Comparison of Executive Functions in Addicted Young People who Referred to Addiction Treatment Camps with Students Ardebill

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Abstract— Background and aim of the study: *The present study compares the executive functions between pre-university male students and young addicted people who referred to addiction treatment camps.****Method:*** *The study is a causal-comparative study. The sample of study consisted of two groups of 25 male students and young addicted people who referred to addiction treatment camps of Ardebill city in 2014-2015, with coordination of sex, education and public health factors. Data was collected through researcher general health questionnaire for primary screening, Wisconsin Card Sorting Test, Stroop Color Word Test and the Wechsler Digit Span subscale. Data were analyzed by multivariate variance analysis.* ***Findings of the study:*** *data analysis indicated that there is a significant difference between the executive functions of young addicted people who are in addiction treatment camps and healthy students.****Conclusion:*** *According to the gathered results, it's likely that in addicts young, existence of neuropsychological anomalies such as weakness in executive function of response inhibition, Set shifting and updating of working memory, resulting in their weak performance compared to normal peers in the executive functions.*

Keywords— Addiction, executive function, set shifting.

I. INTRODUCTION

There exists considerable evidence from both human and experimental animals indicating the central nervous systems' vulnerability to the effects of drug exposure. Drug use, reaches a climax in people between 19 to 22-years old and then declines in people between 20 to 30 years. Young people in this age before committing themselves to the responsibilities of adulthood, like to try much more experiences, and among them it's more likely than younger and older people to smoke, consume marijuana and stimulant drugs. Through which they can increase their cognitive and physical performance (Department of Health and Human Services of America, 2005). Alcoholism, experimentation of prescribed drugs (Like OxyContin which is highly addictive painkillers), party drugs (such as LSD, ecstasy) also increase, which sometimes have dire consequences. The most important risks of these drugs are brain injury, durable impaired mental function and unintentional injury and death (Berck, 2007, Mohammadi, 2008).

Researches has shown that, all age groups are not in danger of addiction equally, and their age is important for addiction and putting them at risk. This vulnerability can be seen more especially among teenagers and young people. Adolescence is a period associated with increase of risk-taking and sensation seeking and often includes drug abuse (Somerville et al., 2010). Based on a national survey of drug use and health (Organization of Health Survey and Human Services of the United States), young people have shown higher rates of drug abuse compared to older age groups (Johnston and Saykin, 2008). In other surveys the history of cannabis use in nearly 45 percent of high school students (Twelfth grade) was obtained in the United States with a report of continuous use among 5% of them (Elrath et al., 2005). Evidence shows that a variety of self-regulation in executive functions during adolescence are still in maturation process. For this reason, teenagers sometimes unfortunately in some situations, have poor judgment and lack of impulse control, even though they tend to seek to increase the level of freshness and external stimulation (Crews & Hodge, 2007).

One of the factors that may play a role in the high rate of such behavior, is the continuation of immaturity in the executive functions (it's a neuropsychological word which refers to a high degree to cognitive control of thinking, action and feeling) (Zelazo, Karlson & Kesek, 2008). Adolescence may indicates a period of special vulnerability and some errors, and the reason is that the executive functions during the period of adolescence grow later than

the development of other cognitive skills (Diamond, 2002, quoted by Zelazo et al., 2010).

The researchers believe that, may be healthy cognitive function and performance is essential and important for self-control behaviors in facing with signs of drug use (Blume & Marlatt, 2007). Executive function skills start to grow in the early years of the babies' life and aspects of executive control over the entire life of a person is likely to continue growing. However, big developmental changes in executive control, during adolescence is remarkable (Chassin & Delucia, 1997, according to Blume & Marlatt, 2009), lack of executive cognitive functions linked with drug use among adolescents and young people, and self-regulation problems has been recognized as a risk factor for alcohol polydipsia problems among young people. Recent studies have reported a relationship between executive malfunction and addiction (George & Koob, 2010). They found a relationship between the vulnerability to addiction and defects of self-regulation, lack of attention, decision-making, responsiveness reward, excitement, pain, and stress. Garavan & Hester (2007), emphasized the role of attentional control, inhibition control, and revision (set of errors), as factors that predict a person's addiction.

The results of some studies indicated that, although many studies have shown the relationship between malfunctions of executive functions and curiosity for drugs use, but it's not clear to a large extent, whether malfunctions of executive functions are the results of facing with drugs or it's the result of vulnerability towards addiction (Li & Sinha, 2008).

Considering that, it's not yet entirely clear whether the malfunctions of executive functions in the brain results in addiction of adolescents and young people or these malfunctions are the consequences of drug use. Thus, comparing young people and teenagers who are in addiction treatment camps and don't use drugs can be a good example for comparing them with normal adolescents in their own age group. Teenager's brain undergoes conditional changes in structural and functional areas, particularly areas of the limbic cortex and the frontal regions, which are known excitement regulators in addition to executive and analytical processes. However, adolescents are in danger of risky behaviors which are the main causes of death and disease in their age group (Merrick et al, 2004). In the studies of Amini, Alizadeh and Rezaei (2012), Obeydi Zadegen, Moradi and Farnam (2008), Visik et al (2011), Wisconsin Card Sorting Test results indicate that, executive functions in addicts was lower than normal group. In other words, addicts showed demolitions in cognitive flexibility and concepts' changing.

The results of the study by Eshel et al (2007), revealed that teenagers often use less cognitive executive functions than adults in risky decision-making processes. The researchers believe that, the risk assessment capabilities for maturation may be continue until adulthood.

Yucel, Lubman & Facham (2007), in a case-control study obtained documents indicating that the destruction of the prefrontal functioning (executive functioning), may be create an uncontrolled, obsessive and risky pattern for drug searching which is characterized by dependence on drugs. The results of the study by Li and Sinha, revealed that there is a common and important neurobiological substrate in frontal cingulate cortex (prefrontal), which involves in response inhibition control, emotional regulation of stress, and tendency towards drug use. In a study by Tapert et al (2012), it was investigated how much brain responses to a measuring assignment of inhibition in young people (mid-teens) can predict drug use after 16 months. The results showed that disorders in cognitive control is strongly associated with drug use in the future. Word Joe-Garcia et al (2004) in their study, referred to the distinctive effect of the use of glass in the destruction of working memory and abstract reasoning index, the effect of cocaine in the destruction of inhibition control index and the effect of cannabis in the destruction of cognitive flexibility index. In the review study by Robbins, Arsch and Oriet (2008), the evidence suggests that, chronic abuse of many drugs could have a direct effect on memory systems through the dysfunctional effects on nerves and conformity of nerves, which lead to cognitive destructions that are important in memory dysfunction.

Chris and Hag (2006), in a review study offered evidence in support of that, adolescence is a critical period of cortex growth and vulnerability to addiction. They found that the growth of the frontal cortex is delayed in adolescents. Phil et al (2010), in a review study discovered that Striatal-frontal circuits are involved in the regulation of inhibition control, and dysfunction of these circuits can be effective in increasing problems related to drug withdrawal.

II. METHODOLOGY

Population and statistical sample of the study:

Population of the study included all High School male students who were studying during the years 2015 in schools of Ardebill as well as all drug addicted boys young who referred to addiction treatment camps in this city whose age range is between 19-30. The sample of the study

consisted of 25 normal students and 25 addicted young who referred to addiction treatment camps of Ardebill. Sampling method of the study will be random cluster sampling and screening method. According to the group of addicts, including young people who referring to addiction treatment camps, and because the number of this age group wasn't enough, sampling method was used, it should be noted that addicted people stay in the treatment camps for 40 days.

Measuring tools

Demographic characteristics questionnaires: This questionnaire was prepared by researchers to determine the demographic characteristics of subjects including age, sex, marital status and education level and also to check the exclusion criteria and control variables such as handedness, history of head trauma, mental and physical diseases, brain tumors, heart disease, and meningitis.

General Health Questionnaire (28 items GHQ): This questionnaire (Goldberg & Williams, 1989) will be used as a screening tool and to assess the general health of the subjects in this study. General validity coefficient of this test by Taghavi was earned 72.0.

Wisconsin Card Sorting Test (WCST): It tests the ability of abstract and change of cognitive strategies in response to changing environmental feedback and it requires planning, organized research and ability to use environmental feedback to change cognitive set shifting (Calaver et al., 2003, quoted by Qadiri, 2006). For the first time this test was prepared by Grant and Berger (1948, quoted by Lezak, 2004). But Milner (1963, quoted by the Javanmard, 2008) was the first one who introduced it as a test which tests the functions of frontal lobe. Miyake et al (2000) concluded that, the ability to change set shifting has an important part in this test. So in this study, the test was used to assess factors of set shifting. The reliability of the test to assess cognitive deficits after brain injuries is higher than 0.68 (quoted by Lezak, 2004). The validity of the tests based on agreement coefficient of assessors in Spearman's and Strauss' study (1998, quoted by Qadiri, 2010), is reported 0.83. Also, Naderi in Iran (1994, ibid), estimated reliability of the test in Iranian population by the use of retested method and it was estimated 0.85. A set of 64 cards was given to participants of the test, and on the card there's one to four symbols (Figure) of triangles, stars, crosses and circles in red, green, yellow and blue, and no two cards are the same. Task of the participants is, based on the presumption of other parties' pattern, replace the card. For example, if the principle being color, red card will be placed under red triangle regardless of the shape or number of symbols. Alternatively, the tester will answer. Tested participant only does the placement of cards, and mutually tester tells him whether replacements are correct or not. Tested participants of this test can be scored in several ways. The highest scores were used for the gathered categories and errors of preservation.

Stroop Color Word Test: This test is one of the most widely used tests of selective attention, focused attention and response inhibition (Chan et al., 2006, Bazikas, Cosmides, Kiyosoghelo and Karavatous, 2006), and for the first time was reported in Jay R. Stroop's doctoral thesis (1935). The version which is used in this study consists of three trials. In each trial, after presenting the agenda for the participants to being familiar with how to run the test, first two, then five workouts are given to participants to do them. In this study, the number of correct answers minus incorrect answers in the third trial (which is considered as interference task) was calculated. The reliability of the Stroop test, based on the researches of Othello and Graf (1995, quoted by Delazar, 2007) for all three trials and by the use of retest method were calculated, respectively1.0, 0.83, and 0.90. Test-retest reliability of this test for every three trials was reported, respectively 0.6, 0.83 and 0.97.

Digit Span subscale of the Wechsler for Adult: this sub-scale is a short-term memory and attention test (Grat Marnat, translated by Sharifi and Nikkhou, 1996), and Wolf (2004), considers it as measures of working memory, particularly the part of reverse numbers. In a national study in Psychological Association of America (1979), Standardization of the Wechsler memory test was conducted on a sample of 1250 people in 13 age groups, mean of Cronbach's alpha for this subscale in all age groups was 0.82, and test-retest reliability was 0.74, respectively. In a study which was done in Iran by Saed (2007, quoted by Asgarpour, 2009), the reliability of this subscale was 0.74 by the use of Cronbach's alpha method, and by split- half method it was 0.75.

III. RESULTS

Kolmogorov-Smirnov test

Variable	N	M	SD	Z	Significant level p>0.05
Set shifting	50	32.83	14.81	0.68	0.73
Working memory	50	17.1	3.2	0.93	0.34

Inhibition	50	64.30	14.60	1.03	0.23

To examine the differences between two groups in all three factors of executive function, multivariate variance analysis test was used, F test results and Eta share coefficient were, respectively 19.50 and 0.51, which was gained statistically at the significant level of 0.01.

Variable	Eta share coefficient	F	significant Level
Set shifting Working memory Inhibition	0.62	20.30	0.01

For the examination of set shifting in two groups, Wisconsin Card Sorting Test was used. This test gives two indices, the first index refers to the number of categories and the second index refers to perseveration errors. In order to compare two groups regarding the number of categories and perseveration errors, t-test was used, which was statistically significant at the level of p <0.05.

Wisconsin test	**Addicts**		**Students**		**Independent t-test**	**Significant level** P<0.05
Number of categories	3/82	Mean	12/83	Mean	-5.24	0.001
	1/67	Standard deviation	1/06	Standard deviation		

Wisconsin test	Addicts		Students		Independent t-test	Significant level P<0.05
Preservation error	44/84	Mean	17/93	Mean	9/26	0.001
	13/66	Standard deviation	5/53	Standard deviation		

According to independent *t* test results for the two groups, the value of calculated *t* for two variables of number of categories and preservation error, in degrees of freedom (48), was obtained, respectively -5.24 and 9.26, which was statistically significant at the level of P <0.05.

To examine the differences of inhibition factor between the two groups, Stroop test was used. The manual version of the test was used to show the number of correct trials in the third stage and they were calculated as the factor of inhibition.

Inhibition	Addicts		Students		Independent t test	Significance level P<0.05
Correct trials in the third stage of Stroop	5.76	Mean	70.53	Mean	-3.84	0.002
	13.84	Standard deviation	11.80	Standard deviation		

Calculated *t* (84.3), at degrees of freedom (48) at the level of P <0.05, is statistically significant.

Working memory	Addicts		Students		Independent *t* test	Significant level P<0.05
General memory	14.56	Mean	17.6	Mean	-3.72	0.002
	3.26	Standard deviation	3.04	Standard deviation		
Reverse memory	Addicts		Students		Independent t test	Significant level P<0.05
	6.23	Mean	8.83	Mean	-5.79	0.001
	1.5	Standard deviation	1.46	Standard deviation		

According to independent *t* test results for reverse memory in two independent groups, *t* was calculated (-5.79) in degrees of freedom (48), which was statistically significant at P<0.05 level.

IV. CONCLUSION

As was shown in Chris and Hodge's review study (2006), adolescence and early youth is a critical stage of growth in prefrontal cortex of the brain, and at this stage of growth due to structural and functional changes in prefrontal cortex, executive functions in some teenagers associated with weaknesses in functions that make them more vulnerable to environmental risks. As mentioned earlier, executive functions are responsible for regulating and controlling of behavior, emotions and our thoughts when dealing with the environment.

Considering that adolescence is a critical period of growth for executive functions, the tendency of adolescents towards drug abuse is caused by the weakness of executive functions in their brain. As mentioned in the results of the study, addicted young people under 21 years old, showed weaker performance in executive function (response inhibition, update of working memory and set shifting) compared to pre-university students, while the addict young people under 21 years old, after detoxification, were attempting for drug withdrawal inside the camp and they were controlled there. The results of the study shows the comparison of drug addicts in normal mode and away from drugs with students, and the difference in executive functions of addicts, can be a sign of weakness in their executive functions. According to the significant difference in executive functions of both groups, we can conclude that in adolescence and early youth, those young people who, due to structural and functional changes in prefrontal cortex and prefrontal areas, experiencing developmental delay or fluctuations in the growth of executive function (working memory, response inhibition and set shifting), when faced with risky situations, are more likely to show uncontrolled and risky behaviors, including drug abuse and weaker performance on executive functions. In other words, the group of addicts under 21 years, showed more weaknesses in the executive functions of response inhibition, updating of working memory and set shifting than the normal group.

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