The purpose of this study was to compare the body fat and blood pressure in physical education and non-physical education female students of University of Guilan in Iran. The target population consisted entirely of female students of University of Guilan. Among them 140 female’s athlete and 160 females non-athlete with mean age of 22.2 ± 1.9 and 23.3 ± 2.1 years, height 168.6 ± 7.3 and 163.4 ± 4.2 cm, weight 60.3 ± 2.4 and 68.3 ± 6.36 kg and body mass index 20.54 ± 9.8 and 25.16 ± 7.7 kg/m² respectively. Statistical tests of t-test and Pearson correlation coefficient were used to analyze the data. Non-physical education female students had a higher blood pressure (BP) than physical education ones. A low physical fitness level and high BMI were independently associated with a high BP and risk of having hypertension in non-education female. The results show that waist-hip ratio (WHR), BP (SBP and DBP) and relative fat had the significant differences among physical education females and non-physical education female students (p < 0.05), with non-physical education female students higher than the physical education female students. In the study, a low physical activity was too important determent for prevalence of obesity, overweight, hypertension in non-athlete females. Therefore, promotion in physical activity level, improving nutrition education program could be an effective way to decrease obesity, overweight and hypertension in non-physical education female students.

**KEY WORDS:** Obesity, Physical Education, Non-Physical Education, Hypertension.
INTRODUCTION

In the past few decades a great deal of attention has been focused on the relationships between body fat and hypertension and Physical activity. Excessive body fat and hypertension are an important public health challenge in both economically developing and undeveloped countries (25). Worldwide prevalence estimates for hypertension may be as much as 1 billion individuals, and approximately 7.1 million deaths per year may be attributable to hypertension (2). It is the most widely recognized risk factor for cardiovascular disease (CVD), cerebrovascular disease and end-stage renal disease. Many studies have reported a significant relationship between hypertension and risk factors such as age, body mass index, smoking and physical inactivity. Physical inactivity may be responsible for various chronic disease conditions, including hypertension (9). There is good evidence that regular physical activity reduces the risk for cardiovascular diseases (13, 27). Part of this effect is thought to be mediated through reduced blood pressure (BP), improved lipid metabolism, and decreased body weight (32). Even though results from clinical trials (26, 38) and cross-sectional studies (20, 21) have indicated that physical activity or aerobic exercise is inversely associated with BP; the evidence of such an association from the prospective studies is still scant. Biological risk factors of Coronary Heart Disease (CHD) track from childhood and adolescence into adulthood (3). Low fitness levels are widespread and associated with increased risk of high BP in middle-aged men and women (6, 31). In his comprehensive review, Malina (1980) reports that absolute amount of total body fat generally increases with age during childhood but shows as the reduced rate of accumulation during adolescence, especially in males (29). Body fat serves three important functions in the human body. It serves as an insulator for conserving body heat; as the source of metabolic fuel energy; and as padding for protection. But excessive body fat leads to obesity and CHD and also hinders performance in many physical activities thereby lowering physical fitness level (19, 34). It has also been observed that an elevated BP is associated with markedly increased risk for numerous cardiovascular pathologies such as CHD, intermittent claudicating, congestive failure and stroke (33). Furthermore, fitness levels are known to correlation with BP in Adolescents and young adults (17, 24).

Many previous studies have investigated the prevalence of specific CHD risk in selected populations in both developing and developed countries. However there is relatively little information on the prevalence of specific CHD and Excessive body fat risk factors in college student. For this reason, the purpose of this study was to compare the body fat and blood pressure in physical education and non-physical education female students of University of Guilan in Iran.
METHODS

The target population consisted entirely of female students of University of Guilan in Iran. Among them, 140 female’s athlete and 160 females non-athlete selected randomly. The condition of the study was thoroughly explained to all subjects, and written informed consent was subsequently obtained. The study protocol was approved by the Ethics Committee of University of Guilan. The measurement taken included height, weight, Waist to Hip Ratio (WHR), BP, Thigh, Triceps and Suprailium skinfold thickness. The skinfold thickness was measured at the right side of the body with Lange skinfold calipers (Cambridge Scientific industries, U.S.A) (10). Percent body fat (relative body fat) was estimated using the formula by Jackson and Pollock 1987 (23). Resting BP was determined by auscultation in the right arm by the same investigator after a 10-minute resting period, using mercurial and Accession s stethoscope. Measurement took place each day between 8.00 a.m. and 10.00 a.m. in accordance with the protocol of the American Heart Association (2). The cuff was applied evenly and snugly about the bare arm with the lower edge at 2.5 cm above the antecubital fossa. The cuff was inflated rapidly and deflated slowly. The onset of the first tapping sound was taken to indicate the SBP as recommended by (2). While the point of complete disappearance of the sound (5th diastolic phase) was taken to indicate the diastolic DBP. For each subject, two measurements were taken and the average the two readings were recorded. BMI = Weigh/height (kg/m²). BMI was used since it is generally used in epidemiological studies as a representative measure of body composition. With the BMI, underweight was determined at a value of 20 or less, normal weight at a value between 20.1 and 25.0 overweight at a value between 25.1 and 30.0 and obesity at a 30.1 more (5, 33, 35). Central obesity was determined as a WHR of > or 0.78 cm for female to determine the association between general and central obesity (5).

STATISTICAL ANALYSIS

SPSS statistical software (version 16.0) was used to analyze. Both descriptive (mean and standard deviation) and inferential statistical were used to analyse the data. t-test was computed to test for any significant difference in the body fat, BMI, WHR, BP measurement of the physical education female and non-physical education female. Furthermore, Pearson correlation coefficient for relationship between BP measurements and anthropometric was used.
RESULTS

Subject anthropometric data are present in Table 1. The blood pressure data of this study show in non-physical education for both systolic and diastolic—the higher than physical education female. The results show that WHR, BP (SBP and DBP) and relative fat had a significant differences among physical education female and non-physical education female (p < 0.05), with non-physical education female higher than the physical education female (Table 2).

Table 1. Age, height, weight and BMI of Physical education female and Non-Physical education female students (Mean ± SD)

<table>
<thead>
<tr>
<th></th>
<th>Physical education female</th>
<th>Non-Physical education female</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (yrs)</td>
<td>22.2 ± 1.9</td>
<td>23.3 ± 2.1</td>
</tr>
<tr>
<td>Height (cm)</td>
<td>168.6 ± 7.3</td>
<td>162.4 ± 4.2</td>
</tr>
<tr>
<td>Weight (kg)</td>
<td>60.3 ± 2.4</td>
<td>68.3 ± 6.3*</td>
</tr>
<tr>
<td>BMI (kg/m²)</td>
<td>21.3 ± 1.2</td>
<td>25.9 ± 3.4*</td>
</tr>
</tbody>
</table>

* Significant difference between two groups at p < 0.05.

Table 2. Anthropometric characteristics and BP between athletes and non-athlete female students

<table>
<thead>
<tr>
<th></th>
<th>Physical education female (n = 140)</th>
<th>Non-Physical education female (n = 160)</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Relative fat (%)</td>
<td>15.8 ± 2.1</td>
<td>20.1 ± 4.3</td>
<td>0.02*</td>
</tr>
<tr>
<td>WHR (cm)</td>
<td>77.5 ± 4.5</td>
<td>86.3 ± 3</td>
<td>0.01*</td>
</tr>
<tr>
<td>SBP (mmHg)</td>
<td>118.4 ± 10</td>
<td>125.7 ± 12</td>
<td>0.05*</td>
</tr>
<tr>
<td>DBP (mmHg)</td>
<td>78.3 ± 3</td>
<td>86.6 ± 6</td>
<td>0.03*</td>
</tr>
</tbody>
</table>

* Significant at p < 0.05

Obesity and overweight was assessed in terms of BMI. With the exception of physical education female that fell within normal weight, but non-physical
education female was overweight (Table 1). Since obesity and body weight have been identified as important factors in elevated blood pressure in many populations their effects were examined (3, 7, 14). The effect of percent fat on blood pressure was also examined. The relationship between the independent variables and both systolic and diastolic pressure (dependent variables) are summarized in table 3. All the independent variable correlation with the both systolic and diastolic pressures a statistically significant level (p < 0.05).

### Table 3. Relationship between BP measurement and anthropometric indices in each group

<table>
<thead>
<tr>
<th></th>
<th>Systolic BP</th>
<th></th>
<th>Diastolic BP</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Physical</td>
<td>Non-Physical</td>
<td>Physical</td>
<td>Non-Physical</td>
</tr>
<tr>
<td></td>
<td>education</td>
<td>education</td>
<td>education</td>
<td>education</td>
</tr>
<tr>
<td></td>
<td>female (n = 140)</td>
<td>female (n = 160)</td>
<td>female (n = 140)</td>
<td>female (n = 160)</td>
</tr>
<tr>
<td>Weight (kg)</td>
<td>0.35*</td>
<td>0.49**</td>
<td>0.31*</td>
<td>0.39*</td>
</tr>
<tr>
<td>Relative fat (%)</td>
<td>0.15</td>
<td>0.29*</td>
<td>0.14*</td>
<td>0.35*</td>
</tr>
<tr>
<td>BMI (kg/m²)</td>
<td>0.29</td>
<td>0.38**</td>
<td>0.23</td>
<td>0.42**</td>
</tr>
</tbody>
</table>

*Significant at p < 0.05
**Significant at p < 0.01

**DISCUSSION**

The aim of the present study was to compare the body fat and blood pressure in physical education and non-physical education female students of University of Guilan in Iran. A look in the Table 1 shows that the non-physical activity female has significantly higher weight and BMI than physical education female. The blood pressure data of this study show in non physical education for both systolic and diastolic—the higher than physical education female. In the present study, BMI and fitness were both independently associated with risk of hypertension. In both unfit and fit subjects, a high BMI was associated with a high risk of being hypertensive. In non-physical education, a strong interaction between fitness and BMI was found; thus or between BMI levels and risk of being hypertensive were substantially higher. The results show that WHR, BP (SBP and DBP) and relative fat indicated a significant difference among physical education female and non-physical education female.
(p < 0.05), with non-physical education female higher than the physical education female (Table 2). The main findings were a positive independent association of both BMI and physical fitness and BP/hypertension and interaction between BMI and physical fitness with a stronger negative association of BMI among subjects with a low fitness level. Based on previous studies, it was hypothesized that the association between fitness and BP was not linear (3, 36).

Shear et al. (1987) found a positive association between BP and body fat in adolescents (28), but Stallone et al. found that the weight-to-BP association was due to components of body weight other than the body fat (37). Only a few studies of children and adolescents have included measures of fitness in the analyses (18, 31), but one controlled trial on the effect of aerobic training on BP in obese children has been conducted (18). A 4.9 mmHg decrease in a SBP and 3.8 mmHg decrease in DBP was found during six months of training in the intervention group compared to the control group. The weight gain of 3 kg was similar in the two groups during the six months and reflected growth. Hagberg et al. (2000), on their review of 15 studies supported the recommendation that exercised training is an important initial or adjunctive step that is highly efficacious in the treatment of individuals with mild to moderate elevations in BP (17). Another article reported that lifestyle physical activity reduces systolic blood pressure in both pre- and hypertensive adults (30). Dickinson et al. (2006) in their systematic review of randomized controlled trials observed blood pressure reductions following weight loss, dietary modification, and increased physical activity (12). Bacon et al. reported that diet and exercise, alone or combined, were effective in reducing the BP in subjects with mild hypertension, with improvements similar to drug therapy in patients with higher baseline BP level (6). A study among Japanese-Americans in Hawaii emphasized the health benefits of leisure-time physical activity, control of body weight, and reeducation in salt intake in population-based control of high BP (28). Physical activity is considered as a natural, inexpensive, feasible, and effective means of control for hypertensions and is a primary lifestyle measure required to lower blood pressure in non-physical education female students. A prospective study among Harvard male alumni reported that men who did not participate in vigorous exercise had a 35% higher incidence of hypertension than those who were more active (31). Another Finnish study found a reduced risk for hypertension in men participating in vigorous physical activity (16).

It is known that insulin sensitivity increases with aerobic training and the effect is local in the trained muscle. In a one-leg training model, Dela et al. (1996) showed an increase in insulin sensitivity in the trained leg, but no change in the untrained leg (11). Insulin is a hormone with many functions, and the fasting serum level of insulin is increased in subjects with a low fitness level as well as in subject with a high BMI. Besides its effect on glucose transportation, insulin has an anabolic effect on fat storage in the fat cells. Insulin
affect appetite regulation through the change in substrates in the blood, and Ferranini (1999) has suggested an effect on blood pressure regulation (15). Insulin sensitivity may therefore, is one of the key mechanisms behind the association found between BP, BMI, and fitness. The results of present study also the significant positive correlation between the weight and blood pressure variables on the on hand and between the BMI and blood pressure variables on the other studies (7). The coefficient of 0.51 between body weight and systolic blood pressure and 0.41 between body weight and diastolic blood pressure reported by Balogun and colleagues (1990) are similar to those found in the present study. Similar, the coefficient of 0.35 and 0.36 between BMI and systolic blood pressure, and diastolic blood pressure respectively reported by Balogun and colleagues (1990) are comparable with those noted in the present study. These results indicated that body weight variables to some observed (7, 22).

**CONCLUSION**

From the findings of this study; it is evident that the incidence of essential hypertension and overweight occurs even in non-physical education, though small. Among anthropometric variables, body weight and BMI tend to be more closely related to both systolic and diastolic pressure. Based on these finding, we wish to recommend that part of the preventive measures, secondary college non-physical education the female students in Iran should be provided with the opportunity to engage in regular and appropriate exercise programmed in order to keep their weights and high blood pressure within desirable levels. Furthermore, there is a need for appropriate health education emphasizing the importance of cardiovascular health at this level of education.

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