Journal of Holistic Medical Technologies
Vol.1 No.1 (2024) 17 – 23
Available online at https://journal.innoscientia.org/index.php/jhmt

Analysis of Beta signal activity before and after smelling the scent of castor oil on Adolescent enthusiasm

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ABSTRACT

Castor oil is an oil that Rasulloh favors. As in the Sahih Muslim Hadith, Rasulloh said, "the best fragrance is Castor oil," therefore this study aims to analyze the activity of beta signals in emotional adolescents. The research was conducted at the Modern Physics Laboratory of Universitas Islam Negeri Walisongo Semarang. This research is quantitative, with an experimental approach of as many as 20 respondents from the Faculty of Science and Technology of Universitas Islam Negeri Walisongo Semarang. Data were collected using the KT88 type EEG device for one minute without treatment and given the treatment of smelling the aroma of castor oil. In addition, respondents filled out an emotional intelligence questionnaire consisting of 5 questions with a scoring system using 3 Likert scales of normal, moderate, and high. Then, processing using Python software using the PSD (power spectral density) algorithm with the extraction method, in which the initial data is amplitude against time and then extracted into frequency against intensity. The results obtained in this study show that the frequency of beta waves before treatment and after treatment is 5.18% to 6.44%, respectively. The questionnaire score data before and after treatment is 7.75 to 9.15, respectively. It can be concluded that the aroma of Kasturi oil affects the increase in beta signals and enthusiasm of adolescents.

Keywords:
Beta Signal Activity; Castor Oil; Scent Stimulation; Adolescent Enthusiasm; EEG Analysis

Introduction

Nowadays, many people, from young to elderly, have a hobby of wearing fragrances. The observation is that the perfume industry has recently increased (Surip et al., 2020). The Prophet himself also had a hobby of wearing fragrances, and the oil that the Prophet liked the most was castor oil as in the Sahih Muslim Hadith that the Prophet said (الطِّيبِ أَطْيَبُ الْمِسْكُ) "the best fragrance is castor oil" (Shahih, 2021).

Castor oil itself is an oil that has a soft but pungent aroma. Castor oil is divided into two types: the first is animal castor oil, which comes from the glandular nodules of stags, and the second is vegetable castor oil (As Perent, 2021). Castor oil is used as aromatherapy, considerably calming the mind and affecting a person's emotional state (Thanatuskitt et al., 2020). In this study, we will use EEG with the KT88 type, which EEG itself is a tool used in processing brain signals whose data can be processed by many methods, one of which is the neural network method (Kurniawan et al., 2021).

Electroencephalogram (EEG) or electroencephalogram examination helps study images of recorded electrical activity in the brain. In the human brain itself, there are various kinds of signal waves: delta wave (0.5-3Hz), theta wave (4-7 Hz), alpha wave (8-13 Hz), beta wave (14-13 Hz), gamma wave (31-100 Hz). In this study will focus on beta signal waves, why beta signals because in beta signals can detect a person's emotional level (Febrina Yumiko et al., 2021). Beta waves are divided into three classifications: low beta, medium beta, and high beta. The beta wave frequency range is 13-30 Hz and usually occurs during a heightened state of consciousness (Nadia, 2021). They are alert, attentive, involved in solving problems, and focused on mental activity (Das et al., 2022). An EEG has been widely used to study the activity of higher mental functions in humans who are affected by the aroma of essential oils; the aroma stimulates olfactory receptor cells in the nose, open channels that lead to olfactory sensory neurons sending electrical signals to the brain through the olfactory bulb and higher olfactory cortex thus affecting a person's emotional state (Ramadhani & Putrianti, 2017).

In previous research on the effects of lavender aromatherapy on relaxation, anxiety, mood, and alertness of a person, EEG signal activity showed a decrease in anxiety and improvement in one's mood

and an increase in the strength of alpha and beta wave signals (Sowndhararajan & Kim, 2016). In other research, lavender aromatherapy affects pregnant women's emotions and sleep quality (Mu'alimah et al., 2022). Furthermore, previous studies have shown the effect of lemongrass oil on a person's mood condition (Sayowan et al., 2012). In previous studies, many examined the effect of fragrances on brain signal activity but most of these studies examined the effect of fragrances for health aromatherapy, one of which was to affect the quality of a person's sleep (Fauzan et al., 2019). In previous studies, the research object was the general public, and the materials used were types of aromatherapy. However, this study only focused on animal-type castor oil without any mixture, and the target object was focused on adolescents. This study aimed to determine the analysis of beta signal activity before and after treatment and the effect of musk oil on adolescent enthusiasm.

Methods

This study uses quantitative methods with an experimental approach that aims to determine the effect of musk oil on changes in beta signals. Twenty healthy respondents were recruited from adolescent boys aged 18-23 years, the age range being late adolescence (Lating, 2016). EEG data was collected at the Modern Physics Laboratory of UIN Walisongo University Semarang. In this study, we will compare the analysis of beta signals under normal conditions and during the condition of smelling the aroma of musk oil, taking beta signals using an EEG tool by placing electrodes on the head according to the point and the electrodes must touch the scalp so that the signal obtained can be appropriate and maximized (Khakim & Kusrohmaniah, 2021).

The tool used in this study is an electroencephalogram (EEG) with the KT88 type connected to a computer that has 16 chanels off EEG +2 chenels of ECG and has a sampling rate of 100 dots / s with an accuracy of 12 bits with imput impendance ≥ 10 M with noise level ≤ 5µvp-P and CMRR ≥ 90 dB and Magnicification 1000 with contant All digital and free anactmen with display speed (Paper sped) 5, 10, 15, 30, 60, 120 mm / s with amplitude 1 . 1.5, 2, 3, 5, 7.5, 10, 12, 15, 20, 30, 50 mm/50µv with playback speed: 1 time, 2 times, 3 times, 10 times, 20 times, 40 times, 60 times with 50 Hz interference suppression: ≥30 Db, with sefety type: class II type BF applied part. The set of 21 electrodes with one additional ground was placed according to the international 10-20 system on Fp1, Fp2, F3, F4, F7, F8, Fz, C3, C4, Cz, P3, P4, Pz, T3, T4, T5, T6, O1, O2. Reference electrodes are applied to measure electrical activity in the ear lobe (A1 and A2) (Febrina Yumiko et al., 2021). Before the electrode is attached to the respondent, the electrode is soaked with water first so that it can conduct electricity (Prastuti, 2017).

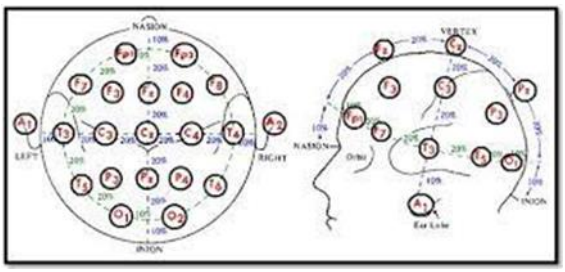


Figure 1. Electrode attachment points

In this study, an emotional questionnaire was used to measure enthusiasm. Enthusiasm is the condition of someone having passion and enthusiasm. To determine whether someone is enthusiastic, such as whether the person is sleepy or tired, including conditions where someone is not enthusiastic and vice versa. This questionnaire consists of 5 questions consisting of 3 positive statement questions and 2 negative statement questions. The assessment's provisions use 3 Likert scales: normal +1, medium +2, and high +3. The Likert scale itself is a scale that is used as a measurement of data both qualitatively and quantitatively. The use of the Likert scale can be from 3, 4, and 5 Likert scales according to the needs of the researcher, as in previous studies of portfolio assessment of Indonesian language subjects using 3 Likert scales, namely very fulfilling, good, and very good (Ichwan, 2012).

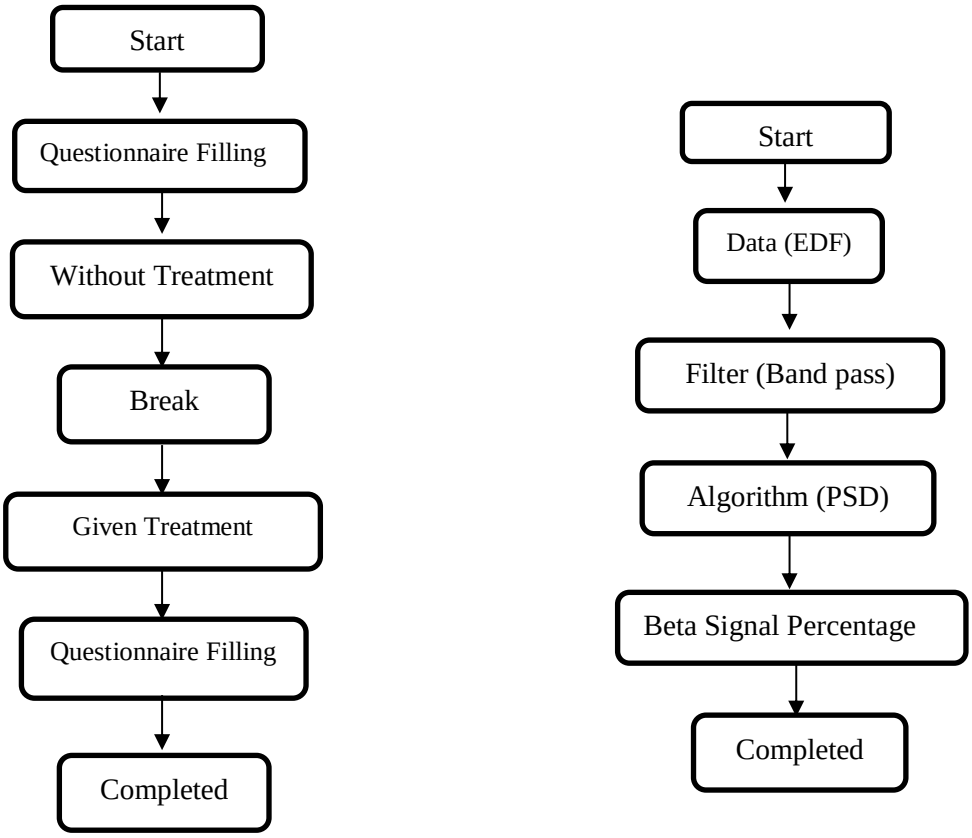


Figure 2 (a) research procedure. (b) data processing

Figure 2 shows the research procedure. At the time of starting conditions, participants are in a relaxed sitting condition and should not use any type of perfume that can cause a fragrance that will interfere with the course of EEG data collection. The participants were also prohibited from using alcohol and smoking before the study because it could affect the results of the data taken (Radyaputra et al., 2018). Before being attached to the electrodes, the participants were asked to fill in the emotional). After completing the questionnaire, the participants were paired with electrodes with a 10-20 system, as shown in Figure 1. This installation system meets international standards (Khakim & Kusrohmaniah, 2021). Furthermore, normal data collection or called data before treatment is given which is carried out for 1 minute, in this normal data collection, the respondent is sitting relaxed with his eyes closed and the room is conducive because under these conditions he will get maximum data results rather than in crowded conditions which can affect the data results from EEG (Sumardiyono et al., 2020).

After normal data collection, respondents were given 5 minutes to prepare for the next stage because rest pauses are essential for brain wave stability (Etika & Hasibuan, 2016). When data collection is given treatment, it is not much different from the conditions at the time of normal data collection, namely in a condition of closing the eyes and sitting relaxed. The treatment is by smelling the aroma of musk oil applied to the cloth and placing 8-15 cm in front of the respondent's nose. Data collection on the condition given treatment is for 1 minute. After that, the respondent filled out a questionnaire about what was felt after smelling the aroma of Kasturi oil.

Figure 2(b) show after the data is obtained, it will be processed using phyton software. Phyton is a programming language application for processing all types of data in images or raw data that will be processed using certain coding (Reza et al., 2022). The data obtained is raw data in the form of EDF (erdium doped fiber) data which is standard EEG output data consisting of 2 data, namely normal and treated. The data is entered at Phyton in Google Colab, then the data will be processed by performing a bandpass filter in order to filter out unnecessary frequencies (other than 1-49 Hz) due to artifacts (Gomez-Garcia et al., 2018). The data will be processed with the PSD (power spectral density)

algorithm. The PSD algorithm is versatile for processing data communication signals, sound, and audio to instrumentation and robotics (Putra, 2019). In processing this data, the PSD algorithm will process time-based data into frequency-based data.

Results and Discussions

Respondents are sitting relaxed in a quiet room so that the data obtained does not have many artifacts; this is because if the respondent is not calm during data collection, it will affect the EEG signal (Sumardiyono et al., 2020). EEG is measured by attaching electrodes to the head, producing graphical data from electrical potential activity in the brain (Aprilian et al., 2021).

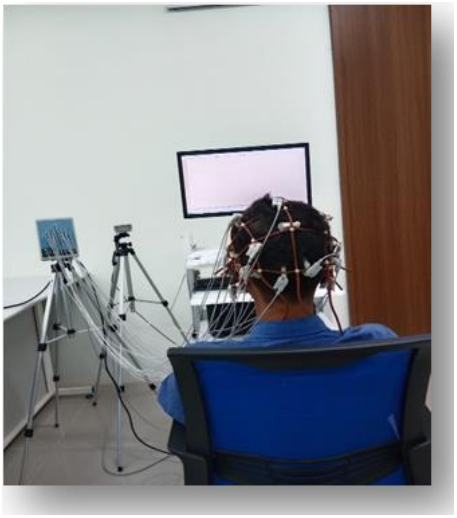
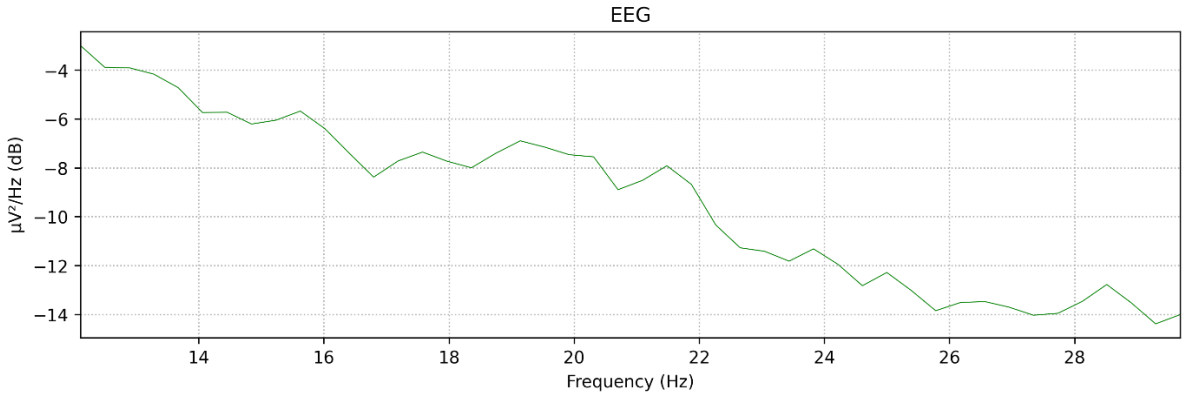
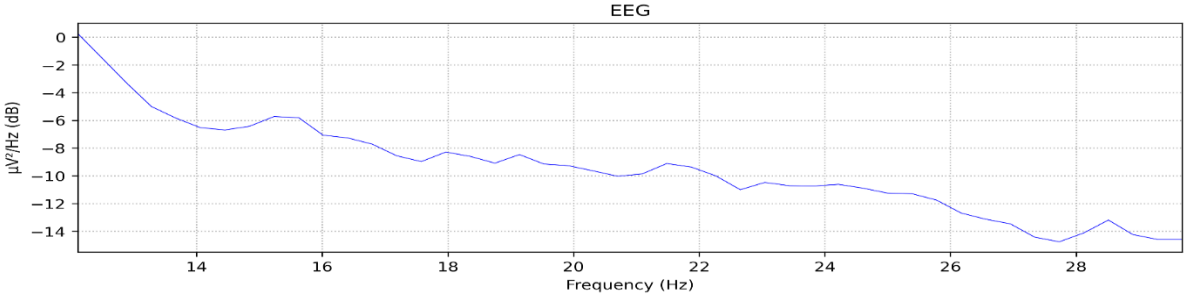


Figure 2. EEG data capture



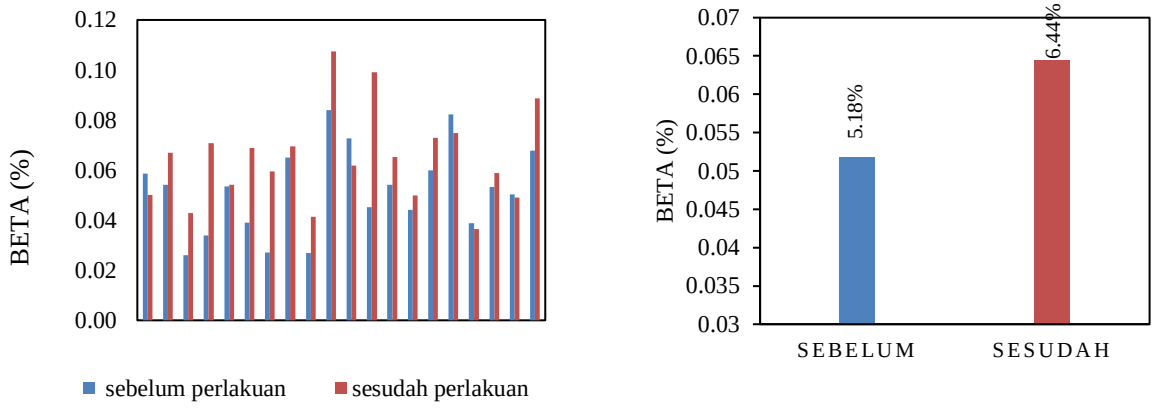
(a)



(b)

Figure 3. (a) beta waves before treatment, (b) beta waves after treatment

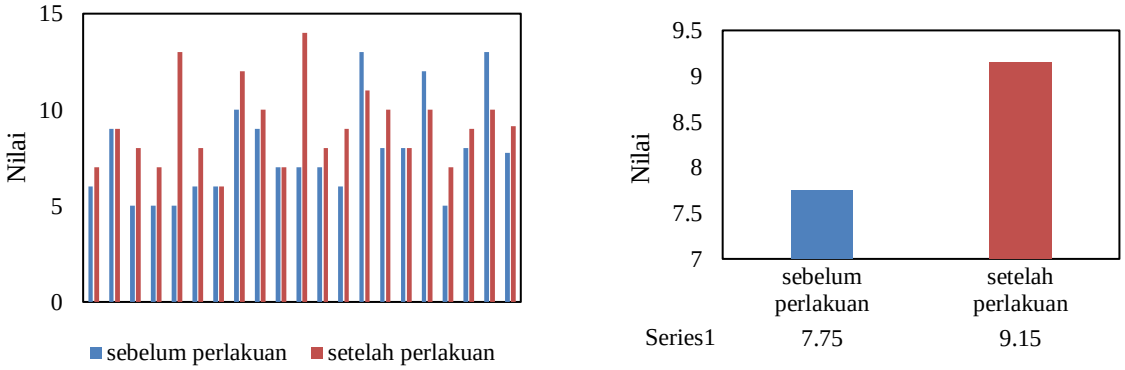
In this study, 2 standard EEG output raw data in the form of EDF were obtained. EDF data is the most secure because it has multi-level protection, so special coding is required for processing (Thirupathi & Rao, 2020). The EDF data obtained will be processed using the PSD algorithm. In Figure 3 a and Figure b are the results of processing beta signal EDF data before and after treatment. It can be seen that the beta signal has increased in frequency to reach the point of 28 Hz or is in the high beta signal vulnerability because it is close to the frequency of 30 Hz; the increase in beta signal is due to the treatment of Kasturi oil aroma. Previous research stated that fragrances affect brain wave activity (Sowndhararajan & Kim, 2016). In this frequency condition, a person will have a high level of alertness.



(a) (b)

Figure 4. (a) beta waves before and after treatment, (b) average beta waves before and after treatment

Figure 4 a is the result of beta waves before and after treatment obtained from 20 respondents; 15 respondents experienced an increase in beta signals, and 5 other respondents experienced a decrease in beta signals. The increase in beta signals is due to the aroma of musk oil that stimulates the brain. At the same time, the beta waves fell because the participants became relaxed due to the aroma of musk oil. In Figure 4 b is the average result of beta waves before and after treatment, before treatment it was 5.18% while after treatment the data obtained was 6.44%. The average wave results increased because the fragrance can trigger powerful emotions and feelings. It is because the fragrances' aroma will stimulate the brain's limbic system.



(a) (b)

Figure 4 (a) questionnaire scores before and after treatment (b) average questionnaire scores before and after treatment.

In Figure 4 a questionnaire value shows that 13 out of 20 respondents experienced an increase in value. In comparison, 3 respondents experienced a decrease in value, and 4 other respondents did not

experience a decrease or increase in value. Figure 4 b shows the average value obtained from 20 respondents; the average value before treatment was 7.75, and the value after treatment was 9.15.

Conclusion

In the recording of beta wave signals, the average before treatment was 5.18%, and after treatment, the value was 6.44%. The average value of the emotional questionnaire before treatment was 7.75; after treatment, it was 9.15. this situation proves that the aroma of musk oil affects the increase in beta signals in the brain and the condition of adolescent enthusiasm.

Acknowledgments

We thank Universitas Islam Negeri Walisongo Semarang for offering the essential facilities and resources that made this work possible.

Conflicts of interest

The authors affirm that they have no conflicts of interest.

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