THE PHYSIOLOGICAL AND PSYCHOLOGICAL EFFECTS OF CLASSICAL MUSIC AND POP MUSIC ON FEMALE HIGH SCHOOL STUDENTS

INTRODUCTION and PURPOSE
The definition of music varies according to different cultures. While Africans define it as a formation close to human nature, American Indians view it as a means of communication between souls. K. M. Weber says, “Melody is the language of human soul”; Beethoven, “Music is a mediator between the physical being and spiritual being of individuals”; Nietzsche, “Music hosts the power to inspire human mind”; Confucius, “With music, relations between people get well, general mood calms down, and everything gets into order” (Fucci et al. 1996). As a combination of sounds, music is a form of art introducing a certain subject that has features like beauty and attraction, following a certain chain of logic, having a logical pattern, requiring its performer/composer to have special talents.

From early ages of history, music has been used as a method of treatment. In fact, music originated from the aim to treat patients. In ancient times, shamans, magicians, and practitioners tried to utilize music as a means affecting individuals or nature. Treatments conducted in the B-V.

ABSTRACT
Purpose: Since the early times of history, music has evolved as a branch of art as well as being applied for the purpose of treatment. The effects of music on individuals, animals and plants have been heavily researched in recent years. So, we aimed to determine the physiological and psychological effects of classical and pop music on young students.

Method: Various types of music invoke different reactions on animals, plants and individuals. We compared the results of effects of music we obtained from 17 female students aged 14-16. In this regard, we measured physiological parameters of subjects such as pulse, systolic and diastolic blood pressures, reaction times to light and sound, and the precision of voluntary action with muscle fatigue and precision test. Moreover, we assessed their psychological mood with the short-term memory, situational anxiety test.

In order to acquire general knowledge about subjects, they were required to fill in information forms. We conducted the test in the same order on subjects who were individually taken into a room. The tests were applied to the subjects while they were a) not exposed to music and to classical music; b) not exposed to music and to pop music.

Findings: According to the results, when prior to listening period was compared with while listening period;

1. the systolic and diastolic blood pressure and the number of pulses remained unchanged;
2. while reaction to light duration decreased, reaction to sound duration increased;
3. short-term memory decreased;
4. rhythmic stroke pace in muscle action increased;
5. the precision of voluntary action decreased in pop music, and it increased in classical music.

Discussion: The reason that the pulse along with the systolic diastolic pressure remained unchanged was because the subjects were inactive and unexcited before and during the music due to the atmosphere of experiment. The duration of reaction to sound by the subjects was supposed to be short but actually their reaction to the light was shorter because music prevented their reaction to the sound stimuli. In the same way, since music distracted the subjects, it affects the memory in the negative way. Since precision decreases the response when listening to the pop music and it increases during classical music, these values indicate to us that music with a fast tempo negatively affects the response at tasks that require concentration.

Conclusions: Music hinders the reactions of the subjects to sound stimulus and affects it in a negative way by extending the reaction time. Therefore their reaction time increases. It is observed that music with fast rhythms affects short-term memory, decreases the effectiveness of the voluntary actions but it increases the effectiveness of the action in which muscle action is needed. Besides, music has the ability to remove stress and also make people feel relaxed and tranquil.

Keywords: music, physiology, psychology, reaction time, situational anxiety measuring, precision test.
KLASİK ve POP MÜZİKLERİNİN LİSELI KIZ TALEBELER ÜZERİNDEKİ FİZYOLOJİK ve PSIKOLOJİK ETKİLERİ

ÖZET


Yöntem: Deneklerin nabiz, sistolik ve diyastolik basınçta bir değişimin olmamasının nedeni, deneklerin sese karşı tepkilerini engelme ve tepki sürelerini uzatarak müzik etiketi olarak kabul edilmektedir. Ayrıca, sese karşı hafıza durumları ve tepki süreleri, testlerin birinci ve ikinci testi ile psikolojik durumların değerlendirilmesinde kullanılmaktadır.

Çalışmamızın sonuçları, genel bilgilere dayanarak, bilgi formülleri doludur. Testlerin deneysel odadaki tek tek alınan deneklere aynı sırayla verilmesi A) Müziksesiz ve klasik müzik dinlerken B) Müziksesiz ve pop müzik dinlerken uygulandığında, elde edilen veriler Student’s-t ve Wilcoxon-t testi ile karşılaştırılmıştır.

Bulgular: Elde edilen verilerin, Student’s-t ve Wilcoxon-t testi ile karşılaştırıldığında, elde edilen verilerin, Student’s-t ve Wilcoxon-t testi ile karşılaştırıldığında, elde edilen verilerin, Student’s-t ve Wilcoxon-t testi ile karşılaştırıldığında, elde edilen verilerin, Student’s-t ve Wilcoxon-t testi ile karşılaştırıldığında, elde edilen verilerin, Student’s-t ve Wilcoxon-t testi ile karşılaştırıldığında, elde edilen verilerin, Student’s-t ve Wilcoxon-t testi ile karşılaştırıldığında, elde edilen verilerin, Student’s-t ve Wilcoxon-t testi ile karşılaştırıldığında, elde edilen verilerin, Student’s-t ve Wilcoxon-t testi ile karşılaştırıldı.


Anatör Celtemeler: Müzik, fiziolojik, psikolojik, tepki zamanı, durumluluk kaygısı ölçümü, istemli hareketin dakiği.
1. Systolic and diastolic blood pressures: We measured the blood pressures over the left brachial artery.

2. Pulse: We counted the heartbeats per minute from the left radial artery.

3. Short-term memory: The subjects were made to repeat three to nine numbers from backwards and forwards right after the numbers were given. Wrong numbers were statistically assessed.

4. Reaction time: With a Varimex brand Messegerat-Mrk 432 reaction measuring device, we measured 10 times the reaction of subjects to light and sound stimuli with 1/100 sec. sensitivity.

5. Muscle fatigue (Endurance): The test is applied as a standard and the muscle fatigue is measured with the number of pencil strokes. In the test we used a piece of paper containing 15 pairs of squares each having edges of 17.5 cm. With the order “Begin!” the subjects were demanded to place points within each square and to pass to the next row of squares every five seconds. We instructed the subjects to keep their arms parallel to the table. We determined the result of the test with the dots placed into the squares. The muscle fatigue curve was drawn as a result of the data obtained with and without music.

6. The precision of voluntary action: It is a standard test measuring the precision of muscle co-ordination. We provided a comfortable seat for subjects. We instructed the subjects to hold a sharp pointed pencil from its upper end. The subjects were supposed to hold their hands parallel and over the table. With the instruction “Begin!” we wanted the subjects to draw straight lines between two parallel lines measuring 23 cm. which got narrower towards the bottom like the letter V. The lines were supposed to be placed within the given lines and not to touch them. We have provided 9 seconds for each line which were repeated five times. The distance between the lines touching the edge of the narrowing lines and starting point were assessed as perfection in terms of cm.

7. Situational anxiety measuring: During these tests 10 positive phrases such as “I am relaxed at the moment”, “I feel safe” and 10 negative phrases such as “I am anxious at the moment”, “I feel depressed” were responded by subjects. We non-parametrically assessed the responses as none-1, a little-2, a lot-3 and completely-4 (Spielberger et al. 1970).

The values obtained over the tests were grouped according to their types. By applying Student’s t and Wilcoxon t-tests to the values, we have determined the indications before and after music.

**FINDINGS**

We conducted the experiments on 17 female students who expressed their liking for both pop and classical music, e.g. Tarkan’s Simarik (Spoiled) - I Die For You, and Vivaldi’s Four Seasons, and who lacked a systematic musical education.

Not a statistically noteworthy difference was observed in the number of pulses and in the systolic and diastolic blood pressure values before the classical and pop music period and while listening period. The relevant results are indicated in Table 1 and Graphics 1, 2 and 3.

The reaction time of subjects got longer during listening to both pop and classical music when compared to prior to listening. However, their reaction to light got shorter. The relevant values are displayed in Table 2 and Graphics 4, 5.

During the short-term memory test, the subjects tend to make more mistakes when they are exposed to music. The number of points the subjects placed onto papers increased in the endurance test. Difference at an important level was observed during the precision test, which resulted in the decrease of attention and punctuality. The re-

<p>| Table 1: The standard deviation of the values of pulse numbers and the systolic and diastolic blood pressure values before the classical and pop music period and while listening period (n=17). |
|--------------------------------------------------|-----------------|-----------------|-----------------|-----------------|</p>
<table>
<thead>
<tr>
<th>Heart pulses (1/min.)</th>
<th>Prior to classical music</th>
<th>While listening to class. music</th>
<th>Prior to pop music</th>
<th>While listening to pop music</th>
</tr>
</thead>
<tbody>
<tr>
<td>Systolic blood pressure (mmHg)</td>
<td>107.42±5.87</td>
<td>106.64±4.86</td>
<td>109±1.10</td>
<td>110.36±3.61</td>
</tr>
<tr>
<td>Diastolic blood pressure (mmHg)</td>
<td>57.9±8.85</td>
<td>58.66±8.33</td>
<td>60.35±7.97</td>
<td>58.92±7.64</td>
</tr>
</tbody>
</table>
Results of the tests are indicated in Table 3 and Graphics 6, 7, 8.

In evaluating the situational anxiety test, we found out that the scores relevant to the negative psychological mood dominant in all subjects decreased prior to listening to music when compared with while listening whereas scores denoting the positive psychological mood of subjects increased.

Based on the points in Table 4 and 5, we determined the situational anxiety scores for each subject as prior to listening and while listening. When we assessed the values with non-parametric...
Wilcoxon t-test, it became obvious that the negative psychological mood decreased while listening to music.

**DISCUSSION**

The facts we obtained during our research led us to the following conclusions:

No change was detected in pulse, diastolic and systolic pressures. The reasons of change in the parameters are mostly due to the comfortable environment provided for the subjects prior to music and while being exposed to music.

We also observed that the time to respond to sound increased. The reason of it could be that our

<table>
<thead>
<tr>
<th>Prior to classical music</th>
<th>While listening to class. music</th>
<th>Prior to pop music</th>
<th>While listening to pop music</th>
</tr>
</thead>
<tbody>
<tr>
<td>Light Reaction Time (s.)</td>
<td>0.296±0.032</td>
<td>0.271±0.030 (*)</td>
<td>0.303±0.027</td>
</tr>
<tr>
<td>Sound Reaction Time (s.)</td>
<td>0.189±0.023</td>
<td>0.228±0.031 (*)</td>
<td>0.202±0.032</td>
</tr>
</tbody>
</table>
subjects reacted to a different sound. Music prevents the subjects to respond to another stimulus, extending the time of reaction negatively. During listening to music, the time to react to light was observed to decrease. The reason may be that the subjects were mostly focused on the sound stimulus which divided their attention as their reflexes relaxed leading to an easy and rapid reaction.

Table 3: The mean values and standard deviations of the short time memory, muscle fatigue and punctuality of voluntary actions of the test subjects the classical and pop music before and while listening period (n=17; *p<0.05).

<table>
<thead>
<tr>
<th></th>
<th>Prior to Classical music</th>
<th>While listening to Classical music</th>
<th>Prior to Pop Music</th>
<th>While listening to Pop Music</th>
</tr>
</thead>
<tbody>
<tr>
<td>Short-term memory (number of errors)</td>
<td>6.36±1.13</td>
<td>6.96±1.17 (*)</td>
<td>5.87±1.16</td>
<td>6.20±1.15 (*)</td>
</tr>
<tr>
<td>Muscle fatigue (number of points)</td>
<td>16.54±1.70</td>
<td>17.95±1.50 (*)</td>
<td>16.46±2.58</td>
<td>18.98±2.56 (*)</td>
</tr>
<tr>
<td>The punctuality of voluntary action (the length of flawless line cm)</td>
<td>7.03±0.59</td>
<td>8.33±0.22 (*)</td>
<td>7.99±0.60</td>
<td>6.85±0.25 (*)</td>
</tr>
</tbody>
</table>

Figure 6. The mean values and standart errors of short-term memory measures of the test subjects before the classical and pop music period while listening (n=17; *p<0.05).

Figure 7. The mean values and standart errors of the measures of voluntary action punctuality obtained through the precision test conducted on test subjects (n=17; *p<0.05).
In the short-term memory test, we concluded that the increase of errors during the listening to music period (when compared with the before listening period) was due to music, which is a factor causing the subjects to be less careful, who are already at an age when the tendency to be less careful is quite high. The effects of melody and lyrics were separately researched during the tests conducted by Soussou (1997) on 137 students. The research revealed the fact that lyrics have no relation with memory but on the other hand music has an overall effect on it. We also reached the same conclusion as the stated one, that is, pop and classical music have negative effects on memory. We observed that the subjects had difficulty in repeating the numbers they were given when exposed to music.

Judging from the values obtained from the muscle fatigue test (endurance), that is, the increase in the number of dots placed onto the paper while listening to music, it was revealed that music increased the rhythmic strokes of muscles and in a way it increased the motivation of subjects. We can conclude that quick rhythms of music cause rapid muscle movements in subjects (Iwanaga and Mori-Ki 1999).
In the precision test, judging from the values indicating that precision of subjects decreased while listening to pop music and increased while listening to classical music, we concluded that music types containing quick rhythms negatively affect the actions requiring focus and concentration.

The negative responses received from all subjects before they were exposed to music were decreased while listening during the measurement of situational anxiety. The subjects said they felt themselves more comfortable and happier. Previous researches conducted on the effect of music upon stress also yielded similar results (Brownley et al. 1995, McIntyre and Cowell 1991).

We found out that music types containing quick rhythms decreased the success at short-term memory and voluntary action; consequently these types of music decrease the amount of attention at deeds requiring attention.

It could be concluded that the music with quick rhythms which is liked by subjects have positive effects on actions demanding muscle movement, removing the stress of the subject and causing a complete peace of mind.
CONCLUSION

When we evaluated the findings, following conclusion were made.

- The pulse and the systolic blood pressure remained unchanged.
- We observed that the duration to the sound reaction time increased.
- The reaction time duration to light decreases in an environment with music.
- We determined that pop and classical music affects the short-term memory in a negative (opposite) ways.
- We observed that music increased the rhythmic stroke pace in muscle action but it negatively affected the success just as in the precision of the voluntary action test.
- We determined that music removed stress from the subjects and it made them feel relaxed and tranquil.

REFERENCES