Determination of EEG for Smell Sensitive Brain's Areas by Using Chemical Stimulators

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Abstract :

The electroencephalogram (EEG) is a unique and valuable measure of the brain's electrical functions. It is a graphic display of a difference in voltages from two sites of brain function recorded over time.

Physical, chemical and mechanical stimulators appear as wave frequency, action potential amplitude changes which are reaching different areas in the brain. Each area is responsible to record a certain type of stimulator whether it is chemical that is received by smelling, and test senses, physical stimulator by hearing, and vision senses, or touching stimulator.

This research concentrates on the determination of the most sensitive areas (the correct channels of electrodes placement system) of the brain that are responsible to receive the highest chemical stimulation due to the action of Lavender perfume stimulator (Lavender perfume with concentration of 50 %), for normal males and females subjects for smelling sense. Ten males and the same number of females are all subjects selected within the age range between (25-30) years old.

It has been found that T3 and T4 are the best channels connections for smelling sense for both male and female, and that the mean relative action potential (The ratio of action potential amplitude after to that before exposure of perfume stimulation) for males are higher than that for females. These results reflect that males are more sensitive than females in this type of perfume and may be it is not in

other type, and the mean relative action potential amplitude for the channels T3, T4, T5, T6, P3, and P4 are 2.05, 1.80, 1.12, 1.20, 1.10, and 1.10 for males and 1.96, 1.76, 1.12, 1.11, 1.09, 1.09 for females respectively.

الخلاصة:

يعتبر مخطط كهربائية الدماغ (EEG) مقياس فريد وذو أهمية لتقييم وظيفة الدماغ كهربائياً وهو عبارة عن مخطط يعرض الاختلاف بفروق الجهد الكهربائي بين اي موقعين على الدماغ تسجل عبر فترة من الزمن.

من ذلک يمكن الحصول على موجات ذات ترددات مختلفة تظهر تبعاً لانواع المحفزات سواءً كانت فيزيائية, كيميائية, او ميكانيكية وعندها يمكن تقييم استجابة المناطق المسؤلة عن اي نوع من المحفزات وتحديد المناطق المثالية للتحسس من قبل الحواس الخمسة (الشم, التذوق, الرؤية, السمع, واللمس) من خلال المخططات التي تسجل قيمة الازاحة لفرق الجهد الكهربائي تبعاً لتركيز المحفز واستجابة المناطق المختلفة التي تستلم وتظهر الاثر الكهربائي الناتج حيث ان هناک مناطق مختلفة في الدماغ کل يستجيب لنوع معين من المحفزات فيما اذا كان كيميائياً يمكن تحسسه بالشم او التذوق, والمحفز الفيزيائي الضوئي الذي يمكن تحسسه بالرؤيه, والمحفز الفيزيائي الصوتي بواسطة السمع اما المحفزات الميكانيكية كالشد والضغط والسحب فان حاسة اللمس هي المسؤلة.

هذا البحث يركز على تقييم تحسس المناطق المختلفة للدماغ ومدى قوة الاستجابة لكل منطقة للحصول على القنوات المثالية لربط الاقطاب الكهربائية لجهاز (EEG) تبعا للتسمية العالمية لنظام التوصيل لتحديد منطقة التحسس لحاسة الشم باستخدام عطر اللافندر(Lavender perfume) وبتركيز 50%.

عينة البحث كانت لاشخاص متطوعين طبيعيين عشرة من الذكور ونفس العدد من الاناث تتراوح اعمارهم بين (25 – 30 سنة).

لقد استخلص من هذا البحث بان القنوات المثالية لربط الاقطاب هي (T4 , T3) وهي الاكثر تحسساً لهذا النوع من المحفزات ولكلا الجنسين وان معدل التاثير النسبي لازاحة فرق الجهد الكهربائي الفعال (نسبة فرق الجهد الكهربائي الفعال بعد الى فرق الجهد قبل التعرض) لمجموعة الذكور كان أكبرمنه عند الاناث ولهذا النوع من المحفزات الكيميائية (عطر اللافندر) وربما يكون يكون التحسس معكوسا لانواع اخرى من العطور.

كان معدل التاثير النسبي لازاحة فرق الجهد الكهربائي لقنوات الربط (T3, T4, T5, T6, P3, and P4) هي (2.05, 1.80, 1.12, 1.20, 1.10,1.10) بالنسبة للذكور و (1.96, 1.76, 1.12, 1.11, 1.09, 1.09) للاناث وعلى التوالي.

Introduction:

From the ancient time up to the 18th century, electricity has been regarded as a strong invisible power, gradually the role of electricity in relation to the nervous system. First it starts from the observation of the effect to the body and eventually from the discovery that many tissues such as muscles and nerves called themselves to be source of this power.

The electroencephalogram (EEG) is a unique and valuable measure of the brain's electrical function. It is a graphic display of a difference in voltages from two sites of the brain function recorded over time. EEG involves the study of recording these electrical signals that are generated by or in the brain.

The first one who showed the electrical activity of the brain on humans was a German psychiatrist, named Hans Berger. He named his activity as EEG. He had found not only the EEG but also described various waves of the brain. He also described different patterns of EEG in various pathological cases such as epilepsy, tumors, and trauma. [1,2,3]

He was also the first to describe the different waves or rhythm which where present in normal and abnormal brain such as alpha wave rhythm (8-12Hz), also known as Berger waves [4,5]. These waves undergo changes according to the actions of physical, chemical and mechanical stimulators. The changes appear as wave frequency, action potential amplitude change of electrical stimulator effect which are reaching different areas in the brain, these areas are responsible according to the type of stimulator whether they are chemical that are received by smelling, hearing, test, vision, and touching senses.

Physical stimulators through which either appear as stress on nerve of different areas on the body touching sense or as light stimulator which is received by vision sense or as a hearing stimulator (sound) through which the hearing system play as a sensitive receiving system .

All these stimulators are received by different areas on the brain. Figure (1) shows each of the five senses that activate a separate area of the cerebral cortex.

The responses to these physical and chemical stimulators appear as action potential differences in the specific areas accordingly. The recording of these action potential signals is done by using Electrodes that have the ability to convert the ionic current in the body into electronic current in the wires, and then appear as analog sig-

nals through which the relation between the time and action potential amplitude, latency period, frequency, and the area under the curve can be determined. The signals from the head surface are recorded from the brain at different places on the scalp at different places which are labeled according to adjacent brain area :F (frontal), C(central), T (temporal), P (posterior) and O (occipital). The letters are a companied by odd numbers at the left side of the head and with even numbers on the right side (Figure 2). This research is concentrated on the determination of the most sensitive areas of the brain that are responsible to receive the highest chemical stimulation due to the action if Lavender perfume stimulator (Lavender perfume with concentration of 50 %), to determine the correct channels of electrodes placement system for male and female normal subjects. [6]

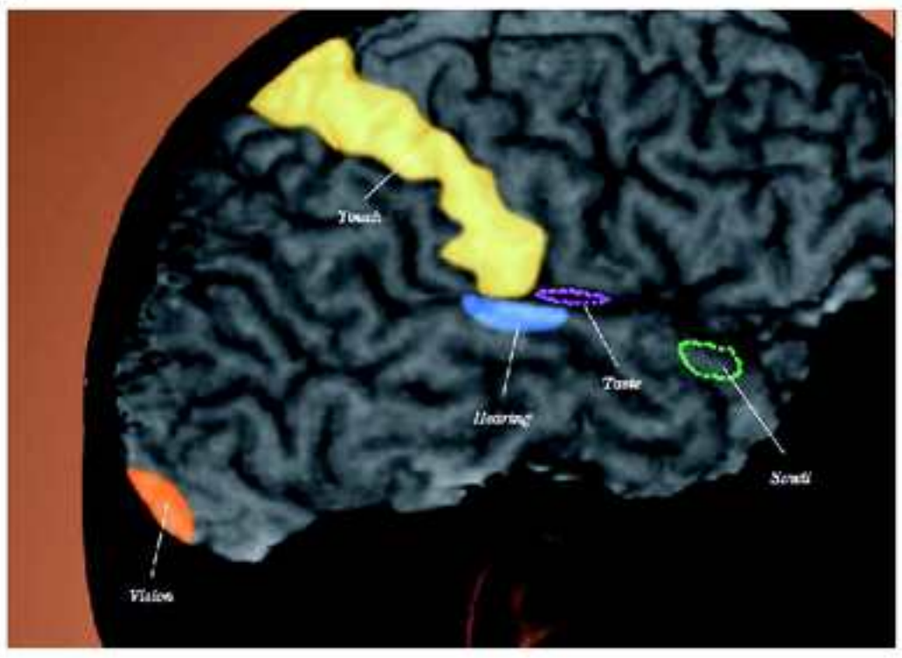


Figure (1) The five senses areas of the cerebral cortex.

Figure 1: The five senses activates separate areas of the cerebral cortex.[7]

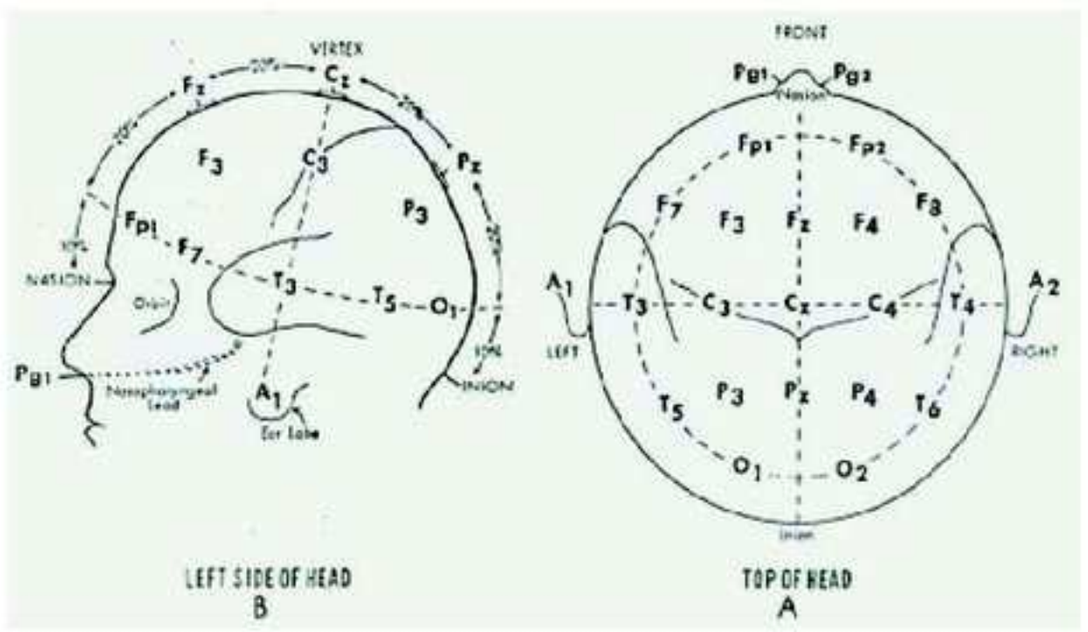


Figure 2: The International 10-20 system placement. Odd number on the left side, and the even on the right side, and Z or zero in the midline.[8]

Material and Method:

1- Equipments and tools:

EEG system which is used in this work is KT88 digital EEG with mapping system together with automatically record EEG, 16 lead EEG and 2-lead ECG. They have the function of automatic measurement multifunctional flash light of USB port, manual control or automatic control. 10/20 electrode placement method goes under the international standard system.

The electrodes read the signal from the head surface, amplifiers bring the microvolt into the range where they can be digitalized accurately, and the converter changes the signals from analogue to digital form and the system computer stores and displays the obtained data. A set of Equipment is shown in Figure (3). [9]

Figure (3): EEG equipment and tools. [9]

2- Subjects under test:

Subjects under test are divided into two groups, ten normal of any respiratory disease males and the same number of females are all the subjects selected within the age range between (25- 30) years old.

Subjects were selected to the test that they have no problem of physiological disorder and that they have no problem of physiological smelling sense; and recently they are not exposed to cold.

Each subject was sited on a comfortable chair. All the electronic system is connected to the head and the channels to the correct positions. A sample of the perfume is fixed at a distance of (2 cm) from the entrance channel nose, watching the change of action potential. The information is collected automatically by the system in both case direct observations on the computer screen and as stored data in a special file since the system can convert the analog action potential curve in to digital data. This test is repeated for each subject either with or without exposing to the standard concentration perfume and for the same exposure time.

3- The chemical stimulator used:

The chemical stimulator used is Lavender perfume and it has been prepared as follow:

Lavender perfume starts with blending the carrier oil and essential Lavender oil, adding a carrier alcohol, such as Ether clear, and allowing the mixture to cure for 24 hours. Before analyzing, it creates a lavender perfume with a helpful device from a natural perfume, from which a sample of the test has been prepared by diluting it to 50% by using alcohol 96%. [6]

Results and discussion:

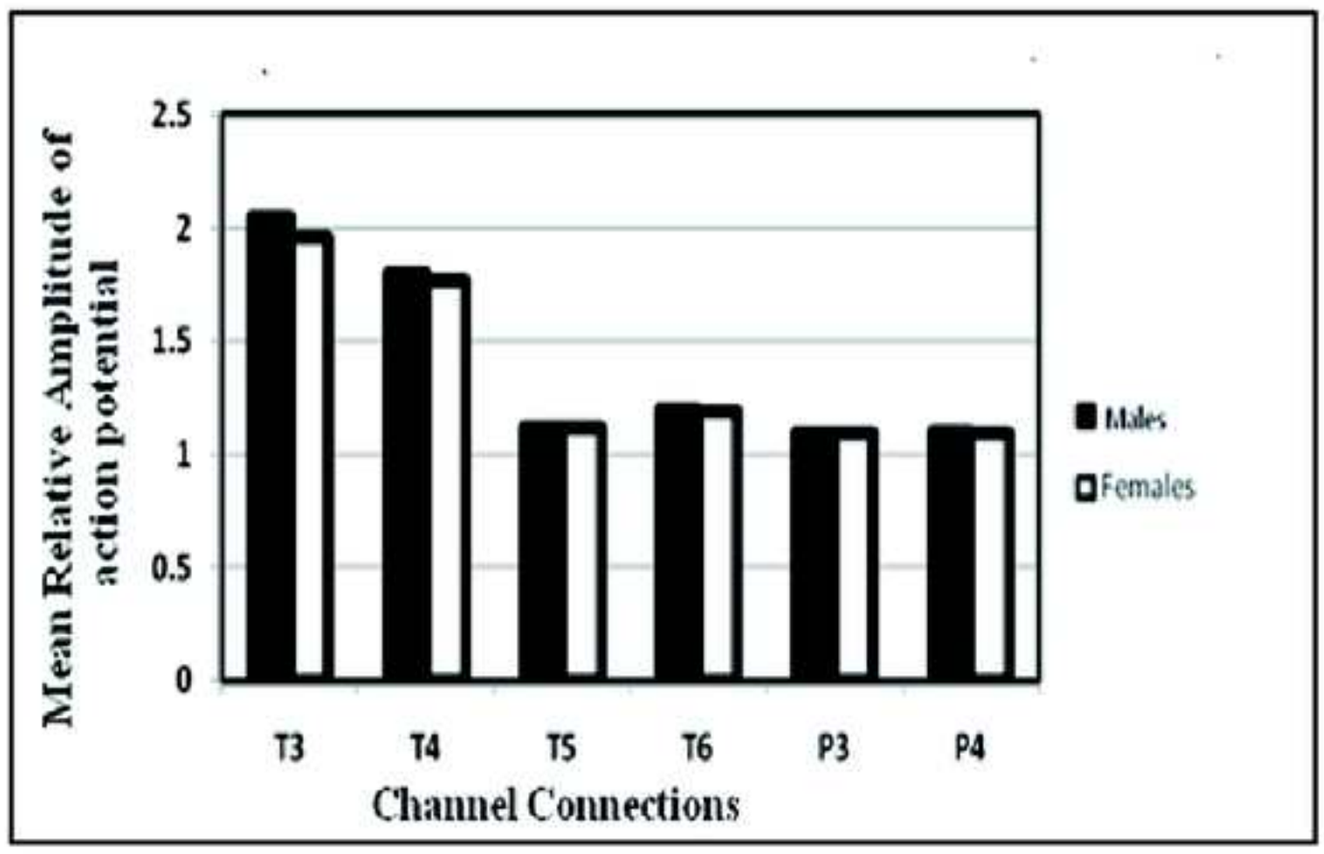
The data that are collected from each subject who are suitable for the test are revised and completed for seventeen female and twenty one males, ten of each group has been selected and the data are arranged in table (1), in which the results of amplitude of action potential before and after exposure to Lavender perfume with a concentration of 50% of the original prepared consideration.

From the data, the relative action potential amplitude ((the ratio of the amplitude (μV/Hz1/2) after exposure to that before exposure)) for each subject in six EEG channel connections are calculated and then the mean for the ten subjects of each group has been calculated. The results also are arranged in the same table below. Here, it has been found that the mean relative action potential for males is higher than that for females. These results reflect that males are more sensitive than females in this type of perfume and may be it is not in other types.

Table 1: The EEG channel connections, and the Mean relative action potential amplitude ((The ratio of action potential amplitude (μV/Hz1/2) after to the before exposure to perfume stimulation)) for males and females.

EEG channel connections	Mean relative action potential amplitude for males	Mean relative action potential amplitude for females
T3	2.05	1.96
T4	1.80	1.76
T5	1.12	1.12
T6	1.20	1.19
P3	1.10	1.09
P4	1.10	1.09

Figure 4: The mean relative action potential amplitude for smell sense in males and females subjects by using lavender perfume as a chemical stimulator.



These results can be used as a guide for the specialist in EEG operator to reduce the test time, the cost of the test, and to be sure that he or she is recording from the specific sensitive area related to determine the EEG of smell sense by using a certain chemical stimulator. We recommend that more researches are required in this field for different chemical stimulators and age groups

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