

## LETTER TO THE EDITOR

## The Influence of Wushu Training on the Neuroscience of Brain Electroencephalogram under Ecological Environment

Hongyu Han<sup>1,2</sup>, Xiujie Ma<sup>3,4\*</sup>

<sup>1</sup>Physical Education Department, Soochow University, Suzhou 215021, China

<sup>2</sup>Department of Chinese Wushu, Hebei Institute of Physical Education, Shijiazhuang 050700, China

<sup>3</sup>College of Chinese Wushu, Shanghai University of Sport, Shanghai 200438, China

<sup>4</sup>Taiji College of Culture, Handan University, Handan 056005, China

\*Email: yematengkong83@126.com

Studies have shown that Wushu training can induce the slow wave activity rhythm of cerebral with high amplitude, which is beneficial to people's physical and mental health and stable nerves. In order to further explore the influence of Wushu training on the human brain electrical nerve, according to the theoretical design experiment for the influence of the head down tilt on the brain electrical activity, the EEG data of the shooting athletes after handstand training of Wushu and the Taijiquan training are obtained. The experimental data show that there are significant differences in the power value of  $\alpha$  and  $\beta$  frequency band of the cerebral nerve, the index of EEG coherence function, the comprehensive index of EEG after the handstand training and the posture of sitting. The indexes of the athletes' EEG are significantly higher than those before the handstand training, indicating that the handstand training of Wushu has a positive effect on the human brain electricity. After the Taijiquan training, the power value of the slow wave of athletes' brain nerve ( $\delta$ ,  $\theta$  wave) decreased, the power value of the fast wave ( $\beta$  wave) increased, indicating that Taijiquan training helps the coordination operation of the brain on both sides of the body.

### I Introduction

Lei Ying. Buslaev published "New Ecology: Chinese Traditional Martial Arts Culture Protection and Carry Forward Game Analysis" on Issue 107, Pages: 2773-2778, Article No: e107309, Year: 2019, in the article. With rapidly development of Chinese economy, martial arts culture has slowly fade out of people's view, now some people only focus on profit, forget Chinese excellent traditional culture, such thought is quite bad for Chinese such extensive and profound marginal culture, therefore the paper takes it as entry point to study. The paper makes specific analysis of Chinese martial arts culture status, by studying Chinese recent years' martial artists amount change and martial artists gender proportions, utilizing numerical analysis and data handling methods, and then finds out that present Chinese martial artists are decreasing by year, it should lay emphasis on cultivating martial artists of more high technology and high quality; establishes contemporary Chinese martial arts development influential relative factors models, by goal programming method and correlation analysis method, it studies martial arts events of masses most satisfaction, final it gets conclusions that: Taijiquan, Wing Chun, and nunchaku are martial arts events of contemporary residents most satisfaction. By above comprehensive analysis, combine with

contemporary martial arts development, put forward relative suggestions to propel to Chinese martial arts development that contemporary Chinese martial arts development has many obstacles, it should expand its publicity, driving martial arts development by sports tourism, and then let masses to go deeper understanding about martial arts knowledge.

**II Methods**

Brain wave is a comprehensive reflection of the cooperation and competition of electrical activity of a large number of neurons in the brain. It can reflect the functional state of the brain and can be used as an objective index to evaluate the brain function (Guo et al. 2015, Liu et al. 2018). In the head down tilt state, the adaptive changes in cerebral circulation lead to the change of the functional state of the human brain and the electrical activity of the brain, so the changes of brain function in the head down tilt state of the head can be explored (Iskragolec et al. 2017, Gao et al. 2018).

A study recorded the EEG of 12 healthy men before HDBR, on bed, awake and closed eye state during recovery, and performed the work spectrum analysis. The results showed that the peak frequency of EEG gradually changed (the sixth day,  $P < 0.05$ , the activity in segment  $\alpha$  enhanced,  $\alpha_1$ :  $P < 0.001$ ;  $\alpha_2$ : the third and sixth day,  $P < 0.05$ ; the fourth day,  $P < 0.001$ ). The fourth day was the most significant, the  $\alpha_1/\alpha_2$  increased,  $\theta$  activity increased, the frontal area of the brain was the most significant on third day, and the occipital region in the fourth day was the most significant. At the same time,  $\theta/\alpha$  increased significantly. In addition, the activity of  $\beta_1$  increased significantly, and the third day was the most obvious. After bed rest, the peak frequency of EEG has recovered to the level before the experiment, and the other indexes were still recovering. Head down tilt position causes significant changes in the EEG spectrum structure and activity intensity of the human brain, and has potential effects on brain function. According to the above research theories and methods, two groups of experiments are designed, that is, to make empirical study for the effect of handstand training and Taijiquan training on the human brain’s electrical nerve in the Wushu training.

The research method adopted the form of qualitative research and quantitative research, which was based on experiment, and the literature retrieval and analysis were assisted, to collate, analyze and discuss the test data obtained by the experiment, and finally put forward the conclusion of the research (Zheng et al. 2015)

**Table 1. General table of subjects**

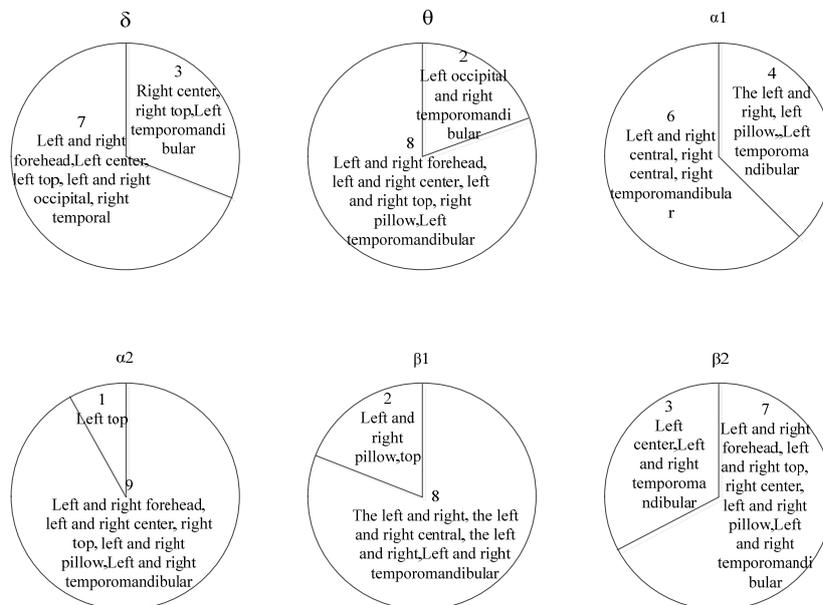
	Age	Training years	Good master	One level	Second level
Male	21.3±4.84	5.44±2.93	6	3	3
Female	20.5±4.65	5.32±2.71	6	2	4

After preliminary screening and processing, the original database was established by Excel, and the t-test was used to test the brain electricity index and psychological index of normal sitting posture and headstand training by using Spss11.0 software (Vasquez et al. 2015).

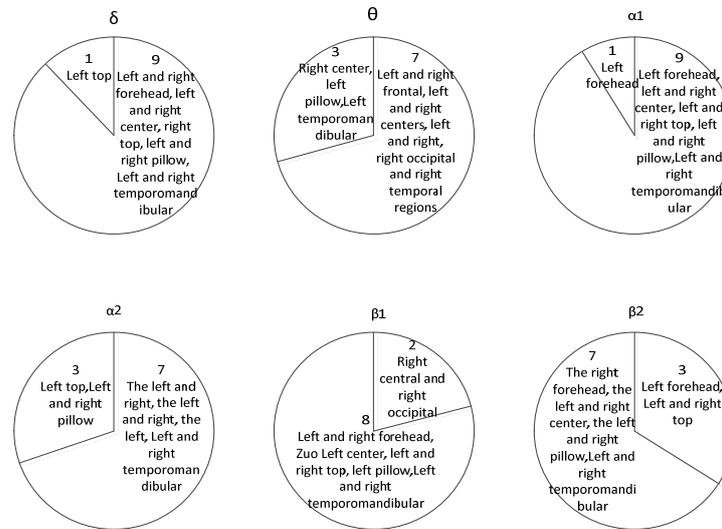
30 s non artifact data were selected to analyze and calculate the power values of each band (Nijboer et al. 2018). The power values in the quiet state, exercising and quiet state after exercise were compared respectively. All data were expressed by means of mean ± standard deviation. The paired sample t-test was used for statistical analysis, with a significant level of  $P < 0.05$ .

### III Results

Compared with the quiet state before the Taijiquan exercise, the power value of the immediate slow wave ( $\delta$ ,  $\theta$  wave) and the slower wave ( $\alpha 1$  wave) in the brain area after exercise decreased more than 60%. Among them, there were significant differences in 4 brain regions of  $\delta$  wave, 4 brain regions of  $\theta$  wave, and 3 brain regions of  $\alpha 1$  wave. However, the power value of faster wave ( $\alpha 2$  wave) and the fast wave ( $\beta 1$  wave and  $\beta 2$  wave) increased in 70% brain regions. Among them, there were significant differences in 3 brain regions of  $\alpha 2$  wave, 4 brain regions of  $\beta 1$  wave, 3 brain regions of  $\beta 2$  waves. The changes of EEG values immediately after Taijiquan exercise were shown in Figure 1. After Taijiquan exercise, the power values of 70% brain regions in slow wave ( $\delta$ ,  $\theta$  wave) and slower ( $\alpha 1$  wave) of the subjects in the quiet state showed an upward trend. Among them, the  $\delta$  wave had significant difference in the 4 brain regions,  $\theta$  wave in 4 brain regions, and the  $\alpha 1$  wave in 3 brain regions. At the same time, the power values of above 70% brain regions in faster wave ( $\alpha 2$  wave) and fast wave ( $\beta 1$  wave,  $\beta 2$  wave) showed a downward trend. Where, the  $\alpha 2$  wave had significant difference in 2 brain regions, the  $\beta 1$  wave and  $\beta 2$  wave in each 3 brain regions. The changes of EEG power value after quieter exercise were shown in Figure 2.



**Fig.1 The trend of power values of 10 brain regions immediately after shadowboxing**



**Fig. 2. The trend of power value of 10 brain regions in each band after Taijiquan Exercise**

#### IV Discussion

In previous studies, we found that there was a significant increase of diastolic pressure and reduced pulse pressure in -80o head down tilt position. This pressor response was probably due to intracranial tension or hypoxemia. The experimental results showed that there was no significant difference between the change trend of the EEG index and the sitting posture of the shooting archers in 1min, and there is no significant change in the electroencephalogram index in the recovery state after the headstand training. There was a difference in the change of the electroencephalogram between the headstand training and the sitting posture in 3 min. In the headstand training, the power of the  $\alpha$  frequency band of the EEG showed a downward trend, while the value of the  $\beta$  band power increases slightly. After the end of the headstand training, the indexes of the athletes' EEG were significantly higher than those before the training, especially the four indexes of high lucidity, temporal synchronization, frontal dominance and EEG coherence function P3-P4, which could be explained to some extent the positive effect of the headstand training on the electroencephalogram of the athletes.

According to the experimental results, the power of EEG fast wave ( $\beta$  wave) increased and the power of slow wave ( $\delta$  and  $\theta$  wave) decreased immediately after Taijiquan exercise.  $\beta$  wave was a conscious brain wave. When people were awake and absorbed, their power was increased. When carrying out Taijiquan, its thinking must follow the steps of Taijiquan step by step, and the consciousness was concentrated. At this time, the neuron was in a strong state of activity and was more excited. The  $\beta$  wave was in a dominant rhythm, indicating that the cerebral cortex was in a state of excitement and concentration. The  $\delta$  wave and  $\theta$  wave were the brain waves which were often inhibited in the cerebral cortex. The decline in power value also proved that the nervous system was in a state of intense activity in Taijiquan exercise. By paired sample T test, there were significant differences in  $\beta1$  wave in right forehead, left top, right top and right temporal regions, and there were significant differences in the left forehead, right center and right top areas of the  $\beta2$  wave (Ata Korkmaz 2019). This difference was mainly concentrated in the right hemisphere, indicating that Taijiquan mainly stimulated the right hemisphere. The right hemisphere of the brain was responsible for the important functions of art appreciation, intuition, space imagination, and body coordination, but with human evolution and living habits, the left brain of 90% of the people was the dominant hemisphere. But in the face of more complex activities and tasks, the coordinated operation of the two hemispheres

of the brain can accomplish more advanced neural activity, so Taijiquan training helped to improve the cooperative operation of the hemispheres of the brain and make an accurate response to various information from outside or inside the brain.

## V Conclusion

After the handstand training, the  $\alpha$  index of the brain cell activation level in the human brain area increased, in which the frontal, temporal and top areas were significantly higher. Meanwhile, the human brain reflected the  $\beta$  index of the central nervous tension level.

The EEG coherence function of the left and right brain regions, which reflects the level of brain coordination, was improved.

The scores of the three psychological scales decreased.

The power value of EEG fast wave ( $\beta$  wave) can be increased and the power value of slow wave ( $\theta$ ,  $\delta$  wave) was reduced, and the increase of the value of the  $\beta$  wave power was mainly concentrated in the right hemisphere of the brain. The training of Taijiquan improved the coordination of the two sides of the brain.

The quiet state after the Taijiquan exercise, the power value of 50% brain area was lower than those in the quiet state before the exercise, suggesting that Taijiquan can be used as the relaxing means of the athletes, and the Taijiquan training was beneficial to the recovery and improvement of the central function of the human brain.

The EEG power of the brain area increased in the brain area after Taijiquan exercise immediately and in the quiet state after the exercise. It showed that the Taijiquan training improved the function of the autonomic nervous system to the visceral activity.

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