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

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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.

The obtained results were compared with Student's-t and Wilcoxon-t tests.

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

1. the systolic and diastolic blood pressure and the number of pulses remained unchan ged;
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 distracts 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.

INTRODUCTION and PURPOSE

The definition of music varies according to different cultures. While Africans defines 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, magician physicians and remedy finders tried to utilize music as a means affecting individuals or nature. Treatments conducted in the Be-

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KLASİK ve POP MÜZİKLERİNİN LİSELİ KIZ TALEBELER ÜZERİNDEKİ FİZYOLOJİK ve PSİKOLOJİK ETKİLERİ

ÖZET

Amaç: Müzik tarihin ilk dönemlerinden beri tedavi amacı ile kullanılmasının yanı sıra bir sanat dalı olarak gelişmiştir. Son yıllarda da müziğin insanlar, hayvanlar ve bitkiler üzerindeki etkileri yoğunlukla araştırılmaktadır. Değişik müzik türleri canlılarda farklı tepkiler oluşturmaktadır. Bizde, 14-l6 yaş grubu 17 kız öğrencide klâsik ve pop müziğin etkilerini karşılaştırmayı amaçladık.

Yöntem: Deneklerin nabız, sistolik ve diyastolik kan basıncı, ışığa ve sese karşı tepki süreleri, endurans testi ile kas yorgunluğu ve precision testi ile istemli hareketin dakikliği gibi fizyolojik parametrelerini ölçtük. Ayrıca kısa süreli hâfıza, durumluk kaygı testi ile psikolojik durumlarını da değerlendirdik.

Çalışmaya başlamadan önce denekler hakkında genel bilgiler edinmek için bilgi formu doldurttuk. Testleri deney odasına tek tek alınan deneklere aynı sırayla verilmek üzere

A) Müziksiz ve klâsik müzik dinlerken

B) Müziksiz ve pop müzik dinlerken uyguladık.

Elde edilen verileri Student's-t ve Wilcoxon-t testi ile karşılaştırdık.

Bulgular: Elde ettiğimiz bulgular; müzik öncesine göre müzik dinlerken

1. Sistolik ve diyastolik kan basıncı ve nabız sayısında bir değişme olmamıştır.
2. Işığa karşı tepki süreleri azalırken,.sese karşı tepki süreleri artmaktadır.
3. Kısa süreli hafıza azalmaktadır.
4. Kas hareketinde ritmik vuruş temposu artmaktadır.
5. İstemli hareketin dakikliği pop müzikte azalmakta, klâsik müzikte artmaktadır.

Tartışma: Nabız, sistolik ve diyastolik basınçta bir değişimin olmamasının nedeni, deneklerin müzik öncesi ve müzik dinlerken rahat, deney ortamından dolayı heyecansız ve hareketsiz olmalarıdır. Deneklerin, sese karşı tepki sürelerinin, kısa olması gerekirken, ışığa karşı daha kısa süreli olmasının nedenini, müziğin, deneklerin sese karşı tepkilerini engellemesindendir. Aynı şekilde müzik deneklerin dikkatlerini dağıttığı için hafızayı olumsuz yönde etkilemektedir. Müzik öncesine göre, pop müzik dinlerken, deneklerden elde edilen dakikliğin azalması ve müzik öncesine göre klasik müzik dinlerken elde edilen dakikliğin artması yönündeki değerler bize dikkat gerektiren işlerde hızlı ritimli müziğin başarıyı olumsuz etkilediğini göstermektedir.

Sonuç: Müzik, deneklerin sese karşı tepkilerini engellemekte ve tepki sürelerini uzatarak olumsuz etkilemektedir. Bu nedenle sese karşı tepki süreleri artmaktadır. Hızlı ritimli müziğin kısa süreli hâfızayı ve istemli hareketlerdeki başarıyı azalttığı, kas hareketi gerektiren eylemlerde de arttırıcı bir eylem olduğu görülmektedir. Ayrıca, sevilen müziğin kişileri stresten uzaklaştırdığını, kendilerini daha rahat ve huzurlu hissetmelerine yol açtığını söyleyebiliriz.

Anahtar Kelimeler: müzik, fizyoloji, psikoloji, tepki zamanı, durumluluk kaygı ölçümü, istemli hareketin dakikliği.

yazit II Complex with various musical modes (maquams: a concept in classical Turkish music which determines tonal relations, starting tone, reciting tone, and the final is as well as an overall indication of the melodic contour and patterns) are the best examples in this regard. Starting from the Middle Ages, music evolved and gained characteristics of entertainment and art (Grebene 1978, Fucci et al. 1996, Tucek 1995).

Studies aimed at revealing the function of music with its various aspects are still conducted today (Mockel et al. 1994, Tucek 2002). Some examples for the studies realised in this field are mentioned below:

- In a research carried out at Ohio University, Audio-visual Sciences Department, the behavioural changes of young adults caused by three different types of music were studied (Fucci et al. 1996).
- S.D. Sousou studied the effects of melodies and lyrics on the memories and mood of 137 students of the Le Moyne College in Switzerland (Soussou 1997).
- The behavioural changes stemming from listening to music during doing exercise were revealed with a study realised by B. D. Mills in the United States Sports Academy (Mills 1996).
- In a study put forward by M. Iwanaga at all from Hiroshima University Behavioural Science Department, the effects of excitative and sedative music on individuals and on psychological relief were indicated (Iwanaga and Tsukamoto 1997, Iwanaga and Moroki 1999).

We conducted a research aiming to determine the physiological and psychological effects of music on 17 female high school students of ages ranging from 14 to 16. Our purpose is to research the quantitative effects of music on individuals.

MATERIAL and METHODS

We began our research over a questionnaire by simply determining the choice of the type of music the students like. According to the data revealed with the questionnaire, Vivaldi's Four Seasons and Tarkan's (a famous Turkish pop star) *Simarik (Spoiled)* are the most renowned and preferred musical compositions. Besides, taking the questionnaire as a basis, we chose 17 female high school students who lacked any musical education or were incapable of playing a musical instrument.

One by one we invited those chosen into a sound-proof room arranged in a way not to distract their attention. We applied the same row of tests on different days between 13:00 and 15:00; a- before music and while listening to classical music; b- before music and while listening to pop music.

On eight subjects, we altered the orders as firstly pop music and then classical music. We paid maximum attention to follow the same pattern of tests under very same circumstances for all subjects. Prior to listening and while listening to music, they were underwent the tests below with the order presented:

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-Mrk432* reaction measuring device, we measured 10 times the reaction of subjects to light and sound stimuli with 1/100 sec. sensitiveness.
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 distance 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-

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).

	Prior to classical music	While listening to class. music	Prior to pop music	While listening to pop music
Heart pulses (1/min.)	82.11±10.36	81.22±11.21	82.76±8.63	83.26±6.68
Systolic blood pressure (mmHg)	107.42±5.87	106.64±4.86	109±1.10	110.36±3.61
Diastolic blood pressure (mmHg)	57.9±8.85	58.66±8.33	60.35±7.97	58.92±7.64

Figure 1. The mean values and standart errors in the heart pulses of the test subjects (n=17).

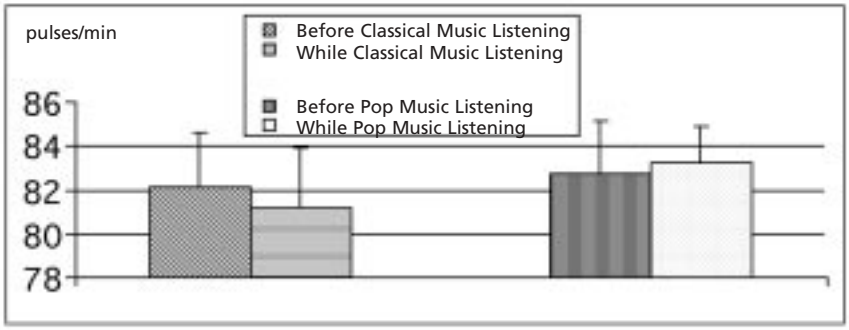


Figure 2. The mean values and standart errors of systolic blood pressures of the test subjects (n=17).

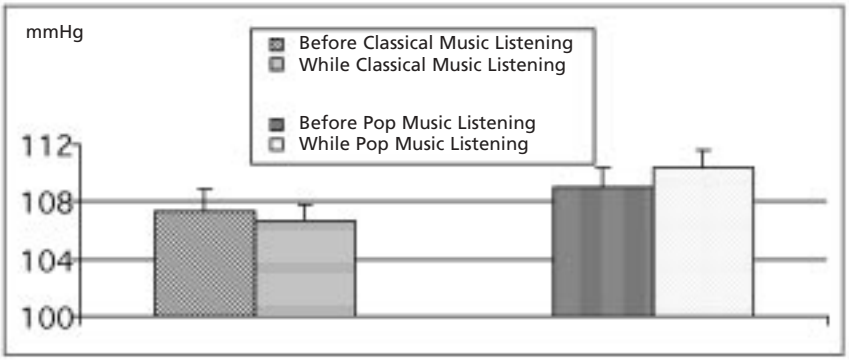
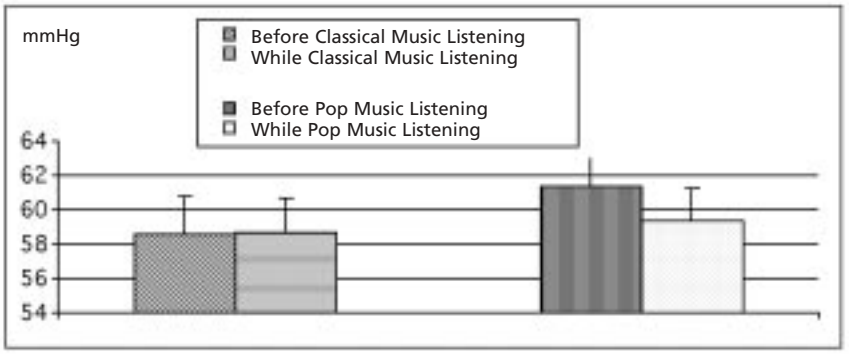


Figure 3. The mean values and standart errors of diastolic blood pressures of the test subjects (n=17).



sults 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

Table 2: The mean values and standard deviations of the reaction time of subjects to light and sound before the classical and pop music period and while listening period (n=17; *p<0.05)

	Prior to classical music	While listening to class. music	Prior to pop music	While listening to pop music
Light Reaction Time (s.)	0.296±0.032	0.271±0.030 (*)	0.303±0.027	0.270±0.025 (*)
Sound Reaction Time (s.)	0.189±0.023	0.228±0.031 (*)	0.202±0.032	0.235±0.041 (*)

Figure 4. The mean values and standart errors of the reaction time of the test subjects to light before the classical and pop music period while listening (n=17).

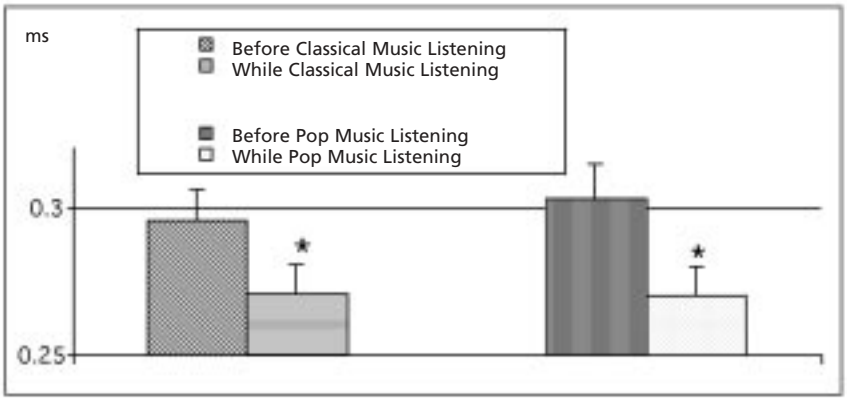
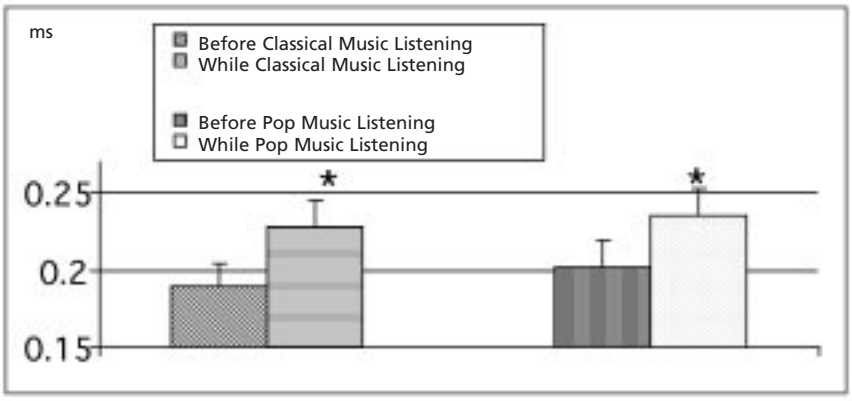


Figure 5. The mean values and standart errors of the reaction time of the test subjects to sound before the classical and pop music period while listening (n=17; *p<0.05).



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

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).

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

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

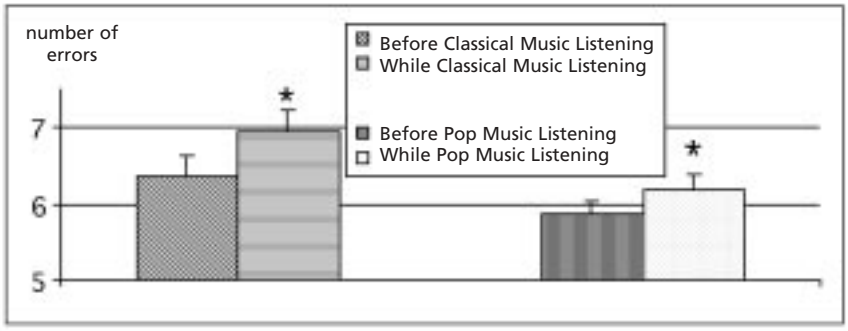


Figure 7. The mean values and standart errors of the measures of voluntary actionpunctuality obtained through the precision test conducted on test subjects (n=17; *p<0.05).

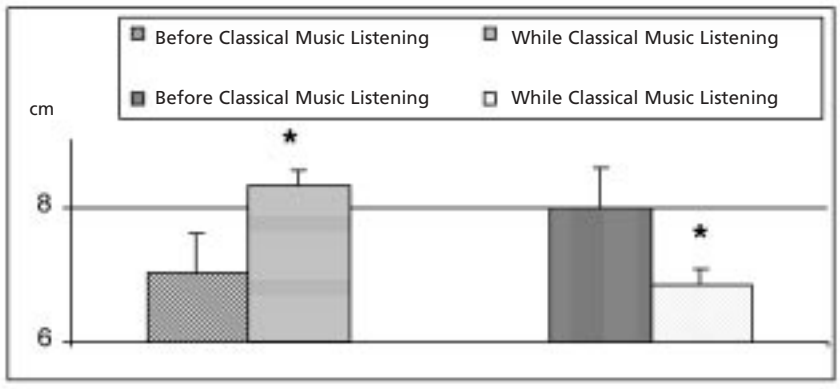


Figure 8. The mean values and standart errors of the muscle fatigue of the test subjects, before and while the classical and pop music listening period (n=17; *p<0.05).

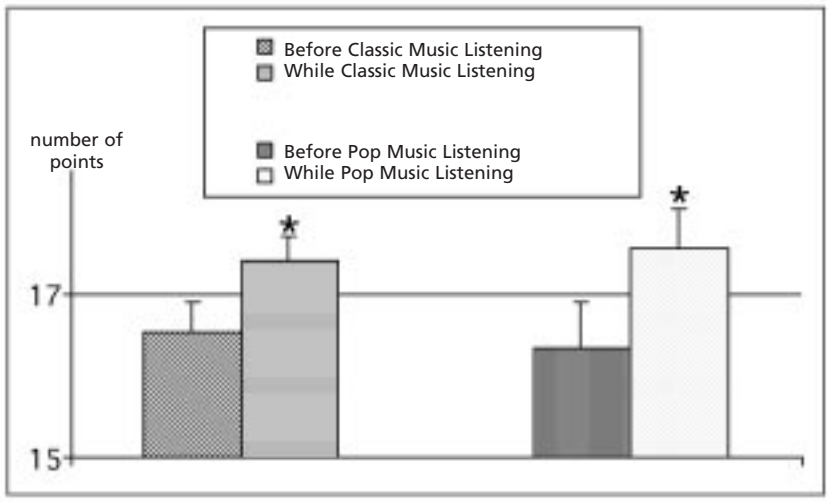
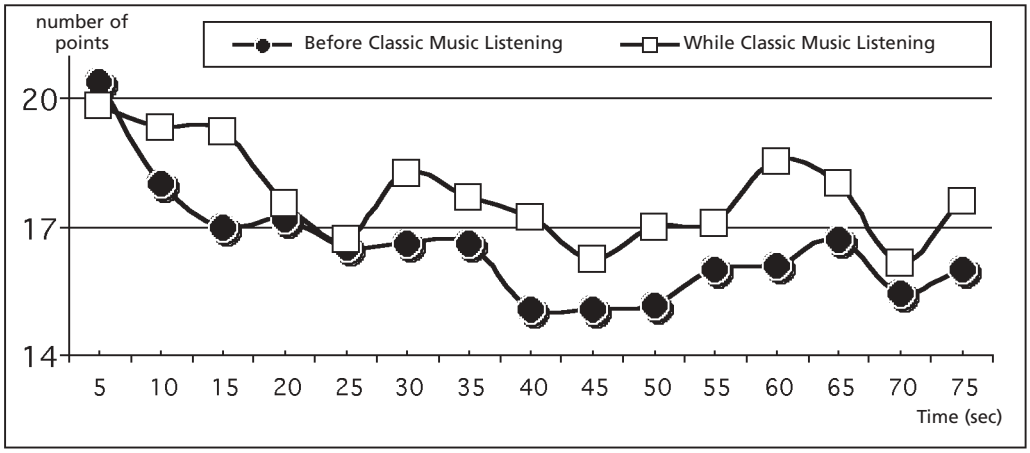


Figure 9. The mean values and standart errors of the measures of muscle fatique of the test sebjects, before and while classic music listening period.



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 Moroki 1999).

Figure 10. The mean values and standart errors of the measures of the muscle fatique of the test sebjects, before and while pop music listening period.

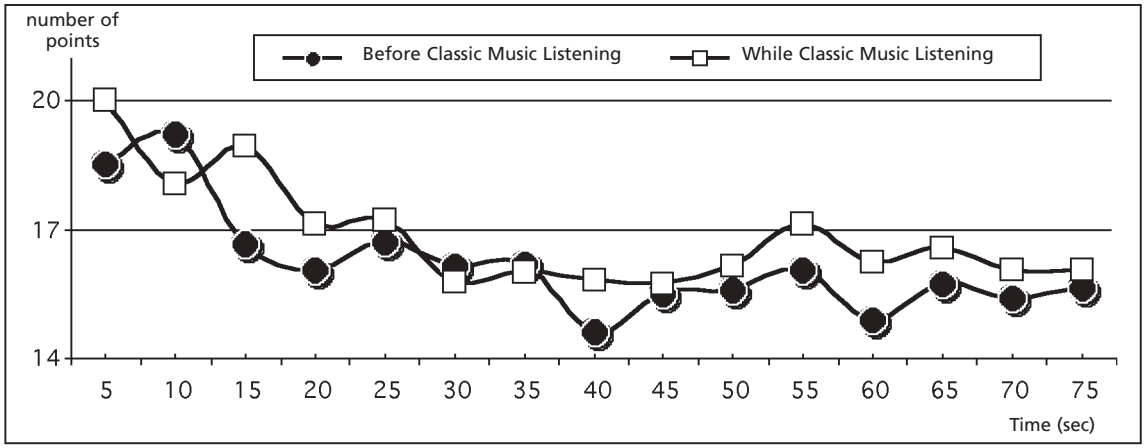


Table 4: The distribution of scores denoting the negative psychological mood of the subjects.

Points	Prior to classical music	While listening to class. music	Prior to pop music	While listening to pop music
1	99	112	120	131
2	11	8	18	9
3	0	0	0	0
4	0	0	1	0

Table 5: The distribution of scores denoting the positive psychological mood of the subjects.

Points	Prior to classical music	While listening to class. music	Prior to pop music	While listening to pop music
1	6	6	6	2
2	15	13	23	16
3	32	42	43	48
4	56	59	68	74

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.

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