The Effect of Stress on Blood Pressure and Heart Rate of High School Girls

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Abstract

Purpose: The purpose of this research was to study the changes of Systolic blood pressure, diastolic blood pressure, and heart rate in the period of the examination, particularly the physics exam for the girls in high school.

Materials and Methods: For the purpose of this study, 58 students were randomly selected (age: 16.58 ± 0.56 years old, height: 157.89 ± 6.64 cm, weight: 53.72 ± 7.3 kg and body mass index (BMI): 21.08 ± 2.96). Their systolic and diastolic blood pressure and heart rate relaxation state were measured and recorded as the first phase. By the 28th day, in the period of the examination, and precisely 15 minutes before the physics exam, the same variables were measured once more, and recorded as the second phase.

Results: The results of the research, using the one sample t test, proved that there is a significant difference between the average systolic and diastolic blood pressure in the first phase and the second phase (P = 0.002). Moreover, the comparison of the averages of the heart rates of the subjects proved a significant difference between these two phases (α=0.05).

Conclusion: The final result of this research proved that the high school physics examination might cause significant changes in the blood pressure and the heart rate of the high-school students.

Keywords: Diastolic, Examination, Stress, Subjects, Systolic.

Introduction

Academic stress is an emotional tension of a student which is expressed or felt by him during his failure to cope with the academic demands and its consequences may be exhibited in the form of major health hazards and problems, both physical and mental. Stress related diseases may be high blood pressure, peptic ulcer, allergies, headache etc. In academic life, stress may act as a negative predictor of academic performance (Endler et al., 1994). One of the important sources of academic stress in school children is the great expectation of parents for achieving good marks in their examination. Students now have more home work than ever before and if the child fails to do home work as per the expectations of their teachers, the results is the cumulative academic stress. In recent time, there have appeared several news regarding the increasing suicide rate among students of as young age as 8 year old (Gupta et al., 2011).

When the narrowing that has developed in a coronary artery grows to the point that blood flow is significantly reduced, stress can lead to a condition known as myocardial ischemia. This condition occurs when the amount of blood reaching heart tissue through the coronary arteries is not enough to support the pumping work the heart is doing (Burg, 2005). Blood pressure is defined as the pressure of the blood against the inner walls of the blood vessels, but it could be controlled through regular medical care and appropriate nourishment (Pickering et al., 1982). As a matter of fact, blood pressure is the abnormal condition of the blood stream in which the systolic pressure is more than 140 mmHg and the diastolic pressure is more than 80 mmHg (Pickering et al., 1982).

High blood pressure increases the work of heart and causes inappropriate abnormal changes in the heart rate, and increases the danger of heart attack, and disrupts the functioning of kidneys (Dallas et al., 2004). Individuals
who have disposition of having high blood pressure, are more likely to have high blood pressure at the age of 40 years old (Dallas et al., 2004). A large number of environmental factors might change the normal and natural blood pressure to the unnatural and morbid state. Some factors including: social class (Dawn et al., 2002) racism, poverty (Sheps, 2002) short-term and long-term stress (Pickering et al., 1982; Dawn et al., 2002; Douglas et al., 2002) and the lack of support from society towards individuals' occupations lead to an increase in heart rate and blood pressure. A great number of the researchers have reported a relationship between stress and blood pressure. In fact, the natural reaction of the cardiovascular responses to the stress is the increase in the heart rate (Alan et al., 2003). Stress starts while the emotional, environmental, and physical needs of the individuals compete with one another, and exceed the ability of the individual. Short-term stress (acute) increases the blood pressure.

This is because epinephrine (Adrenalin) and the cortisol hormones are secreted. The blood vessels tighten and the activity of the nervous system and the heart rate increase. As a result, blood pressure occurs (Pickering et al., 1982; Sheps, 2002). Acute or chronic stress, also causes vessel resistance and increase tiredness (Pickering et al., 1982). On the other hand, it has been reported that avoiding stress decreases blood pressure and, therefore, prevents damages to main tissues of the body (Harshfiled et al., 2002). Active people or those who have a high level of physical fitness reflect less response to stress and are able to return to the original and natural state more quickly (Dallas et al., 2004). Blood pressure seems to be different for boys and girls. In a research 151 boys and 141 girls, between 15 to 18 years old of age, experienced 5 hours of stress (2 hours of pre-stress, 1 hour of stress and 2 hours of post-stress).

Systolic blood pressure of the boys was higher during the research (P = 0.001). This increase is caused by slow response of sodium secretion in boys’ urine, which increases blood pressure. Another possibility is secretion of estradiol in girls, which might delay and decrease the blood pressure (Harshfiled et al., 2003). On the other hand, girls might have more fat than boys; however, more than 25% fat quantity of the body in comparison with fat quantity of 12% to 20% has the same stimulating effect on the blood pressure (Coatmellick-Taglioni et al., 2003). In a different research, in which 190 girls between 8 and 16 years old of age participated, it was reported that computer stress games increase blood pressure (Karen et al., 2003). This increase was reported less in girls than in boys (Kayya, 2005). Prior researches proved that most people have circadian rhythm of blood pressure. This change includes an increase in blood pressure in the morning and in non-sleep times and a decrease in blood pressure at night and during sleep (Pourvaghar et al., 2010).

It seems that final examination in high school, particularly physics, can cause the adequate stress in girl students. The purpose of this research is to study the possible changes in systolic and diastolic blood pressure and heart rate of girls when resting and before the period of the final examination in comparison to the period of the final examination itself.

Materials and Methods

In this quasi-experimental research, the effect of high school physics final exam on the changes of blood pressure and heart rate of the girls was studied. The population was high-school girl students from which a sample of 58 students was randomly selected. The average and standard deviation of measured variables of the subjects are shown in table 1. The purpose of this research was explained to the students’ stress and heart beats by the researchers. Due to the effect of particular nutrition on the changes of the research variables, it was recommended that in the second phase subjects should consume the same nutrition as the first phase, and should not take any kind of medicine 24 hours prior to the phases of the research. Moreover, due to the circadian rhythm of the blood pressure, systolic and diastolic blood pressure and heart rate were measured at eight o’clock in the morning, when the subjects were sitting on a chair, by a German digital sphygmomanometer model HARTMANN and they were recorded as the first phase of the research (Table 2).

With regard to menstruation of the girls, the second level of the research was delayed for 28 days and was measured and recorded at the same time and with the same conditions (Table 2). Fifteen minutes after the measuring of the blood pressure in the second phase of the research, physics final exam was administered by the instructors. The data were analyzed by using SPSS: PC. Kolmogorov-Smirnov test was used to examine the normality of data and parametric tests including independent t-test was employed to test the hypothesis. All the tests were examined in alpha level set to 0.05.

Results

The presupposition was that the physics final exam might cause adequate stress in the subjects of the research and some degrees of changes in the heart rate and the systolic and diastolic blood pressure. One sample t-test and SPSS Software were used to analyze the research data and the Microsoft office word was used for drawing the chart. Comparing averages of systolic blood pressure proved that there are significant differences between two phases (df = 57, P = 0.002, t = 3.33). Likewise, comparing the averages of diastolic blood pressure
proved that there are significant differences between two phases (df = 57, P = 0.002, t = 3.47). There are significant differences between averages of heart rates (df = 57, P = 0.0001, t = 7.25) (Figure 1).

**Table 1: Average and standard deviation of age, height, weight and body mass index (BMI)**

<table>
<thead>
<tr>
<th>Variable</th>
<th>Average</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years old)</td>
<td>16.58</td>
<td>0.56</td>
</tr>
<tr>
<td>Height (cm)</td>
<td>157.89</td>
<td>6.64</td>
</tr>
<tr>
<td>Weight (kg)</td>
<td>53.72</td>
<td>7.3</td>
</tr>
<tr>
<td>BMI</td>
<td>21.08</td>
<td>2.96</td>
</tr>
</tbody>
</table>

**Table 2: Average and standard deviation of variables in two phase and acquired t and P values of subjects**

<table>
<thead>
<tr>
<th>Variables</th>
<th>First phase (M±SD)</th>
<th>Second phase(M±SD)</th>
<th>t</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Systolic blood pressure (mmHg)</td>
<td>107±12.39</td>
<td>114.17±11.20</td>
<td>3.33</td>
<td>0.0002</td>
</tr>
<tr>
<td>Diastolic blood pressure (mmHg)</td>
<td>67.82±9.78</td>
<td>73.93±8.88</td>
<td>3.47</td>
<td>0.002</td>
</tr>
<tr>
<td>Heart rate (min)</td>
<td>83.20±13.39</td>
<td>97.44±11.60</td>
<td>7.25</td>
<td>0.0001</td>
</tr>
</tbody>
</table>

All the observed differences are significant.

![Figure 1](image)

**Figure 1: The changes of systolic and diastolic blood pressure and heart rate of subjects**

**Discussion and Conclusion**

Stress represents a severe psychosocial problem already in many school-age children who are able to define it. This research is done to study the changes of blood pressure and heart rate in high-school students during final examination. It seems that sudden changes in blood pressure and heart rate that are caused by stress increase the danger of cardiovascular diseases and endanger students’ health (Douglas et al., 2002). Therefore, the people who have more disposition of having blood pressure and heart rate would be more in the danger of having blood pressure at the age of 40 years old (Dallas et al., 2004).

The results of statistical analyses proved that there are significant differences between the averages of first phase and the second phase concerning systolic and diastolic blood pressure and heart rate variables (P > 0.05). The results of this research correspond to the majority of the researches that consider the stress as the factor increasing blood pressure and heart rate (Alan et al., 2003). This research corresponds with the findings of Livingston (1993), Mirescu et al (2004) and Harshfiled et al (2002). These researchers, by creating different conditions for their subjects, have reported the stress as the factor of the increase in heart rate and blood pressure. Moreover, they reported that avoiding the stress prevents damage to the main tissues of the body. While having stress, central sympathetic nervous system (CNS) and after wards secretion of Corticosteroid cause the stimulation of heart rate and the increase in blood pressure (Sheps, 2002). In addition, this research does not correspond with the findings of Van Dooren et al (2004), although these researchers studied the stress and mental pressure of the nurses at their jobs.

It seems that much pressure and stress did not occur in the subjects of their research. It seems that slight stress does not create significant change in the blood pressure and heart rate variables. Some techniques and skills such as breathing, meditation (Karen et al., 2003), Yuga (Pickering et al., 1982; Kauts and Harma, 2012),...
can have an effective role in decreasing the stress, and application of these methods can free the students from the stress and also cardiovascular damages. The results have indicated the need of lowering school stress. One of effective ways is to promote physical activity in the life of children (Sevcikova et al., 2001).

References


