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Experimental study on Taijiquan exercise improving university students' cognitive function

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Abstract

Taijiquan is a traditional Chinese martial arts which is popular in China and even Southeast Asia. Now, many university students are Practicing it. Previous studies focused on the cognitive effects of aerobic exercise with different intensities on the human brain. This paper will present an experiment on Whether Taijiquan can develop cognitive function and what is the effective frequency of cognition developed by Taijiquan. In experiment 1: seventeen male university students were recruited as EG who had been exercising Taijiquan more than one year, another thirty male university students who were healthy but whose major were not sports were as CG. The differences of P_{300} were compared; In experiment 2: thirty female healthy university students were recruited for six weeks, randomly divided into 3 groups, 10 in each group. EG1 and EG2 for six weeks Taijiquan exercise. EG1 did Taijiquan exercise 3 times a week (Monday, Wednesday, Friday). EG2 did Taijiquan exercise 5 times a week (from Monday to Friday). CG did not do any sports. The P_{300} of each group were recorded before the experiment, and in the second, fourth, sixth and eighth week. Through scientific reasoning and strict analysis, this study found: the long-term Taijiquan exercise can improve the cognitive function of the practitioners; For short-term Taijiquan exercise, the positive effects of Taijiquan exercise 5 times a week is better than that of 3 times a week.

Keywords: Cognitive function; Taijiquan; Sports

1. Introduction

Cognitive function is the psychological basis of university students learning. Good cognitive ability can help university students to rapidly grasp new knowledge and acquire new skills. Most scholars believe that sports can improve the cognitive function of the central nervous system (Hillman, Erickson, & Kramer, 2008; Jagadeeswari & Bharathiraja, 2018; Kashihara, Maruyama, & Murota, 2009), and the participation of university students in sports has a positive effect on improving learning ability (Diederich, Bastl, & Wersching, 2017). KASHIHARA K and others (Kashihara et al., 2009) found that the relationship between the function of the central nervous system and the intensity of sports are inverted U, and it has an ideal effect on the improvement of cognitive function when the intensity of sports is close to the threshold of lactic acid. Parihar, Yadav, and Dube (2016) studied the relationship between the heart rate and the percentage of maximum

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oxygen uptake in people who are not athletes. It was found that when the age of 10–27 years old, the intensity of sports could reach the threshold of lactic acid when the heart rate is 115–135 times/min.

Taijiquan is a traditional martial arts event in China which is very popular. The characteristics of Taijiquan are mental concentration, inner peace, thought focus, body relaxion. Many scholars have confirmed that Taijiquan has good fitness effect (Cui & Limin, 2017; Xiao, Tong, & Jiang, 2006; Yang & Yu, 2013; Yu, Wang, & Yang, 2012; Zhang, 2017; Zou, Wang, & Chen, 2017). Therefore, promoting Taijiquan on campus has positive effect on improving students' physique. Laura Brown and Todd Sherman (Brown, Jennings, & Sparkes, 2014) studied the intensity of Taijiquan exercise, and found that the average heart rate of the full set of Taijiquan exercise is 121 times /min, which is the most ideal heart rate range to improve the cognitive function. Therefore, the Taijiquan exercise not only has the healthy effects, but also promotes the cognitive function of university students. But at present, this inference has not been confirmed by the experiment.

Event-related potential P_{300} is a basic neurobiological evaluation index reflecting the cognitive function, which is a positive wave induced by target stimulation, and the time that the wave occurs is about 300 ms after the target stimulation appears. P_{300} is a kind of endogenous component related to attention, memory and cognition. Because of its unstimulated physical properties, the waveform also has good stability. It has become a hot spot in the field of cognitive neurologic function in recent years. Its Latency time, reaction time, amplitude can reflect cognitive ability from different aspects. The latency time of P_{300} is the time interval (MS) from the beginning of the stimulus to the amplitude, reflecting the cognitive speed. The amplitude of P_{300} refers to the potential difference between the baseline and the wave top (μV), reflecting the attention distribution; The reaction time refers to the total time from the beginning of the stimulus to the end of the movement (MS), which means the speed the human body mobilize the organism, reflecting the activation speed of information processing (Yusuf & Adem, 2017). It is generally believed that the latency and response time are shortened, the amplitude value is increased, and the cognitive ability is enhanced. The purpose of this study is to verify the effect of Taijiquan exercise on the cognitive function of university students by using the event-related potential P_{300}, and to further explore the more ideal frequency.

2. Experimental objects and methods

2.1. Experimental objects

Experiment 1: 17 male students from Physical Education College, HuNan First Normal University (HNFNU for short) were recruited as EG who had been exercising Taijiquan more than one year. Another thirty male students of HNFNU who were healthy but no-sports as CG. The purpose is to study the effect of long-term Taijiquan exercise on cognitive function of university students Table 1).

Experiment 2: Female volunteers whose major are not sports from HNFNU were asked to fill in the physical activity index scale and PAR&.Q questionnaire, and were introduced the purpose and points for attention of this experiment. 30 volunteers who agreed and whose body activity index was less than 2, and PAR&.Q questionnaire selected "not" were recruited to take part in the Experiment. The 30 volunteers were equally divided into EG1, EG2 and CG.10 in each group. EG1 and EG2 did Taijiquan exercise six weeks, but frequency are different. CG no sports. The purpose of this experiment is to explore the effective frequencies of Taijiquan exercise Table 2).

2.2. Experimental methods

Exercise methods: EG students of Experiment 1 did Taijiquan exercise 6.00–7.30 every morning for six weeks, CG no any exercise; EG1 and EG2 students of Experiment 2 did Taijiquan exercise 6.30–7.45 for six weeks, EG1 3 times a week (Monday, Wednesday, Friday), EG2 5 times a week (from Monday to Friday). CG no any exercise. Both Experiment 1 and Experiment 2, EG students did some warming-up exercise 15 min before Taijiquan, for example, jogging and gymnastics.

Test method: The P_{300} test was based on the NDI200 nerve electrical diagnostic instrument produced by Haishen medical electronic instrument factory in Shanghai. The test electrode was Ag/AgCl disk electrode. Before testing, it

Table 2
The demographic characteristics of experiment 2.

	n	Index		
		Old (year)	Height (cm)	Weight (kg)
EG1	10	21.14 ± 0.88	159.66 ± 4.42	49.86 ± 3.26
EG2	10	21.35 ± 1.55	159.81 ± 5.01	50.51 ± 4.20
CG	10	20.86 ± 1.98	160.03 ± 4.77	50.09 ± 3.22

Table 1
The demographic characteristics of experiment 1.

	n	Taijiquan time (year)	Index		
			Old (year)	Height (cm)	Weight (kg)
EG	17	2.85 ± 2.20	21.47 ± 1.66	170.64 ± 5.42	63.87 ± 6.39
CG	30	0	21.29 ± 1.18	169.85 ± 7.01	64.51 ± 8.17