Effects of Japanese Esoteric Buddhism Meditation on Stress Management in Human

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Abstract

In this study, the electroencephalogram (E.E.G.) and stress hormone analysis were applied to investigate the emotional fluctuations in healthy male monks. The alpha waves were significantly increased during the Susokukan meditation in a fairly-trained monk. The alpha waves and theta waves were significantly increased during Sannenju meditation in a well-trained monk. The stress hormone, amylase, was significantly increased during Susokukan meditation. From these results, it is concluded that, despite stressful conditions, one can reset the brain and bring it to a calm condition willingly by doing the Esoteric Buddhism meditation.

Keywords: stress management, Japanese Esoteric Buddhism Meditation, EEG

1. Introduction

There are several meditational methods of stress management such as autogenic training⁽¹⁾ and Buddhism meditation⁽²⁾ for people who are suffering from various stressors. However the nature and the benefits of the Esoteric Buddhism Meditation, Shingon Mikkyo Meiso, has not been well studied. This research may give some insights for monks who have been practicing meditation and people who are going to practice meditation for well-being.

The present study was intended to examine the meditation and experience-dependent change, if any, on the emotional state. It is of further interest to study the effect of meditation on stress hormone.

2. Materials and Methods

2.1 Experiment 1. EEG of Sannenju Meditation

The E.E.G. was recorded during the Sannenju meditation and the change of the frequency bands (delta waves: 0.5 – 4 Hz, theta waves: 4.5 – 8 Hz, alpha waves: 8.5 – 12 Hz, beta waves: 12.5 – 20.0 Hz) were compared under closed eye condition in this study. Sannenju meditation is one that is continuously imaging a particular Buddha and chanting a mantra continuously. The number of chants is counted with beads during this meditation.

A healthy male well-trained monk who was 54 years old and has been practicing meditation for 30 years was the volunteer for this study.

The subject agreed to participate in this study with full knowledge of the experimental nature of the research.

The subject entered the hall at 6:00 and was equipped with electrodes of 21-channel EEG. Fig. 1 shows the recording scene of EEG. Under dim illumination, the subject sat down on the seat in a lotus posture. This meditation session was repeated for six consecutive days.

Fig. 1. Recording of the meditation.

Fig. 2. Electrode locations of International 10 - 20 system for EEG recording.

During the 3 min meditation session, frontal lobe F4 EEG, in reference to the right ear-lobe potential, was recorded continuously according to the International 10-20 Standard and stored in a special computer-aided ESA device (Emotion Spectrum Analyzer, ESA-16; Brain Function Laboratory, Yokohama, Japan). The location of the EEG electrodes are illustrated in Fig.2. Each relative value was then pooled for statistical analysis, Student t-test.

2.2 Experiment 2. EEG of Susokukan Meditation

Susokukan meditation is also called breathing meditation. One is simply breathing slowly but deeply. A healthy male fairly-trained monk who was 42 years old and who has been practicing meditation for 5 years was the volunteer for this study.

The subject entered the hall at 16:00 and EEG was recorded as mentioned before.

2.3 Experiment 3. Stress Hormone

The change of the stress hormone, amylase, during the Susokukan meditation was analyzed. Salivary amylase concentration was selected as a stress marker. The reason being, the collection of saliva is non-invasive and no psychological stress will be given to the subject compared to blood collection by a syringe. Four young monks (23.7 $\pm$ 4.8 years old) who just started their Buddhist school course participated in this study. The study was performed at 13:00.

3. Results

3.1 Experiment 1. EEG of Sannenju Meditation

As summarized in Table 1 and Fig. 3, during the Sannenju meditation, the delta waves in control was 7.8 μ V², while that in Sannenju meditation was significantly

Table 1. Change of the power by Sannenju meditation.

EEG frequency Band	Power (μ V ²)	
	Control	Sannenju
Delta waves	7.8 $\pm$ 1.3	4.6 $\pm$ 0.5**
Theta waves	0.9 $\pm$ 0.1	1.4 $\pm$ 0.3**
Alpha waves	0.8 $\pm$ 0.2	2.3 $\pm$ 0.4**
Beta waves	0.5 $\pm$ 0.1	0.4 $\pm$ 0.1
Mean $\pm$ SD, **: p < 0.01, n = 4

Fig.3. Change of the power by Sannenju meditation. (** : p < 0.01, n = 4)

decreased to 4.6 μ V². The alpha waves and theta waves in control were 0.9 and 0.8 μ V², respectively, while that in the Sannenju meditation were significantly increased to 1.4 and 2.3 μ V², respectively, as shown in the same table and figure. The subject moved during Sannenju meditation in order to chant and count the number with beads, hence the number of the results for statistical analysis were decreased.

3.2 Experiment 2. EEG of Susokukan Meditation

Fig. 4 is the time-course of the EEG power spectrum in control. The alpha and sometime theta waves are usually detected when the subject closes his/her eyes and sit quietly. While the dramatic increase of the alpha and theta waves are shown in the time-course of the EEG power spectrum in Susokukan meditation, Fig. 5.

Fig. 4. Power spectrum of Susokukan meditation. (control) Alpha and Theta power are relatively increased.

Fig. 5. Power spectrum of Susokukan meditation. (experiment) Alpha and theta power are increased greatly.

Table 2. Change of the power by Susokukan meditation.

EEG frequency Band	Power (μV^2)	
	Control	Susokukan
Delta waves	1.7 ± 0.6	1.9 ± 0.3
Theta waves	0.9 ± 0.1	0.8 ± 0.1
Alpha waves	3.2 ± 0.3	$3.5 \pm 0.2^*$
Beta waves	0.6 ± 0.1	0.7 ± 0.2
Mean $\pm$ SD, *: $p < 0.05$, $n = 6$

Fig.6. Change of the power by Susokukan meditation. (* : $p < 0.05$, $n = 6$)

The alpha waves were significantly increased to $3.5 \mu V^2$ in the Susokukan meditation compared to the control, $3.2 \mu V^2$ as shown in Table 2 and Fig.6. No other changes were detected.

3.3 Experiment 3. Stress Hormone

Table 3 and Fig. 7 show the change of the salivary amylase concentration by Susokukan meditation. The stress hormone, amylase, was 102.3 unit in control, while it was significantly increased to 152.0 unit by Susokukan meditation.

Table 3. Change of amylase by Susokukan meditation.

Salivary amylase concentration	
Control	Susokukan
102.3 ± 20.1	$152.0 \pm 22.8^{**}$
Mean $\pm$ SD, **: $p < 0.01$, $n = 4$

Fig.7. Percent change of salivary amylase concentration by Susokukan meditation. (** : $p < 0.01$, $n = 4$)

4. Discussion

The frequency of the EEG is divided into the following four groups.

Beta waves: observed when the eyes are opened and the subject is very active both physically and mentally

Alpha waves: observed when the eyes are closed and the subject is very calm

Theta waves: observed when the eyes are closed and the subject is even more calm

Delta waves: observed when the eyes are closed and the subject is asleep

The new findings by the present study were the following four things.

1. The alpha waves were significantly increased and the brain became sedative by Susokukan meditation.
2. Although the body was physically and mentally active during Sannenju meditation, the alpha and theta waves increased significantly.
3. The stress hormone, amylase, was increased by Susokukan meditation and it was confirmed that the subject was conscious.
4. The hormonal test demonstrated that the subject was in a stressful condition, while the EEG recording demonstrated that the subject was in a sedative condition during Susokukan meditation.

Sichijo and Matsumoto reported that the 8 Hz alpha wave was dominant in the frontal part of the head during the Ajikan meditation⁽³⁾. It was confirmed by the present study on the frontal recording electrode F4. Takase et. al

reported the alpha waves on the occipital part was decreased by Vipassana meditation⁽⁴⁾. Kawano et. al also reported the alpha waves were increased by the deep Buddhism meditation but the theta waves were not observed so often⁽⁵⁾. Unfortunately these reports were case reports and were recorded just one time.

The sedative brain waves such as alpha and theta waves are usually observed during the quiet conditions in both physical and mental states. The fairly-trained monk who was fully awake and was concentrating on breathing during the Susokukan meditation showed an increase in alpha waves. While, the well-trained monk who was actively performing the Sannenju meditation and continuously chanting and counting with beads and forming an special symbols with his fingers continuously showed an unexpected increase of alpha and theta waves. An experience-dependent change of the emotional state was confirmed.

Salivary amylase concentration demonstrated that the body was in a stressful condition. Takase et. al also reported that the salivary amylase concentration and the sympathetic nerves were excited by Vipassana meditation⁽⁴⁾. This study demonstrated that the body was stressed but the brain was in a calm state during the meditation, which is a new and interesting finding of this study. It is a very surprising new finding. Neural network and hormonal network may have different mechanism on human stress control.

The delta waves during the Sannenju meditation at 6:00 were high in control but were decreased significantly by the meditation. The delta waves are usually observed during deep sleep. The time effect of the early morning was considered but the subject took a water bath before entering the hall and renewed himself in body and spirit. The delta waves may not be responsible for the meditational sedation.

Selye reported that excitation and anger due to stress can be ceased by counting numbers or stimulate the frontal lobe to meet one's goal⁽⁶⁾. Japanese Esoteric Buddhism meditation includes deep breathing and repeating mantras many times. This is exactly the same as what Salye mentioned and the meditation has been medically proven.

5. Conclusions

From these results, it was concluded that, despite the stressful conditions in our daily life, one can reset the brain

and bring it to a calm state willingly by doing Esoteric Buddhism meditation. The meaningful object was imaged in this study. It will be interesting to study the effects of meaningless object meditation in the future.

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