JOURNAL OF SUBSTANCE USE
https://doi.org/10.1080/14659891.2020.1779360

Mini mental state examination (MMSE) in substance users and non substance users: A comparison study

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ABSTRACT

Background: Due to its progressive nature, substance use impacts the entire aspects of life, and can result in adverse repercussions on mental status. Accordingly, the current article seeks to compare the mental status of substance abusers with that of normal individuals.

Methods: The study is a cross-sectional research. The study population is comprised of 50 methamphetamine users, 52 opium users, and 100 normal individuals referred to Farabi Psychiatric Hospital in Kermanshah, 2018, in Iran. The subjects were selected by convenience sampling method and matched in terms of demographic characteristics. Data collection was performed using Mental State Examination (MMSE) and demographic questionnaire.

Results: The results showed that mean scores of orientation, attention, and mental status were significantly different between the normal and substance abusers ($P < .05$). However, the above-mentioned difference was not significant between methamphetamine abusers and opioid abusers ($P > .05$). In addition, the mean score of the language tests was statistically significant only among the normal and methamphetamine abusers ($P < .05$).

Conclusions: Based on the obtained results, it can be concluded that the opium and methamphetamine users showed poorer performance in MMSE than the normal group.

ARTICLE HISTORY
Received 26 January 2020
Revised 8 May 2020
Accepted 28 May 2020

KEYWORDS
Mini mental state examination; methamphetamine; opium

Introduction

The use of substances is one of the most important global risk factors for disability and early mortality (Lim et al., 2012). The amphetamine-type stimulants (ATS) that contain mainly methamphetamine (MA) are the second most used illegal substance in the world after cannabis (Su et al., 2018). Use of amphetamine-type substances (ATS) is an important contributor to the global burden of disease (Degenhardt et al., 2014). ATS are the second most commonly used type of illicit drug worldwide after cannabis (Degenhardt et al., 2013). Compared to cocaine or opiates precursors that can grow only in areas with appropriate weather and soil, the amphetamines group can be synthesized anywhere with availability to the incumbent components. While in Iran opium and its derivatives have traditionally been used. recently, the use of ATS (with methamphetamine as the dominant substance) has been increased. The use of methamphetamine was rare before 2005, but a few years later, research showed that nearly one-quarter of people with opioid dependence were methamphetamine users. And the use of amphetamine among former users of opium increased from 6% in 2009 to about 20% in 2011 (Bananej et al., 2018).

The use of amphetamine and methamphetamine can result in psychiatric complications in acute consumption, discontinuation, and chronic consumption. The most dangerous of these complications are psychosis and aggressive behavior, but it creates various types of unwanted changes in cognition and emotions. Use of amphetamine and methamphetamine causes several changes in the gray and white matters of the brain, such as volume changes of tissue, metabolism, or at the molecular level which are associated with psychiatric symptoms (Harro, 2015). Also, Interpersonal problems, impulsivity, and unemployment interfere with everyday life (Semple et al., 2005). In addition, there are significant negative effects on many neurocognitive domains including attention, memory, visual memory, information processing, language functions, processing speed, learning, and executive function (Casaletto et al., 2015; Jovanovski et al., 2005; Kalechstein et al., 2003; Rogers & Robbins, 2001; Scott et al., 2007). Ability to understand spatial relationships the place of objects in their environment, and plays an important role in daily life. Unfortunately, our current understanding is rather limited about the impact of MA use in spatial processing. A number of small animal studies suggest that MA exposure may lead to a significant deficit in spatial learning, and poor performances in the spatial task (Hrebickova et al., 2016). It was also reported that abstinent MA users for 6 months presented considerably impaired social emotion cognition and spatial working memory (Zhong et al., 2016). However, the impact of MA use has been rarely investigated in human spatial cognitive function. Notably, accumulating evidence indicates that methylene dioxy methamphetamine (MDMA) is associated with the impairment of visuospatial processing (Luo et al., 2018). There is no treatment for some neurologic complications

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associated with chronic methamphetamine use, such as cognitive impairments. Understanding the relationship between the molecular mechanisms underlying neurotoxicity of methamphetamine and related clinical manifestations may help to develop pharmacological treatment of neurologic impairments associated with METH use, as well as improve therapies aimed at METH dependence and relapse (Yang et al., 2018).

According to World Drug Report 2015, about 16.5 million people, 0.4% of the world's adult population, use opiates such as heroin and opium (UNODC, 2015). In addition to being a worldwide problem, opium is traditionally used in many south-central Asian countries, especially Iran, Pakistan, Afghanistan, and India (Shakeri et al., 2013). Considering the long border between Iran and Afghanistan (a country with large opium production), opium is readily available in Iran (Naghibzadeh Tahami et al., 2014). In fact, in 2012 and 2013, Iran had the first rank regarding the quantity of opium seized (UNODC, 2015). Opium consumption is more common in northern and southern parts of Iran(Naghibzadeh Tahami et al., 2014). In a study on substance users in Drop in Centers in Shiraz, a major city in southern Iran, opiates were the most common substances used (Salehi et al., 2015). The opiate compounds used by Iranian people were reported to be opium, followed by shireh (opium residue), heroin, and hashish (Fallahzadeh et al., 2017).

Opiate use also correlates with long-lasting cognitive deficits in humans. Users of morphine, heroin, and methadone show impairments in episodic memory, visual memory, verbal memory, information processing, problem-solving, word fluency and attention, and spatial tactile and verbal memory. In addition to the effects of chronic use of opiates, Curran et al. (2001) showed that a single dose of methadone resulted in impaired episodic memory in a population tolerant to opiates. Although several studies have suggested that opiate user-related cognitive decline may be linked to compromised frontal lobe function, studies examining the effects of opiate exposure on hippocampus morphology and hippocampus-dependent learning and memory suggested that some of the cognitive deficits observed in opiate users may be related to altered hippocampal function. For example, opiates have been shown to inhibit adult neurogenesis in the hippocampus and alter proteins associated with a hippocampal synaptic density such as clathrin (Kutlu & Gould, 2016).

Estimates regarding the prevalence of cognitive impairment in SUD patients vary widely and range from about 30-80% (Copersino et al., 2009). Cognitive deficits have an impact on treatment and outcome, including patient's understanding of the problem, as well as with treatment compliance and relapse. These cognitive deficits may be amenable to retraining, thereby having an impact on the overall prognosis. A knowledge of past and present cognitive dysfunction is important in treating persons with addiction, as these cognitive changes may result in what is perceived as 'denial' and the person continues to engage in behaviors that maintain the addictions. Such cognitive deficits may also hinder the person's ability to benefit from counseling and more sessions and/or reminders may be necessary to aid these patients in incorporating abstinence-sustaining strategies into their daily routines (Gupta et al., 2018).

There is a need to develop a routine screening instrument for cognitive function in persons with substance use disorders and monitor cognitive functions at follow-up, both to determine the restitution of these functions with abstinence, as well as to monitor for lasting cognitive impairment, which may warrant the use of other psychosocial strategies apart from those routinely used in addiction recovery. Accordingly, the current article seeks to compare the mental status of substance users with that of non substance users individuals.

Method

The present study was approved by the ethics committee of Kermanshah university of medical sciences, Kermanshah, Iran. This is an analytical study that was conducted to evaluate and compare the score of mini-mental state examination (MMSE) in people with methamphetamine or opium dependence and non substance users. The study population included all patients with methamphetamine or opium dependence who referred to Farabi hospital in Kermanshah, Iran, in 2018. Healthy non-relative attendants were considered as a control group. Diagnosis of methamphetamine or opium dependence was confirmed by a psychiatrist based on the DSM-IV-TR structural interview. After receiving written informed consent from the patients, they were asked to complete MMSE. The inclusion criteria were age range of 20 to 50 years, having at least middle school, Diagnosis of methamphetamine or opium dependence based on DSM-IV-TR criteria and exclusion criteria included: Having diagnostic criteria for other psychiatric disorders, any medical comorbidities, history of alcohol use over the past 5 years, more than one substance addiction at the same time. The statistical population was selected through the available sampling method and assigned to three groups of patients with methamphetamine dependence, opium dependence, and control group. Fifty patients as methamphetamine group, 52 as opium group and 100 as non-substance users group entered in the study.

Mini-Mental Status Examination (MMSE)

A translated (to Persian) and validated version of the test was used, which had also been applied before to a similar population. This exam consists of 11 items that evaluate 5 areas of cognitive function: orientation, attention, calculation, memory, and language. The maximum score allowed is 30 points. All individuals with scores between 24 and 30 points were considered to be without cognitive impairment.

Data analysis

All of participants were evaluated for demographic data including age, gender, marital status, level of education, occupation. The collected data were entered into SPSS-20 software and analyzed by appropriate analytical methods. To determine the distribution of age, gender, marital status, level of education, occupation, frequency, and percentage were used as descriptive statistics. Chi-square test was used to evaluate the homogeneity of demographic variables such as age, gender, marital status, occupation, and educational level in three groups. And if needed to adjust, Fisher's exact test was used.

Ethical considerations

The study was approved by the ethics committee of the vice chancellery of research and technology, Kermanshah University of Medical Sciences (KUMS.REC.227). In order to follow the ethical principles, the questionnaires were filled out after obtaining the informed consent of the participants, and they were assured that their information would stay confidential.

Results

Fifty patients with methamphetamine dependence, 52 patients with opium dependence and 100 as non-substance users group participated in this study. The results of the correlation showed that the three groups were matched in terms of demographic characteristics such as age, gender, marital status, occupation, and education level ($P > .05$) (Table 1).

Distribution of the scores of mental status were very similar in two groups of opium dependence and methamphetamine dependence. But the distribution of mental status scores for each of the opium and methamphetamine groups was different from the non substance users group. In the non-substance users group, 94.0% of persons got the non-substance users mental status score of 25.1–30, % 9.0 scored 20.1–25 (mild), and 2.0% scored 10.1–20 (moderate). The score of none of the non-substance users group was not in the range of 0–10 (sever). In the opium dependent group, 24 (46.2%) were in non-substance users range, 19 (36.5%) were in mild range, 7 (13.5%) were in moderate and 2 (3.8%) were severe cases. In the methamphetamine-dependent group, 23 (46.0%) were non-substance users, 18 (36.0%) were mild, 7 (14.0) were moderate and 2 (4.0%) were severe. The results of the correlation showed that there was a strong significant statistical relation between mental status score (with different cutting levels) and the studied groups ($P < .05$) (Table 2).

After charting (Q–Q) and confirming the non-substance users of univariate scores of each dependent variables of orientation, calculation, attention, language tests, constructs and the overall score of MMSE, the mean scores of these variables were compared with the multivariate analysis of variance (MANOVA) among the three groups. Box test results showed that the observed covariance matrix of the dependent variables (orientation, calculation, attention, language testing, construction, and general MMSE score) is homogeneous (F (42,68401.85) = 21.78, $P < .0001$). The results of Bartlett's Test of Sphericity also showed that the dependent variables are sufficiently correlated (x^2 = 1541.83, $P < .0001$). Also, the results of Levene's Test showed that the error variance of the dependent variables was equal in the studied groups ($P > .05$) and multivariate effects were statistically significant among the groups (F = 5.63, $P < .0001\eta2 = 0.148$). The results of single-variable tests indicated that except construction there was a statistically significant difference between the mean scores of orientation, recording, attention, language tests and the overall score MMSE among the methamphetamine dependence, opium dependence, and non-substance users people ($P < .05$). In other words, for all the variables of the MMSE, except the constructive variable, the mean scores in the non substance users group were higher than the two other groups. The means of orientation, calculation, language tests and an overall score of MMSE in opium dependents were higher than in methamphetamine dependents, but the mean of attention in methamphetamine-dependent group was higher than opium dependent group. However, this difference was not significant between methamphetamine dependents and opium dependents ($P > .05$). Also, the difference in mean of record and language tests was statistically significant only among the non-substance users and methamphetamine-dependent groups ($P < .05$) (Table 3).

Discussion

The current research aimed to investigate the mental status of drug users and non-substance users people. The results showed that substance users had poorer performance on attention, orientation, and language performance than the non-substance users group. However, the difference was not significant between opium and methamphetamine users. Similarly, a meta-analysis conducted by Scott et al. (2007) on methamphetamine users and non substance users subjects indicated that methamphetamine users (compared to non-

Table 1. Demographic characteristics and association results of age, gender, education, occupation, marital status of studied groups.

		Groups n (%)				
Variable	Level	Normal group	Opium dependence group	Methamphetamine dependence group	Total	x^2(Sig)
Age	15–25	10(10.0)	7(13.5)	9(18.0)	26(12.9)	11.40
	26–35	5252.0	19(36.5)	27(54.0)	98(48.5)	(0.07)
	36–45	23(23.0)	13(25.0)	12(24.0)	48(23.8)	
	> 45	15(15.0)	13(25.0)	2(4.0)	30(14.9)	
Gender	Female	7(7.0)	3(5.8)	5(10.0)	15(7.4)	0.72
	Male	93(93.0)	49(94.2)	45(90.0)	187(92.6)	(0.69)
Education	Middle school	78(78.0)	42(82.4)	42(84.0)	162(80.6)	3.96
	High school to diploma	15(15.0)	7(23.3)	8(26.7)	30(14.9)	(0.41)
	Academic	7(7.0)	2(3.9)	0(0.0)	9(4.5)	
Occupation	Employee	13(13.0)	8(15.4)	714.0()	28(13.9)	1.36
	Self-employed	28(28.0)	16(30.8)	18(36.0)	62(30.7)	(0.85)
	Jobless	59(59.0)	28(53.8)	25(50.0)	112(55.4)	
Marital status	Single	53(53.0)	21(40.4)	26(52.0)	100(49.5)	7.65
	Married	40(40.0)	26(50.0)	15(30.0)	81(40.1)	(0.10)
	Divorced	7(7.0)	5(9.6)	9(18.0)	21(10.4)	
Total		100(100.0)	52(100.0)	50(100.0)	202(100.0)	-

Table 2. Frequency distribution of the MMSE score in the studied groups and the results the association between the scores of MMSE and the groups studied.

Variable	Levels	Normal group n(%)	Opium dependence n(%)	Methamphetamine dependence n(%)	Total n(%)	x^2(Sig)
MMSE1	< 24	6(6.0)	20(38.5)	18(36.0)	44(21.8)	29.04
	≥ 24	94(94.0)	32(61.5)	32(64.0)	158(78.2)	(< 0.0001)
MMSE2	0–17	0(0.0)	5(9.6)	6(12.0)	11(5.4)	30.69
	18–23	6(6.0)	15(28.8)	12(24.0)	33(16.3)	(< 0.0001)
	24–30	94(94.0)	32(61.5)	32(64.0)	158(78.2)	
MMSE3	0–10 (Sever)	0(0.0)	2(3.8)	2(4.0)	4(2.0)	43.01
	10.1–20 (Moderate)	2(2.0)	7(13.5)	7(14.0)	16(7.9)	(< 0.0001)
	20.1–25 (mild)	9(9.0)	19(36.5)	18(36.0)	46(22.8)	
	25.1–30 (Questionably Significant)	89(89.0)	24(46.2)	23(46.0)	136(67.3)	
Total		100(100.0)	52(100.0)	50(100.0)	202(100.0)	

Table 3. Results of the means comparison of orientation, recording, attention, language tests, constructs, and total score among the studied groups.

								Post Hoc Tests		
	Variable	Group	Number	Min-Max	Standard deviation ± mean	ANOVA F (Sig)	Partial Eta Squared	Compared groups		(Sig) Mean difference
MMSE	Orientation	(1)[a]	100	8–10	9.95 ± 0.26	27.71	0.218	(1)	(2),(3)	1.43*(< 0.0001),1.95*(< 0.0001)
		(2)[b]	52	0–10	8.52 ± 2.08	(< 0.0001)		(2)	(1),(3)	− 1.43*(< 0.0001),0.52(0.25)
		(3)[c]	50	0–10	8.0 ± 2.52			(3)	(1),(2)	− 1.95*(<0.0001),-0.52(0.25)
	Record	(1)	100	0–7	2.91 ± 0.71	3.055	0.030	(1)	(2),(3)	0.14(0.57),0.35*(0.04)
		(2)	52	0–3	2.77 ± 0.76	(0.049)		(2)	(1),(3)	−0.14(0.57),0.21(0.40)
		(3)	50	0–3	2.56 ± 1.05			(3)	(1),(2)	− 0.35*(0.04),-0.21(0.40)
	Attention	(1)	100	0–8	6.82 ± 1.87	12.27	0.110	(1)	(2),(3)	1.65*(0 < 0.0001),1.46*(0.001)
		(2)	52	0–8	5.17 ± 2.62	(< 0.0001)		(2)	(1),(3)	− 1.65*(<0.0001),-0.19(0.91)
		(3)	50	0–8	5.36 ± 2.47			(3)	(1),(2)	− 1.46*(0.001),0.19(0.91)
	language tests	(1)	100	0–7	6.60 ± 0.97	4.56	0.044	(1)	(2),(3)	0.37(0.07),0.46*(0.021)
		(2)	52	2–7	6.23 ± 0.92	(0.012)		(2)	(1),(3)	−0.37(0.075),0.09(0.89)
		(3)	50	2–7	6.14 ± 1.07			(3)	(1),(2)	− 0.46*(0.021),-0.09(0.89)
	Construction	(1)	100	1–2	1.98 ± 0.14	1.12	0.011	(1)	(2),(3)	−0.25(0.41),0.06(0.95)
		(2)	52	1–18	2.23 ± 2.25	(0.33)		(2)	(1),(3)	0.25(0.41),-0.31(0.36)
		(3)	50	18–30	1.92 ± 0.27			(3)	(1),(2)	−0.06(0.95),-0.31(0.36)
	Total score	(1)	100	5–30	28.24 ± 2.51	24.69	0.199	(1)	(2),(3)	3.91*(< 0.0001),4.16*(<0.0001)
		(2)	52	9–30	24.33 ± 5.17	(< 0.0001)		(2)	(1),(3)	− 3.91*(<0.0001),0.25(0.95)
		(3)	50	5–30	24.08 ± 5.21			(3)	(1),(2)	− 4.16*(0.0001),-0.25(0.95)

[a]1-normal group, [b]2-opium dependent group, [c]3-methamphetamine dependent group.

substance users subjects) showed deficits in learning, executive function, memory, processing speed, and to some extent, in the area of the language.

Further, Kalechstein et al. (2003). investigated the association between cognitive neuropathy defect and methamphetamine dependence in a 27-person sample. Methamphetamine addicts had significantly more problems with attention, psychomotor speed, verbal learning, and memory than the non-substance users group.

In other research, Jovanovski et al. (2005). examined the neurological deficits in cocaine users. The study was conducted on 481 cocaine users and 586 non-substance users subjects. The results showed that cocaine use had the highest impact, and cocaine users experienced some disorders including attention deficit disorder, visual memory, operational memory, language functions, and motor sensory functions.

In addition, Rogers and Robbins (2001) in a review examined neuropsychological deficits associated with chronic substance use, and concluded that attention and memory impairment is associated with substance use.

On the basis of the findings of the study, it can be said that impairment to some cerebral areas can cause attention deficit disorder, which one of the sensitive areas is the front-*striatal* connections (Motzkin et al., 2014). Substance addicts suffer from many problems when they are required to focus on homework assignments that necessitates attention (Gould, 2010). An addict's brain is less active than non-substance users people in the anterior-visual and anterior-frontal areas (Goldstein et al., 2009; Simon et al., 2010). Simon et al. in a research indicated that the destruction of dopaminergic neurons in the frontostriatal areas such as striatum and the anterior cingulate cortex (ACC) is associated with impaired selective attention and cognitive control among the methamphetamine users.

In addition, an animal study showed that hippocampal inhibitory neurons caused by the use of methamphetamine leads to some defects in cognitive processes dependent on the hippocampus (Takashima & Mandyam, 2018). Consumption of substances such as opium can affect neurotransmitters that discharge dopamine terminals in the striatum, increase the release of serotonin and norepinephrine, and release glutamate from the cell. This causes functional changes in the brain and leads to psychological and cognitive problems (Sulzer, 2011). Furthermore, cognitive problems in people with substance use may also be due to the direct effect of the substance on the brain and the effects on the cerebral systems and frontal-hippocampal fragments (Kutlu & Gould, 2016).

Generally speaking, substance use can lead to changes in mental status and cognitive impairments. Investigating the mental status of substance users is of critical theoretical and clinical importance, as problems with mental status can be a barrier to treatment. Therefore, advances in drug use prevention and treatment require a greater understanding of the importance of cognitive impairment in initiating and maintaining substance use behavior, and research is needed to prevent drug use.

Conclusion

On the basis of the current research results, it can be concluded that the opioid and methamphetamine users showed a poorer performance in the MMSE than the non-substance users people, although any definite viewpoint on the issue requires further forthcoming research. Substance use can have a serious detrimental effect on human health, and there is not any specific therapeutic strategy or solution to these side effects. Thus, a closer and more detailed examination of the drug use effects is of necessity to be able to develop and adopt informative and preventive programs on the issue. The present study was accompanied by limitations such as the low number of participants and the avoidance of intruding variables. Thus, it is recommended to eliminate these issues in the forthcoming research, and, if possible, to examine the mental status of the people addicted to stimulants and opiates.

Acknowledgments

The authors would like to thank the Substance Abuse Prevention Research Center, Clinical Research Development Center, Imam Khomeini and Mohammad Kermanshahi and Farabi Hospitals, Kermanshah University of Medical Sciences, Kermanshah, Iran for their cooperation and scientific assistance throughout the period of study.

Disclosure of potential conflict of interest

The authors declared no conflicts of interest.

Funding

This Study was supported by the Kermanshah University of Medical Sciences, Kermanshah, Iran (Grant no. 97214).

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