood pressure and body composition (Ahmed, Blaha, Nasir, Rivera, & Blumenthal, 2012; Boutcher & Boutcher, 2017; Tartibian, Kushkestani, & Nosrani, 2019). Furthermore, improving the diet such as reduction of sodium intake, alcohol consumption, saturated fat intake, and the increase of potassium, and the more consumption of natural and organic substances can be considered as an effective strategy to improve the body composition and prevent the onset of high blood pressure (Bazzano, Green, Harrison, & Reynolds, 2013; Mohanlal, Parsa, & Weir, 2012).

Limitation

As this was a cross-sectional study, it could not clarify the cause-effect relationship between body composition with blood pressure and sleep quality and also sample size was small. Blood pressure was measured only once. It would be more accurate to measure the blood pressure

three times within an interval of at least five minutes and then used its average in the analysis.

Finally, according to the direct relationship between fat percentage and hypertension among students living in the dormitory, it can be concluded that the use of exercise in leisure time and recreational programs to improve body composition can play an important role in the prevention and treatment of hypertension in their future.

Declaration of interest
The authors declare that there is no conflict of interest.

Acknowledgment
We would like to thank all students who participated in the study.

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