ORIGINAL RESEARCH

Effect of the Most and the Least Favorite Music Genre of Youngs on Their ECGs

Gençlerin En Sevdiği ve En Az Sevdiği Müzik Türünün EKG'lerine Etkisi

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Abstract

Objective: Does music really touch our heart? To answer this question, this study aimed to investigate the effect of the most and least favorite type of music on echocardiography (ECG) of boys or girls.

Method: While we were recording the lead II ECG, the most and the least favorite songs of the participants were listened by a total of 54 participants (33 girls and 21 boys). The heart rates (HR), the amplitudes, and durations of the waves in the ECGs, and the durations of the intervals [P-R (s) and Q-T (s)] of the resting period 1, favorite song period, resting period 2 and least favorite song period were analyzed.

Results: Girls' HRs increased significantly (p<0.05) while they were listening to their most favorite music however listening to their least favorite song did not change their HRs. Unlike that, boys' HRs did not change significantly while listening to their most or least favorite music. In addition, the amplitudes and durations of the waves in the ECGs, and the durations of the intervals did not change significantly by listening to either music genre in boys or girls.

Conclusion: Girls reacted more to the type of music they liked than men. This may be due to girls having more emotional nature and thus limbic system activation.

Keywords: ECG, heart rate, most and the least favorite music, music, pulse

Öz

Amaç: Müzik gerçekten kalbimize dokunuyor mu? Bu soruyu cevaplamak amacıyla bu çalışma, genç kız ve erkeklerde en çok ve en az sevdikleri müzik türünün ekokardiyografilerine (EKG) etkisini araştırmak için tasarlandı.

Yöntem: Toplam 54 katılımcıdan (33 kız ve 21 erkek) en sevdikleri ve en sevmedikleri müzikleri dinlemeleri istendi ve II. derivasyona göre EKG kaydı yapıldı. Gönüllülerin kalp atım hızları, EKG dalgalarının genlikleri, süreleri ve intervallerin [P-R(s) ve Q-T(s)] süreleri dinlenme periyodu 1, favori şarkı periyodu, dinlenme periyodu 2 ve en az sevilen şarkı periyodu esnasında hesaplandı.

Bulgular: Kızların kalp atım hızları en sevdikleri müzik türünü dinlerken anlamlı olarak arttı (p<0,05), ancak en az sevmedikleri şarkıyı dinlemek kalp atım hızlarını değiştirmedi. Aksine, erkeklerin kalp atım hızları en sevdikleri veya en az sevmedikleri müzik türlerini dinlerken anlamlı bir değişiklik göstermedi. Ayrıca hem kızlarda hem de erkeklerde EKG dalgalarının ve intervallerinin genlikleri ve süreleri her iki müzik türüne göre anlamlı bir değişiklik göstermedi.

Sonuç: Sonuç olarak kızlar en sevdikleri müzik türüne erkeklerden daha çok tepki verdiler. Bunun nedeni, kızların daha duygusal bir yapıya sahip olmaları olabilir.

Anahtar kelimeler: EKG, en çok ve en az sevilen müzik, müzik, nabız

Introduction

Nowadays, music plays a meaningful role in our lives. Our body's response to music can be conscious or unconscious, involving hormonal and neurological reactions and changes in emotions and mood. But does music really touch our heart?

The question of whether and how music affects the human heart has been a popular topic of interest for scientists. The use of music in medicine dates to the 6th century. At the beginning of the 20th century, views advocating the validation and application of music for therapeutic purposes increased in modern medicine (1). It is thought that music may provide cardiovascular benefits through

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complex interactions between respiratory activity and autonomic cardiovascular control. Experimental results show that music therapy can effectively reduce the activity of sympathetic nerves and increase the activity of parasympathetic nerves (2). Several studies suggest that listening to music may have longer-term effects on the balance of sympathetic vs. parasympathetic activity (3).

Even though there have, been some studies about the effect of music on the human body, the physiological effects of listening to the most favorite and the least favorite musical genre on the heart are still not clear enough. Based on this information, this study investigates the effect of the most and the least favorite music genres of boys or girls on their ECGs.

Materials and Methods

Students between the ages of 18-30 and studying at the Faculty of Medicine of Bezmialem Vakıf University were included in the study (33 females and 21 males). The ethic regulations have been followed in accordance with the National and Institutional guidelines. All ethical procedures were approved by the Non-Interventional Research Ethics Committee, Bezmialem University (04.06.2021-18725). An informed consent form was read and signed to obtain the participants' consent that they voluntarily participate. The compliance of the patients who will participate in the study with the inclusion and exclusion criteria has been checked. Selection criteria included similar age (18-30 years old), body mass index (20-25), being student in faculty of medicine, not using any treatment or medication during the study period. Exclusion criteria included that the participants had any acute or chronic illness.

ECG Recording

A total of 54 participants (33 females and 21 males) were asked to listen to their favorite and least favorite music while we recorded a lead II ECG. The ECG signals were recorded through the PowerLab data system (PowerLab System, ADInstruments), which contained an input amplifier (BioAmp). A five-lead patient cable was connected to the input of the BioAmp. The inner aspect of the right forearm just above the wrist was rubbed briskly with alcohol. A disposable electrode was then placed onto the cleansed area. The electrodes were placed in the same way for both legs, attaching the electrodes a few inches above the subject's ankle. For the record from Lead II, cables were snapped on the electrodes as follows:

Negative to the right arm, positive to the left leg, and earth to the right leg. The paper speed was adjusted to 25 mm/sec, and 1 cm =1 mV.

The subjects lied in a supine position on a wheeled bed and calmed down for 4 min to get rid of stress and slow down their heart rate (HR) (resting 1 period, R1). They were told to close their eyes and try not to think about anything so that their emotional state would not affect their hearts' responses. Afterwards, they listened to their self-chosen favorite song for 4 min (favorite song period, FavS) before resting for another 4 minutes (resting 2 period, R2). During this period, they were allowed to think about anything they wanted, and to feel freely what their favorite song made them to feel. Finally, their least favorite song was played for 4 min (least favorite song period, LFavS), and the process was done. The ECGs were recorded at the beginning of the study and at the end of each period. The HRs, the amplitudes and durations of the waves [P (s), P (mV), QRS (s), QRS (mV), T (s) and T (mV)] in the ECG, and the durations of the intervals [P-R (s) and Q-T (s)] were calculated.

Statistical Analysis

Statistical analysis was performed with Instat Statistical Package Program (GraphPad Prism Version 8.0.1 Software Program San Diego, CA) at a significance level of $p < 0.05$. The normality of the data was tested with Shapiro-Wilk test. The data with a normal distribution analyzed by One-Way ANOVA and the data without normal distribution analyzed by Kruskal-Wallis test. The post-hoc Bonferroni and Dunn tests were used to indicate differences between the groups. All results were expressed as ± standard deviation of means (standard deviation).

Results

It was found that the female's HRs decreased ($p < 0.05$) during the R1 period with an average of 82,33/min at the beginning and 73,76/min at the end of the R1 period (Figure 1). Listening to their favorite song increased ($p < 0.05$) the HR significantly, shown as an average of 79,10/min at the end of the FavS period. However, listening to their least favorite song did not change significantly ($p > 0.05$) the HR (only slight increase was observed) with an average of 75,93/min at the end of their LFavS period (Figure 2). On the other hand, male's HRs did not change significantly while listening to their favorite nor their least favorite music (Figure 2). In addition, the amplitudes, and durations of the waves in the ECGs, and the durations of the intervals did not change ($p > 0.05$) by the listening of either music genre in males or females (Table 1).

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Discussion

Since ancient times music has been considered a form of expression that affects both the body and the soul of people. The rhythm of a piece of music is perceived acoustically and translated into motor movement patterns that motivate physical movement or clapping. Music is one of the factors of the environment, which is one of the influences on health. Nowadays, the use of music is part of the medical standard of treatment in various medical fields, such as in pain and palliative medicine, in neurology and psychiatry or in pediatrics as well as in the field of rehabilitation medicine or in curative and special education (4-7).

The effect that music has on physical processes is explained by the effects of the nervous system and emotional states on the human body and organs (8). With its harmonic, melodic and rhythmic elements, music can influence the human body, its heart rhythm, and other physiological processes in such a way because the central nervous system, especially through the structures of the limbic system, has a direct influence on various organs (9). The limbic system regulates emotional processes and is involved in learning and memory formation: The enjoyment and artistic understanding of music are not possible without the cooperation of the limbic system (10). Hypothalamus, one of the major centers of the limbic system, controls the autonomic nervous system, itself another negative feedback loop with excitatory (sympathetic) and inhibitory (parasympathetic) components.

Music can cause cardio-respiratory modifications. Music is associated with changes in activity in brain structures known to modulate cardiac activity (11). While predominantly

Figure 1. Representative ECGs of girls (n=33)

B: Beginning, R1: Resting 1, FavS: Favorite song, R2: Resting 2, LFavS: Least favorite song. Paper speed =25 mm/sec, 1 cm =1 mV
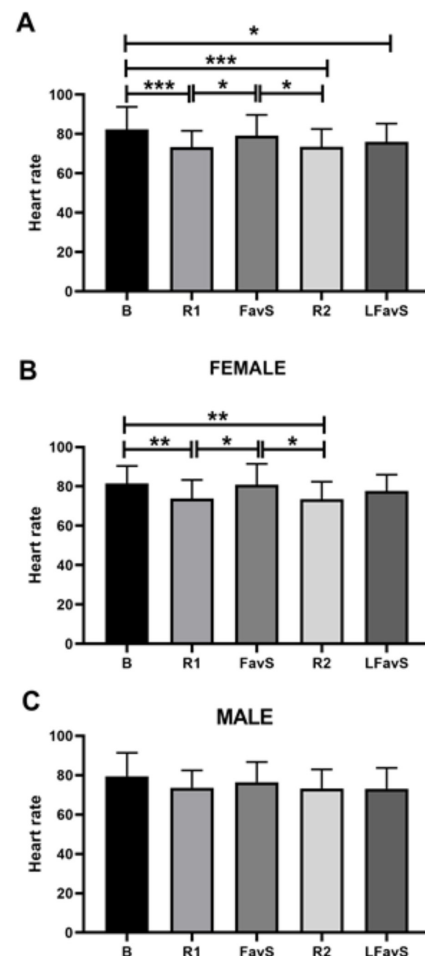

Figure 2. The heart rate values of all participants (A, n=54), females (B, n=33) and males (C, n=21)

*B: Beginning, R1: Resting 1, FavS: Favorite song, R2: Resting 2, LFavS: Least favorite song. Data are presented as mean ± standard deviation. *p<0.05, **p<0.01, ***p<0.001 statistical significance*

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Table 1. The amplitudes and durations of the waves, and the durations of the intervals in ECGs of girls (n=33)

Female

Parameter	B	R1	FavS	R2	LFavS
P (s)	0.1089±0.016	0.117±0.015	0.1082±0.017	0.1112±0.019	0.1071±0.017
P (mV)	0.1039±0.021	0.1038±0.025	0.0976±0.025	0.0995±0.027	0.0964±0.027
QRS (s)	0.085±0.016	0.0904±0.021	0.0819±0.015	0.0888±0.019	0.12±0.2
QRS (mV)	0.8073±0.317	0.8308±0.33	0.8009±0.31	0.8157±0.332	0.8032±0.336
T (s)	0.2112±0.107	0.2052±0.046	0.1974±0.043	0.2095±0.047	0.202±0.046
T (mV)	0.1901±0.068	0.2108±0.07	0.1992±0.062	0.2116±0.073	0.2009±0.064
P-R (s)	0.1552±0.026	0.1624±0.027	0.1596±0.023	0.1622±0.022	0.1604±0.019
Q-T (s)	0.3660±0.038	0.3928±0.039	0.3786±0.039	0.3842±0.038	0.3766±0.032

B: Beginning, R1: Resting 1, FavS: Favorite song, R2: Resting 2, LFavS: Least favorite song, Data were presented as mean ± standard deviation, $p<0.05$, statistical significance compared to B group

quiet music has a relaxing effect on the psyche and body and therefore produces a general calming effect with lowering the HR and blood pressure, loud and rhythmic music has a stimulating effect and causes an acceleration of the pulse and an increase in blood pressure (12). Magnetic resonance tomography studies on healthy subjects showed increased cerebral activity in the prefrontal, auditory, and parietal areas, as well as in the cingulate and lower gyrus, which are closely related to the limbic system, and are thought to affect cardiopulmonary mechanisms in this way (13,14). In a study, it was determined that classical music had a significantly lower effects on cardiovascular parameters such as blood pressure and HR in both human and animal subjects (15). Trappe (16) found that heavy metal music increased HR and can lead to stress and arrhythmias. Escher and Evéquoz (17) investigated the effect of relaxing music on HR and HR variability in 23 healthy young individuals by means of 24-hour holter-ECG. They suggested that relaxing music (Bach, Vivaldi, Mozart) significantly decreased the HR and HR variability. Suguna and Deepika (12) have suggested that listening to slow beat music activates parasympathetic nervous system thus causing a decrease in HR, while listening to fast beat music activates sympathetic nervous system thus causing an increase in HR. Similarly, Koelsch and Jäncke (18) reported that HR and respiratory rate were increased in response to exciting music compared with calming music. Trappe and Voit (19) also found that the music by Mozart and Strauss lowered the subjects' blood pressure and HR.

There are only a few studies showing the direct effect of one's personal choices of music genres on the heart by using an ECG. Sills and Todd (20) investigated the change in HR by letting twenty-four high-school students listen to a selection of six pieces of music, each of a different type (classical, electronic, jazz, world, RnB, and rock). A hand-held HR monitor was used to measure and record the HR of each student. The results suggested that students' average HRs throughout their favorite music selection (rock) were not significantly different from their resting HRs, but students' HRs increased significantly after listening to their favorite music selection.

According to our results, a decrease in resting HR was an expected finding since it is known that the parasympathetic nervous system is stimulated at rest, thus increasing the mean resting heart rate to 60-100 bpm (21). Listening to one's favorite song is mostly associated with having good mood and feeling excitement due to activation of sympathetic system. These two things lead to increase the HR. It is still unclear why the favorite song has a significant effect on the increase whereas least favorite songs only slightly increase the HR. This is may be related to the control of the limbic system over the cardiac centers. Thus, when listening to the least favorite type of music, limbic system is not activated and may not exert a stimulating effect on the cardio regulatory centers.

Study Limitations

One of the limitations of our study was the lack of the population and the equipment required for continuous blood pressure measurement. However, we considered that blood pressure results are also in line with the results of the heart rate with the activation of cardiac regulatory centers.

Conclusion

The results suggested that listening to favorite music has an increasing effect on heart rate. This increment may have occurred by increasing sympathetic tone and activating the cardio-regulatory center through the activated limbic

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system. Additionally, listening to favorite song was more effective on heart rates in females than in males. That may be the emotional nature of girls and with more limbic discharge.

Ethics

Ethics Committee Approval: All ethical procedures were approved by the Non-Interventional Research Ethics Committee, Bezmialem University (04.06.2021-18725).

Informed Consent: An informed consent form was read and signed to obtain the participants' consent that they voluntarily participate.

Peer-review: Internally and externally peer-reviewed.

Authorship Contributions

Concept: İ.M., Design: İ.M., Data Collection or Processing: N.N.P., A.K., İ.M., Analysis or Interpretation: N.N.P., A.K., İ.M., Drafting Manuscript: N.N.P., A.K., Writing: İ.M., Final Approval and Accountability: İ.M.

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