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BAB 6

ELECTROENCEPHALOGRAM (EEG) PATTERN FOR HUMAN SMOKE HABIT

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ABSTRACT

The brain is most important part of the human body. Smoking cigarettes is a bad habit, however the total numbers of smokers continue developing. Most smokers give 'to release stress and bored' as a purpose behind smoking. Under this circumstance, the interested of brain condition for smoke affinity are useful for varies biomedical field. The essential motivation behind this research is to investigate the Electroencephalogram (EEG) pattern for smoker using sub-band of theta, alpha and beta groups focus on Power Spectral Density (PSD). EMOTIV Pure•EEG™, SPSS and Excel is used as the software while Emotiv Insight is used as the hardware in this research. 5 smokers and 5 non-smokers were tested for this exploration. EEG data was recorded for 5 minutes. Results demonstrated that smokers have lesser theta band which shows a less stressed on feeling as contrasted with non-smokers with a higher theta band. Smokers additionally higher alpha band which shows that they are more casual contrasted with non-smokers with lower alpha band. In any case, smokers are lower beta band that shows they are less-cognizant contrasted with non-smokers. Recently, electronic cigarettes (e-cigarette) have been proposed as a successful instrument for smoking restraint.

Keywords: Electroencephalogram (EEG), Power Spectrum Density (PSD), Smokers and Non-smokers.

1.0 INTRODUCTION

The brain is most valuable organ of the human body. This organ is an arrangement of insights, mediator of the faculties, initiator of body development, and controller of conduct. Lying in its hard shell and washed by defensive liquid, mind is the wellspring of the considerable number of characteristics that characterize our humankind. Cerebrum is the crown gem of the human body. Mind

resembles an advisory group of specialists. Every one of the parts of the mind cooperate, yet each part has its own uncommon properties. Cerebrum can be separated into three essential units which is the forebrain, the midbrain, and the hindbrain [1, 2], [4].

At the base of every one of our contemplations, feelings and behaviours is the correspondence between neurons inside our brains. Brainwaves are delivered by synchronized electrical heartbeats from masses of neurons communicating with each other. The electroencephalogram (EEG) will differ significantly and are in consistent flux, it can likewise for the most part be separated into four fundamental frequencies which is beta waves, alpha waves, theta waves and delta waves [1, 2], [4].

EEG spectral pattern is described by a several spectral segments which are spectral powers inside universally concurred recurrence groups: Delta band (up to 3Hz) are moderate, noisy brainwaves (low recurrence and profoundly infiltrating, similar to a drum beat), Theta band (3Hz to 8Hz) happen regularly in rest but at the same time are prevailing in profound reflection, Alpha band (8Hz to 12Hz) are overwhelming amid discreetly streaming considerations, and in some thoughtful states and lastly Beta band (12Hz to 38Hz) rule our typical waking condition of awareness when consideration is coordinated towards intellectual errands and the outside world [1, 2].

Smoke has many negative impacts and is terrible for a body. There are numerous hurtful things in cigarettes like nicotine [3]. A few people encounter an identity change which may incorporate an absence of certainty. Cigarettes demolish the inward covering of the nose. Smokers begin to create what is known as the smoker's hack. A portion of the genuine antagonistic impacts of smoking are tumour, strokes, incessant bronchitis, emphysema, and backs off a man's physical execution [10-14].

2.0 PROBLEM STATEMENT

Smoking is generally prohibited on public transportation, except in air-conditioned areas of trains and ships where food is served. Smoking is prohibited in specified public places and workplaces listed in the regulations including, among others, in workplaces with a centralized air-conditioning system; health, education, government and cultural facilities; and indoor stadiums. Smoking is permitted in pubs, discotheques, nightclubs, casinos, in designated smoking areas in air-conditioned eating places and non-air-conditioned public transport terminals. Sub-national purviews may authorize smoke free laws that are more stringent than the national law. Smoke can give terrible impact to human organ particularly to cerebrum [8-12]. Human mind get to be distinctly lopsided and don't work easily. In addition, the human life get to be distinctly shaky in light of unequal mind [6]. In Islam also state that all intoxicants are ‘HARAM’ whereas tobacco is an intoxicating substance.

Under this situation, the intrigued of mind condition for smoke propensity are helpful for fluctuates biomedical field. It additionally can demonstrate out that the smoking will influenced our body in long haul period. Thus, every one of the gatherings must be as one to notice ourselves to prevent or stay away from smoking. As authorities should to exhibit and held a campaign on how risky the impact of smoking as the mindfulness.

These illness from smoking can be cured just if that individual quits smoking, and if the human's organ is not very harmed due to long-haul time of smoking propensity. Nicotine can likewise bring about smoker's skin to get wrinkled ahead of schedule in life. Nicotine speeds up a person's heart and central nervous system. The heart then beats faster, blood vessels become smaller, and blood pressure increases. This could then lead to heart failure. After a while this affects the amount of blood and oxygen that moves through a smoker's body. Nicotine is addictive, which implies that it is a substance that enters the body and changes the compound cosmetics of the body's cells. The cells then ache for more nicotine. This circumstance causes smokers to wind up distinctly dependent and difficult to quit smoking [9].

3.0 METHODOLOGY

The overall process flow chart in conducting this project is show in Figure 1. This flow chart explains the steps taken in this project. The process is including selecting a suitable topic in the beginning of this project, deciding the objective as well as scope and handling over the proposal for proceeding. After that, the project proceeds to the literature review chapter and methodology development planning. After the data collection have been finished, the flow is continuing to the test and evaluate of results to ensure that the objective of the project is achieved. Some correction and modification to the project will be done if it is not functioning well or having a problem.

The process flow is proceeds to the preparation of the final presentation and hand in the full reports of PSM.

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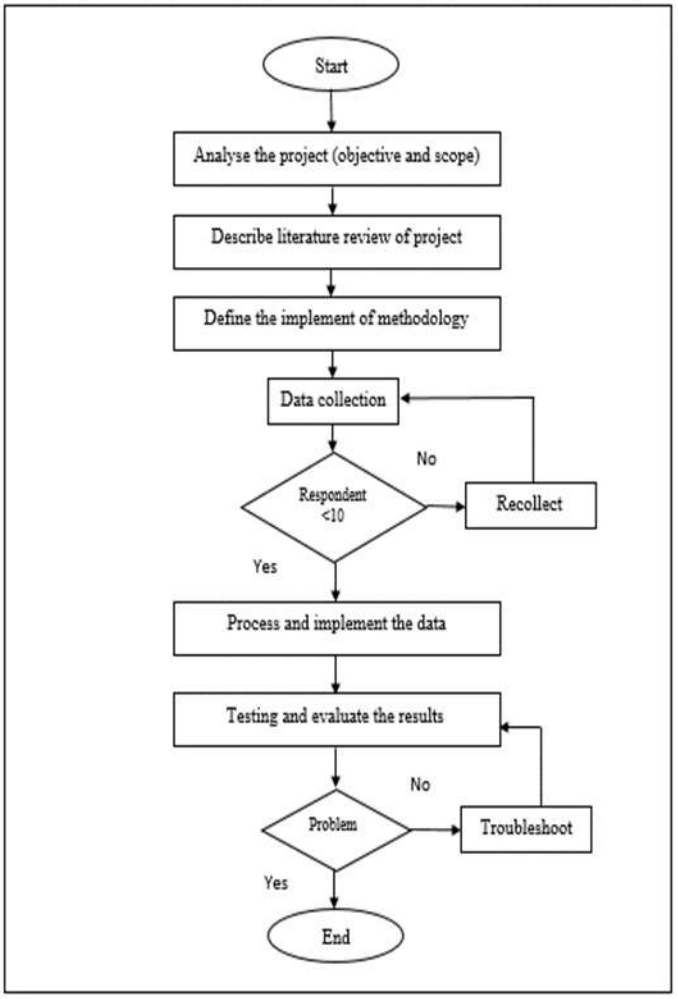

Figure 1: Flow diagram of methodology

A. Initial Literature Review

Literature review is very important to know the whole scenario project on this field. The task involves critical review of key literature from journals, proceeding papers from international conference, magazine, books, articles and etc. in EEG, wave band of brainwaves, EEG spectral identification, signal and image processing of the data captured from the samples.

B. Data Collection

The samples from 10 students are divided into two groups; Smokers and Non-smokers. The Emotiv equipment will be set up to the sample for EEG recording [1], [15]. As the observation, this research will investigate the data pattern from smokers in two states; before and while smoking. Each of the samples will be recorded in the duration of 5 minutes. Figure 2 shows the flow of data collection process and Figure 3 shows the activity while recording the data.

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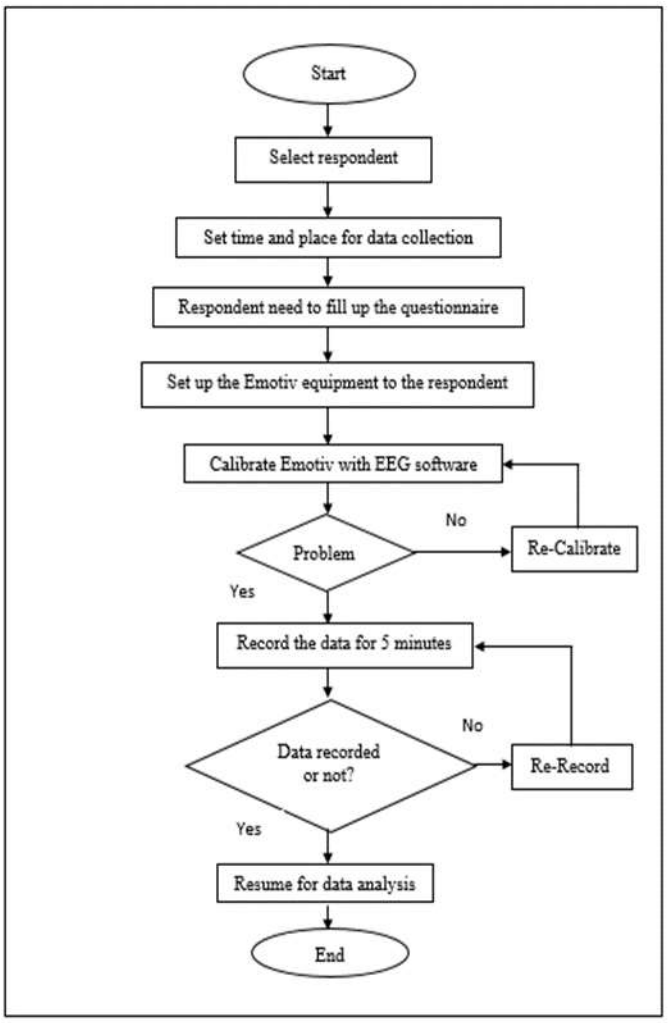

Figure 2: Flow diagram of data collection

Figure 3: Data collection by using Emotiv equipment

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C. *Processing and Implementation of Data*

After data collection, the next stage is pre-processing, processing and post-processing method to raw EEG data. This task is important to generate the expected outcome and results. EMOTIV Pure•EEG™ software is used for offline analysis. After that, the data is being downloaded from that software by connecting through Wi-Fi. The data will be in form of Microsoft Excel file. First, the data is being analysed by looking at their average between samples. Next, the data from Excel is being converted to SPSS software [7]. There are many tools that have been used in SPSS such as descriptive type, and spectral density type. The formulas of mean, variance and standard deviation are shown as below.

$$\text{Mean, } \bar{x} = \frac{\sum x}{N}$$

$\bar{x}$ = represents the mean

$\sum x$ = represents sum up of every samples

N = represents number of samples

$$\text{Variance, } \sigma^2 = \frac{\sum (X - \bar{X})^2}{n-1}$$

X = Each data in the samples

$\bar{X}$ = Mean of data

n = Number of data samples

$$\text{Standard deviation, } \sigma = \sqrt{\frac{\sum (X - \bar{X})^2}{n-1}}$$

X = Each data in the samples

$\bar{X}$ = Mean of data

n = Number of data samples

D. *Testing and Evaluation of Results*

Brainwaves are categorized into four bands known as delta, theta, alpha and beta frequency bands. But, in this research only focus on theta, alpha and beta band due to the main attraction of the observation. This task become successful by defining the normality or distribution data from the result [2].

4.0 RESULTS AND DISCUSSION

Result have been made by two method which is by questionnaire and experimental test.

A. *Questionnaire*

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A questionnaire is an exploration instrument comprising of a series of inquiries and different prompts with the end goal of social occasion data from respondents. Questionnaires are likewise pointedly restricted by the way that respondents must have the ability to fulfil the inquiries and react to them. Hence, for some statistic bunches leading a review by questionnaire may not be concrete.

Figure 4 shows about the percentage of smokers and non-smokers. As the total respondents that have been took part as the samples which is 10 persons, 5 smokers and 5 non-smokers, the percentage illustrate that half of them are answering yes for smoking and other half are answering no for no smoking.

Figure 4: Percentage of smokers versus non-smokers

Figure 5 indicates for the question asking about consideration of smoking. The result also states same like Figure 4 which is the smokers answer yes but for non-smokers answer no for smoking.

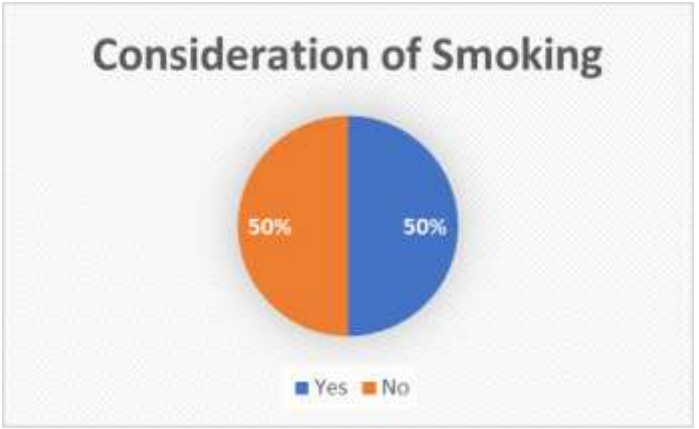

Figure 5: Percentage of consideration of smoking

Figure 6 illustrate the ratio of respondents that have been tried smoking. The result state that even though non-smokers is not considering to smoke, but few of them have been tried for smoking.

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Figure 6: Ratio of respondents have been tried smoking

Figure 7 shows the frequently the smokers prefer to smoke in daily. For sure as non-smokers will answering no for the frequency of smoking but there are different answers from the smokers itself that prefer the amount of their needs.

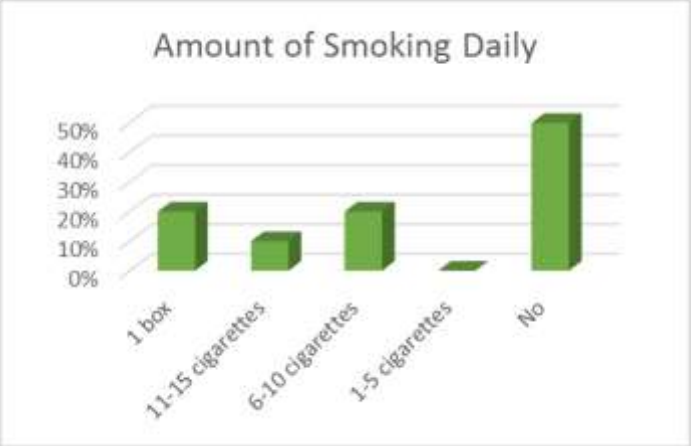

Figure 7: The amount of smoking daily

Figure 8 shows the duration of time of the smokers since first trial of smoking. The result proven that most of the smokers are smoking since their secondary school. That means actually the smokers have been influenced by their friend itself for trying to smoke at first.

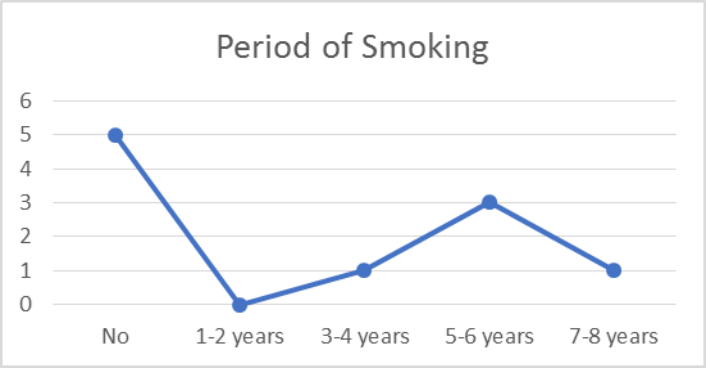

Figure 8: The duration of time for smoking habit

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Figure 9 indicates the question for the additivity of smoking. Basically, as the smokers will say yes for additivity of smoking. But there is one respondent of the smokers do not agree with that statement. Actually, it can be concluded that some of people smoking because get bored or feeling stressed only, not for addicted.

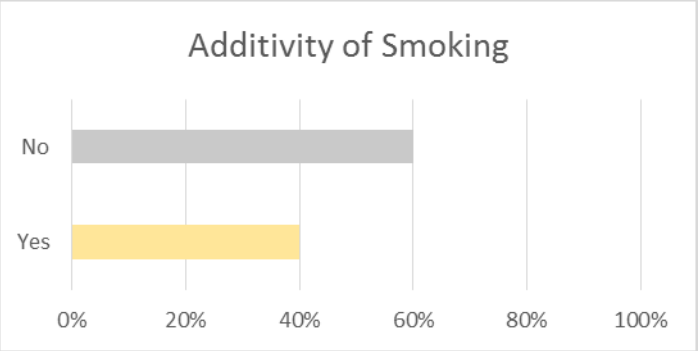

Figure 9: The additivity of smoking

Figure 10 shows the timing of the smoking habit. Majority smokers agree that they are smoking right after finished their meal or feeling stressed. Maybe at that time, they feel so addicted to smoke.

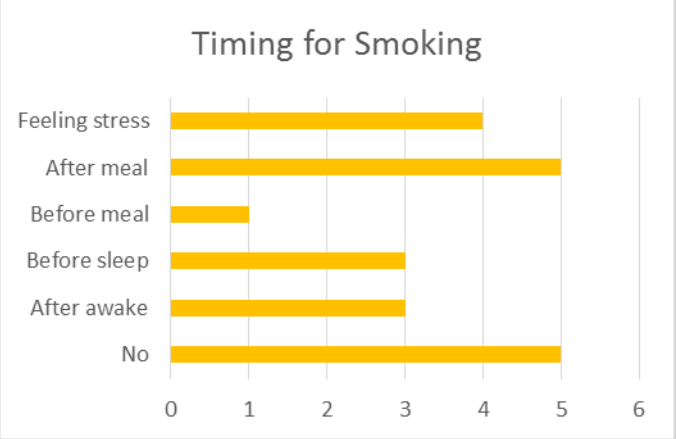

Figure 10: The timing of smoking for the smokers

Figure 11 states the percentage of answer the question relate between smoking and the emotion. There are three over five of smoke's respondents answering yes for affecting their emotion after smoking. This shows that sometimes the smokers are taking smoke due to their emotion either they feel so stress, sad or boring.

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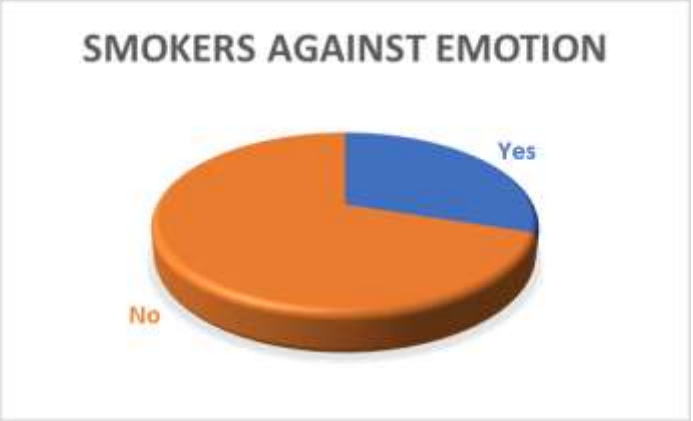

Figure 11: The percentage of smoking affect the emotion

Figure 12 shows the proportion of the respondents noticed about long term effect about smoking. Almost of them answering yes for knowing the effect of their health due to smoke. But the question arises here, why the smokers continue to smoke even though they recognize the bad effects.

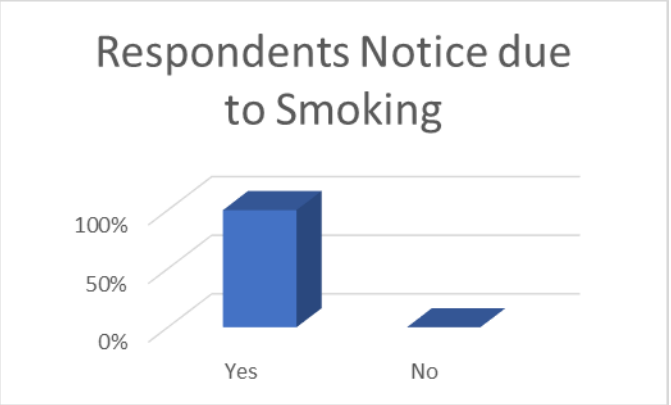

Figure 12: The ratio of respondents noticed about effect of smoking

Last but not least, Figure 13 describes about the smokers have been considered to stop smoking. For sure, all of them are answering yes for considering to stop. Maybe it will take a time due to their addicted of smoking.

Figure 13: The percentage of considering to stop smoking

B. Experimental Results

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EEG data is recorded from the frontal zone of the skull. Along these lines, making the electroencephalographic strategy totally non-obtrusive can be connected over and over to the respondents with no hazard or restriction [4, 5]. This research concentrates on the smoking propensity on the theta, alpha and beta groups of the brainwave. The goal of this exploration to examine a smoker's EEG pattern with the speculation that the smoker will have higher alpha band and lower theta band and beta band contrasted with non-smokers. This theory depends on the way that smokers smoke cigarette to calm anxiety and to be relaxed [9].

I. Spectral Density Graph

The power spectral density (PSD) of the signal describes the power present in the signal as a function of frequency, per unit frequency. Power spectral density is commonly expressed in watts per hertz (W/Hz). Based on Figure 14, 15 and 16 show the results of spectral density each of alpha band, beta band and theta band for non-smokers. Furthermore, the results of spectral density each of alpha band, beta band and theta band for smokers is shown as in Figure 17, 18 and 19.

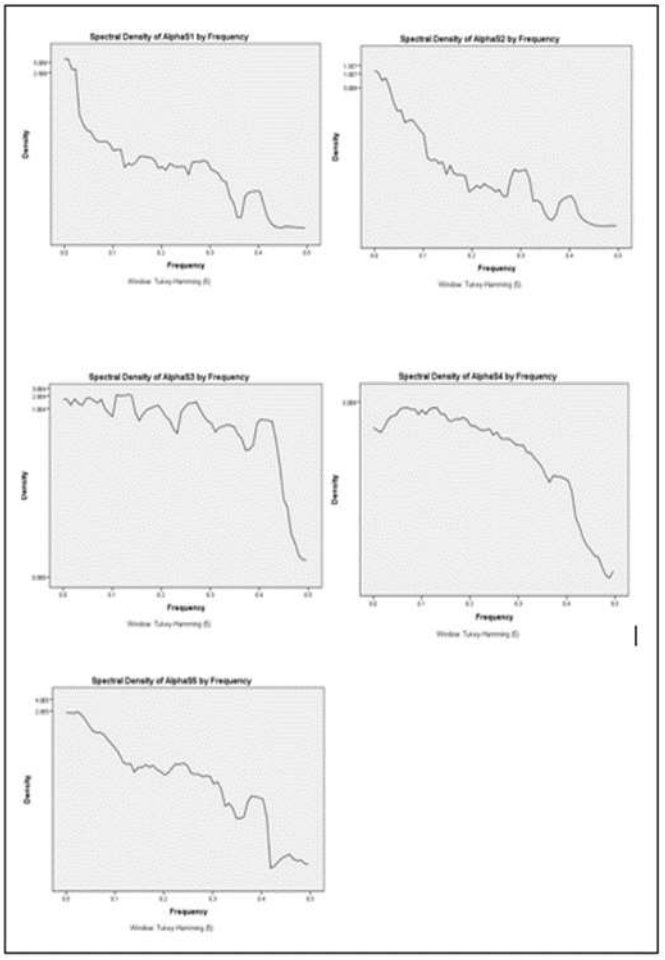

Figure 14: The spectral density graph of non-smokers for alpha band

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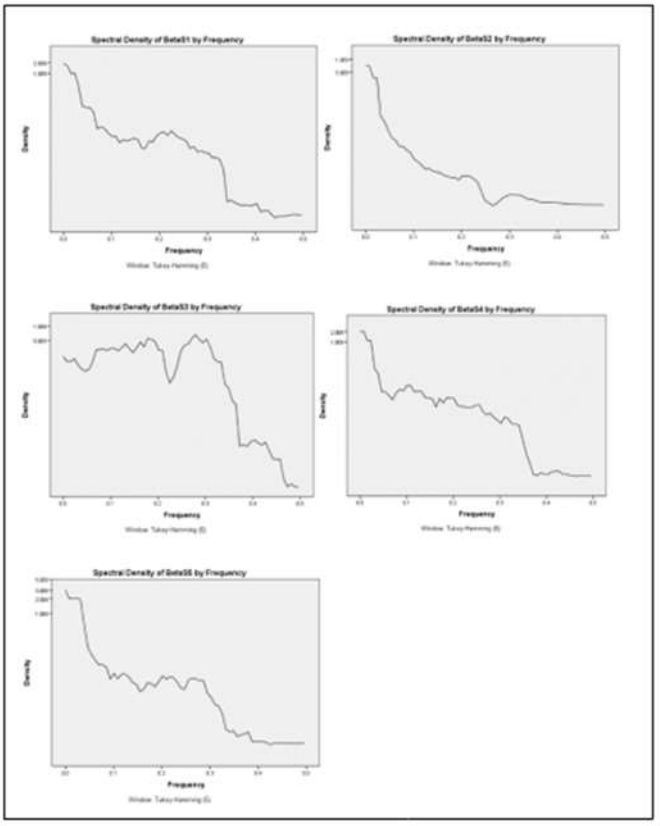

Figure 15: The spectral density graph of non-smokers for beta band

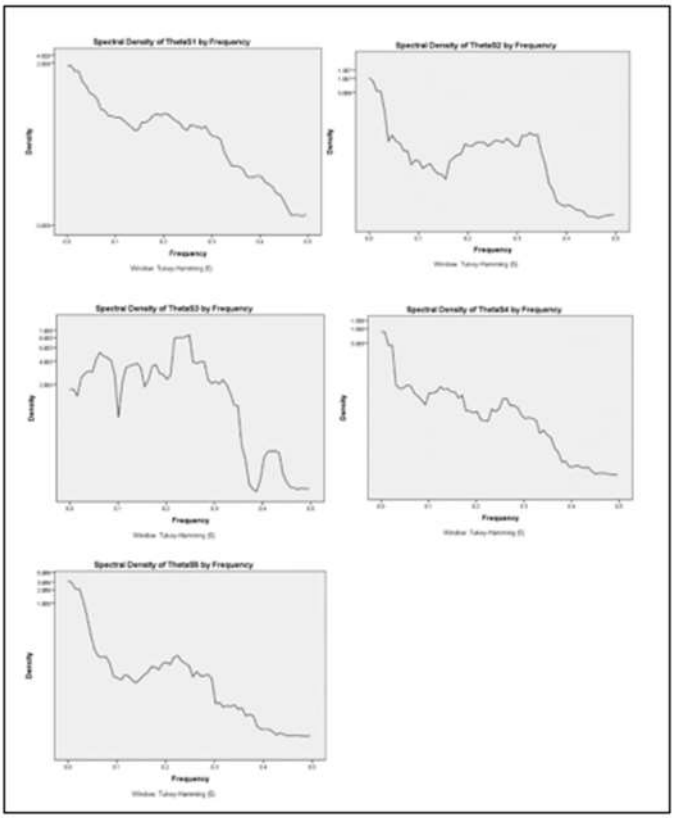

Figure 16: The spectral density graph of non-smokers for theta band

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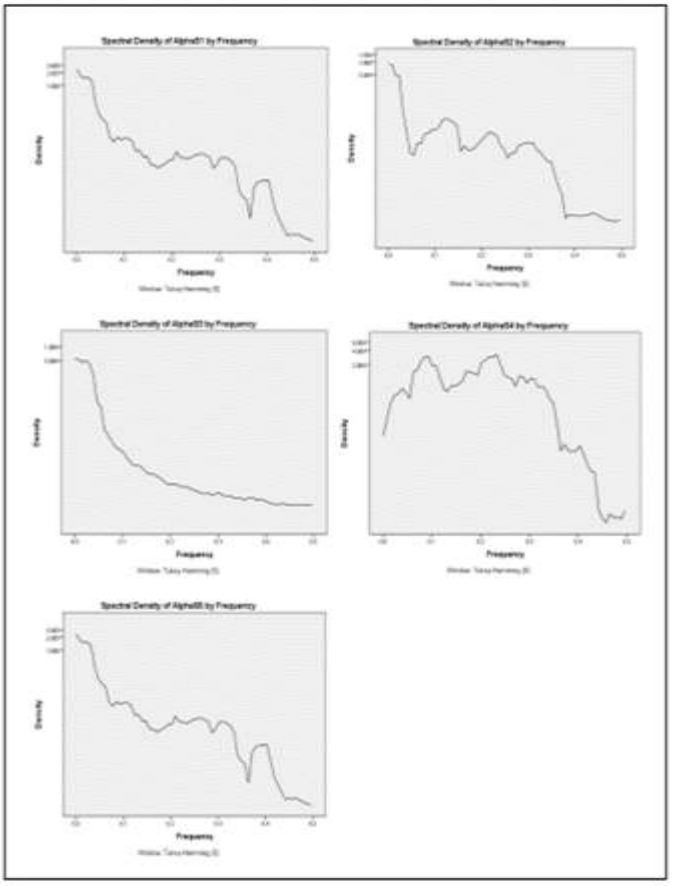

Figure 17: The spectral density graph of smokers for alpha band

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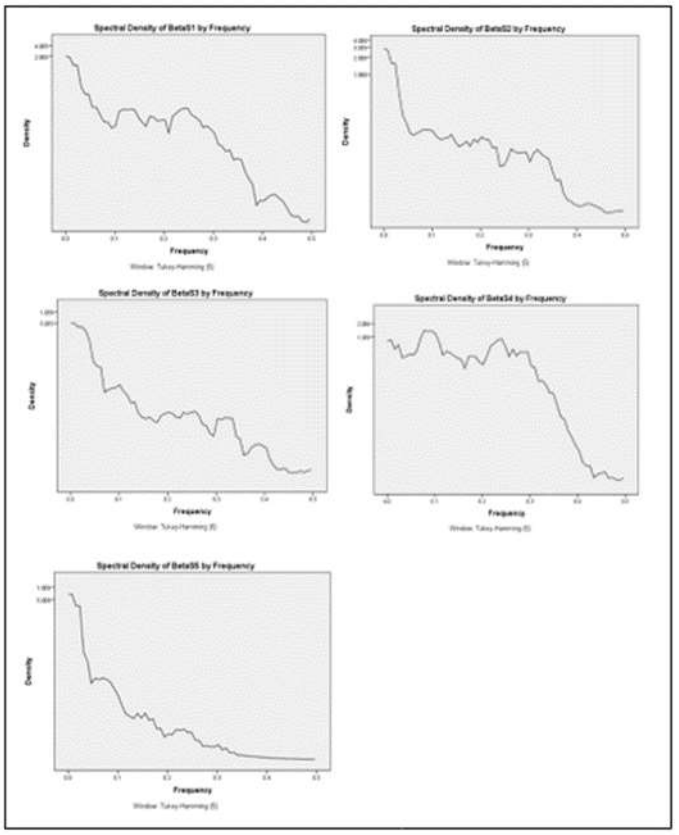

Figure 18: The spectral density graph of smokers for beta band

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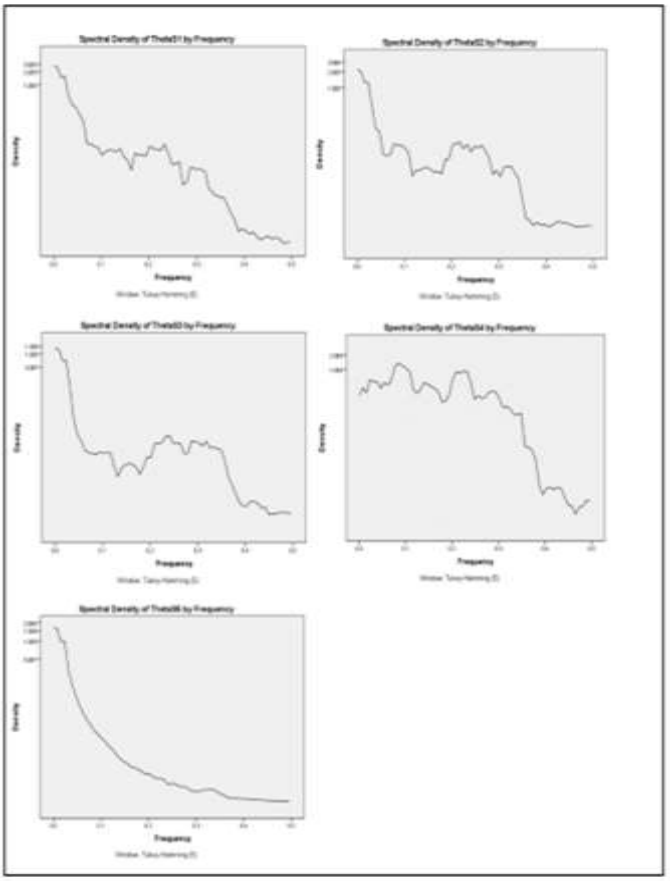

Figure 19: The spectral density graph of smokers for theta band

From pattern of spectral density graph, it shows the different formation of brainwaves among the respondents. It means the different person will generate the different brainwave even though they are in the same category of smokers. This is proven that the graph shown indicate that for a non-smoker, there is lower theta band and alpha band but for the beta band is higher compared to the smokers based on the rate of density values.

II. Difference between Alpha Band and Beta Band

As the main attraction in this research, the average magnitude between alpha band and beta band between smokers and non-smokers is being illustrate in Figure 20. High beta wave prevails amid learning while in an excitement state or when focusing on specific occasions. Brain neurons utilize a lot of vitality amid excitement, fixation, uneasiness, and disorder, and further basic leadership is bargained if beta wave incitement holds on, bringing about the loss of perfect focus. As needs be, the present review researched the impact of smoking on cerebrum wave movement by looking at the adjustment in alpha wave and beta wave before and keeping in mind that smoking.

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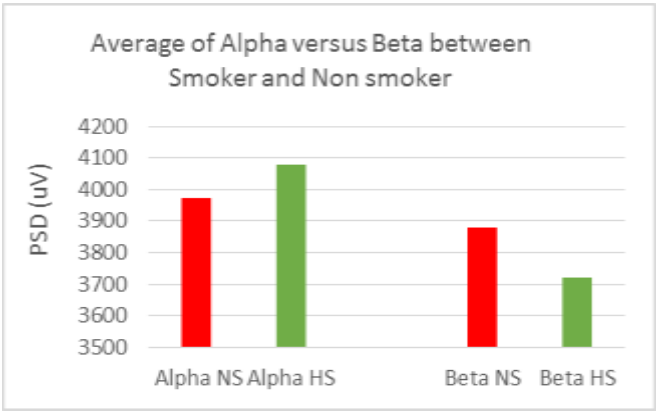

Figure 20: Average of alpha versus beta between smokers and non-smokers

The graph verifies that there is higher alpha band for smokers compared to non-smokers. But for the beta band, it shows that the smokers are lower magnitude compared to non-smokers. This is due to the impact of smoking that will cause the smokers feel experienced from the arousal state.

III. Difference between Theta Band and Beta Band

Last but not least, Figure 21 indicates the result of the average between theta band and beta band for smokers and non-smokers. Moreover, theta oscillations are included in the data encoding through spatial route and development of dynamic exploratory. The expansion of beta oscillations may likewise indicate centered attention, as beta beat has been appeared to increment with attention.

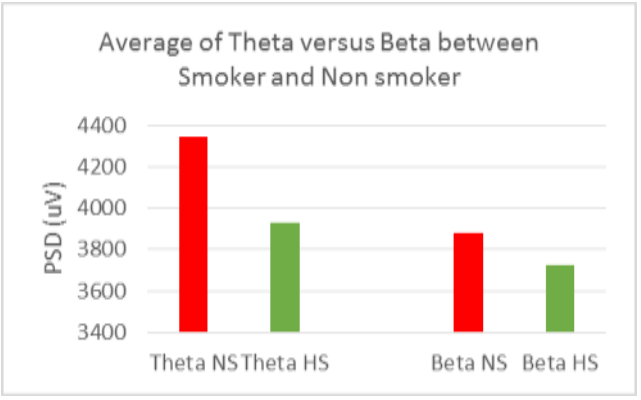

Figure 21: Average of theta versus beta between smokers and non-smokers

The result shows that for the smokers have lower theta band which indicates a less stressed feeling as compared to non-smokers. As the discussion stated, it tells that beta band of the smoker is lower than the non-smokers which means the smokers are less focusing compared to non-smokers.

5.0 CONCLUSION

From the investigation that have been done, it can be inferred that there is some exceptional EEG pattern for smokers which additionally concurs with an underlying initial study findings [3]. Smokers have brought down theta band control which illustrates a less stressed feeling when compared with non-smokers with a bigger theta band. Smokers additionally higher alpha band which demonstrates more relaxed as contrasted with non-smokers with lower alpha band. However, smokers are lower

beta band that means less-alert contrasted with non-smokers [4, 5]. A conceivable purpose behind why the smoker's relaxation level and less stressed on feeling is higher may because of the state of mood and behavior considering impacts of the nicotine itself.

Moreover, it found that smoking instantly influences the brain, as the smokers watched a quick lessening in the steady state and increment in the excitement state taking after smoking. Probably, these progressions may demonstrate hurtful to brain health if smoking is proceeded for a long term [11].

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