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Executive Functions in Patients with Cannabis Use Disorder, Recovered and Normal

1.Hasanshahi, Mohammad Mehdi* ; 2.Pooladi, Shirin

1.Assistant professor, Islamic Azad University, Arsanjan, Iran. m_hassanshahi@iaua.ac.ir
2.PhD student, Islamic Azad University, Arsanjan, Iran. shirinpooladi@ymail.com

Abstract

purpose of this study were compared Executive Functions and memory in patients with cannabis use, recovered and normal individuals. For this purpose, in a causal-comparative study, 50 patients who used cannabis who referred to Shiraz psychiatric centers, 50 patients recovered and 50 normal individuals were selected by available sampling method and were evaluated by the Wisconsin card sorting test and the Wechsler memory scale. Multivariate analysis of variance showed that the performance of cannabis group compared to the improved group and normal individuals and the performance of the improved group compared to the normal group in Wisconsin test and Wechsler memory scale were significantly different. But there was no significant difference in the perseveration error in the improved and normal groups. Therefore, it can be said that cannabis consumption disrupts the executive functions and memory of consumers and can continue even after quitting.

Keywords: Cannabis use, Executive Functions, Memory.

Introduction

Diagnostic and Statistical Manual of Mental Disorders-V (2013) describes the important feature of cannabis use disorder as the problematic consumption pattern, which causes significant clinical disorder or discomfort, and people continue to use c despite its significant problems. Cannabis is the most widely used and popular illicit substance around the world (Curran, et al., 2016) and its use is expected to increase regarding changes in the legal status of some countries (Frolli, et al., 2020). In addition, the introduction of synthetic cannabinoids with more severe psychological effects, had made governments and health care providers to conduct extensive studies to prevent the spread of these drugs and improve knowledge about their potential risks (Weinstein, et al., 2020). Continuous cannabis use has long-term negative effects (Volkow, et al., 2016) on memory and concentration (Hindocha, et al., 2017), physical and mental health as well as overall performance and cognitive function (Frolli, et al., 2020). Also, regular continuous use of cannabis makes structural changes in the brain (Lorenzetti, et al., 2019) and deteriorate cognitive and functional problems (Koenis, et al., 2021), which ultimately affect the brain organization and function. In this regard, executive function is stressed as an important cognitive function in cannabis-related disorders. In fact, cognitive function in general, and executive functions in particular are affected by cannabis use (Frolli, et al., 2020) which in turn, makes several deficits in attention (Koenis, et al., 2021), memory (Lovel, et al., 2020; Minarrd, 2021), concentration and stimulus evaluation mechanism, and finally, information processing ability decreases (Cohen, et al., 2020). Regarding permanent changes in the neural circuits of the brain specific areas and executive functions (Weinstein, et al., 2017) caused by the continuous use of cannabis on the one hand, and its increased consumption, especially among adolescents on the other hand, more research is needed. Obviously, identifying the cognitive changes caused by cannabis use both helps to better understand the problem and to offer more useful treatment strategies. Therefore,

inspired by the previous findings, the current study was performed to investigate executive and memory dysfunctions in cannabis patients compared to the improved and normal groups.

Method

This is a causal-comparative study. The sample consisted of 50 cannabis-using patients (referring to psychiatric clinics in Shiraz), 50 recovered patients (at least 6 months without any use) and 50 normal people with no history of drug use, and preferably a family member of the cannabis-using patients) who were selected through convenient sampling method, and matched in terms of education, age and marital status. The inclusion criteria were the absence of any other psychiatric and neurological disorder and cognitive impairments; definitive diagnosis of cannabis consumption disorder by a psychiatrist; no dependence on opioids; age range 16 to 20 years; and no drug use during the research period.

Wisconsin Card Sorting Test (WCST) were used to evaluate the research dependent variables. WCST, designed by Grant and Berg (1948), is widely used in the study of abstract behavior and cognitive flexibility. The validity of WCST for cognitive deficits following brain injuries has been reported above 0.86 (Lezak, 1995). The reliability of this test is reported 0.83 by the agreement coefficient of evaluators (Spreen and Strauss, 1991), and 0.85 in the Iranian sample by test-retest method (Naderi, 1994).

Wechsler Memory Scale (WMS) was designed by David Wechsler in 1945 to measure different memory functions (Ryan, et al., 1981). The reliability of WMS is reported 0.89 for the total scale, and 0.75 for personal and general information, 0.76 for orientation, 0.80 for mental control, 0.62 for logical memory, 0.68 for digit repetition, 0.80 for visual memory, and 0.68 for learning associations (Ryan, et al., 1981). To analyze the data, after confirming the important assumptions, multivariate analysis of variance (MANOVA) was performed through SPSS-24.

Findings

Table 1 manifests the mean and standard deviation of the scores of WCST and the WMS in the research groups.

Table 1. Descriptive components of the WCST and WMS in Research Groups

Test	Groups	Cannabis-users		Recovered patients		Normal	
	Subscales	**M**	**SD**	**M**	**SD**	**M**	**SD**
WCST	Preservation error	8.12	3.32	4.90	3.70	2.05	2.17
	Total error	11.43	4.20	7.74	4.81	4.96	2.11
WMS	Personal and general information	4.89	1.43	5.62	1.25	7.15	2.67
	Orientation	3.66	1.04	4.85	1.62	7.81	3.01
	Mental control	5.05	1.36	6.53	1.82	8.80	2.46
	Logical memory	8.99	2.19	14.08	2.93	13.17	4.12
	digit repetition	4.14	2.01	5.68	2.64	9.13	2.97
	Visual memory	6.21	1.41	8.77	1.64	10.61	2.43
	Learning associations	7.88	2.82	9.45	3.17	12.22	3.07
	Memory total score	76.56	6.68	96.37	8.16	114.67	19.63

Regarding the results of Lambda-Wilk's multivariate test (value = 0.056) which confirmed the significant differences between the research groups in terms of the variable (p = 0.0001), the dependent variables were evaluated (Table 2).

Table 2. Variance analysis of the intergroup effects in WCST and WMS

Source of dispersion	Dependent variable	Sum of squares	df	Mean of squares	F	P
WCST	Preservation error	501.66	2	250.83	18.34	0.0001
	Total error	884.86	2	442.43	22.06	0.0001
WMS	Personal and general information	144.88	2	68.72	18.37	0.0001
	Orientation	340.23	2	171.22	29.34	0.0001
	Mental control	345.01	2	174.26	45.46	0.0001
	Logical memory	683.32	2	365.42	28.50	0.0001
	digit repetition	452.21	2	241.32	39.02	0.0001
	Visual memory	429.60	2	212.87	55.49	0.0001
	Learning associations	187.62	2	199.35	19.06	0.0001
	Memory total score	50630.82	2	23672.41	531.11	0.0001

The results showed that the three groups were significantly different in terms of preservation error and total error in WCST. They were also significantly different in all the subscales of WMS (personal and general information, orientation, mental control, logical memory, digit repetition, visual memory, learning associations, and total memory score). Finding the groups differences required the use of multiple comparisons. Cannabis users' performance on the WCST was the worst, but there was no significant difference between the recovered patients and the normal individuals on the preservation error subscale in WCST. Also, Bonferny's multiple comparisons on the memory subscale in WMS showed that the mean of performance in the three groups was significantly different in all the subscales ($P < 0.0001$). In other words, the recovered patients performed weaker than the normal individuals on memory tasks.

Discussion and conclusion

It was revealed that cannabis-using patients had weaker executive and memory functions compared to the other groups. This was also true for the recovered patients compared to the normal individuals. These results point to the effects of cannabis consumption on executive and memory functions. Consistent with these results, the literature also emphasizes the impairment of executive functions in cannabis users. Overall, seemingly, cannabis use significantly impairs executive and memory functions even after its cessation (6 months later). In explaining the findings, the role of injuries in different areas of the brain, especially the frontal lobe, prefrontal and hippocampus to make executive dysfunctions could be stressed. Additionally, cannabis use may accelerate the process of apoptosis and neurogenesis (nerve tissue formation).

In shorts, neurophysiological and psychological processes involved in the cannabis use disorder cause neurophysiological, psychological and neuropsychological changes, including dysfunction of executive and memory functions. Therefore, these changes should be considered in the initial assessments of cannabis users in any treatment plan.

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Conflicts of interest

Authors have declared that no competing interests exist.