

# Beta signal activity analysis using Power Spectra Density (PSD) algorithm with murrotal surah al-Fatihah stimulation on adolescent anxiety

Tika Rahmawati<sup>1</sup> and Latifatul Istianah<sup>2\*</sup>

<sup>1</sup> Department of Physics, Faculty of Science and Technology, Universitas Islam Negeri Walisongo Semarang, Indonesia

<sup>2</sup> Department of Physics, Faculty of Mathematics and Natural Science, Universitas Brawijaya, Indonesia

\*Corresponding author's e-mail: [latifatulistianah@gmail.com](mailto:latifatulistianah@gmail.com)

## ABSTRACT

Adolescence is a period of changes within adolescents, both physically and emotionally. According to the results of the Basic Health Research (Riskesmas) from the data of the Indonesian Ministry of Health, people over the age of 15 experience indications of anxiety around 14 million people. This figure is equivalent to 6% of the total population of Indonesia. This study aims to determine changes in Beta signals and measure adolescent anxiety in anxious conditions and after listening to the murrotal letter Al-Fatihah. This study uses quantitative methods with an experimental approach. Respondents were students of Walisongo State Islamic University aged 17-21 years. This study used a KT88-type EEG device to measure respondents' brain waves and used the Zung Self-Rating Anxiety Scale (SAS/SRAS) questionnaire to measure anxiety. Respondents filled out the questionnaire when they were anxious, and then they were fitted with an EEG and listened to the murrotal of Surah Al-Fatihah. The results of this study showed that the average beta wave decreased from 5.83% to 5.08% after listening to the murrotal surat Al-Fatihah, and measurement using the SRAS questionnaire obtained an average score when anxious was 55.85, while when listening to the murrotal the average was 36.7. It shows that murrotal surat Al-Fatihah can reduce anxiety in adolescents.

### Keywords:

Beta signal; adolescence; anxiety; electroencephalograph

## Introduction

Adolescence is a period of emotional, physical, and cognitive changes within adolescents. Adolescence is also often said to be a time of typhoons and storms because there is much turmoil that adolescents want to feel when experiencing changes that occur in their lives. Changes in various aspects of life can cause anxiety in adolescents. Some research that has been done says that anxiety is more common in women than men (Situmorang et al., 2018).

According to the results of the Basic Health Research (Riskesmas) from the data of the Indonesian Ministry of Health (2013), people over the age of 15 experience indications of anxiety around 14 million people. This figure is equivalent to 6% of the total population of Indonesia. Based on the results of the Indonesia National Adolescent Mental Health Survey (I-NAMHS) (2022), in the last 12 months, as many as one in three adolescents in Indonesia aged 10-17 years had mental health problems. The most common mental disorder experienced by adolescents is anxiety, at 3.7%. The mental disorder is a combination of antisocial and generalized anxiety disorder.

Anxiety disorders can cause psychological conditions that lead to productivity problems. People who experience anxiety tend to have negative emotional states such as anxiety, worry, and fear. Anxiety is not always detrimental, because anxiety that is not excessive can act as a self-control mechanism to remain cautious about every event that takes place. However, if the anxiety experienced is excessive, it will become an obstacle and it can be detrimental. People who experience anxiety disorders will find it difficult to concentrate and socialize, resulting in interference in carrying out their social, occupational, and role functions, so treatment and management steps must be taken. Anxiety in a small sense can increase a person's productivity, but when it occurs continuously it can interfere with work mechanisms, both physical and psychological. Based on the results of the Social Anxiety Disorder

Self-Report from 311 subjects in Indonesia related to social anxiety, information was obtained that there were 15.8% of adolescents experienced social anxiety. This result shows that the number of anxiety sufferers has increased from year to year (Vriends et al., 2013).

An electroencephalograph (EEG) is an activity that records the spontaneous electrical activity of neurons contained in the brain at a particular time (Bintoro, 2013). Based on the frequency, human brain waves are divided into 5 types, namely: alpha waves with frequency (8-13 Hz), theta with frequency (4-8 Hz), beta with frequency (14-26 Hz), delta with frequency (0.5-4.0 Hz), and gamma with frequency (above 30 Hz) (Luck, 2014). Beta signals will appear when a person concentrates and feels anxious and worried (Tarmizi, 2012). Beta waves often appear and are associated with a state of consciousness, namely when someone is doing daily activities. A person will have sound logic and alertness when consciousness is entire (Akbar, 2014).

According to Zahrofi (2013), Qur'anic murottal treatment is religious treatment, which is reading the Qur'an every few moments or hours so that it will have a positive effect on a person's body. According to Mahjoob et al. (2016), listening to the Koran can provide benefits, and the mental health of the listener can increase. Along with this research, Julianto & Subandi (2015) stated that reading Al-Fatihah can increase immunity and reduce a person's stress. Allah SWT says in QS. Al-Isra: 82

خَسَارًا إِلَّا الظَّالِمِينَ يَزِيدُ وَلَا لِلْمُؤْمِنِينَ وَرَحْمَةً شِفَاءً هُوَ مَا أَقْرَأْنَا مِنْ مَنْ وَنُنَزِّلُ

“And We have sent down from the Quran an antidote and a mercy for those who believe, and it does not add to the wrongdoers anything but harm.”

Ma'âlim al-Tanzîl Al-Baghawî interprets the word *shifâ'* (remedy) as a healer of the heart. According to Al-Baghawî, the Qur'an was revealed by Allah as a medicine or antidote which means explaining the error (*adh-dhalâlah*) and ignorance (*al-jahâlah*). Therefore, the Qur'an is a form of Allah's compassion towards (*rahmatan lil mu'minîn*) or people who believe and heal the heart to eliminate ignorance. Meanwhile, the word “*shifâ'*” according to the tafsir of al-Baidhawî means only likeness. This means, the Qur'an functions as a healer of the heart so that it can straighten religion and improve themselves. The verse explains that the Koran is a cure for disease so it can also be used as a solution to reduce anxiety in adolescents.

Previous research conducted by Zahrofi (2013) suggested that the benefits of Al-Quran murottal can reduce the anxiety level of hemodialysis patients (patients with end-stage kidney disease) at PKU Muhammadiyah Hospital, Surakarta. Research by Faradisi & Aktifah (2018) suggests that murottal treatment has proven significant, and can be used as an additional treatment to control anxiety after surgery, especially in post-orthopedic surgery. Therefore, this study was conducted to determine changes in Beta signals before and after listening to the murottal letter Al-Fatihah and to find out how to measure anxiety before and after listening to the murottal letter Al-Fatihah in adolescents.

## Methods

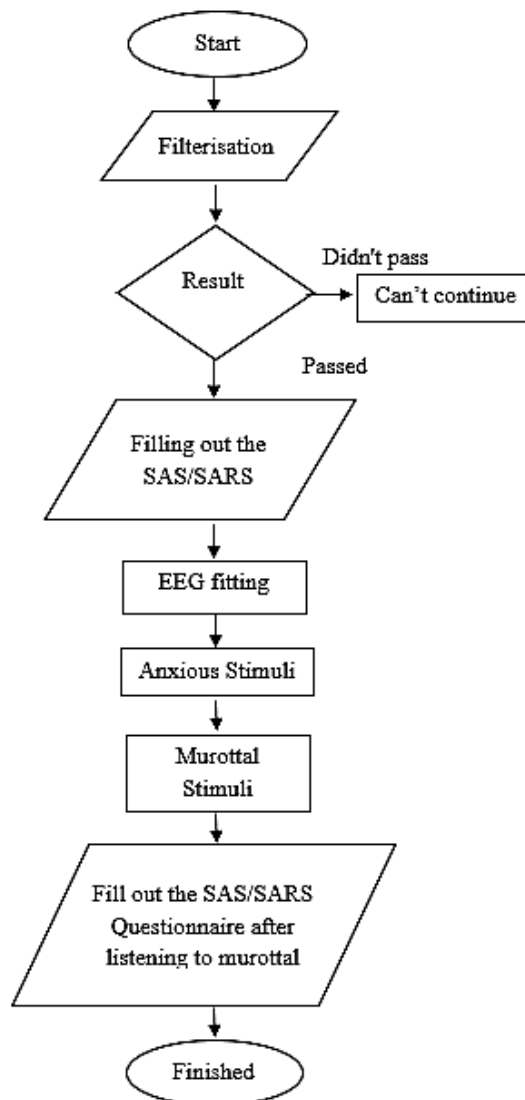
This research was conducted at the Modern Physics Laboratory of Walisongo State Islamic University Semarang. This research uses quantitative methods with an experimental approach. This study used a KT88-type EEG device with 16 channels, 10M input impedance, and 12-bit accuracy. Generally, EEG is installed by attaching electrodes to the patient's head non-invasively, making it safer without surgery (Bocchio et al., 2017). Electrode placement is adjusted to the anatomy of the human brain, namely Frontal (F), Parietal (P), Occipital (O), and Temporal (T) (Arline et al., 2021).

This study uses an MP3 Player containing Murottal Surah Al-Fatihah and Earphones and uses the Zung Self-Rating Anxiety Scale (SAS/SRAS) questionnaire. SAS/SRAS is an assessment of anxiety in adult patients designed by William W.K.Zung, developed based on anxiety symptoms in the Diagnostic and Statistical Manual of Mental Disorders (DSM-II) (Mcdowell, 2006). There are 20 questions, 15 towards increasing anxiety and 5 towards decreasing anxiety. Each question has a score of 1-4, namely 1 (never), 2 (sometimes), 3 (some of the time), and 4 (almost every time) (Nursalam, 2016). The results of the summation of these scores were grouped according to Table 1.

**Table 1.** Score Grouping

Grouping	Score
Not Anxious	20-44
Mild Anxiety	45-59
Moderate Anxiety	60-74
Severe Anxiety	75-80

First, respondents who did not meet the exclusion criteria (students with mental disorders, history of trauma, mental illness, and epilepsy) were filtered. 20 respondents were obtained with the criteria of 17-21 years old, Muslim, and Walisongo State Islamic University students. Then, the respondents filled out the SAS / SARS questionnaire; out of 20 respondents, 16 respondents experienced anxiety. Furthermore, in EEG installation on respondents, electrodes are attached to the scalp by international rules 10 20 (Shen et al., 2022). After being paired with EEG, the respondent is given an anxious stimulus; the respondent thinks about a problem or something so that he is in a state of anxiety. After that, EEG recording was carried out for 5 minutes, each 1 minute of data collection during anxious conditions, 2 minutes of listening to the murottal letter Al-Fatihah, and 1 minute of data collection when listening to the murottal. When measuring brain waves using EEG, respondents are relaxed and their eyes are closed to minimize the occurrence of artifacts (Casson et al., 2018). After measurement using EEG, respondents filled out the SAS / SARS questionnaire again to find out the anxiety condition after listening to the murrotal surat Al-Fatihah.



**Figure 1.** Research Procedure

Then, the raw data in EDF files were processed using the phyton application in Google Collab. Before data processing, a bandpass filter was used to filter out artifacts, and Power Spectral Density (PSD) features were used for extraction using Welch's method (Al-Fahoum & Al-Fraihat, 2014). The signal was converted using PSD from the time domain to the frequency domain (Novani et al., 2016). The recorded data is processed per unit of time to show changes in brain wave activity, and the final result is a percent.

## Results and Discussions

The process of data collection using EEG is shown in Figure 2. Respondents sit relaxed and comfortable while their eyes are closed so that during the data collection process, no accumulation of waves will be challenging to read (Yang et al., 2016).

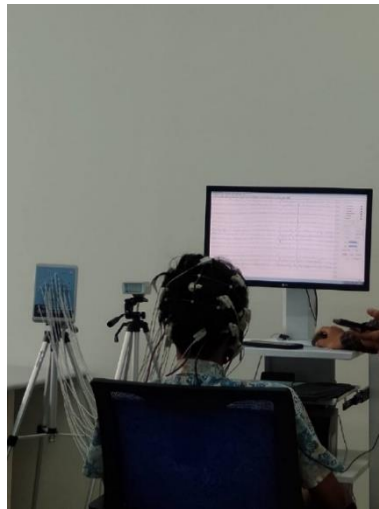
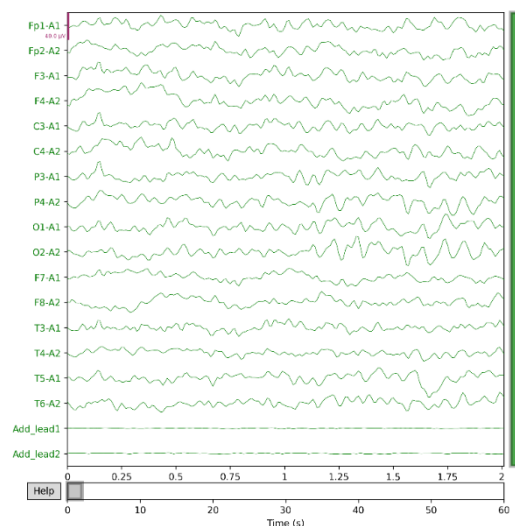
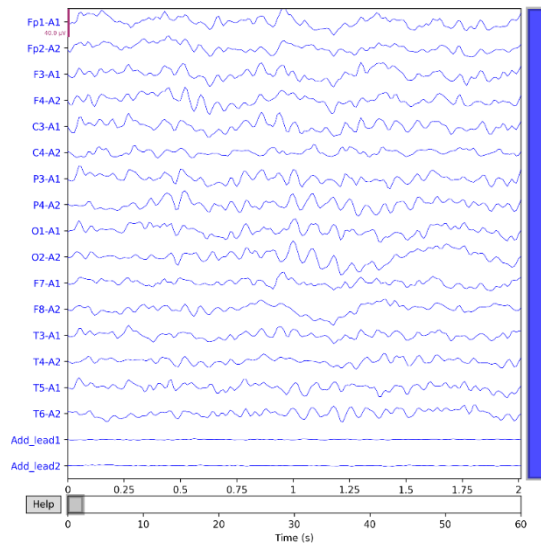


Figure 2. Data collection with EEG

The data collection results using EEG for 2 seconds are shown in Figure 3 The image is a beta wave when anxious conditions and listening to the murottal of Surah Al-Fatihah. The recorded EEG signal is a signal in the time domain. Then, the signal is converted into the frequency domain using PSD signal processing to determine whether the beta waves have changed.



(a)



(b)

Figure 3. Beta waves during (a) anxious (b) after listening to murottal

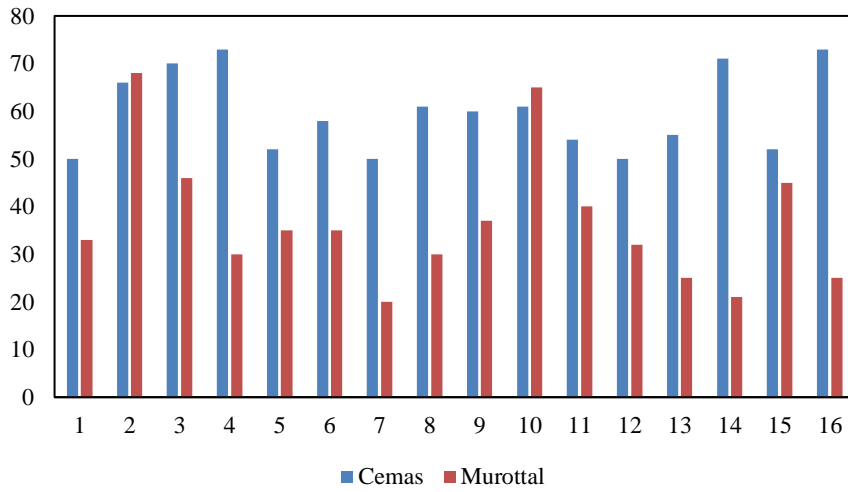


Figure 4. Results of anxiety measurement using the SAS/SARS questionnaire

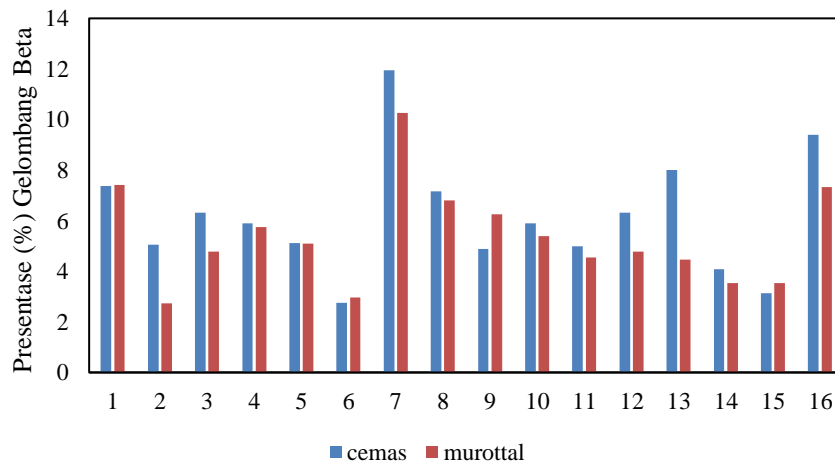


Figure 5. Measurement results using EEG

The data collection results using the SAS/SARS questionnaire are shown in Figure 4. Of the 20 respondents, 4 respondents did not indicate anxiety, and 16 people experienced anxiety. Each of them is 8 people experiencing mild anxiety and 8 other people experiencing moderate anxiety. After being stimulated by the murottal of Surah Al-Fatihah, 12 respondents became normal, 2 respondents were in a mild anxiety condition, and 2 respondents were in a moderate anxiety condition. The average score of the SAS/SARS questionnaire after listening to the murottal, anxiety decreased from 59.75 to 36.68.

The results of measurements using EEG are shown in Figure 5. After being stimulated by the murottal letter Al-Fatihah, 4 respondents experienced an increase in beta waves and 12 respondents experienced a decrease in beta waves. After listening to the murottal letter Al-Fatihah, the average beta wave decreased from 6.14% to 5.35%.

One effective relaxation method when feeling anxious and tense is listening to the murottal Al-Quran. Research by Prapto, Nashori, & Rumiani (2015) says that reading the Koran and understanding its content can calm the heart and eliminate anxiety. Tasyakuranti's (2022) research explains that the dhikr of the Koran can reduce anxiety. The average beta wave indicates this during anxious conditions, which is 14.213 Hz, and the average after listening to dhikr is 13.085 Hz. Research by Kardiatur (2016) obtained the results of  $p$  value ( $0.001$ )  $p < 0.05$  in patients at RSUD dr. Soedarso who experienced anxiety after surgery. The patient was given murottal therapy of surah Al-Fatihah. So it can be concluded that murottal therapy surah Al-Fatihah can reduce anxiety. Another study by Yunus et al. (2019) showed that the results of the anxiety test obtained an average of 0.119 before being given Al Quran Murrotal therapy. The average value after being given Al Quran Murrotal therapy decreased to 0.046. It shows that murrotal Al-Quran can reduce anxiety.

## **Conclusion**

The research that has been done shows that the average beta wave has decreased from 6.14% to 5.35% after listening to the murottal surat Al-Fatihah and measuring using the SRAS questionnaire, the average score when anxious is 59.75, while when listening to the murottal the average is 36.68. It shows that murottal surat Al-Fatihah can reduce anxiety in adolescents.

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## **Conflicts of interest**

The authors affirm that they have no conflicts of interest.

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