ORIGINAL ARTICLE

The effect of neurofeedback training on the perceptual-motor abilities of basketball athletes

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ABSTRACT

The aim of this study was to investigate the effect of neurofeedback training on the perceptual-motor abilities of basketball athletes. For this purpose, 60 male athletes in this field were selected voluntarily. Subjects were divided into 2 groups of 15 ones; Experimental and 4 Control groups. The experimental intervention was practiced two sessions a week for 6 weeks. Subjects participated in pre- and post-test to measure the dependent variable. One-way analysis of variance were used to analyze the data. The results showed significant changes in reducing simple and selective reaction time and anxiety, improving balance and also increasing attention in the intervention group compared to control group ($p < 0.05$). According to the mentioned results, neurofeedback training can be used for the perceptual-motor abilities of athletes, which is the basis of their sports skills.

Key Words: simple and selective reaction time, anxiety, balance, attention

INTRODUCTION

Neurofeedback is a form of biofeedback and a permanent indicator and reference of brain function that is related to the electrical activity of the brain. Based on practical principles, neurofeedback may be applicable to all feedback therapies that include biofeedback. Neurofeedback exercises are known by different titles such as: brain self-regulation, brain exercise and brain training.[1]

Neurofeedback training deals directly with the brain. In this method, each barley treatment is trained according to its conditions, and in each session, the amount of progress can be seen by the viewer training.[2]

Neurofeedback provides appropriate feedback to the individual to correct brain abnormalities and based on specific protocols. The received information is provided to the patient and the therapist by two separate monitors. In this case, both the patient and the therapist will be able to observe the patient's brain waves. Will be able to manipulate abnormal waves and turn them into normal during treatment sessions As a result, the unconscious and involuntary processes of brain waves are completely felt by the patient by observing them in the computer, and the patient will be able to manipulate abnormal waves with the help of a therapist and provide visual-auditory stimuli and Convert to normal mode.[1] In the most common method used for neurofeedback, the patient plays a video game on the screen. Of course, unlike common games, the patient should not use his hand, but does so through his brain wave pattern. Today, neurofeedback is used to treat many disorders, diseases and problems. For example, it is used in the treatment of attention deficit hyperactivity disorder, anxiety, learning disorders, sleep disorders, epilepsy, chronic pain, migraine headaches, depression, substance abuse, attention and concentration problems, excellent performance, etc.[1] Neurofeedback can affect an athlete's performance in throwing sports such as shooting, archery, and golf. In fact, neurofeedback constantly challenges the brain by providing images and sounds. This training system encourages the brain to correct, adjust, and maintain proper activity by giving feedback to the brain about what the person has done in the past few seconds. As a result, the brain is asked to manipulate different brain waves by producing more of some waves and producing less of others.[4]

There is a very strong relationship between mind and physical function in sports. A wide range of mental powers such as concentration and attention are required to enhance athletic performance. Neurofeedback has shown excellent results in improving sports performance, music, ballet, and singer performance.[5] In neurofeedback training, the alpha/ theta protocol is used to increase the performance of athletes. They try to improve attention and concentration by strengthening SMR.[6]

The first study on the use of neurofeedback exercises to improve balance was published by Kuipers et al (2014).[5] His subjects were patients with balance problems following minor head injuries and mild strokes. After eight sessions of neurofeedback training, a significant improvement was observed in all subjects. In subsequent studies, Hammond studied the effect of neurofeedback on skiers on the US national team and noticed its positive effects on athlete subjects. The use of neurofeedback to bring the athlete to the peak of performance in recent years has been highly regarded by researchers in this field. Given the importance of the balance factor in most sports as a determining factor in the quality of performance, this study seeks to determine the effects of neurofeedback training on cognitive-motor abilities.

MATERIAL AND METHOD

The present study is a quasi-experimental laboratory and applied research, which is a pre-test and post-test research design with a control group and an experimental group. Independently evaluate athletes' perceptual-motor abilities as a dependent variable. And since the process of measuring the dependent variable (perceptual-motor abilities) is independent of the presence of the researcher and is done by the examiner and considering that the examiner as well as the participants did not know about the classification and learning of people in different groups (real or fictitious neural feedback), the present design is double-blind.

Statistical Society: The statistical population of the study is athletics athletes who are in both sexes (girls and boys).

And for this purpose, 48 of them have been selected voluntarily and purposefully. Within a week, two members of the experimental group withdrew from the exercise. The number of samples was selected based on 80% test power and 95% confidence interval and according to similar researches that formed the statistical sample of the research. The samples were randomly divided into 2 groups of 15 people. 15 people in the training protocol group (experiment), 15 people in the control group.

Measuring tools:

1. In order to perform neurofeedback exercises, a neurofeedback device with US-made ProCamp hardware and US-made biographer software was used.
2. In order to measure the reaction time, the Asian Pars Circuit device, model PM-RT16881 made in Turkey was used. This device has two types of audible alarms with different frequencies and three types of optical alarms.
3. In order to measure the balance, the digital balance meter of Satrap company made in Turkey was used. The static balance device measures and analyzes the ability of the balance device, measuring the stability of the body position, body fluctuations indirectly based on the reaction of the static surface to the forces due to the displacement of the subject's center of gravity.

The information resulting from the shift of body weight (out of balance and return to balance) is used instantaneously and visually to calculate various parameters in two dimensions and when standing in both open and closed eyes.

How to use the device: The subject stands still on the balance plate (rigid and motionless plate) and according to the sensitive points of the plate (two claws and two heels), the smallest displacement of his body weight, which represents the force applied to each of the four points, which are two claws and The two heels are recorded at each moment, and finally the curves related to the displacements of the hypothetical points of the subject's center of gravity are displayed in the open and closed eye position.

CSAI-2 Anxiety Scale questionnaires were used to test anxiety.

We grade the CSAI-2 questionnaire with this instruction.

The CSAI-2 test has three subscales: Cognitive Anxiety, Physical Anxiety, and Self-Confidence. Each one is scored separately.

Validity: Considering that the research tool and working method are standard, its validity is confirmed.

Questionnaire reliability: Using the following formula, the alpha coefficient value was 85%.

Procedure: At the beginning of the coordination session in the amphitheater of the Faculty of Psychiatry, Erzurum University was held to acquaint the subjects with different types of neural feedback. After providing the necessary information and familiarity, those interested in participating in the research completed the forms of participation in the research and personal information**.**

Statistical Methods: In this study, in order to analyze the data, one-way analysis of variance was used and if significant, LSD post hoc test was used. Significance level was considered for p = 0.05. Also, Spss / pc ++ software package has been used to perform calculations.

Findings:

Table 1. The resultof simple reaction timeof athletes

Sources / Indexes	SS	df	MS	F	Sig.
Between groups	3985.34	2	1645.54	3.99	0.001
Within groups	14903.532	29	298.65		
Total	2685.92	31			

As table 1 shows there is a significant difference between 2 groups in selected reaction time.

DISCUSSION AND CONCLUSION

According to the results of the study, the selected simple reaction time of bsketball athletes in the experimental group after the neural feedback training was less than the simple and selective reaction time of the athletes in other groups. Reaction time is one of the most important measurements of human performance in many situations, and indicates the speed of decision-making and its efficiency. It is also an important aspect of understanding how the information processing steps work. As the results showed, the neural feedback exercises improved the simple and selective reaction time of the athletes in the experimental group.[6] To examine the changes that have taken place, we must look for these changes in the information processing process. Given that the beta wave is the fastest and most active form of short-range brain waves and is related to some intellectual activities, the center and focus of external attention and orientation, and expresses a state of consciousness with increased metabolism (56 and 13) and the points where the subjects in the reaction time group (Cz, 1.5 cm in front of FZ, parietal area) practiced.[7]

The results may be interpreted as beta-1 waves leading to better stimulus recognition by increasing attention, concentration, and alertness. On the other hand, increased cerebral blood flow in the cerebral cortex, which is accompanied by oxygen and glucose, has led to better functioning of the parietal or parietal area, also known as the motor-sensory area.[8] The experimental group has become more real than the other groups. As the results show, the effect of these exercises on the selected reaction time due to the existence of a longer processing phase due to the greater number of stimuli has a higher potential for effectiveness. The results obtained in this section were consistent with the results of Charness (2012) and inconsistent with the results of Birbaumer (2009).[9, 10]

Unfortunately, due to the lack of research in this field, there is little research to agreement and disagreement.

According to the results of the study, the static balance of basketball athletes in experimental group 2 after training was better than the static balance of athletes in the control group. Equilibrium is a typical motor response that depends on the integration of stimuli received from the visual and sensory systems.[11] Sense of sight tells you what relative position your body is in the environment. Sense data from internal receptors in the body tells you what relative position the different organs and parts of the body are in relative to each other.

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