

# **BRAIN WAVES IN RESPONSE TO AI-QURAN & DHIKR**

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## **ABSTRACT**

The purpose of the study was to identify the differences that occur in the brain (the region of interest, ROI) while reciting and listening to Dhikr & Al-Quran, such as "Astaghfirullah", Subhan Allah, Allahmulillah, Lailaha - illa Allah - huakbar". 10 students were involved voluntarily for the resesarch. Brain waves were recorded from the subject based on 10-20 using 19 qEEG Mitsar current channel subjects of reciting and listening. Based on statistical analysis contained in the details, test results paired t test to both hypotheses found there was no significant difference between cognitive activity such as reciting and hearing. The results of the analysis revealed that the dominant wave was Delta, followed by Theta waves. (113 words)

Keywords: Qeeg, brainwave and Dhikr & Al-Quran

## **INTRODUCTION**

The purpose of this study was to analyze the brain response at the region of interest (ROI) while reciting and listening to the Al-Quran (Al-Mulk verse) and Dhikr, "Astaghfirullah halazim" "Subhanallah, Allahmulillah, Lailaha – illallah, Allah – huakbar. Brainwave is identified as the cumulative electrical change that occurs in the brain as a result of information or stimulus processing. There are basically 5 types of brainwaves – delta, theta, alpha, beta and gamma and each of it symbolizes different information processing in brain. To measure brainwave, specific tool is needed, which is by using quantitative electroencephalogram (qEEG), where it will produce reciting in terms of frequency and amplitude using a method known as Fast Fourier Transform (FFT).

## **BACKGROUND OF STUDY**

Dhikr & Al-Quran plays a very important role in the life of the muslim as a source of peace of mind . However, less attention were given by the scholars, researchers and the general public into this area. Lack of awareness and knowledge concerning the role of Dhikr & Al-Quran makes us forget the importance of inculcating the added value of reciting Dhikr & Al-Quran in our daily lives. It is the simplest way to get us closer to Allah and to seek the calmness and love from the Almighty. A handful of researchers and scientists in recent years are actively looking for the relationship between science and holistic (religion). Several studies have been conducted and the resulting findings have begun to receive the

attention of the general public. For example, John Rael Cahn and Polish (2006) conducted a study titled *Meditation States and Traits: EEG, ERP, and Neuroimaging Studies*. In the study under discussion, the study found that use of EEG waves such as Alpha and Theta waves are most active after meditation. Among other studies, were studies conducted by Noor Ashikin, Zulkurnaini, Ros Shilawani S. Abdul Kadir et. al (2012), entitled *The Comparison between Listening to Dhikr & Al-Quran and Listening to Classical Music on the Brainwave Signal for the Alpha Band*. Although the study were conducted from a different scope, this study can still be a source of reference for future research. Dhikr & Al-Quran is one of the therapy in meditation activities. Review from past studies put a marker in the direction of holistic science to be a catalyst for efforts to conduct similar studies, but however more focused on the practice of Dhikr & Al-Quran & Al-Quran and its impact on human neurological change together with some additional concern in the research objectives. According to Fazrena (2010), Alpha band is the dominant brainwave during recitation of Dhikr & Al-Quran where the band have high change in amplitude at point of electrode P3, Pz and P4 which represent parietal cortex of human brain. This shows that reciting al-Dhikr & Al-Quran & Al-Quran produces resting and calming effect to the readers and reduces stress level. But according to research done by Abdurrochman et al. on effect of Dhikr & Al-Quran recital (2007), it is found that subjects produce Delta wave as the dominant brainwave which can be used as therapy in sleeping disorder. In addition, the research revealed that reciting Dhikr & Al-Quran also increase the percentage ration of beta and gamma waves.

## **SIGNIFICANCE OF STUDY**

This research is vital because there had been no specific research to see the difference between the brain wave while recitating Dhikr & Al-Quran verbally and listening to Dhikr & Al-Quran. The aim of this study is to investigate the benefit of reciting Dhikr & Al-Quran verbally and listening to them. In addition, until June 2010, there are more than 10,000 people are having learning disabilities in Malaysia. Therefore, the result of this study will be useful to maximize Malaysian students learning performance by optimizing the benefit of brainwave towards learning process. In addition, this is the simplest method for remembering the Almighty and repent. In addition, this study will enable researcher to design protocol of Neurofeedback training to train specific brain region for students to learn better as this research will be able to pinpoint region of brain that are important for peak performance and activation of creativity for peak performance. Training for Alpha will be able to increase calmness and activate the expression domain (verbal, music and arts) on the left hemisphere for creativity.

## **METHODOLOGY**

This is a quantitative study using qEEG to observe and record the brainwaves of 10 undergraduate students from cognitive sciences program. These students were given three cognitive tasks such as reciting and listening to Dhikr & Al-Quran while their brain signals were recorded to generate spectral analysis using Fast Fourier transform to produce the brain waves into different bands and sub-bands.

## **Participants**

10 undergraduate students aged 19-25 years old (7 female and 3 male) volunteered for the study.

## **Technique of data collection**

The data collected were analyzed using Quantitative Encephalogram (qEEG). Consent forms were distributed to participant to inform them about the details and schedule of this research. Participant was placed in a dimly lighted room, with room temperature ranging from 21 to 23 degree Celsius, where participant sat down on a chair. In order to collect data, cognitive task were given to participant, which involve relaxation stage, reciting al-Dhikr & Al-Quran without looking at the meaning and reciting al-Dhikr & Al-Quran without looking at the meaning, with 3 minutes time allotted respectively. Below was the flow of the cognitive task:-

### **1. Relaxation**

After the EEG cap (figure 3.2) and the electrode (figure 3.1) were placed on participants head, a conductive gel was inserted in the tube for electrode. This is to minimize impedance between electrodes and scalp. Then, they were asked to focus at a point on the computer for 3 minutes. Then, participants are asked to close their eyes for 3 minutes to record participant's brainwave while they are in relaxation mode and also to familiarize participants with EEG tools.

### **2. Open eyes**

Participants were asked to focus on the dot on the screen for 3 minutes while their brain waves were recorded.

### **3. Closed eyes**

Participants closed their eyes for 3 minutes in a resting state conditions.

### **4. Verbally recites Dhikr & Al-Quran consistently for 3 minutes**

Participants were asked to verbally recite Dhikr & Al-Quran for 3 minutes. At this point of time, EEG will record changes of participant's brainwaves as participants were involved in multiple cognitive activities and the brain was in working state. Any changes to frequency of brainwave at specific point of electrodes were recorded.

### **5. Listening to Dhikr & Al-Quran**

Participants were asked to listen to Dhikr & Al-Quran consistently for 3 minutes. Any changes to brainwave recording were recorded in order to compare to recitation of Dhikr & Al-Quran verbally and g because at this point, the brain was processing additional type of cognitive activity which is comprehension.

## Research Objective

This research was carried out to study the dominant brainwave and region of the brain during recitation of Dhikr & Al-Quran and listening to the Dhikr & Al-Quran.

## Specific objectives

1. To analyze dominant brainwave during the activity of reciting Dhikr & Al-Quran verbally and listening to Dhikr & Al-Quran.
2. To analyze point of interest (placement of electrodes) during both activities.

## FINDINGS AND DISCUSSION

### Demographic information

The majority of respondents involved voluntarily in this research consists of 7 female out of 10 participants. This number is equivalent to 70% of the total respondents. While the balance of 30% of the total participants are male. –Average age of participants are around 22-24 years. The remaining 20% of students aged 19-21 years and 25 years or older.

Average frequencies of delta wave while reciting the Dhikr & Al-Quran is higher with the mean average of 28.48 compared to the cognitive activity of listening to Dhikr & Al-Quran, where the mean average is 16.32.during listening to the Dhikr & Al-Quran.

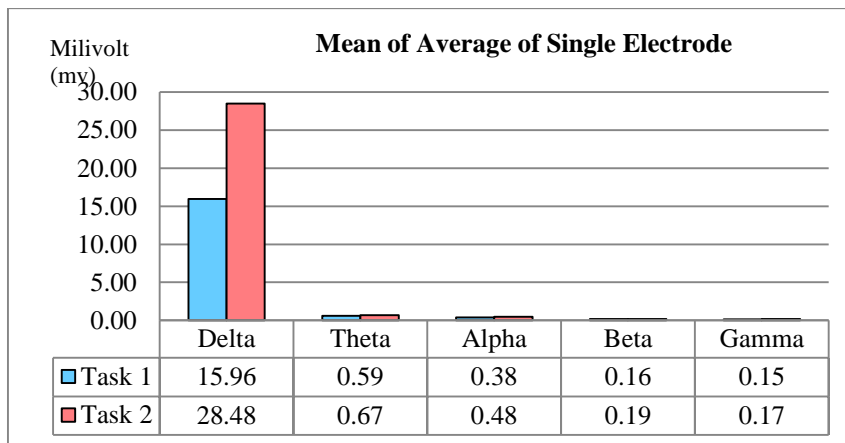
Recite Dhikr & Al-Quran	Delta	Theta	Alpha	Beta	Gamma
Mean	28.48	0.67	0.38	0.19	0.17
SD	28.78	0.36	0.44	0.14	0.14
Listening Dhikr & Al-Quran					
Mean	15.96	0.59	0.38	0.16	0.15
SD	16.32	0.74	0.24	0.19	0.26

Table 1 Average Mean and Standard Deviation while Listen to Dhikr & Al-Quran and verbally recite

Table 1 shows that the dominant wave produced during recitation and listening to Dhikr & Al-Quran was delta followed by Alpha with an average frequencies of 0.79 while reciting verbally and 0.79 of theta while listening. This is associated with the human cognitive and neurological functioning where indepth focus during a deep spiritual meditation may lead to a condition where it leads to stimulation of higher delta waves.

On the other hand, alpha waves (9-13 Hz) are often encountered when an individual is in a state of conscious, awake, during the learning process as well as physical and emotional situation of a person in a state of calm . Most investigation and previous studies found the stimulation of alpha waves while prayer and meditation when it implicates on tranquility within an individual during the state of meditation. Meanwhile, the active and dominant wave in the theta state of deep meditation. (4.0 – 7.5.0 Hz). Theta wave is often detected in a child aged 2-6 years. The stimulation of theta waves are attributed to the activity beyond consciousness and when the mind are in a state of calm, creative and mesmerized.

### Dominant brainwave

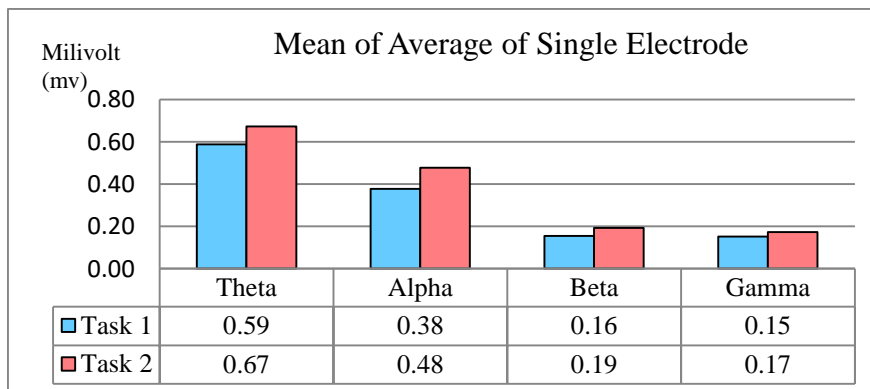


**Figure 1**

Task 1: Listening to Dhikr & Al-Quran    Task 2: Recite Dhikr & Al-Quran

According to the graph above, we can see that in both tasks, Delta was the dominant brainwave as it possesses the highest value. In task 1, the mean of single electrode in Delta band is 15.96 mv and in task 2 it increases to 28.48 mv, where the increase is 78.45%. The p-value is equal to 0.01; therefore there is significant difference of Delta wave between Listening.and reciting Dhikr & Al-Quran.

### Second dominant brainwave



**Figure 2**

Since the difference of value between Delta wave and other wave were high, we have to take a look at the second dominant wave, which is Theta wave. In task 1, mean of single electrode is 0.59 mv and in task 2, it increases 13.56% to 0.67 mv. But the p-value is equal to 0.09, which shows that there is no significant difference of Theta wave between Listening and reciting Dhikr & Al-Quran.

On top of that, we can see that the value of mean increase in each band for second task. Alpha wave increases 26.32% with p-value of 0.01 which shows that there is significant difference of Alpha wave between the two tasks.

Beta wave increases 18.75% with p-value of 0.1 which shows that there is no significant difference of Beta wave between listening and reciting Dhikr & Al-Quran verbally.

Gamma wave increases 13.33% with p-value 0.04 that shows significant difference of Gamma waves between reciting Dhikr & Al-Quran and listening.

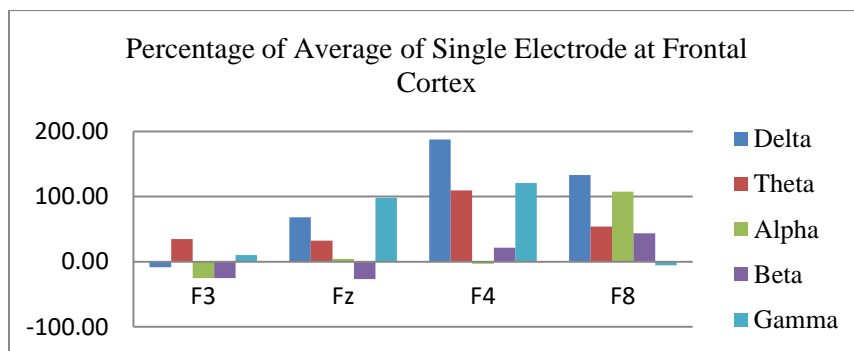
### Relative Power at Brain Cortex

Relative power was calculated to find out percentage of increase in average of single electrode during reciting al-Dhikr & Al-Quran verbally. The relative power was calculated using the following formula:-

$$\text{Relative Power} = \frac{\text{Average of Single Electrode in Task 2} - \text{Average of Single electrode in Task 1}}{\text{Average of Single electrode in Task 1}} \times 100\%$$

**Figure 3**

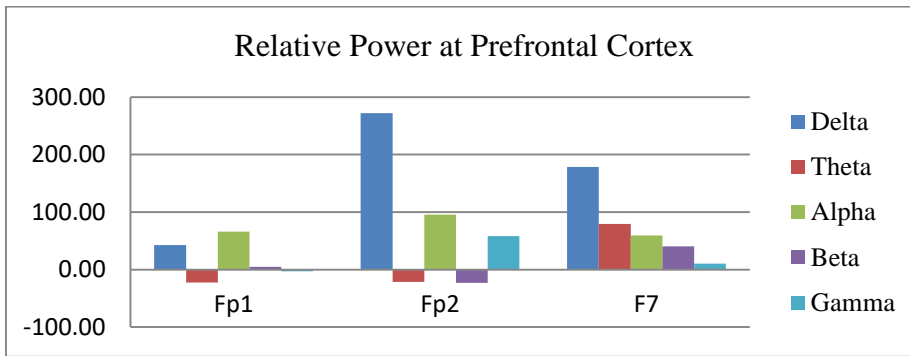
### Relative Power at Frontal Cortex



**Figure 4**

Highest increase in percentage is Delta wave at point F4 with 187.61%. Theta wave shows positive increase in all point of electrodes in frontal cortex; F3 with 34.60%, Fz with 32.18%, F4 with 109.46% and F8 with 53.91%.

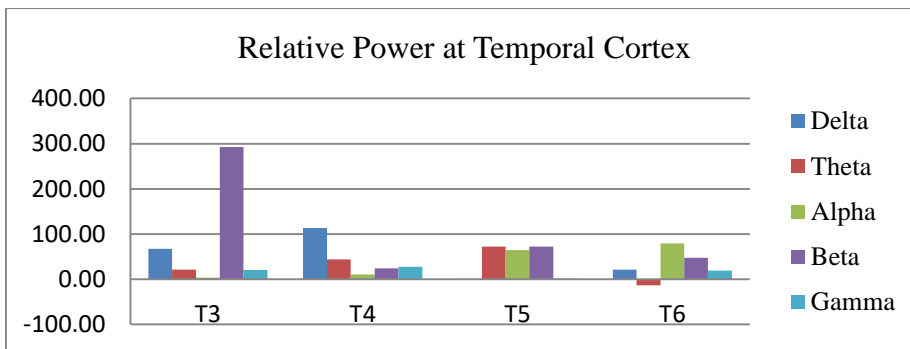
### Relative Power at Prefrontal Cortex



**Figure 5**

Highest increase in percentage is Delta wave at F7 with 178.53%. Delta and Alpha wave shows positive increase at all point of electrodes at prefrontal cortex. Point F7 shows positive increase in all 5 brainwaves.

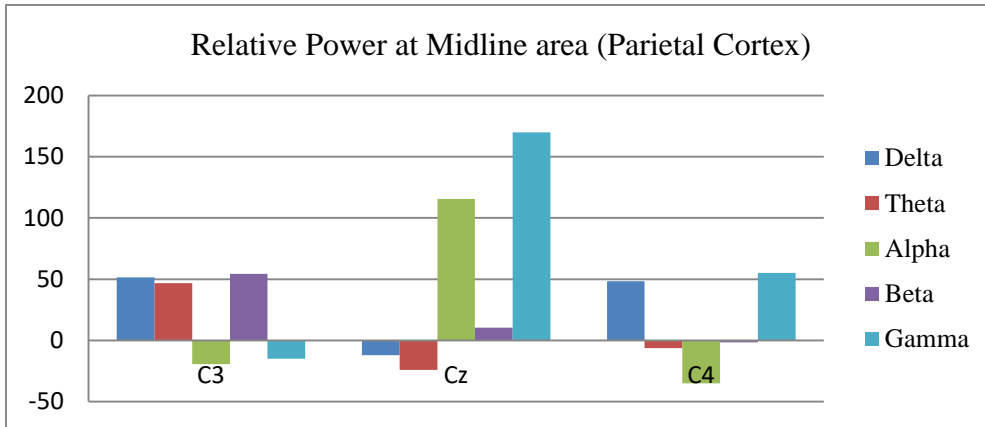
### Relative Power at Temporal Cortex



**Figure 6**

Highest increase in percentage is Beta wave at T3 with 292.45%. Beta wave shows positive increase at all point of electrodes in temporal cortex. Delta, Alpha, Beta and Gamma wave shows positive increase at all point of electrodes at prefrontal cortex. Point T3, T4 and T5 shows positive increase in all 5 brainwaves.

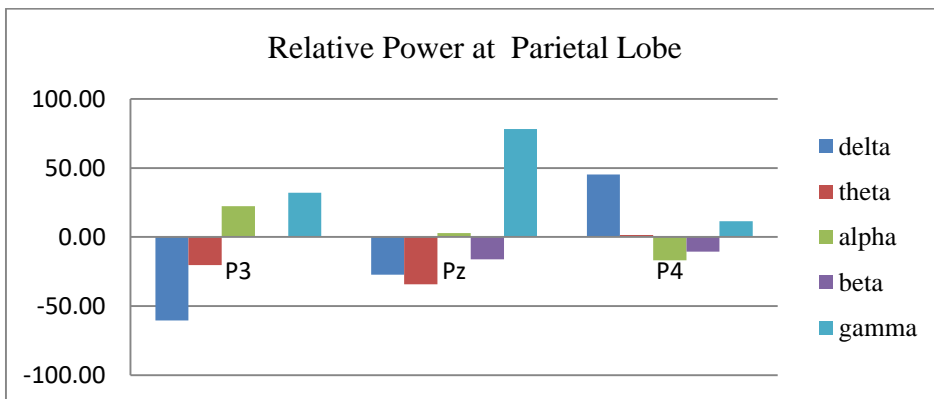
### Relative Power at Midline Area



**Figure 7**

Highest increase in percentage is Gamma wave at CZ with 169.98%. Alpha wave at CZ shows high increase in percentage with 115.45%.

### Relative Power at Parietal Lobe

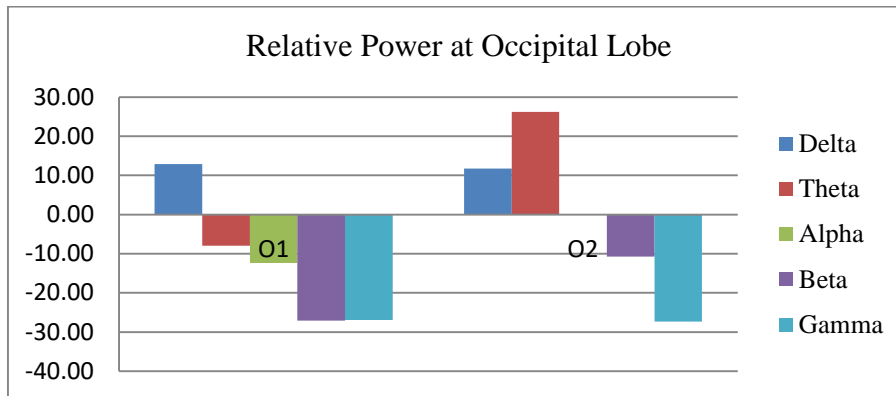


**Figure 8**

Highest increase in percentage is Gamma wave at Pz with 78.23%. Gamma waves also shows positive increase at all points in parietal lobe with 32.01% at P3, 78.23% at Pz and 11.35% at P4.



## Relative Power at Occipital Lobe



**Figure 9**

Highest increase in percentage is Theta wave at O2 with 26.24%. Delta waves shows positive increase at all point at occipital cortex with 12.86% at O1 and 11.73% at O2.

## DISCUSSION

### Dominant brainwave

During both tasks, Delta wave was the dominant wave; 15.96 mv during reciting without meaning and 28.48 mv during reciting with meaning. T-test shows that p-value is 0.01, thus there is significant difference of Delta wave between reciting al-Dhikr & Al-Quran and listening to Dhikr & Al-Quran therefore we reject null hypothesis. This result is similar to previous research done by Abdurrochman et al. (2007) where they found Delta wave was dominant during recitation of al-Dhikr & Al-Quran.

According to Knyazev (2011), delta wave is important in attention as motivational relevance of task and salience of target stimulus is related to increase in Delta wave activity. Delta wave also involved in constant screening of internal and external stimuli in search of motivationally salient cues that signal potential threat or reward. This can be related to the verses that gives warning to whoever disbelieves their Lord will be tormented in hell. Delta wave is also related to subconscious perception.

According to Mendoza (2013), Delta wave is associated with very deep relaxation and spiritual awareness. Since task given to participant were reciting al-Dhikr & Al-Quran which was a spiritual activity, it explains why Delta was the dominant brainwave. Aside from that, since participants were engaging with the meaning of al-Dhikr & Al-Quran, it causes Delta wave to increase. This shows that they were more engage in the spiritual activity when they read Dhikr & Al-Quran with meaning in comparison to listening to al-Dhikr & Al-Quran. On top of that, reciting al-Dhikr & Al-Quran produces relaxation effect for the readers.

### Second dominant wave

Since the difference of value between Delta wave and other wave were high, therefore, we have to take a look at the second dominant wave, which was Theta wave. In task 1, mean of single electrode is 0.59 mv and in task 2, it increases 13.56% to 0.67 mv. But the p-value is equal to 0.09, which shows that there is no significant difference of Theta wave between reciting Dhikr & Al-Quran and listenng to Dhikr & Al-Quran..

Theta wave is reported to be responsible for mental imagery or visualization and deeply internalized state.

## **REGION AND POINT OF INTEREST**

Brain mapping from the ten participants (Refer to appendix 1)

### **Frontal Cortex**

Frontal cortex is responsible for high level cognitive functions or called as executive function. According to Fuster (2008), executive function is defined as the ability to organize a sequence of actions towards a goal. In humans, executive function; the principal function of the prefrontal cortex is defined as the ability to temporally organize purposive behavior, language and reasoning.

Delta wave shows highest increase in percentage which is 187.61% at point F4. This can be explained by the fact that Delta wave is required to achieve attention in doing a task. In relation to cortical area, F4 correspond to Brodmann area 8 (located at intermediate frontal, superior and middle frontal gyri), where the main function of this area is control of eye movement. Therefore, it shows that participants were paying attention in reciting the Dhikr & Al-Quranic verses. Brodmann area 8 also represents point F3, Fz and F4.

Meanwhile, F8 correspond to Brodmann area 45, pars triangularis of inferior frontal cortex. This area is included in Broca's area where it involved in the processing of semantic aspect of language and verbal fluency (Dubuc, 2004). This shows that participants were accessing the meaning of the verses that they read.

Theta wave shows increase in relative power at all point in frontal cortex. This shows that participants were internalizing the meaning of Al-Quranic verse.

### **Prefrontal Cortex**

At prefrontal cortex, F7 shows positive increase in all bands. This shows increase of neuronal electrical activity at this point. This point corresponds to Brodmann area 47 which represent orbitofrontal cortex. According to Hooker and Knight (2006), orbitofrontal cortex is responsible for emotion regulation, where it refers to behavioral processes that individuals use to influence which emotions they have, experience and express them. It includes decreasing, maintaining or increasing both negative and positive emotions through rationalization, reappraisal and suppression. When people allowed themselves to feel the full negative impact of negative scenes causes orbitofrontal cortex to activate.

This can be related back to verse 6 to 11 that describe punishment given to those whom disbelieve God. Hell is described as a place that is built from fire and those who disobey their Lord are to dwell in the flame of hell. This shows that subjects are engaging in visual imagery and are internalizing the meaning of the verses which causes emotions activations.

Delta wave was also highest at F7 with increase of 178.53%. This clearly shows that the activity of reciting Dhikr & Al-Quran with understanding causes Delta wave which is responsible for spiritual awareness activated at point F7 that is responsible for emotions regulations.

Meanwhile, Delta wave at Fp2 shows the highest increase in percentage which is 272.10%. Point Fp2 corresponds to Brodmann area 10. The first function of area 10 that can be

related to this finding is that it is activated when there is recollection of episodic memory. This shows that participants are trying to remember past deeds that they have done. Aside from that, area 10 is also responsible for metacognition; an activity of reflecting on self thought and evaluation or monitoring internally generated information (Burgess et al., 2003). This shows those participants are engaging with self-reflection on what deeds they have done in the past.

On top of that, Alpha wave shows positive increase in all point at prefrontal cortex. Alpha wave is responsible for alert and conscious state but at the same time in a state of relaxation and calmness (Miller, 2011).

### **Temporal Cortex**

Beta wave was the highest wave in T3 with 292.45%. T3 correspond to Brodmann area 42 which is posterior transverse temporal area. This area functions as an auditory cortex. Beta waves generated by the activity of active thinking and when one is engaging with mental activity. Since now participant need to read and internalize the meaning of verses they read, that explain why Beta waves increased in all point of electrodes in temporal cortex. In relation to the function of temporal cortex which is an auditory cortex, participants were engaging in detection and recognition of speech.

Point T3, T4 and T5 shows positive increase in all 5 brainwaves. Point T4 corresponds to Brodmann area 21, which is located at middle temporal lobe. The middle temporal cortex has limbic system, which consist of hippocampus, amygdala and limbic cortex (Baars and Gage, 2010). Hippocampus has function of remembering conscious experience or episodic memory. For amygdala, it is responsible for mood and conscious emotions. Meanwhile, for limbic cortex, it is involved in emotions and memory. In sum, this limbic system has the function of regulating emotions and memory. The fact that this area was activated during recitation of Dhikr & Al-Quran with meaning shows that reciting Dhikr & Al-Quran with understanding evoked emotions and proves that the brain is accessing episodic memory.

Point T5 is located at fusiform gyrus (Brodmann area 37). According to Fitzpatrick and Weber (2008), this area is activated during language switches (second to first language or vice versa) and processing of lexical semantic – associated words with visual percepts.

### **Midline Area**

At midline area which is situated at parietal cortex, Gamma waves show highest increase in percentage at Cz with 169.98%. Alpha wave at Cz also shows high increase in percentage with 115.45%.

Area Cz correspond to Brodmann area 5 which is somatosensory association cortex. According to Marley (2011), this area is responsible for speech production and language. Speech is considered to be a type of somatosensory activity.

### **Parietal Cortex**

The recording shows that increase in percentage was highest at Pz (78.23 %), which correspond to Brodmann area 7, or superior parietal lobule. This area becomes active when one is trying to visually determine the location, depth and trajectory of object in physical space (Williams, 2009). This shows that while reciting Dhikr & Al-Quran with understanding, readers is engaged in higher order thinking as the dominant wave is Gamma and they are visualizing the meaning of the verses that they read.

According to Keizer et al. (2009), Gamma wave is responsible as the medium to bind different types of information that are coded in different brain areas. On top of that, intelligence related performance is codetermined by that binding process. Thus, this shows that the brain is engaging in neural synchronizations during recitation of al-Dhikr & Al-Quran with understanding.

### **Occipital Cortex**

At occipital lobe, Theta wave shows the highest increase in percentage which is 26.24%. Delta waves shows positive increase at all point in occipital lobe with 12.86% at O1 and 11.73% at O2. Electrode O1 and O2 is located at Broadmann area 18 which is prestriate cortex. This area is known as secondary visual association cortex where it is involve in ventral pathway where it involve the processing of shape, color and identity of visual objects (Baars&Gage,2010). This explains the fact that Arabic writings have orthographical feature.

In sum, during recitation of Dhikr & Al-Quran with meaning, Delta wave was the dominant wave and Theta was the second dominant wave. For brain region, prefrontal, frontal and temporal cortex were the dominant brain region. During this activity, the brain was engaging with processing of emotions, episodic memory, speech production, language, mental imagery, visualizations metacognition and neural synchronizations. Lastly, points of interests were F4, F8, F7, T3, T4 and T5.

### **CONCLUSION**

The purpose of this study was to identify dominant brainwave and brain region during recitation of al-Dhikr & Al-Quran and listening to Dhikr & Al-Quran. The specific objective of this research is to analyze dominant brainwave, dominant brain region and point of interest during recitation of al-Dhikr. The main instrument used in this research was Quantitative Electroencephalogram (qEEG) that was used to record recitings of brainwave during recitation of al-Dhikr & Al-Quran. The findings showed that:

- I. There is significant difference in dominant brainwaves between reciting al-Dhikr & Al-Quran and listening to Dhikr & Al-Quran.
- II. There is no significant difference in second dominant brainwave between reciting al-Dhikr & Al-Quran with and listening to Dhikr & Al-Quran
- III. Dominant brain region during recitation of al-Dhikr & Al-Quran with meaning are frontal, prefrontal and temporal cortex.
- IV. Point of interest during recitation of al-Dhikr & Al-Quran with meaning are F4, F8, F7, T3, T4 and T5.

The findings from this research will enable others to pinpoint suitable brainwaves needed to achieve effective learning by training certain brainwaves based on its function. It will enable researchers to design protocol for Neurofeedback Training (NFT) in order to train specific brain area for people with learning disabilities. On top of that, from this research, Muslims will be enlightened on the importance of understanding Dhikr & Al-Quran verses that we read all this time; not that it only influence to be a better Muslims but it also gives certain health benefits to the readers. According to Mendoza (2013), activation of Delta waves contributes to the production of human growth hormone (HGH) as a result from the stimulation of pituitary gland during activation of Delta wave. On top of that, Delta wave

also stimulates the release of anti-aging hormones such as DHEA and melatonin (Mendoza, 2013).

Some of the finding contradicts with previous researches. Factors that affecting this outcome might because of the imbalance proportion of male to female participants; with 2 males and 8 females. Aside from that, the participants were randomly selected in terms of their ability to read Dhikr & Al-Quran which might affect the activation of the brainwaves. On top of that, participants have their own respective schedule therefore collecting the data were very time consuming.

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Appendix 1(Brain topography from 10 Participants recorded from qEEG)

