

Research on Physiological Reactions to Bath Salts Aroma

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Abstract

The bath salts is high-profile as its distinctive aroma makes people relaxed with fresh and energetic feelings. EEG is analyzed with the lavipeditum bath method in this study and the physiological reactions (relaxation effects) are discussed and investigated in order to provide basic data for developing the practical products that can make life more comfortable and affluent by quantification for its effect. The experiment demonstrates that the physiological reaction generated by bath salts aroma is composed of the factor of energy difference value of the mid-alpha wave of the frontal lobe in the emotion field. The analysis on energy difference value of the mid-alpha wave that can cause physiological reaction in this experiment. In general, the aroma that induces a higher physiological reaction is the pomelo, green apple, sakura, rose, chamomile, peppermint for both sexes.

Keywords: Physiological reactions; EEG; mid-alpha wave; bath salts; aroma.

1. Introduction

The bath salts is high-profile as its distinctive aroma makes people relaxed with fresh and energetic feelings, and it will also be popularized henceforth. It might cares most about the aroma among the characteristics of bath salts[1]. And there presumably exists a wonderful sensation if leisurely enjoying in the enamored space with filled aroma. Relaxing the body in favorite aroma will make you fulfilled and open after daily fatigue [2]. Aroma also has the effect of aromatherapy, and relaxing is one of its advantages as well [3]. The selected aroma will be illustrated in this study. The aroma of fruit is actually the scent felt in eating fruit, so this sort of easily imaginary aroma is very easy to be perceived. For example, the fruity aroma of green apple, peach, raspberry, lemon, pomelo and other citrus fruit is widely known. But not just the fruits, there are also more than a few commodities that can spread the similar fruity aroma.

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The flower with the largest variety of potpourri certainly is rose. Its elegant image and aroma glance the world that differs from normal life [4]. In general, the aroma of jasmine obsesses people infatuated within it and relaxes them. So nothing will be better than smelling aroma of this flower upon exhaustion. The bath salts is added with the herbal ingredients, thus people can heartily enjoy the aroma with various mingled smells[5]. The chamomile will fire ones desire when it mentions the herbal fragrance, which has a favorable relaxation effect. The most popular aroma among other kinds is the woody fragrance with ligneous sense, which seems to provide people with the enjoyment in a forest bath. In addition, it enables people to remind of the sea and feel at ease as if they are enjoying the sea bathing in the ocean[6].

The history of EEG is detailed by Richard Caton, a physician practicing in Liverpool. He presented his findings about electrical phenomena of the exposed cerebral hemispheres of rabbits and monkeys in the British Medical Journal in 1875[7]. German physiologist and psychiatrist Hans Berger recorded the first human electroencephalogram (EEG) in 1924. He characterized the wave patterns, including α and β waves, and coined the term "electroencephalogram." He described or touched upon a large number of normal and abnormal EEG phenomena, for example, EEG changes associated with attention and mental effort, and alterations in the EEG associated with cerebral injury[8]. EEG is used extensively in neuroscience, cognitive science, cognitive psychology, neurolinguistics and physiological research.

EEG is an electrophysiological monitoring method to record electrical activity of the brain. It is typically noninvasive, with the electrodes placed along the scalp, although invasive electrodes are sometimes used in specific applications[9]. EEG measures voltage fluctuations resulting from ionic currents within the neurons of the brain. In clinical contexts, EEG refers to the recording of the brain's spontaneous electrical activity over a period of time, as recorded from multiple electrodes placed on the scalp [10,11].

EEG can be classified into four categories: delta-wave, theta-wave, alpha-wave, and beta-wave. The delta-wave shows the rhythm of the 1hz-3hz. It appears when a person sleeps so deeply that they do not dream. The theta-wave shows the rhythm from 4hz-7hz. In a shallow sleep condition, the temporal advantage appears when meditating. The alpha-wave appears at the back of head and shows the rhythm from 8hz-13hz, which appears at the time of awakening, and appears when the brain is not mentally active [12]. The slower alpha-wave (8~9hz) appears during a sleeping state, mid-alpha wave (9~11hz) appears during a relaxed state, and fast alpha-wave (11~13hz) occurs during a tense state [13,14]. The beta-wave shows a rhythm of 14 Hz or more and is the most common during the consciousness state, and is recorded in the center of the frontal part [15].

The purpose of this study is to provide basic data for the development of practical products to make life richer and more comfortable by quantifying its effect. We will study and consider the physiological reactions (relaxation effects) and compare them with psychological effects. EEG is analyzed with the lavipeditum bath method in this study and the physiological reaction (relaxation effect) are discussed and investigated. An EEG will obtain information on how the aroma of the bath salts affects the physiological reaction (relaxation effect). It is necessary to choose the most appropriate aroma for raising the bath salts effect due to diverse "aroma" with different impression.

2. Experimental

The aroma utilized in this experiment is twelve kinds of aroma of bath salts (pomelo, lemon, grapefruit, green apple, peach, raspberry, sakura, jasmine, rose, chamomile, peppermint, lavender). Pouring water into a colorless and transparent vessel and then melting the aromatic powder, thus the aroma aqueous solution forms. The dosage of the powder should be adjusted as the occasion demands until the aroma of each aqueous solution is consistent. The measured level value of sensor is controlled within 230~240 using XP-329 III sensor (Figure1). And this level value can fully measure the aroma of aqueous solution. The utilized vessel are provided with the specifications of 60cm length, 40cm width, 38cm height and water depth of 20cm. Water temperature should be ensure at 40°C when taking a bath with colorless and transparent bath water. The integrated aqueous solution with various aromas is poured into vessel with seal to make sure of no leakage of aroma. Then their perceptions on the aroma are measured with EEG recorded data. The number of individual subjects participated in the experiment was 40 (20 males, 20 females).



Figure 1: XP-329 III sensor

First, an electrode was placed on the subject and the subject was allowed to rest for 5 minutes. Then, the subject was allowed to close their eyes 5 minutes and the EEG was recorded for one minute. Then, the subject would put both feet in the aqueous solution and get acclimated to the water temperature before smelling the aroma while the EEG recorded data. Then, after another 5 minutes of a break with closed eyes, the EEG would record for one minute. Continue to experiment with the same procedure, this time with another aroma. The subject would put both feet into water for an allotted time until acclimated to the water temperature. Then, the subject was allowed to smell the aroma of the aqueous solution while the experimenter began to obtain data (Figure2).

In this experiment, the electrodes of 19 poles were placed based on the International 10-20 system on the scalp of the subject (Figure3). The International 10-20 System of Electrode Placement is the most widely used method to describe the placement of electrodes at specific intervals along the head [16]. Each electrode site has a letter to identify the lobe, along with a number or another letter to identify the hemispheric location. In the structure of the human brain, the frontal lobe functions are to engage in emotions [17]. Also, when seen from the EEG

diagram, the electrodes that placed on the frontal lobe area are Fp1, Fpz, and Fp2. Therefore, we can obtain the dopamine-sensitive response of the frontal lobe by analyzing the signals of electrode Fp1, Fpz, and Fp2.



Figure 2: Image of experimental

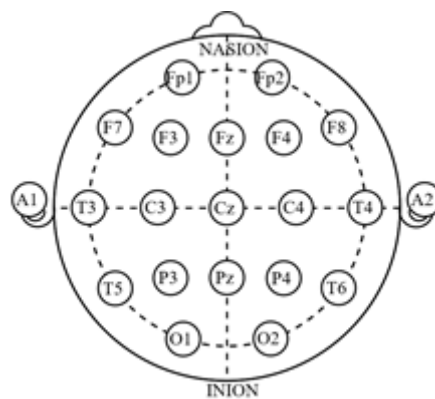


Figure 3: Electrode locations of International 10-20 system for EEG

3. Result and Discussions

In all results, the highest energy value moves between the alpha-waves of the frequency 8 ~ 13hz in Figure4 and Figure5. The horizontal axis is frequency, the vertical axis is energy value. In all results, the highest energy value moves between the alpha waves of the frequency 8 ~ 13hz. The alpha wave of 8 ~ 13hz is figured out when relaxing. In addition, the peak value of all results comes out at the time of the mid-alpha wave in a relaxed state of 9 ~ 11hz. Therefore, in this study, the analysis is performed using the average of the power value of the mid-alpha wave band, which is in a relaxed state of 9 ~ 11hz.

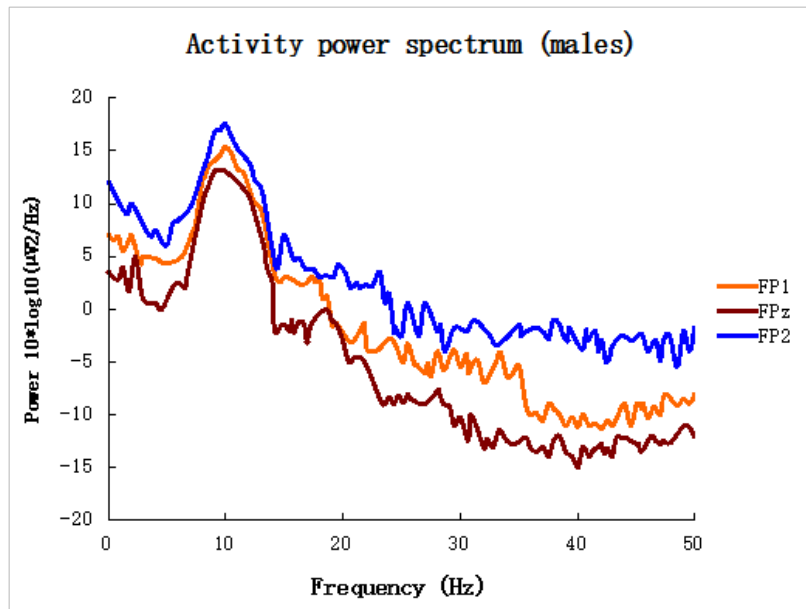


Figure 4: Fp1, Fpz and Fp2 in the case of males

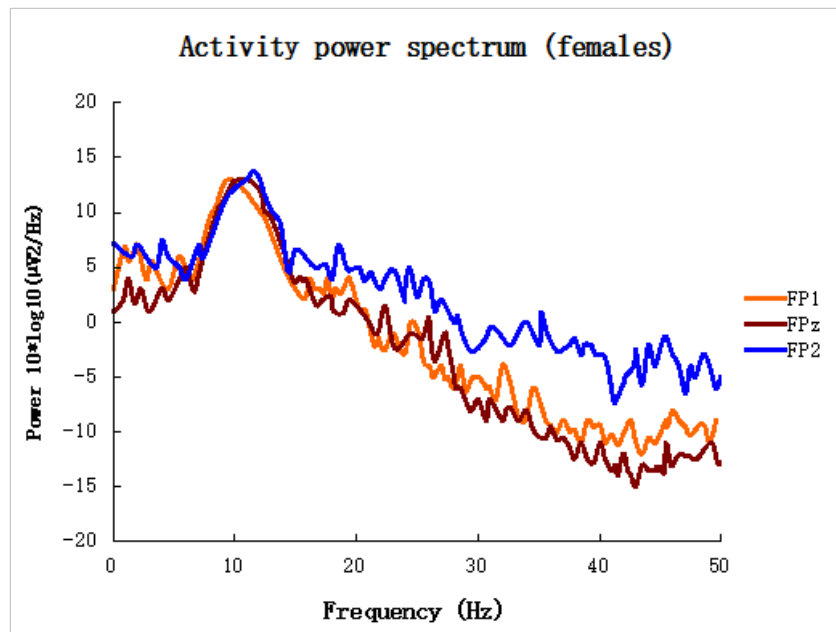


Figure 5: Fp1, Fpz and Fp2 in the case of females

It finds that the various aromas with the relaxing effect will change in accordance with the gender shift by comparing their results. Therefore, the males and females will be analyzed separately in this experiment. And taking the tendency of aroma classification into account, the figure of average situation for the relaxing effect of each aroma classification among sexes will be provided and the results will be analyzed.

Figure 6 is a diagram of relaxing effect on energy value of the mid-alpha wave's reaction to each aroma in

electrode Fp1, Fpz, and Fp2. As shown in the figure, both sexes show similar tendency for citrus (pomelo, lemon, grapefruit). Males love pomelo with the highest energy difference value of the mid-alpha wave and the best relaxing effect. But the grapefruit reflects the lowest energy difference value of the mid-alpha wave and the worst relaxing effect. In the case of female subjects, the pomelo manifests the highest energy difference value of the mid-alpha wave and the best relaxing effect. While the grapefruit shows lower energy difference value of the mid-alpha wave and poorer relaxing effect. Besides, citrus aromas have better effect on males than females in the mass.

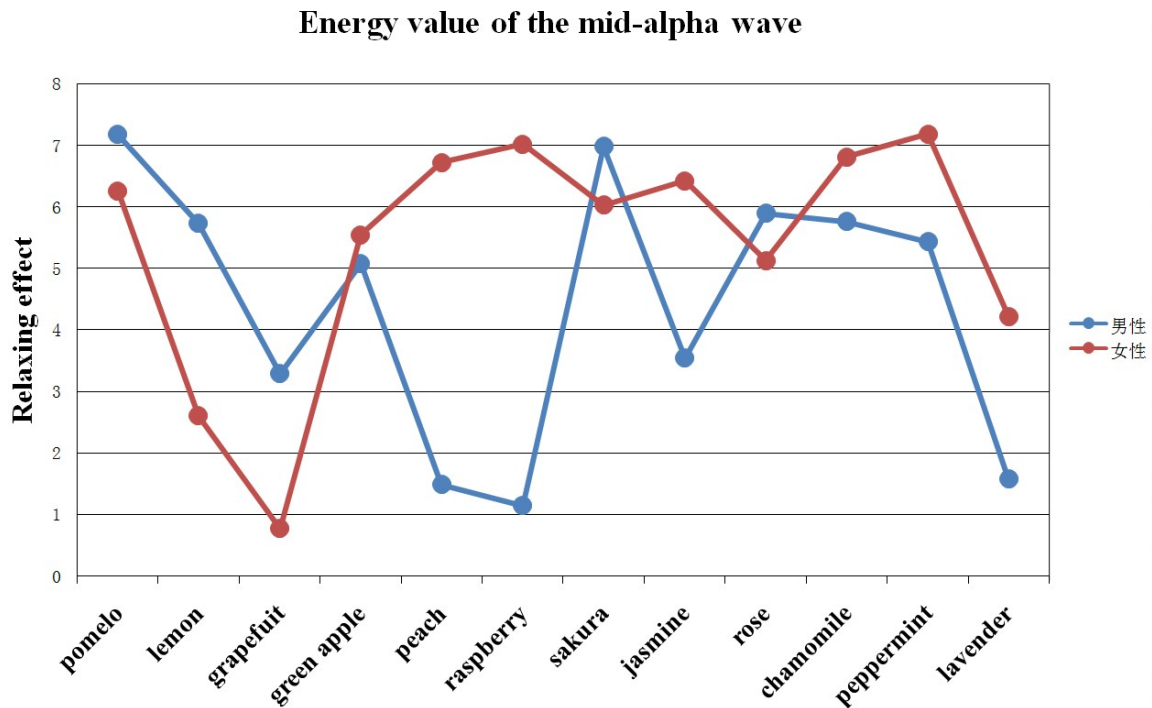


Figure 6: The diagram of relaxing effect on energy value of the mid-alpha wave's reaction to each aroma

There will be dissimilarity in effect values according to gender for fruity aromas (green apple, peach, raspberry). In the case of female subjects, it has better relaxing effect in the mass. Males love green apple with the highest energy difference value of the mid-alpha wave and the best relaxing effect. But the raspberry and peach reflect the lower energy difference value of the mid-alpha wave.

Females show similar tendency for flower aromas (sakura, jasmine, rose). And the higher energy difference value of the mid-alpha wave and the better relaxing effect in the mass. While, males show similar tendency except jasmine. The sakura reflects the highest energy difference value of the mid-alpha.

Both sexes show similar tendency for herbals aromas (chamomile, peppermint, lavender). Males and females love chamomile and peppermint. But the lavender reflects the lowest energy difference value of the mid-alpha wave and the worst relaxing effect.

Various aromas with the relaxing effect will change as gender. The situation of both sexes will be compared for a more detailed analysis on the results. Both sexes present similar tendency towards citrus aromas. In addition, citrus is more effective for males than females on the whole. There will be dissimilarity in effect values according to gender for fruity aromas. Besides, fruity aroma is more effective for females than males on the whole. Flower aromas have better relaxing effect on both sexes. Sakura and rose are more effective for males than females. And jasmine has better effects on females than males. Both sexes exhibit similar tendency for herbal aromas.

The experiment demonstrates that the physiological reaction generated by bath salts aroma is composed of the factor of energy difference value of the mid-alpha wave of the frontal lobe in the emotion field. In this experiment we see that in spite of at the same peak values, the occupancy rate of the mid-alpha wave were different. Therefore, the results are considered to be much more precise to compare the signals of the mid-alpha wave than to compare the values to each other.

4. Conclusion

In general, the aromas that induces the higher physiological reactions are pomelo, green apple, sakura, rose, chamomile, peppermint, that has a higher effect for both sexes. It's of extreme significance to utilize the comparative method according to energy difference value of the mid-alpha wave as the method to investigate the relaxing effect of aromas while analyzing the brainwave. That is to say, this experiment can quantify the physiological reaction of aroma, which has positive effects on developing the commodities.

The existing physiological effect and the caused physiological reaction of the aroma of aqueous solution are investigated in this paper. However, it can be anticipated that the effect will vary as the intensity of the aroma. Therefore, it believes that dividing the aromas into several classes to conduct the experiments can obtain more accurate data. In addition, the aroma will also change with different ages of subjects. Thus the experiment conducted on this basis is of profound significance. It hopes to obtain practical applications for more effective products and develop the data with positive effects via the combination of color and aroma.

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