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## A brief study on Digital Drugs (Binaural beats)

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### Abstract

Digital drugs are the most commonly used by people around the world which do not have any particular laws to control them. Digital drugs mentioned in this article are about the Binaural beats which stimulate the brain to get the same effect as consuming the drugs. When binaural beats are used, it triggers a frequency range that will generate a specific response, the brain waves will entrain to a frequency that is either the alpha or beta range, depending on the individual, and therefore they will feel either more relaxed or more alert. These types of Binaural beats are most commonly available easily and there is no regulation to control their usage and sale. These Binaural beats are been used as drugs, to relax the mind, increase brain power, etc. This article will be a brief study of these Binaural beats, their usage and legality.

**Keywords:** Digital Drug, Binaural Beats, Musical Drug, Drug

### I. Introduction:

Drugs are compounds that affect the physiology of the body, and it is generally understood that they are substances. There is another form of drug called digital drug on consuming which the human body will get the same effect as consuming injected or inhaled drugs. Using digital drugs in the form of Binaural beats gives the user an auditory illusion. The Binaural beats mean providing two different frequency tones in each ear. Humans perceive all sounds between 20 Hz and 20,000 Hz, yet the human brain perceives frequencies below 20 Hz. When the therapy of binaural beats is used, it triggers a frequency range that will provide the human with a specific response, for example, if a tone of 315 Hz is played into one ear and a tone of 325 Hz into the other ear, the brain waves will entrain to a frequency of 10 Hz which is either the alpha or beta range, depending on the individual, and therefore they will feel either more relaxed or more alert.

### Objective

1. To know the function of the binaural beats
2. How the effect of binaural beats will affect the brain
3. The usage of the binaural beats is legal or illegal

### Research Methodology: -

The authors have selected an analytical research methodology for this study. To satisfy the objectives of the research, the researcher used secondary data from various publications by financial websites, the government of India, journals, newspapers, books, magazines, etc... and the analysis of these factors was based merely on the author's personal opinion

**Table 1. Brainwave types and associating effects<sup>1</sup>**

Range of Brainwave Type	Associating behavioural effects and emotional
Beta between the range of 15Hz – 30Hz	normal alert consciousness, Awake
Alpha between the range of 9Hz – 14Hz	meditation, creative visualization, calm, relax,
Theta between the range of 4Hz – 8Hz	meditation, problem solving and deep relaxation
Delta between the range of 1hz – 3Hz	dreamless sleep, Deep sleep

<sup>1</sup> <https://www.researchgate.net/publication/361810630>

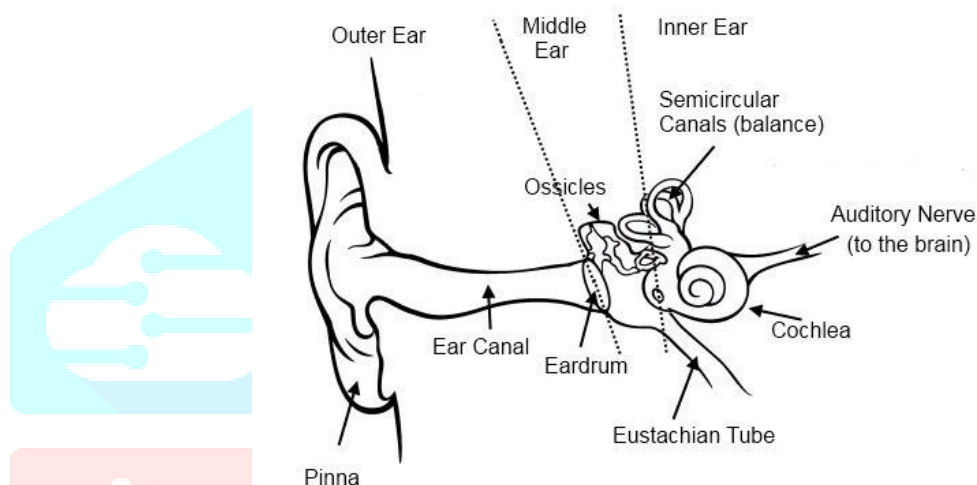
## II. History of Binaural Beats<sup>2</sup>

German physicist Heinrich Wilhelm Dove, a meteorologist who had a great influence on the science of climatology, first discovered the theory of binaural beats in 1839. In one of his experiments, he unwittingly paved the way for research into the field of brainwave entrainment, albeit in time. Dove found that when pure tones of slightly different frequencies were presented separately to each ear at the same time, a phantom "beat" was perceived. Dove's key discovery was that the perceived sound (beat) should only be present in the auditory (hearing) system, especially the part that processes binaural (such as stereo) sound. I didn't have headphones at the time. He had a volunteer booth in his room. In one corner of the room, he placed a tuning fork. The fork was attached to a tube leading to the subject's right ear. The tuning fork was placed on another side of the room and inserted a tube into the person's left ear. Since the fork did not vibrate at a low frequency, so the subject heard different frequencies in his left and right ears. Dove recorded that his subjects perceived the effect of combining the two frequencies as a slow beat. It turns out that this is a binaural beat.

Gerald Oster<sup>3</sup> wrote a paper titled "Auditory Beats in the Brain" in 1973, which is when people really began to take attention. Oster concurred that binaural beats are an effective instrument for studying cognition and the nervous system. It took a long time for the iDoser company to popularise and sell them binaural beats in the market

## III. Function of Human Ear<sup>2</sup>

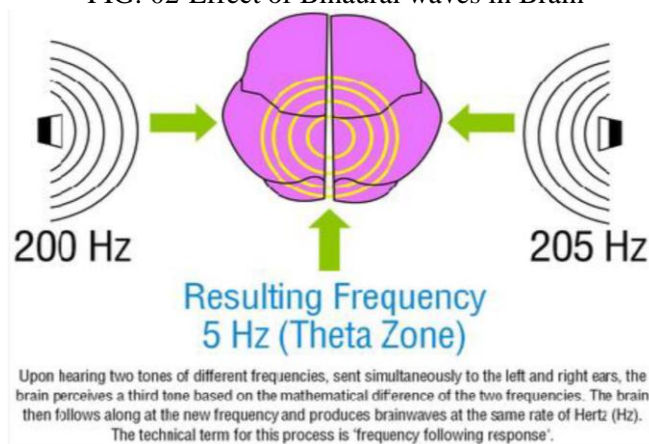
FIG 01<sup>4</sup> Anatomy of Human ear



The pinna and ear canal direct pressure waves carried by air or water to the tympanic membrane. The auditory ossicles move concurrently in response to the pressure waves that cause the tympanic membrane to vibrate. The cochlea's oval window is struck by the stapes, the last bone in the chain. Being a closed system, the round window pushes outward when the oval window moves inward. The auditory nerve receives the pressure waves from the fluid in the cochlea and transmits them to the brain, where the brain interprets the information as sound. Semi-circular canals are projections that make up a portion of the vestibule. This system's fluid moves in step with how the head moves. The semi-circular canals contain cilia, which resemble hairs. The brain interprets the movement and uses it to assist estimate the position of the head in three dimensions when the cilia detect fluid movement in the canals and send signals to it via the vestibular nerves.

## IV. Effect of Brain with Binaural Waves

FIG: 02<sup>5</sup>Effect of Binaural waves in Brain



<sup>2</sup>A Beginner's Guide to Binaural Beats - BinauralBeatsMeditation.com - 4th Edition

<sup>3</sup> Brief History of Binaural Beats and Uses for Binaural Beats (binauralblog.com)

<sup>4</sup> Functioning of Human Ear | Definition, Examples, Diagrams (toppr.com)

<sup>5</sup> A Beginner's Guide to Binaural Beats - BinauralBeatsMeditation.com - 4th Edition

Binaural beats music is used to influence the brain to move into different brainwave states. By using the appropriate track, we can use this special music to help entrain the brain to a desired mode of operation.

#### V. Change of Mood with Binaural Beats<sup>6</sup>

A study was conducted by Misss. Julia Jurczyk, SWPS University of Social Science and Humanities, Poland. to determine whether emotional stimuli will have an effect on subjective mood, executive functions, and pulse rate when binaural beats at alpha wave frequency (10 Hz) are applied. The hypothesis that these changes might be accompanied by an increase in the strength of the alpha band EEG signal was made in the research that was discussed. A manipulation experiment involving listening to binaural beats involved 30 people, 15 in the experimental group and 15 in the control group. The experimental group listened to binaural beats twice at a frequency of 10 Hz for three minutes, while the control group listened to nothing for the same amount of time. In both groups, the Emotional Stroop Test was administered, pulse measurements were taken, and the UMACL questionnaire was completed. After that, it was determined whether or not the groups' mean values of these variables were significantly different.

The analysis showed that the people who heard binaural beats at 10 Hz had a higher hedonic tone, which means that they felt more pleasure than the people who didn't get this stimulation. In addition, there were no significant differences between the groups in the measurements of energy arousal, executive functions, tension, or heart rate.

#### VI. Binaural Beats with Music<sup>7</sup>

Music with binaural beats is used to sway the brain into various brainwave states. We can use particular music to help entrain the brain into a desired mode of operation by using a suitable track.

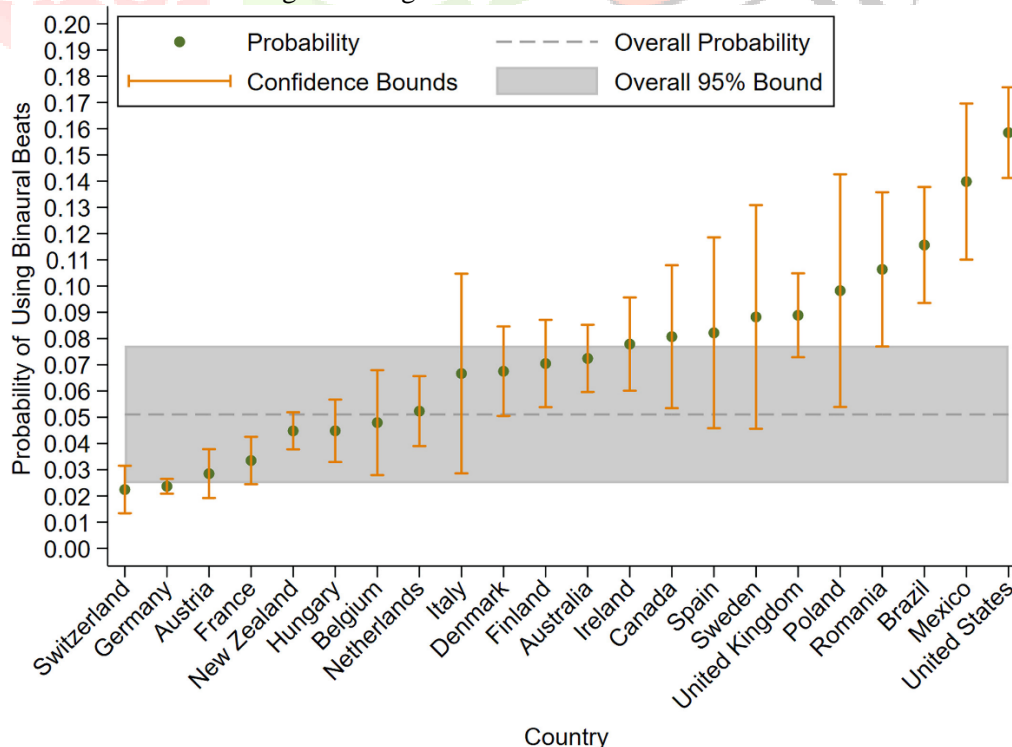
For instance, someone who is stressed out can relax by listening to theta wave binaural beats. The brain would be trained to create lower frequency waves as a result, which would relax the listener and quiet their minds.

Similar to how those who are easily distracted and lack focus would benefit from listening to an Alpha binaural beats track. By doing so, the brain would enter a state of "flow," which is a calm yet the hyper-focused state of high productivity and is frequently referred to as being awake but focused.

#### Usage of Binaural Beats in the world<sup>8</sup>

As part of the Global Drug Survey 2021, which was translated into 11 languages, 30 896 responses from 22 countries were gathered. Results. The countries with the greatest rates were the United States, Mexico, Brazil, Poland, Romania, and the United Kingdom. The sample as a whole had a 5.3% reported usage rate (median age 27; 60.5% male). Age, non-male gender, recent cannabis, psychedelic, and novel/new drug use were all significant predictors of binaural beat use after accounting for all other characteristics. Binaural beats were most frequently used by respondents to "relax or fall asleep" (72.2%) and "alter my mood" (34.7%), while 11.7% claimed to be seeking an effect "similar to that of other medicines." This latter motivation was more commonly reported among those who used classic psychedelics (16.5% vs. 7.9%;  $P < 0.001$ ). The majority wanted to use the experience to connect with themselves (53.1%) or "something bigger than themselves" (22.5%). Mobile phone users mostly used video streaming websites to access binaural beats.

Fig. 03. Usage of Binaural Beats in the world



<sup>6</sup> <https://www.researchgate.net/publication/360283013>

<sup>7</sup> A Beginner's Guide to Binaural Beats - BinauralBeatsMeditation.com - 4th Edition

<sup>8</sup> Drug and Alcohol Review (July 2022), 41, 1126–1130 DOI: 10.1111/dar.13464

Among **those** respondents who reported **using** binaural **beats**, the median number of days **they used binaural beats was 10** in the last 12 **months**. **H. Approximately** once a month (interquartile range **3-30**, range **1-365**). On the **days** they listened to binaural beats, 49.3% reported listening for less than **1 hour**, 26.9% for **1 hour**, 11.7% for **2 hours**, and the remaining 12.1% for more than **2 hours**. When asked what altered **state** or **effect** they **would like to achieve with binaural beats**, the most common **answers** were **“relax or fall asleep”** (72.2%) and **“change mood”** (34.7%), with 11.7% trying **said there is**. This latter motivation of **“producing similar effects to other drugs”** was **reported more frequently** in those who used **classical** psychedelics (16.5% vs 7.9%;  $\chi^2(1) = 18.54$ , **P<0.001**). In 'Other' text responses, respondents noted that they were using binaural beats to increase concentration, focus or productivity, for meditation or spiritual practices, to ease headaches or pain, and to facilitate lucid dreaming, astral projection and other 'out of body' experiences. Others reported use of binaural beats to enhance experiences with psychoactive drugs, for example 'to help relax when using drugs like psilocybin which can create meditative states' and 'while smoking DMT'. When asked whether they used binaural beats to feel connected to themselves or others, 59.5% reported using them to feel connected with someone or something – including 53.1% with 'myself' and 22.5% with 'something bigger than myself', with only small numbers reporting connecting with 'other people like me' (2.5%) or 'the content producer' (1.6%). Binaural beat content was accessed primarily through video streaming sites (e.g. YouTube, Vimeo) (68.3%), followed by the audio streaming service Spotify (34.4%) and other app-based services (19.4%). The content was primarily accessed through mobile devices (80.7%), but also via laptop (30.6%), desktop (13.8%) and tablet (9.6%).

## VII. Influence of Binaural Beats on EEG<sup>9</sup>

C. Kasprzak and colleagues carried out a study in the Faculty of Mechanical Engineering and Robotics, Department of Mechanics and Vibroacoustic, University of Science and Technology as part of the N N501 247740 research project, which is supported by the National Science Centre, at A. Mickiewicza 30, 30-059 Kraków, Poland.

A sample of twenty males served as the subject of the experiment. The volunteers who were examined claimed to be free of any medical conditions and not under the influence of any medications. Additionally, they were informed that they were prohibited from consuming stimulants or narcotics prior to the experiment.

The following frequencies were used in the research: Binaural beats with an acoustic pressure level of SPL = 73 dB. 110 Hz in the right ear and 100 Hz in the left. The entire experiment lasted 35 minutes. The stimulus was presented for 20 minutes. Stereo headphones were used to hear the acoustic signal, which was recorded in waveform and played back from a computer. The purpose of the electroencephalogram (EEG) test was to record the human brain's functional currents using electrodes positioned on the scalp. These currents are characterized by low tension (ranging from several to several hundred microvolts). These currents have frequencies ranging from 0.5 Hz to 50 Hz. MICROMED employed a 25-channel sound box of the SAM 25 type for the registration of the EEG signal. The standard 10/20 system, in which electrodes are positioned along the sagittal line of the head (5 on the left side: Fp1, F3, C3, P3, O1 and 5 on the right side: Fp2, F4, C4, P4, O2, and the OP's reference electrode, Pz). A permission form confirming their conscious consent for the experiment was signed after the individuals being examined were informed of the general goal of the research and the rules of the experiment. After the skin had been cleaned, EEG signal measurement electrodes were fitted. A person being tested was seated comfortably at a testing site after the effective resistance was checked (the electrodes were applied correctly).

A proper experiment was carried out after the activities of preparation were completed; that amounts to 35 minutes of continuous EEG human bioelectric signal acquisition. The binaural beats exposition was absent for the first five minutes, followed by the signal exposition for twenty minutes, and then the exposition for ten minutes.

**.Analysis of the Results** :The accuracy of the recording of the obtained EEG runs was verified. Due to the numerous disturbances in the recordings, two people were excluded from EEG analysis. In addition, errors and artifacts were reported for seven individuals on some channels. Data from those channels were not analysed.

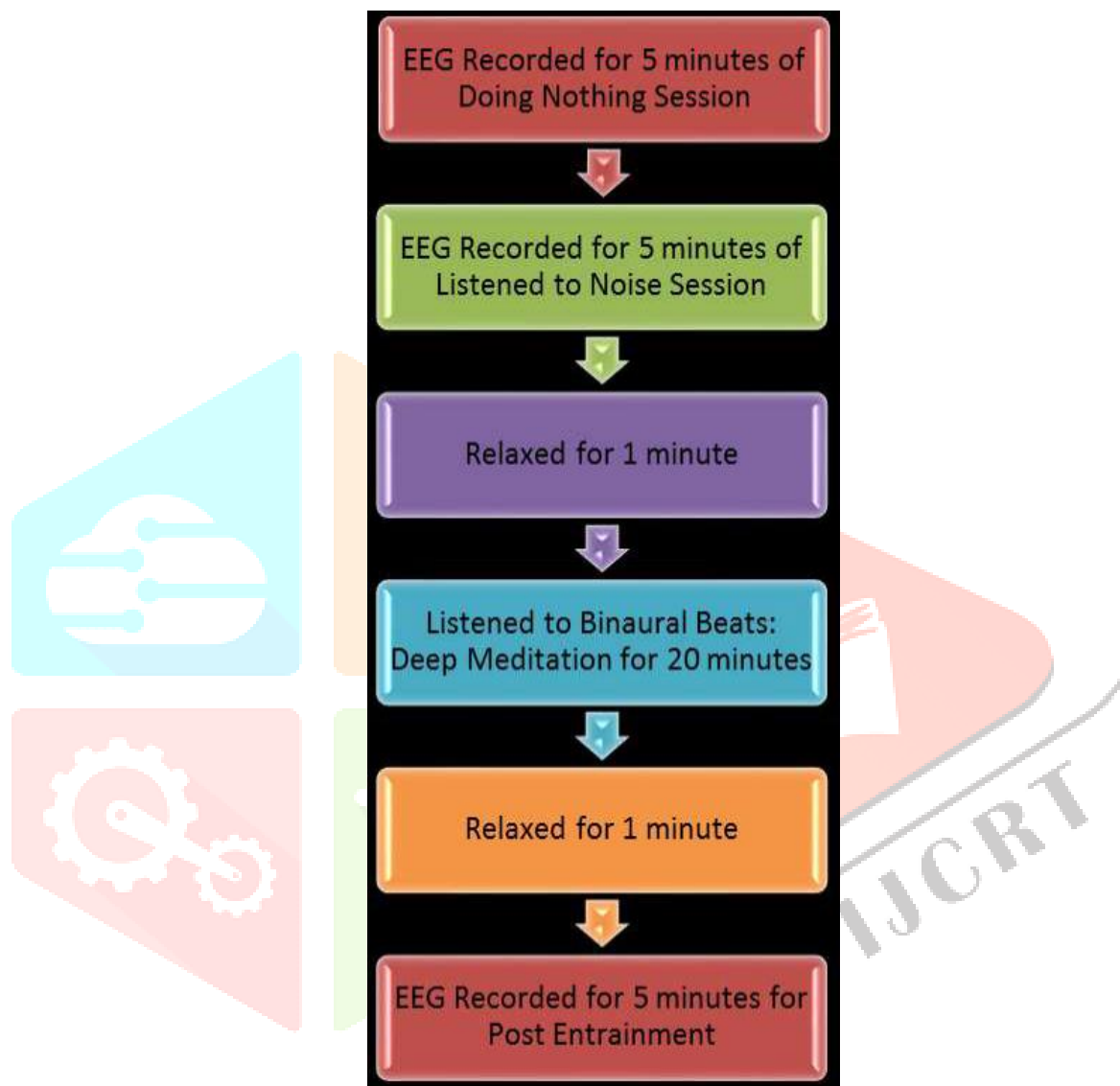
The study came to the conclusion that the statistical observations it reported and compiled support the idea that binaural beats appear to cause changes in cortical arousal that can be monitored with the EEG. The experiment that was carried out to investigate the impact that binaural beats with a frequency of  $f = 10$  Hz and an acoustic level of SPL = 73 dB had on a human confirm that the exposure of binaural beats results in morphological changes to the EEG signal that are statistically significant. In terms of qualitative analysis, the exposition of binaural beats produced a follow-up effect in four experiment participants. This meant that an EEG signal morphology component with a frequency that corresponded to the presented binaural beats was observed. A statistically significant decrease in the average amplitudes of an EEG strength signal's spectral density function for the alpha ( $p < 0:001$ ) and beta ( $p < 0:001$ ) frequency ranges was also observed during the binaural beats exposition. However, a spectral density function of the EEG strength signal increased in the theta ( $p < 0:0231$ ) frequency range. There were no changes that were statistically significant in the delta frequency range. The study revealed an increase in narrow band share between 9.9 and 10.1 Hz while a statistically significant decrease in alpha rhythm (8–12 Hz). The following could be the reasons: blockage of the alpha rhythm and the simultaneous occurrence of the follow-up effect phenomenon. This could be the result of the orienting reflex nervous system, which is a response to an acoustic stimulus and involves tuning to maximize the nervous system's ability to receive information from the environment. It does this, for example, by blocking the alpha rhythm. On the other hand, the observed increase in amplitude for a frequency that corresponds to the binaural beat frequency  $f = 10$  Hz was based on the assumption that the human brain has a tendency to shift its dominant EEG frequency in the direction of the frequency of a dominant external stimulus.

<sup>9</sup> <https://www.researchgate.net/publication/289943134>

### VIII. Effect of Binaural Beats in Male and Female <sup>10</sup>

Norhazman H., Mohamad Zaini N., Tain M. N., Kama Azura Othman, Jailani R., and Omar H. A. carried out a study at the Faculty of Electrical Engineering of the Universiti Teknologi MARA. EEG data from male and female subjects were collected using an experimental method. This experiment's EEG data will be processed and analyzed specifically to study and identify the distinct EEG patterns of men and women in three distinct stress-related states, as previously defined. This study included 40 voluntary participants, including 18 males and 22 females. They are all right-handed and have never been diagnosed with a mental illness.

FIG:03. Procedure of the experiment



The Result shows that the Alpha Beta Frontal Energy Ratio function can show the effect of binaural beat tones on the alpha and beta subbands of different profiles (male and female). Graphical statistical analysis, boxplots, show that alpha and beta subbands behave as expected in both hemispheres, with alpha subbands decreasing during stress induction and increasing after entrainment with binaural beat tones. can be observed. In contrast, the beta subband increased after stress was induced and decreased after the tone was entrained to the binaural beat. That being said, men's brain waves are more likely to be stimulated than women's. In other words, it has been shown that men are more likely to reduce stress and women are more susceptible to stress. In other words, binaural beats have been shown to help reduce stress levels. Future work will include classification of different profiles in different sessions.

<sup>10</sup> The Effect of Listening To Binaural Beats on Frontal EEG Alpha and Beta of Males and Female, December 2015, [Social and Management Research Journal](#) 12(2):77 DOI: [10.24191/smrj.v12i2.5051](#)

### IX. Drug Effect by Binaural Beats (Marijuana)<sup>11</sup>

Marijuana, also known as weed, herb, pot, grass, bud, ganja, Mary Jane, and many more colloquial names for dried *Cannabis sativa* flowers, is a greenish-gray combination. Some people choose to consume their marijuana as joints, pipes, water pipes (also known as bong), or blunts (marijuana rolled in cigar wraps)

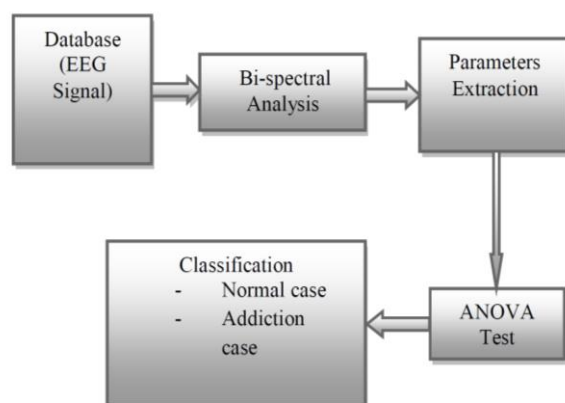
The research was conducted by BAAKEK Yettou Nour El houda Debbal Sidi Mohammed El Amine, Biomedical Engineering Department, Faculty of Technology, Tlemcen University. Biomedical Engineering Laboratory (GBM), Tlemcen, Algeria. BP 13000.

The study was conducted using a Bitalono sensor and Matlab software, the Electroencephalogram (EEG) signal was detected before, during, and after 10 minutes of hearing marijuana binaural beats in 23 healthy students who participated in the study. Bispectral analysis was utilized to examine the EEG signal; In addition to being a power estimator like the Fast Fourier Transform (FFT) or autoregressive models (AR), it also keeps and considers phase information. We are also able to extract additional parameters using this method, such as synchronization degree, phase entropy, mean bispectral amplitude, weighted center of the bi-spectrum, square and cubic entropy, and entropy of phase in the following sections, the results that were obtained for the various sets are shown and discussed in detail. A statistical classifier that is equivalent to the ANOVA test is used to evaluate the proposed method.

The proposed method is depicted in the block diagram (Figure) below, which consists of four steps:

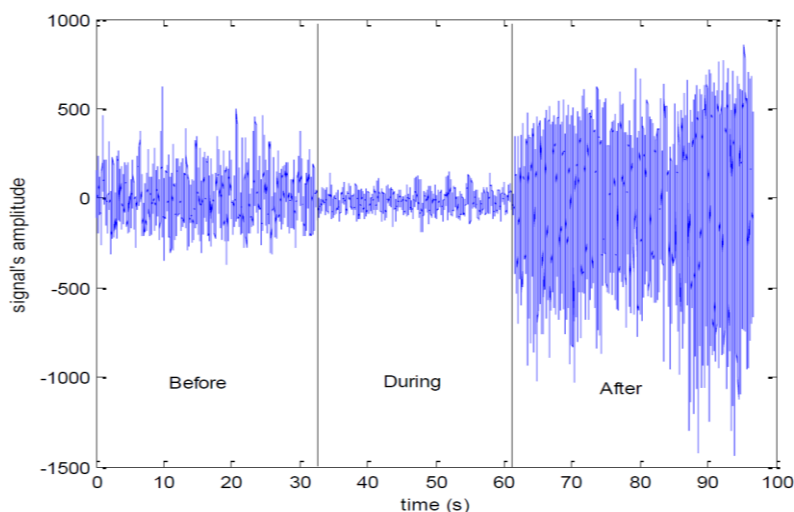
Database, bispectral analysis, extraction of bispectral parameters (synchronization degree, entropy, square and cubic entropy, phase entropy, mean bispectral amplitude, weighted center of bispectrum), and ANOVA test

FIG 04 Block Diagram of Excrement



Group A represents the acquired EEG signals of 23 healthy volunteers before hearing Marijuana binaural beats. Group B represents the acquired EEG signals of the same volunteers during hearing the Marijuana binaural beats, however group C represents the acquired EEG signals of the same volunteers after 10 min from hearing the Marijuana binaural beats.

FIG 05 effect of brain before, during and after taking of Binaural Beats



In this research, the EEG signal is analyzed using bi-spectral analysis in three situations (three groups): before, during, and after the binaural beats of marijuana were heard (A, B, and C, respectively). After 20 minutes of hearing the binaural beats, the obtained results are very satisfactory and show that delta, theta, and alpha waves dominate, indicating that beta waves decrease during this phase and delta, theta, and alpha waves increase. Comparing the synchronization degree to the

<sup>11</sup> <https://www.researchgate.net/publication/344953965>

entropies (Ent1, Ent2, Ent3, EntPh), average amplitude (mAmp), and weighted center of the bi-spectrum (wc1) yields satisfactory results; however, no significant values were found in parameter WC2, indicating that the proposed algorithm is able to differentiate between the various scenarios; where group A had synchronization values that were higher than those in group C; In contrast, there is no synchronization in group B. In point of fact, in comparison to the other groups, the EEG signals during this phase are more regular and less complex; because the brain is controlled by the music (e-drug).

## X. Impacts on Human Body<sup>12</sup>

The right and left lobes of the human brain are the brain's two divisions. When applying sound vibrations that are different in each ear, then, the brain tries correcting the vibrational acoustic musical frequency, because there is a relationship between what humans hear and watch, and the consciousness of the mind. For instance, listening to certain kinds of music can cause Sufi sect members to tap into their subconscious and even make them feel and act drunk. In addition, an American expert discusses the neurological and psychological effects of digital drugs, as well as the ways in which they pose a threat to the lives and health of their users. He goes on to say that drugs that rely on the technique of ear drumming cause two frequencies to be aired in each ear, causing the brain to generate slow alpha waves that induce relaxation in psychiatric experiment patients. Subjects may experience increased alertness and concentration as a result of fast beta waves, but the recipient may also experience a state of unconsciousness and a loss of physical, psychological, and mental equilibrium as a result of excessive stimulation. It can also cause anxiety that is similar to using steroids and long-term sleep disorders.

## XI. Binaural Beats and Cyber Threat<sup>13</sup>

According to a study on Binaural Beats on Cyber threats, Binaural Beats are social engineering tools that have the ability to influence user actions and pose significant cyber threats. The study considers binaural beats or digital drugs to be emerging cyber threats because it measures human responses to auditory stimulation. However, the reviewed paper did not go into great detail about how Binaural Beats pose direct cyber threats to the network. Additionally, there are not many resources addressing Binaural Beats-related cyber threats, which is considered a knowledge gap. Since little research has been done on the effects of binaural beats on cyber threats, it stands to reason that there are currently no cyber laws that deal with binaural beats.

### Regulations and rules in different countries regarding Digital drugs

This section looks at articles from the United Arab Emirates, the Council of Europe, and the United Kingdom on cyber laws, as well as other articles on topics like regulating and legalizing the use of binaural beats.

UAE's federal decree law number 5 of 2012 on combating cybercrime had anything to do with binaural beats, either directly or indirectly. The Council of Europe's 2001 Budapest-issued European Treaty Series number 185 convention on cybercrime had no mention of binaural beats in any form. The same is true for the Computer Misuse Act in the United Kingdom, which was updated on February 13, 2017, as there are no articles addressing binaural beats. These researchers were unable to locate any cyber law articles addressing Binaural Beats in the United Arab Emirates, the United Kingdom, or any of the Council of Europe nations.

Binaural Beats, on the other hand, were classified as narcotics in a study that looked into the I-Doser application on smartphones. Based on the findings of "normative research using statute, conceptual, and comparative approaches"-based research, this paper also emphasized the threats that Binaural Beats would pose to future national security. In the end, the author recommended enacting policies and laws that label binaural beats as narcotics and prosecute those who use them or distribute them to others.

## XII. Recommendation

Based on the above information, the author recommended the following

- a) Binaural Beats has to be added under the category of the drug in different regulations
- b) India and other countries should ban Binaural beats such as I-Doser.com for the benefit of the public and future generations.
- c) Commercial websites such as I-Doser.com must be banned or regulated in order to reduce the implications.
- d) A Special provision has to be added in NDPS Act, 1985 to control and prevent the use of usage of Digital drugs in India.

## XIII. Conclusion

Based on the discussion that has been stated, it can be concluded as follows: Given the concept of the drug itself, it is essentially the side effects of abuse that point to it. Leaving aside the basic idea, from the author's point of view, binaural beats can be classified as a new drug. This is the claim that binaural beats are not drugs or substances, but that the effects they cause are about the same as conventional drug use. The legal implication of the void is that the application of binaural beats continues to be pervasive, deepening the country's generation-destroying hegemony in the future, hence concrete prescribed legal action to address. The harm that is occurring now or will occur in the future may provide answers to concerns that the community has been experiencing. Sooner or later, the technology of aggression will bring new colors and influences to many aspects of life in general, and the drug industry in particular. Policy to restructure the rule of law regarding the use of binaural beats as digital narcotics in legislation by updating his NDPS Act of 1985.

<sup>12</sup> <https://www.researchgate.net/publication/331352725>

<sup>13</sup> <https://www.researchgate.net/publication/331352725>