The Effect of Bach's Music towards Simple Reaction Time and Vital Signs

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Abstract: One of the method to influence the reaction time and vital signs is by listening to classical music especially Bach's music. Bach's music has a slow tempo (60-80 bpm) which can affect blood pressure (BP), heart rate (HT), and simple reaction time (SRT). Bach's music has a composition of fluctuating tones between high notes and low notes. The objective of this study is to determine the effect of Bach's music toward simple reaction time and vital signs Material and methods: The study design was quasi-experimental with a pretest and posttest design. This study was conducted at 30 night shift security guards aged 20-45 years. The measured data were blood pressure, heart rate, and simple reaction time before and after listening to Bach's music "Largo Ma Non Tanto" with a tempo of 80 bpm. Statistical analysis using t-paired parametric test and Wilcoxon non-parametric test. There were 30 adult, aged 20-45 years. The systolic BP; diastolic BP; HR pre and during experiment were 116.67 ±6.4 and 101.67 ± 4.61 mmHg ($p<0,01$); 75.00 ± 5.08 and 61.50 ± 2.68 mmHg ($p<0,01$), 75.00 ± 5.08 and 61.50 ± 2.68 beats/min ($p<0,01$). The post experiment SRT have shown shorter time in the all colors ($p<0,01$) Listening Bach's music can decrease BP, HR, and accelerate SRT.

1 INTRODUCTION

Music is an artwork that is not separated from the influence of the supporting community. Music is also a series of tones that become melodies and arranged according to the sequence and in which there is rhythm and harmony and arranged in such a way (Muttaqin, 2008). Listening to music involves two networks that is external and internal network. External network involvement when listening to music, starting when the sound that enters through our ears is captured by the cochlea. Low sound frequencies will stimulate cells in the area of the apex, while high-frequency sounds will be captured at the base of the cochlea. Then through the vestibulo-cochlearis, the impulses will go towards the ventral cochlear nucleus in the medulla oblongata area, proceeding to the inferior colliculus in the brainstem through the lateral lemniscus tract. From the colliculus inferior to the sound of the musical impulse was forwarded to the branch of inferior colliculus, then to the corpus medial geniculatum and was last received in the superior temporal lobe. From the lobe, music affects a wide range of parts in our brains, such as the amygdala, the tegmentum, the striatum, the superior temporal lobe, the prefrontal region and some other parts, such as the Heschl girding which plays a role in the recognition of music heard (Essi et al, 2012).

The Baroque comes from the Portuguese language 'barucco' or 'barocco' which means a sloped, rounded shape, such as pearl shape. In the Baroque era, music experienced many developments characterized by the use of new bars system, orchestral form or formation, enhancement of string instruments, operas, secular music, and instrumental music (Fitria, 2008). The music of the Baroque era began in 1600 and ended in 1750. The composer is Claudio Monteverdi, Antonio Vivaldi, George Frideric Handel, Arcangelo Corelli, and Johan

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Sebastian Bach (Fritz, 2012). The benefits of music therapy according to Djohan (2006) is affecting respiratory rate, heart rate, blood pressure, increasing concentration, decreasing pain (Djohan, 2009).

The beneficial effects of Bach's music is possibly caused by his "mathematical" compositions avoiding sudden changes (Trappe, 2012). One of Bach's music is Largo Ma Non Tanto that has a slow tempo of 80 beats per minute (bpm), according to the condition of a relaxed human heart rate in optimal learning conditions (Pieri, 2017). Bach's music has a composition of fluctuating tones between high notes and low notes that provide stimulation as alpha waves. Alpha waves have been shown to be used as a therapeutic tool. Music with alpha waves can be obtained through slow tempo music (60-80 beats per minute). This tempo is able to shift the brain waves from the beta wave (14-8Hz) to alpha wave (8-12Hz), so that the condition obtained relaxed, relaxed, calm. This will then help the brain to improve attention and short-term memory. Alpha waves can also help stimulate the release of a peptide, i.e. beta-endorphins and endogenous serotonin which has the effect of lowering the sympainkous tone and enhancing the parasympathetic tone, thereby causing a sense of calm and increase concentration (Sherwood, 2013).

Knowing music's effect on concentration is measuring simple reaction times. Reaction speed is the ability to quick motor response to definite stimulus, while the time that elapses between the sensory stimulation and the motor reaction time is called reaction time (Hurless et al, 2013). Simple reaction time is the time required from the introduction of the stimulus until the response arises. Reaction time is used to evaluate the process speed of the central nervous system and coordination between the motor and sensory systems. Reaction time becomes faster for example due to increased stimulation intensity and exercise. Instead the reaction time becomes longer in times of fatigue, mental tension, pain, a state of worry, and nerve disorders (Varun et al, 2014). The aims of this study is to determine the effect of listening to Bach's music toward simple reaction time and vital signs (blood pressure and heart rate).

2 MATERIAL AND METHODS

The study design is quasi-experimental with a pre- and post-test design. This study was conducted in the Skills Lab of the Faculty of Medicine of the Maranatha Christian University (MCU) during May 2018 to October 2018. The subject consisted of 30 males night shift security guard with inclusion criteria: (1) male gender; (2) Age 20 – 45 years old; (3) good hearing; (4) willing to follow the research voluntarily and approve informed consent. It was excluded when had (1) colour blind; (2) tremor.

For pretest all of subject measured blood pressure, heart rate and simple reaction time. For a simple reaction time the subject is asked to press the stop button when viewing the red light, then do the reaction time recording required by each subject. This pretest is done five times, then take the reaction time average. The above steps are repeated for light yellow, green, and blue. Then the subject listened to Bach's music "Largo Ma Non Tanto" from the album Concertos Pour Violin Nigel Kennedy, Baroque, BMV 1403 with the tempo of Andante 80 bpm for 15 minutes.

Upon completion of the pretest, the subject breaks for 5 minutes, then blood pressure, heart rate, simple reaction time is measured while listening to music (for posttest).

Blood pressure, heart rate and simple reaction time are compared before and during listening to Bach music.

Data analysis begins with Shapiro-Wilk normality test. When the data is normal distribution, it will be followed by a parametric paired t-test, whereas when the data is not normal distribution it will be continued with a non parametric test Wilcoxon. Statistical significance was defined as $p < 0.05$. Statistics were obtained using SPSS.

This study was approved by Research Ethical Committee of Faculty of Medicine of the Maranatha Christian University (MCU) /Immanuel Hospital Bandung No. 112 & 128/KEP/III/2-18.

3 RESULTS

Data characteristic of 30 males subject has shown in table 1.

Table 1: Baseline Data.

No.	Variable	Subject (n=30)	
		n	%
1.	Educational Level		
	Senior High School	30	100
2.	History of Past Illness		
	a. Hypertension	1	3.3
	b. Heart Disease	0	0
3.	Habituation		
	a. Smoking	14	46.6
	b. Drinking Alcohol	2	6.6
	c. Drinking Coffee	16	53.3
4.	History of Family Illness		
	a. Hypertension	7	23.3
	b. Heart Disease	3	10
5.	Music Listener	29	96.6
6.	Classical Music Lover	20	66.6
	Playing Instrument		
7.	a. Guitar	13	43.3
	b. Kendang	1	3.3

The results have been conducted in Shapiro-Wilk normality test on blood pressure and obtained by normally undistributed data (p value < 0.05), so that data analysis continued with Wilcoxon nonparametric test. The heart rate is obtained by normal distributed data (p value ≥ 0.05), so it is continued with paired t-test. Data analysis results are shown in figure 1.

Test the normality of Shapiro-Wilk in the simple reaction time data against the red light and obtained the result of normal distribution data (p value > 0.05), so that the data analysis continued with paired t-test. But the yellow, green, and blue light were obtained by normal non-distributed data (p value ≤ 0.05) so it was continued with a nonparametric test of Wilcoxon. Data analysis results are shown in table 2.

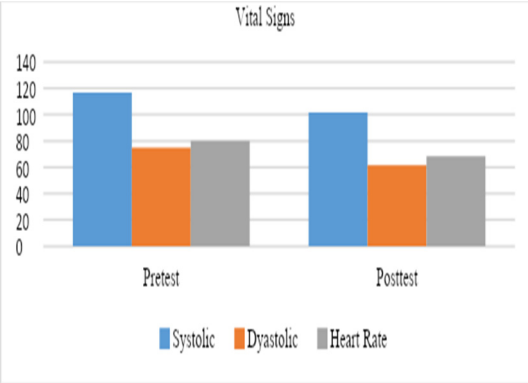

Figure 1: The Mean Values of Vital Signs Before and While Listening to Bach's Music.

In figure 1, the mean values of systolic blood pressure were 116.67 ±6.48 mmHg before and 101.67 ± 4.61 mmHg while listening to Bach's music. There was a significant differences between mean values of systolic blood pressure before and while listening to Bach's music (p<0.01). The mean values of dyastolic blood pressure were 75.00 ± 5.08 mmHg before and 61.50 ± 2.68 mmHg while listening to Bach's music. There was a significant differences between mean values of dyastolic blood pressure before and while listening to Bach's music (p<0.01). The mean values of heart rate were 75.00 ± 5.08 beats/min before and 61.50 ± 2.68 beats/min while listening to Bach's music. There was a significant differences between mean values of heart rate before and while listening to Bach's music (p<0.01).

Table 2. The Mean Values of Simple Reaction Time to Light Before and While Listening to Bach's Music.

Light	Mean ± SD (ms)		p value
	Pretest	Posttest	
Red	208.17 ± 71.22	159.73 ± 66.43	<0.01
Yellow	210.80 ± 101.647	171.03 ± 99.971	<0.01
Green	200.13 ± 114.02	172.07 ± 101.60	0.03
Blue	204.73 ± 93.02	161.50 ± 85.75	<0.01

Table 2 shown ranges and a mean values of the simple reaction time to red light were between 85 – 344 ms and 208.17 ms (SD±71.22) before and between 64 – 329 ms and 159.73 ms (SD±66.43) while listening to Bach's music (p< 0.01). Ranges and a mean values of the simple reaction time to yellow light were between 90 – 540 ms and 210.80 ms (SD± 101.64) before and between 31 – 521 ms and 171.03 ms (SD±99.97) while listening to Bach's music (p< 0.01). Ranges and a mean values of the simple reaction time to green light were between 85 – 621 ms and 200.13 ms (SD± 114.01) before and between 58 – 571 ms and 172.07 ms (SD± 101.59) while listening to Bach's music (p value = 0.03). Ranges and a mean values of the simple reaction time to blue light were between 90 – 466 ms and 204.73 ms (SD± 93.02) before and between 66 – 462 ms and 161.50 ms (SD± 85.75) while listening to Bach's music (p< 0.01).

4 DISCUSSIONS

From the results of the study gained that a decrease in blood pressure and heart rate after and during listening to Bach's music. In accordance with the previous study by Andhika Mahatidanar obtained the results that listening to classical music can decrease blood pressure (Kosinski, 2013). Another study by Yohana Dani Hartono with the results obtained after and during listening to Baroque music is better than before listening to Baroque music (Mahatinandar, 2016). Other research conducted by Yenni Limyati, Widjaja Lakshmi, using rhythmic auditory stimulation with the results of exercises using rhythmic auditory stimulation better than conventional exercises in improving the walking patterns of patients hemiparese pasca stroke clinically significant differences (Hartono, 2013).

The results of the study for a simple reaction to light after listening to classical music Johann Sebastian Bach faster when compared with a simple reaction time before listening to classical music Johann Sebastian Bach (Instrumental music). This is in accordance with the research conducted by Prasad B.K. in 2013, it is known that the visual reaction time to light yellow and green is faster by listening to instrumental music as well as showing that instrumental music is better result when compared to rock music (Limyati et al, 2012). Based on research conducted by Mihaela Chraif et al. in 2013 gained that results in groups that listened to classical music and reggae music during research had a faster reaction time compared to a group that did not listen to music during the study (Nurulita, 2015).

In the study conducted by Rini Dharmastiti and Retno Wijayanti in 2008, the results of the reaction time on men were faster when listening to instrumental music compared to when not listening to music, and the results of research Shows that there is no significant difference between simple reaction times while listening to favorite music, disliked music, and instrumental music (Chraif et al, 2013).

5 CONCLUSIONS

Bach's music can decrease blood pressure, heart rate and accelerate simple reaction times.

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