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BAB 4

EEG PATTERN OF HUMAN CALMNESS DURING LISTENING TO AL-QURAN RECITATION AND SOFT INSTRUMENTAL MUSIC

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ABSTRACT

Emotions is a really importance and powerful in human life this is because it can affect the brain which is the most importance organ in human organic system. Good emotion will gives a good effect towards the brain and human while the bad emotion will be vice versa from the good emotion. This is the reasons why emotion needs to manage wisely. Calmness is the one thing that people always seek off after having a hard time or stress. Music has a great effect towards human mind and body. It has proven that listening to music increase the alpha wave level associated to the increase of relaxation. Music is one of therapy that beneficial the people who experiencing depression, stress or anxiety. This research used al-Quran recitation of Surah al-Shua'ara and soft instrumental music as the material to simulate the brain to generate the calmness. There are 10 subject were recorded the EEG signal during listening to al-Quran recitation and soft instrumental music by using Emotiv Insight equipment. The raw data of EEG will undergo analysing process by using SPSS software to test the accurately of the data. The objective of this research is to compare the calmness between the Al-Quran recitation and soft instrumental music. As the result, it is found that most of the subjects were calm during listening to al-Quran recitation compared to the soft instrumental music, but still the soft instrumental music gives calmness towards the listener this is because alpha wave level is low during listening to them compared to beta wave level. In conclusion, al-Quran recitation gives calmness towards the listener compared to the soft instrumental music.

KEY WORDS: Electroencephalogram (EEG), Calmness, Al-Quran recitation, Soft Instrumental Music, Power Spectrum Density (PSD).

1.0 INTRODUCTION

Brain is the organ inside the head that empower all the human activities; for example, movement, thought, memory, taste, and feeling. It additionally can allude to somebody's knowledge which is in study and their profession. It is the capacity to learn rapidly and consider things in a consistent and clever way [1].

Human brain is responsible to the whole body regulation and human thought. This is the reasons why human brain is the most complicated organic system. It takes a lot of time in research and study to explain the reasons behind all the creatures. Is also functioning as a command centre of human nervous system [2]-[4]. Brain also known as frontal, which consist of one hundred billion neurons that connected to another two hundred thousand other neuron, it causes the brain are able to processes, receives and sends information. Human brain are divided into two parts which known as right frontal and left frontal [5], [6].

Brain are able to generate an electrical power that called brainwaves. Brainwaves is defined as arrhythmic of electric potential between neurons [3], [4]. It have five major sub-brainwave that generated by brain which known as delta band, theta band [7], beta band [8], alpha band [9] and gamma band [10]. Each of the brainwaves has their own range of frequency and different pattern of amplitude. The brainwave generated by the brain will representing the brain behaviour and the human condition [2], [3], [5], [11]-[15].

In order to determine the type brainwaves, high sensitivity of medical equipment are used, known as Emotiv Insight [16]-[19]. Emotiv Insight is the latest technology that used to study the brainwave generated by the brain. Biomedical research and clinical diagnosis, brain activity is reflected in the form of brainwave that also known as electroencephalogram (EEG). The frequency range of brainwaves during the brain activity is 1 to 100Hz [8], [12]. Error! Reference source not found. illustrates the structure of human brain.

Besides that, brain also affect the individual emotion, it is related to people's feeling such as happiness, anger, fear, sadness, stress, peace and calm. Facing difficulties, problems and pressure at work make most people seek for calmness and relaxation. One of the way to reduce the level of tension and pressure is listening to music, since, it is low at cost and easy to get. This research was performed by using the Al-Quran recitation and soft instrumental music to determine the EEG pattern of human calmness.

2.0 PROBLEM STATEMENT

Emotions are really powerful, if it is not managed wisely, it able to sweep us and affecting our health, happiness and success. This era, stress is something that is usually alive in conversation. It happen because of there are many people facing stress either at their work place that need to fulfil the company demand or in their studies where their needs to complete assignments, tests and projects. Stress is something when people feel that everything has been too much, overloaded and wondering if they can cope with the pressure [20]. Stress sometimes gives good effect to human, but it also can be bad towards human, it depends on how it is handled.

Calmness is the opposite emotion from stress, it is the situation of mind being free from excitement or disturbance [1]. One of the solution to overcome stress is relaxation technique. There are so many ways to reduce stress such as listening to music, joining yoga class, watching movie, jogging, play game and taking hot bath or shower. The best way to overcome is depends on the individual itself. Listening to music is highly preferable way to reduce the stress. The type of music that can reduce the stress is depend to the individual because different people will have different preferable in music [3], [12], [21], [22].

Current research area of human emotion and music, found that music do give an affect toward human emotion in positive sides. It can affect the listener mood and enjoyment which can influence their performance in variety of tasks. It depends on the rhythm of the music that they choose to listen. There some researcher stated that music has a countless of health-related benefit, both physiological and psychological [3]. Therefore, this research is designed to focus on the EEG pattern of human calmness Al-Quran recitation and soft instrumental music towards human calmness. Besides, deciding either Al-Quran recitation or soft instrumental music can give more calmness towards human.

3.0 METHODOLOGY

Figure 1 explained the flow of the whole process and method that will be done in this research. There are four stages to be conduct so that this research can be completed; first stage will be the literature review from the previous researches related to this research. This stage are really important to help having a better understanding and gain related information about the research. The second stage is finding the subjects to provide the samples of brain activity during listening to Al-Quran recitation and soft instrument music. Each of the subject were needed to listen to both audio that has been prepared. After they has been decided to give the sample, the date of sample collection will be discussed with the participant in order to facilitate both sides. Next, third stage is conducting the experiment. The subject that has been qualifying after examine will be sit for the experiment to gives the sample. Last but not least, the fourth stages which is analyzing and examine the sample that has been collected and recorded during conducting the experiment. This stage the data given by the sample will be analyzed, tested and classified to make the conclusion for this research.

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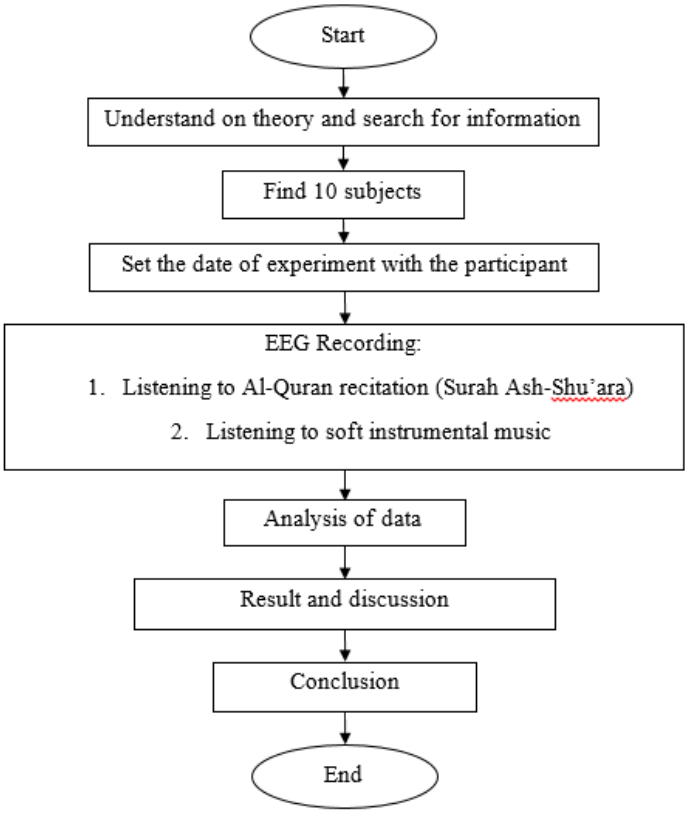


Figure 1. Flow diagram of methodology

A. Subjects

There are 10 subjects, which consist from both gender; females and males. The health of the subject will be examine to ensure that the participant free from medical issues such as cardiac, brain dysfunction and neurological symptoms [19], [25], [32], [33]. This step is importance to avoid noise on the brainwaves recorded during the experiment is conducted. The chosen subject will be among male and female from Faculty of Electrical and Electronic Engineering's student within the group age of 19 until 30 years old.

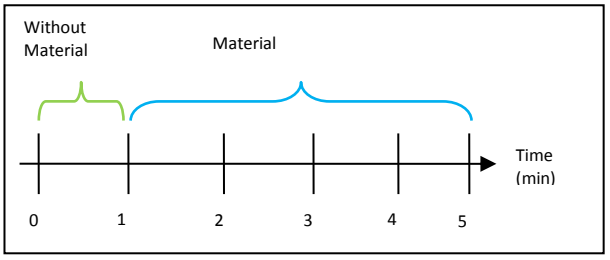
B. Data Collections

Emotiv Insight is used. Emotiv Insight is a user-friendly and wireless device used to collect and record the raw of EEG signals [17]-[19]. It is advance electronic that designed for everyday used to records brainwaves and translated into meaningful data that human can understand. The subjects were asked to answer a questionnaire before starts the experiment in order to have the data name for the subject that will be recorded as references. Next, all the equipment used in this experiment will be wear by the subject.

During the EEG signal is recorded, subjects need to closed they eyes by wearing the eye mask to avoid disturbance from the surrounding environment and reduce the stress around eye muscles, this is because the EEG result can be affected by the stimulation from the external environment since calmness is the main subjective in this research [4], [9]. Low connection in internet also can cause disturbance to the EEG result. Figure 2 shows the subject after wearing all the equipment need.

Figure 2: The view of subject wearing all the equipment from sides and front view.

Next, the subject will listen to the audio prepared, both Quran recitation and soft instrumental music were listened from laptop through headphone in mp3 format. Each of the subject will undergo two session, the first session conducted is for Al-Quran recitation audio and the second session is for soft instrumental music audio. Both session were conducted on the same day on the same subject. Each session the EEG signal were recorded for 5 minutes, within 5 minutes of recording, from minute 0 there no audio will be played until it reached minute 1, then only the subject will listen to the stimulation material for 4 minutes from minute 1 until minute 5. After the first session, the subject will rest about 1 minute before continued with the second session for another 5 minutes with the same procedure. It can be illustrate as timeline in Figure 3.



C. Analysis of Data

The EEG signal gained from the collecting data process will undergo the next step which testing and evaluation of data. This tasks is important to generate the outcome and result from this research. This stage, all the data related to this research will be process by using Statistical Package for the Social Sciences (SPSS) software and Microsoft Excel software. This is because SPSS is a comprehensive system for analyzing data, it consist of a set of software tools for data management, data entry, statistical and presentation. It also able to take information from almost any file and process it to generate the results in form of charts, tabulated form, and plots of the distribution and patterns, and descriptive statistic [29]. Microsoft Excel also will be used to generate some of the result, it is because the ability of Microsoft Excel software calculation, pivot tables, and graphing tools helps to fasten the process of processing the data.

3.7.1 Statistical Analysis Theory

Statistic is very useful and been widely used in variety field such as medical research, engineering fields, finance, social science and physical science. Statistic is a numerical measurement to describe something, interpret the data or analyse the relationship between things. The concept includes the collection, analysis and presenting numerical data [29]. Mathematical theory is applied to the

statistics makes it possible to test relationship between two or more group. Under the statistical analyse, data have to undergo several test to get the result before the conclusion is made. The test have their own purposes and gives better understanding of the obtaining results.

3.7.1.1 Descriptive Analysis

Descriptive analysis is the summarization of the data set which can represent the whole data. There several parameter that usually been summarize form the set of data based on what have been chose on the SPSS software. It can summarize the minimum and maximum value of the data set. It also can calculate the mean or the average value of the data. Last but not least, standard deviation and variance of the data also can be summarize. This descriptive analysis on SPSS really helps the user to do their analysis of data if they have larger data since it helps to minimize the calculation error if doing it manually. The standard deviation, σ and variance, σ2 can be calculated by using formula in Equation 3.4 and Equation 3.5 [49].

$$\sigma = \frac{\sqrt{\Sigma(x-\bar{x})^2}}{\mathrm{n}-1} \qquad (3.1)$$

$$\sigma^2 = \frac{\Sigma(x-\bar{x})^2}{\mathrm{n}-1} \qquad (3.2)$$

4.0 RESULTS AND DISCUSSION

A. Questionnaire Result

The main aim of conducting questionnaire is to have an information of the subjects that willingly helps to give sample of their brainwave for this research. It helps us to detect the sample obtained that given by the subject. The questionnaire consist of ten (10) questions that related to the research such as calmness, Al-Quran and music. It also asked what help to reduce their stress and the preference on music.

Question 1: Gender

Figure 4 shows the percentage of the gender of the subject. The total numbers of subject were 10 students which covered only the students from Faculty of Electrical and Electronics Engineering (FKEE), UTHM. Most of it is conger by female students from the Faculty of Electrical and Electronics Engineering (FKEE). The percentage of the gender of the sample for female student is 70 percent equivalent to 7 people from the total number of subject which is 10. The subject from male gender is 30 percent which is equivalent to 3 male student.

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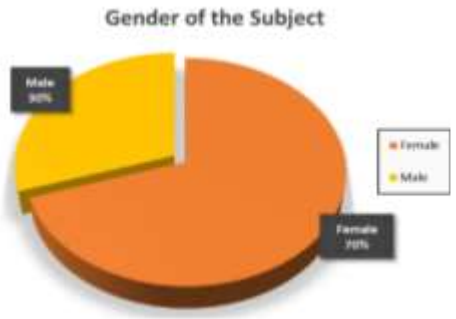

Figure 4: Gender of the subject.

Question 2: Age

Second question is about the age group of the subject. There are four group of age that has been fixed on the answer choice which are; 'below than 20', '21 to 23', '24 to 26' and '27 and above', this is because this research scope was conducted from age group 19 until 30 only. Figure 5 shows the age group of the subject. There are no subject from age group of below 20 and 27 and above. Most of the subject were aged around 21 until 23, which 9 over 10 with percentage of 90%. Another 10% is in age group of 24-26 which equivalent to 1 person.

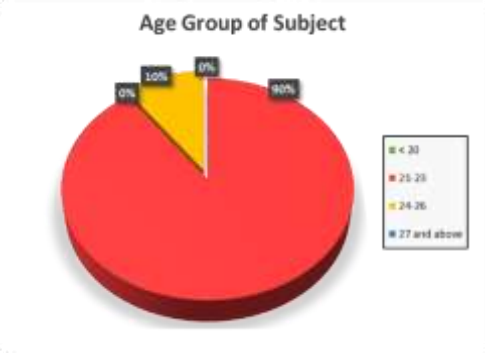

Figure 5: Age group of subject.

Question 3: Semester of study

The third questions is regarding semester study of subject. All of the subject was in last semester which is semester 8. Figure 6 illustrate the bar chart of semester study of the subject.

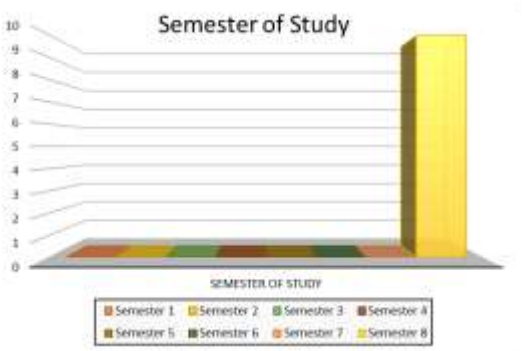

Figure 6: Semester of study.

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Question 4: What is your highest qualification?

There three different places of study before entering university for degree level in specific studies such as STPM, matriculation and diploma. The questionnaire result shows all of the subject were from matriculation before further their studies in engineering course for their bachelor. Figure 7 illustrates the highest qualification of subject from Faculty of Electrical and Electronics Engineering (FKEE).

Figure 7: Highest qualification of study.

Question 5: From below, which activity that will you do to calm yourself?

There are several activity that usually people do to reduce their stress. This question there are four answer has been provided regarding the activity that can calm people which is listening to music, travelling, shopping and playing games. All the activity is chosen based on the activity that people used do to reduce stress. Listening to music is easy to access at anytime and anywhere.

Figure 8 shows the result of chosen activity by subject that can calm them. 70% choose listening to music as activity that can calm them which is equal to 7 people. The other 3 people chose travelling, shopping and playing games as their activity that calm them. This proven the previous researcher findings that listening to music is more preferable to reduce human stress because it is the easier way compared to others [3].

Figure 8: Activity that can calm yourself.

Question 6: Do you think listening to Al-Quran can calm yourself?

The percentage of yes answer was 100%. This means all the subjects was answer yes to this question. Figure 9 shows the different in number of the answer for this question. This is because all the subject is Muslims, and Muslims believe that Quran is the messenger from the Creator to His creatures that contains a lot of scientific facts and miracles that human can benefit from it [13], [14], [29]. Other than that, Al-Quran has been used to cure some of serious health problem and emotional problem such as depression [29], [30]. Al-Quran has its own unique that give a good effect towards the human body [3]. There are verses in Quran has states that how to overcome stress, depression and pressure in life [21]. This helps human to achieve their calmness through Al-Quran and why Al-Quran can gives calm towards the reader and the listener.

Figure 9: Did Listening to Al-Quran can calm yourself.

Question 7: How often that your read Al-Quran or listening to Al-Quran recitation?

There four answer that has prepared which is ‘everyday’, ‘once a week’, ‘twice a week’ and ‘others’. The highest answer were chosen is ‘everyday’ with percentage of 50% that equivalent to 5 subjects out of 10. Both ‘once a week’ and ‘twice a week’ answer were having 20% which equivalent to 2 subjects. Lastly, the other 10% was answered ‘others’ which need to fill their owned answer and the answer is ‘once in two weeks’. Figure 10 shows the pie chart of the subject frequently reading Al-Quran or listening to al-Quran recitation.

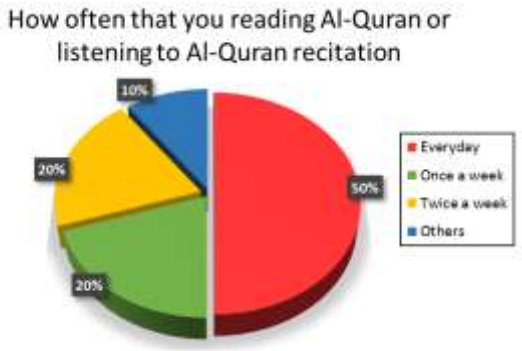

Figure 10: How often that you read or listening to Al-Quran.

Question 8: Are you love listening to music?

Figure 11 illustrate the result of this question. The percentage that answered ‘yes’ is 100% while answered ‘no’ is 0%. The characteristic of music itself is to entertain the listener. It has been proven that music really make people feel better [3]. Seldom people dislike entertainment. This is the reasons

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why 0% for answer ‘no’ for this question.

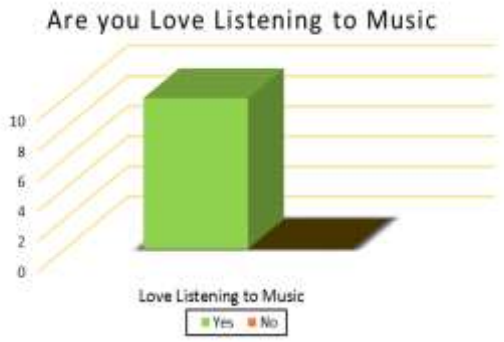

Figure 11: Are you love listening to music.

Question 9: Which type of music that you like to hear?

There are three answers provided which is ‘instrumental music’, ‘hard music’, and ‘soft music’. Figure 12 shows the pie chart of the answer from the subjects. The highest answer is ‘soft music’ with percentage of 50% which equal to 5 by person followed by ‘hard music’ with percentage of 30% that equivalent to 3 person and the other 2 person were chose ‘instrumental music’ as their music that they like to hear with percentage of 20%.

From the result obtained in this question, it shows that different people will have different preferable type in music [21]. It is depend on the individual reaction itself towards the music. The reaction can be either they feel comfortable and relaxed or feel uncomfortable towards the song. In between this three type of music, ‘soft music’ is the most preference between the subjects. It can be because of the characteristic in soft music which slow in rhythm and low pitch give peace towards the listener. There has some researcher state that some music that gives relaxation towards some people, it might be the stressful music to others [21]. The result from this question has been proved that different people will have different type of song that they like depend on themselves.

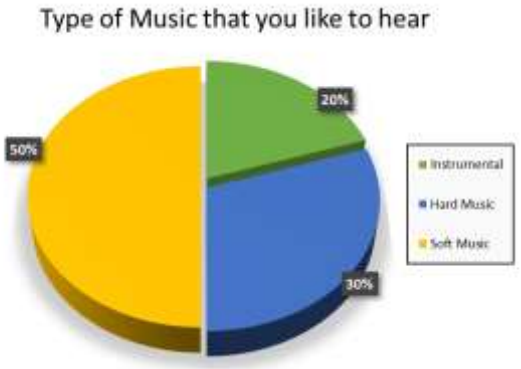

Figure 12: Type of music that you like to hear.

Question 10: In your opinion, what type of music can give calm to human? (Choose your answer not more than 3)

There were nine answer that has been provided which is classical music, jazz, rock music, opera, techno, melody, blues, hip hop music and orchestra. All of them has their own unique and all of this is famous in certain aged. For example, classical music, opera and orchestra is famous among adults and musician, while jazz, hip hop music and techno are famous among young people. This is question the subject can chose more

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than one answer but not more than three and in total there are 30 answers.

Figure 13 illustrates the result of the answered by the subject for this question. Among 30 answers, the highest type of music that gives calm to human is techno which there 6 answers on this type of music followed by jazz and melody with 5 answers. Both blues and hip hop music having 4 answers. The remaining 6 answers were on classical music and rock music with 3 answers each. There are no answers for both opera and orchestra. A conclusion can be made that young people think techno music can gives calm to the listener, since all the subject is from aged group of 21 until 23. There are no words in techno music it just a rhythm that will make people feel more enjoy and happy.

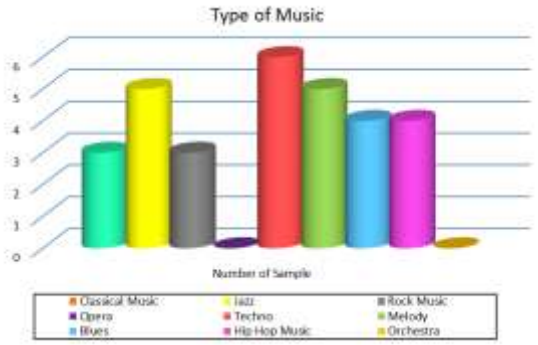

Figure 13: Type of music that can gives calmness to human.

Experimental Result

The obtaining result was in numerical data form. To show the pattern of the focused brainwaves, the numerical data obtained is plotted on the SPSS software in form of Power Spectral Density (PSD). The data of alpha band and beta band from both sound; al-Quran recitation and soft instrumental music is used to compare to show the result and helps to make accurate conclusion for this research. The result obtained from the explained methodology in previous chapter must be correlated.

4.1 Power Spectral Density (PSD) of Alpha Brainwave on Al-Quran Recitation

Figure 4.14 (a) until (j) show the power spectral density (PSD) of alpha brainwaves during listening to Surah Ash-Shua'ara (Al-Quran recitation). The result shows that most of the sample has higher peak of alpha waves during listening to Al-Quran recitation. There are 8 peoples out of 10 having an alpha brainwaves pattern that qualify during listening to Al-Quran recitation which is the alpha wave was at high state. Only two peoples have low pattern of alpha which is sample 7 and sample 9. It can see clearly that the level of alpha wave were drop drastically at sample 9 and for sample 7 the wave was drop gradually.

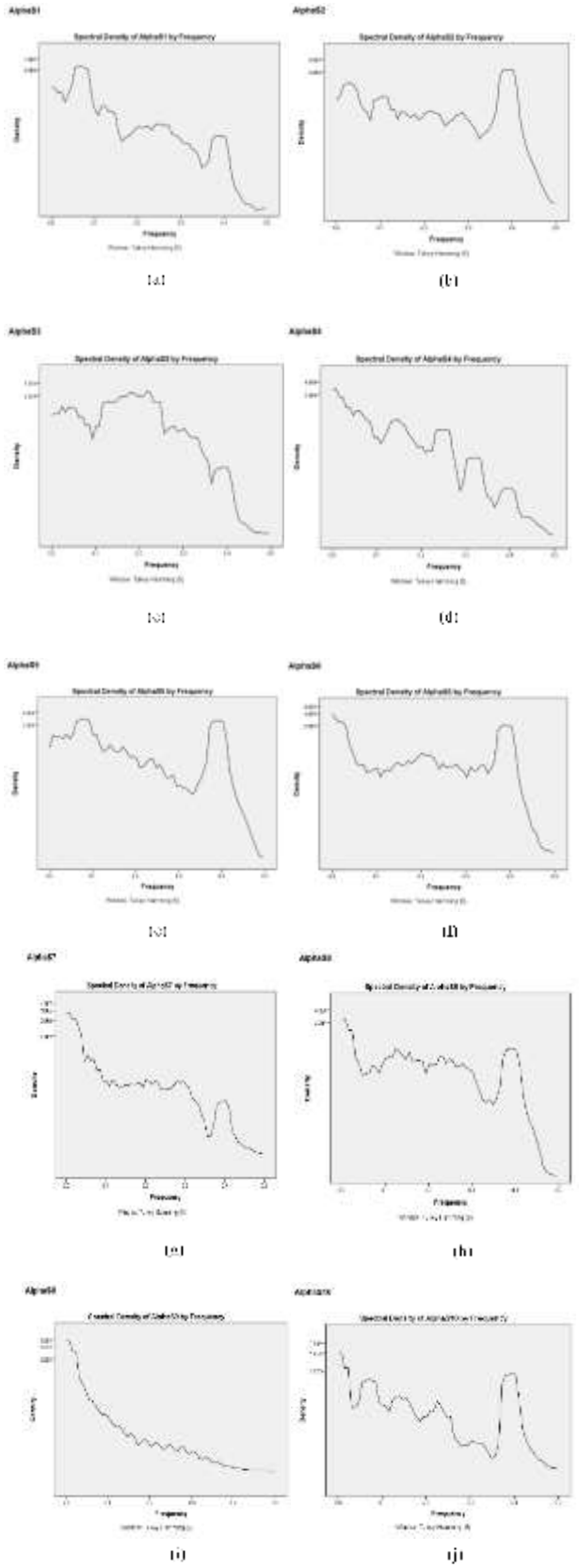

Figure 4.14: Spectral density of Alpha brainwave during listening to Surah Ash-Shua'ara (Al-Quran recitation) (a) Sample 1 (b) Sample 2 (c) Sample 3 (d) Sample 4 (e) Sample 5 (f) Sample 6 (g) Sample 7 (h) Sample 8 (i) Sample 9 (j) Sample 10.

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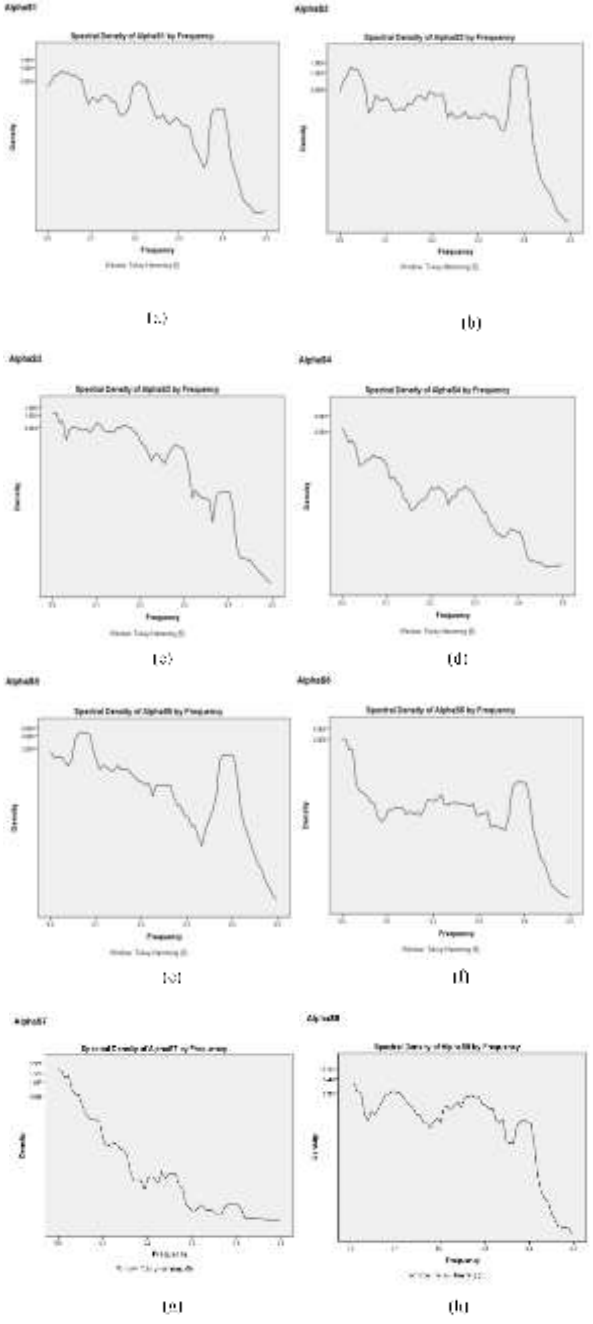
4.2 Power Spectral Density (PSD) of Alpha Brainwaves on Soft Instrumental Music

The power spectral density of alpha brainwave during listening to soft instrumental music for 10 samples as shown in Figure 4.15 (a) until (j). The results show at least 6 samples were qualify the alpha brainwave of calmness. The pattern of brainwave were at high and start to fall gradually during listening to soft instrumental music. There 2 samples that show the brainwave pattern of alpha were declined sharply which is sample 4 and sample 7. The reasons can be that the subject feel uneasy during listening to the music, as know different people will have different music that helps them to calm [22].



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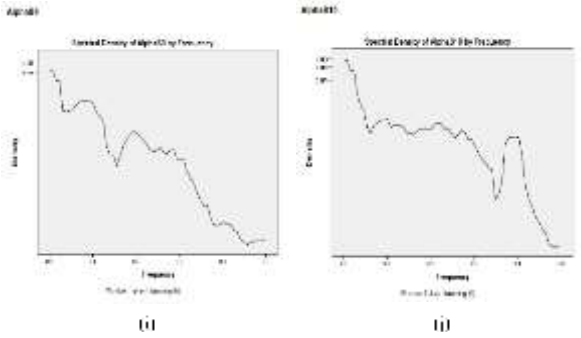
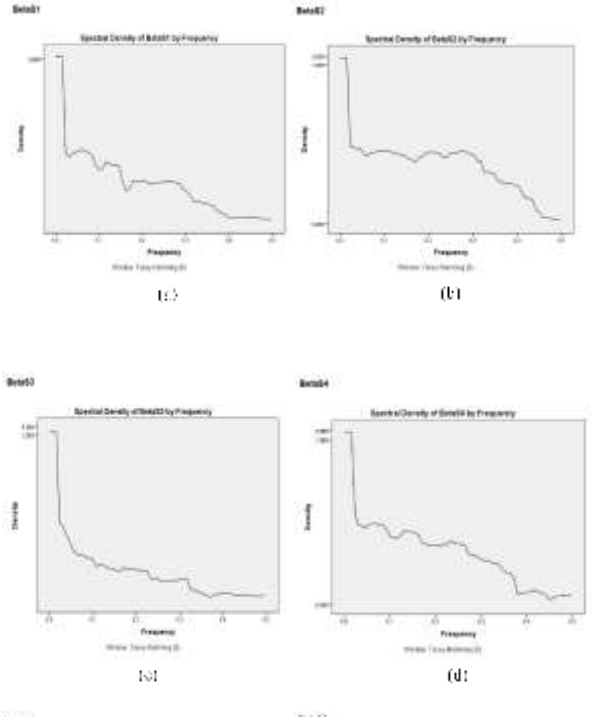


Figure 4.15: Spectral density of Alpha brainwave during listening to soft instrumental music (a) Sample 1 (b) Sample 2 (c) Sample 3 (d) Sample 4 (e) Sample 5 (f) Sample 6 (g) Sample 7 (h) Sample 8 (i) Sample 9 (j) Sample 10.

4.3 Power Spectral Density (PSD) of Beta Brainwave on Al-Quran Recitation

The results of power spectral density (PSD) generated by using SPSS software of beta brainwave during listening to Al-Quran recitation as shown in Figure 4.16 (a) until (j) for all 10 sample. The pattern of beta brainwave must be opposite to the pattern of alpha brainwaves. This is because both of the brainwave were dominant at different state of human emotion. All of the 10 samples were show the same pattern of beta brainwave which is it drops sharply in between frequency of 0.0Hz to 0.1Hz and maintain the beta level in between frequency 0.1Hz to 0.4Hz, then it will drop again between the frequency interval of 0.4Hz to 0.5Hz.

It shows the opposite pattern from alpha wave pattern. The spectral density shows the reaction of human emotion towards Quran recitation. It reacts immediately and drop the level of stress or focus as soon as their listening to Quran recitation.



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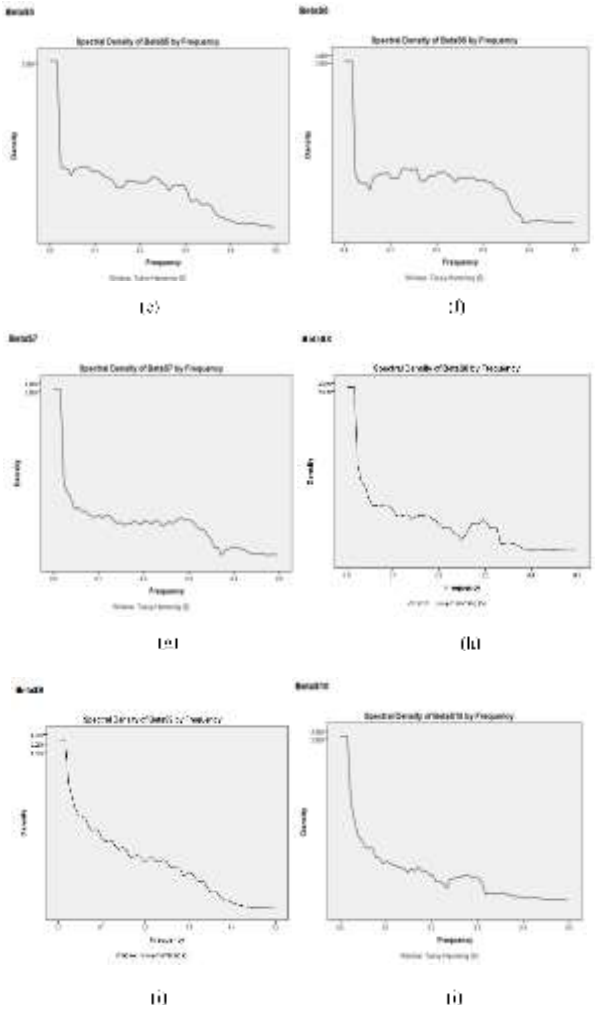

Figure 4.16: Spectral density of Beta brainwave during listening to Surah Ash-Shua'ara (Al-Quran recitation) (a) Sample 1 (b) Sample 2 (c) Sample 3 (d) Sample 4 (e) Sample 5 (f) Sample 6 (g) Sample 7 (h) Sample 8 (i) Sample 9 (j) Sample 10.

4.3.4 Power Spectral Density (PSD) of Beta Brainwave on Soft Instrumental Music

Figure 4.17 (a) until (j) show the pattern of power spectral density (PSD) of beta brainwave during listening to soft instrumental music. All of the 10 samples results were show the same pattern of beta wave which it takes time to lower the level of beta wave during listening to soft instrumental music. There 80% of the sample shows that beta wave were declined slowly in between 0.0Hz to 0.3 frequency. Then, at the frequency between the 0.3Hz to 0.5Hz it drops sharply. Another 20% shows that the beta wave declined with huge amount during the frequency at 0.0Hz to 0.2Hz and from 0.2Hz to 0.5Hz is keep on dropping but in small amount.

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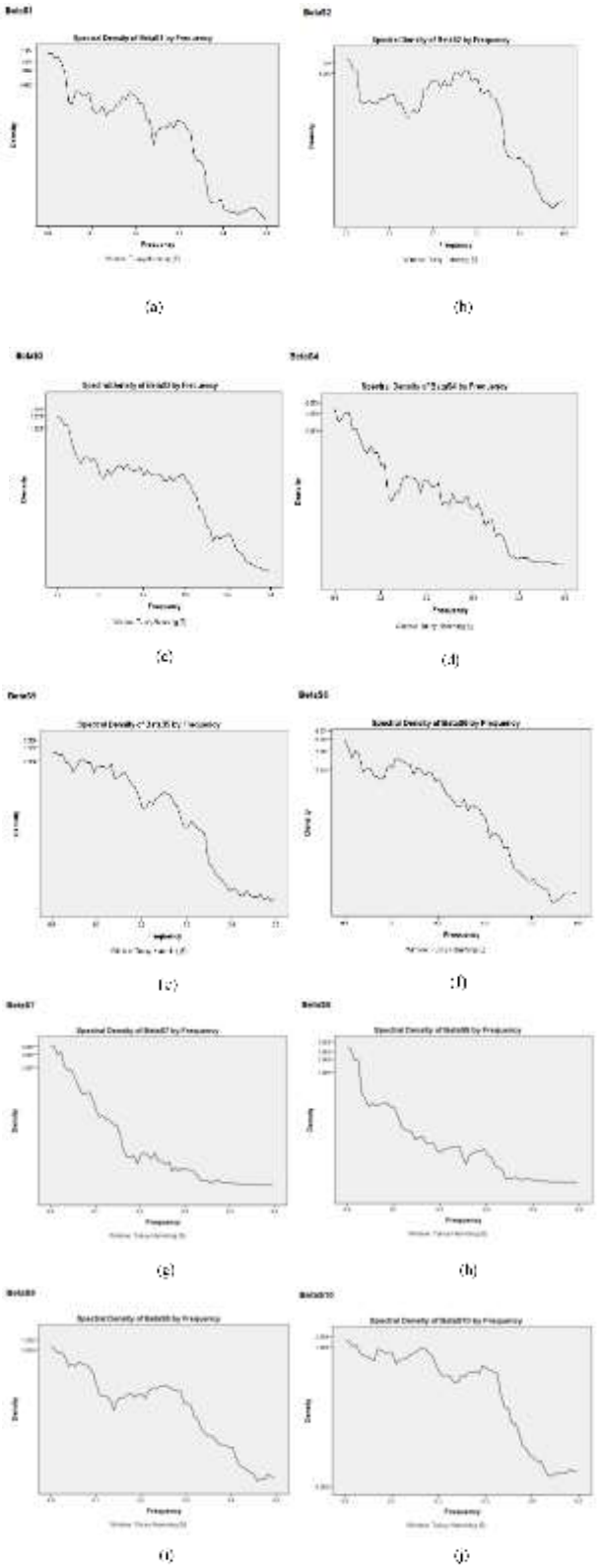

Figure 4.17: Spectral density of Beta brainwave during listening to soft instrumental music (a) Sample 1 (b) Sample 2 (c) Sample 3 (d) Sample 4 (e) Sample 5 (f) Sample 6 (g) Sample 7 (h) Sample 8 (i) Sample 9 (j) Sample 10.

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4.4.1.1 Standard Deviation Data for Al-Quran Recitation

Figure 4.18 and Figure 4.19 show the values of standard deviation has been plotted for both alpha and beta brainwave respectively during listening to Al-Quran recitation. Al-Quran recitation material on alpha brainwave, the standard deviation data shows that, 90% of the sample has value less than 50 and only 10% is more than 50 which is the value is 778.11 is shows clearly in graph form on Figure 4.15. The reaction of the 90% sample towards Al-Quran shows that it gives calmness to them, while the other 10% sample shows the opposite from the other. For beta brainwaves data shows that 90% of the sample is below than 200 and 10% is the highest standard deviation with value of 638.22 and it shows clearly on Figure 4.16. The data that has highest standard deviation on both brainwaves type is from the same sample which is sample 9.

This situation can be happen if there are distraction during recording the data and the distraction can be either the environment distraction or the sample itself. During analysing the data, this condition is special and unique and wonder what the reasons behind it is. The Sample 9 were contacted to the sample itself what was happen during that time. The sample said that she feel empty and start daydreaming during listening to the Surah Ash-Shua'ara and it lead her to light sleep. The light sleep condition causing the alpha brainwave to drop and the theta brainwaves will be increasing [32]. This is because theta brainwaves are predominant at this condition which drifting in to sleep [32].

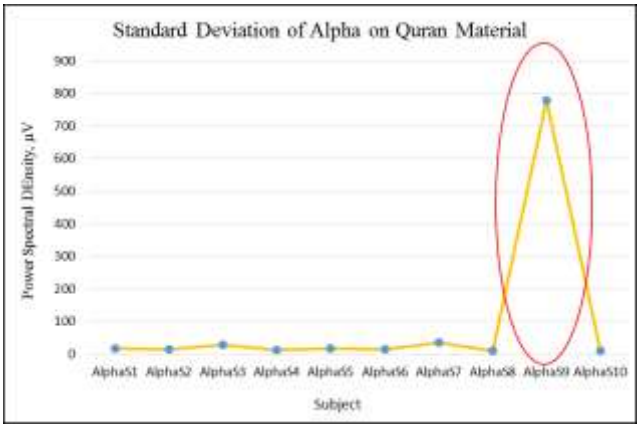

Figure 4.18: Standard Deviation of Alpha wave During Listening to Surah al-Shua'ara.

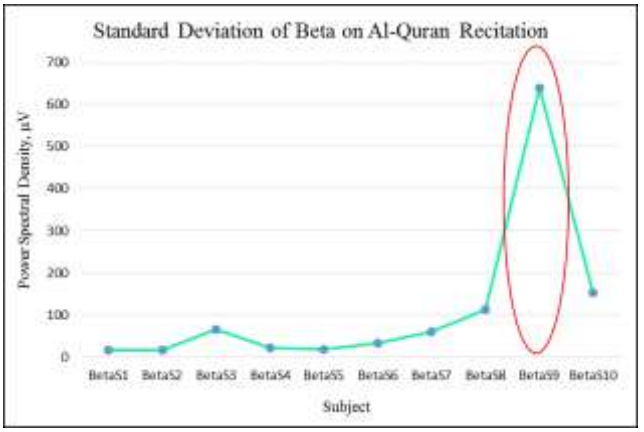

Figure 4.19: Standard Deviation of Beta wave during Listening to Surah Ash-Shua'ara.

4.4.1.2 Standard Deviation Data for Soft Instrumental Music

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Figure 4.20 and Figure 4.21 show the standard deviation values that has been plotted for both brainwave during listening to soft instrumental music material in graphical from. Soft instrumental music material, the data of standard deviation for both alpha brainwave and beta brainwaves shows that both 90% of the sample has value less than 50 and only 10% is more than 50 which is the value is for alpha waves is 247.7 and for beta brainwave is 448.46 it has been illustrate in form of graphical on Figure 4.17 and Figure 4.18 respectively. The data that has highest standard deviation on both types of brainwaves type is from the same sample again but differ from the Al-Quran recitation which is sample 7.

This situation happen again but on different material which is soft instrumental music. To know the reasons again, the has been contacted to asked about what is happening during the recording of EEG signal for soft instrumental music since her EEG signal result on Al-Quran recitation were in good condition. The sample said that she during early stage of hearing the material (soft instrumental music), she feel quite comfortable with the music but in the middle of the music she start feeling bored and trying to focused to avoid her from fall asleep. She is trying to stay focused to avoid from sleep causing the disturbance to the result, this is because stay focused were beta wave predominant condition it cause alpha wave to drop [3], [9]. From the sample answer it proven that people will have different preferable on music [21].

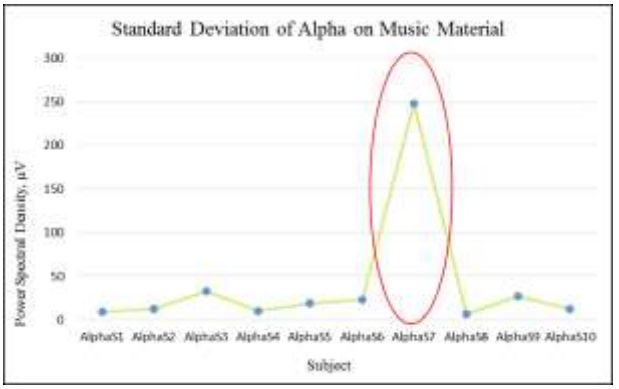

Figure 4.20: Standard Deviation of Alpha wave during listening to Soft Instrumental Music.

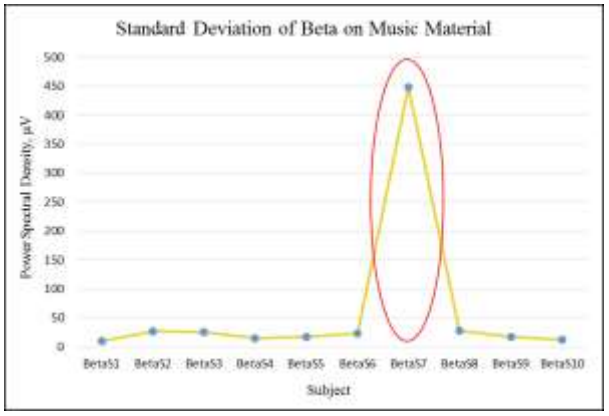

Figure 4.21: Standard Deviation of Beta wave during listening to Soft Instrumental Music.

5.0 CONCLUSION

As the conclusion, music do gives effect towards human emotion and brain. It can gives good effect and bad effect depends on the listener. From the result, it can be conclude that alpha waves has a higher level during listening to the Al-Quran recitation and soft instrumental music compared to beta waves. This prove that both of materials gives calmness towards the listener. Al-Quran recitation is the most calmness compare to the soft instrumental music since 80% of the sample result feel calmer during listening to Al-Quran recitation sessions based on the observation of alpha waves and beta waves. Last but not least, it was clear that main objective of this research has been achieved which to determine the EEG pattern of human calmness during listening to Al-Quran recitation and soft instrumental music.

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