Iran J Public Health, Vol. 52, No.10, Oct 2023, pp.2232-2233

Letter to the Editor

Neurofeedback on Reward Processing among Children with Attention Deficit/Hyperactivity Disorder

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(Received 13 Nov 2022; accepted 14 Dec 2022)

Dear Editor-in-Chief

Deficiencies in the reward system of children with attention-deficit/hyperactivity disorder (ADHD) especially dopamine D2 receptors, affect executive functions and motivational system (1). Thus, they are not motivated enough to perform at the same level as their normal-growing peers and they engage in impulsive actions to gain reward (1,2). It seems that neurofeedback can be effective in improving their performance. Neurofeedback can be used to reward brain and calm the nervous system (3). In fact, neurofeedback is a special protocol used to improve brain function, especially for the treatment of neuropsychological disorders such as; ADHD is useful (4). In other words, neurofeedback is essentially a reward system that teaches the brain how to function in a more optimal range and given the brain's ability to change and adapt to new patterns (Neuroplasticity) (5). Indeed, the brain is able to create new neural pathways that it stabilizes over time, and neurofeedback therapy seeks to reconstruct these pathways, which reward the brain through feedback, in other words, feedback is when the brain sends a specific wave to the computer (6). Therefore, neurofeedback is a reliable and non-invasive strategy to modulate the activity of dopaminergic regions.

The present study was experimental with pre-test, post-test, follow-up, and control group. The study population consisted of children aged 7 to 12 years with ADHD. Available sampling method was used for sampling in this study. The sample size was selected 46 people based on the purpose and method of research. Neurofeedback was performed on the intervention group as an intervention, each session was performed for 12 sessions and each session was performed for 45 minutes. Balloon risk test and Social-economic states scale were used to collect data in pre-test, post-test and follow-up stages and the data were analyzed by using SPSS-23 (IBM Corp., Armonk, NY, USA).

Following the implementation of treatment sessions, the dependent variables in the intervention group changed, which were different from those in the control group. In this regard, the mean of impulsivity (25.73±4.02, *P*=0.001), sensitivity to reward (34.13±2.31, *P*=0.001) and sensitivity to *P*unishment (26.87±2.09, *P*=0.001) decreased after the treatment sessions. On the other hand, the dependent variables in the control group were without any change in posttest phase. Indeed, the mean of impulsivity (32.87±4.08, *P*=0.24), sensitivity to reward (42.53±3.26, *P*=0.14) and sensitivity to punishment (33.27±2.21, *P*=0.22) in the control group were without any significant change (Table 1).

Table 1: Comparison of the mean scores of the groups

Variables	***Pretest***		***P***	***Posttest***		***P***
	Intervention M(SD)	Control M (SD)		Intervention M(SD)	Control M (SD)	
Impulsivity	32.40±2.63	32.60±2.05	*P*= 0.24	25.73±4.02	32.87±4.08	*P*= 0.001
Sensitivity to reward	42.27±3.07	42.73±3.03	*P*= 0.14	34.13±2.31	42.53±3.26	*P*=0.001
Sensitivity to punishment	32.12±3.2	32.67±3.4	*P*= 0.22	26.87±2.09	33.27±2.21	*P*= 0.001

Overall, voluntary activation of dopaminergic regions of the brain by neurofeedback and motivational manipulation leads to endogenous dopamine control in these structures, leading to successful regulation or inhibitory control and reduced cravings, which reduces impulsivity, and sensitivity to reward (7).

Acknowledgements

We thank all participants who helped us with this research.

Conflict of interest

The authors declare that there is no conflict of interest.

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