

Personality traits and its relation to craving and serum oxytocin among male patients with opioid dependence

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Received: 24 December 2020

Revised: 15 January 2021

Accepted: 5 February 2021

Published: 2 July 2021

Egyptian Journal of Psychiatry 2021, 42:59–68

Background

As craving is one of the main problems that affect substance users and their progress during treatment, it was important to investigate personality traits that affect it. Although oxytocin (OT) system is regarded as being of relevance for social interaction, very few studies have investigated the relationship between OT and personality traits in clinical psychiatric populations.

Objectives

The aim of the work is to assess the personality traits among patients with active opioid dependence in comparison with abstinent patients and healthy controls and to assess the relation of personality traits with the degree of craving and serum OT level.

Patients and methods

A consecutive sample of 30 opiate-dependent patients who fully meet the fifth edition of the Diagnostic and Statistical Manual of Mental Disorders (DSM-V) criteria for opiate dependence and 30 patients fulfilling the DSM-V criteria of opiate dependence with at least 6 months of abstinence were assessed regarding personality traits, serum craving levels, and OT levels using Personality Inventory for DSM-brief form, brief substance craving scale, and immunoassay kit, correspondingly. They were compared with each other and with a sample of 30 healthy controls matching both groups.

Results

Total personality dysfunction scores were statistically significantly higher in the patient group than the control group ($P < 0.001$) and the abstinent group ($P < 0.05$). There was no statistically significant difference between the abstinent group and the control group. A positive correlation was found between craving and total personality dysfunction ($P < 0.001$) as well as each of the five traits [negative affect ($P < 0.05$), detachment ($P < 0.001$), antagonism ($P < 0.05$), disinhibition ($P < 0.001$), and psychoticism ($P < 0.05$)]. Craving levels showed a statistically significant difference between the patient group and the abstinent group ($P < 0.001$). There was a statistically significant difference between the patient group and the control group in serum OT levels ($P < 0.05$). The correlation between personality dysfunction and serum OT level in the patient group was not significant.

Conclusion

The interaction between personality traits, craving, and serum OT levels should be considered when dealing with opiate-dependent patients as they affect and are affected by opiate dependence. Further studies regarding how to implement this during the patient's treatment should be considered.

Keywords:

addiction, craving, opiate dependence, oxytocin, personality dysfunction, personality traits

Egypt J Psychiatr 42:59–68

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1110-1105

Introduction

The complex relation between substance abuse and personality traits, problems, and disorders is best illustrated by attempts to differentiate addiction from personality constructs over the past 50 years. The first (American Psychiatric Association, 1952) and second (American Psychiatric Association, 1967) editions of the Diagnostics and Statistical Manual (DSM) classified alcoholism and drug addiction initially as types of 'sociopathic personality

disturbances,' and then later under a broader category of 'personality disorders,' identifying explicitly an overlap of addiction and personality. This conceptualization was abandoned with the radical change of DSM-III (American Psychiatric

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Association, 1980) and its differentiation of substance use from personality disorders through their relocation on separate axes. The median rates of personality disorders across different studies range from a low of 44% for alcohol to a high of 79% for opioid-dependent patients (Verheul *et al.*, 1998). The presence of a personality disorder appears to render substance abusers more susceptible to relapse in the presence of craving, negative physical and emotional states, and interpersonal conflict (Smyth and Washousky, 1995) and worse outcome when provided routine or less intensive addiction treatment (Thomas *et al.*, 1999). As craving is one of the main problems that affect substance users and their progress during treatment, it was important to investigate personality traits that affect it (Zilberman *et al.*, 2003). Craving is related to multiple dimensions, including biological and psychosocial aspects. In the psychological field, certain personality traits have been posited to affect the craving experiences of substance users (Zilberman *et al.*, 2003). High impulsiveness and novelty seeking seem to be associated with craving in individuals with alcoholism and cocaine/crack users (Papachristou *et al.*, 2012). Neuroticism and impulsiveness have been correlated with craving among nicotine-dependent and opiate-dependent patients (Powell *et al.*, 1992). Personality traits of novelty seeking, reward dependence, and harm avoidance interacted with craving intensity and the personality trait of persistence interacted with craving duration throughout the treatment period (Ismael and Baltieri, 2014). A possible explanation for the mediating role of craving in the association between negative affect and opioid misuse is the interaction between the neural pathways involved in the regulation of craving and drug use, which are primarily located within the mesolimbic areas, and involve the nucleus accumbens, the amygdala, the prefrontal cortex, and the anterior cingulate cortex (Weiss, 2005). The mesolimbic system receives direct projections from cortical areas involved in the regulation of negative affect, providing a neural basis for the influence of negative affect on craving and patterns of drug use. For example, previous studies have found that negative affect may enhance drug craving and the likelihood of drug abuse through increased dopaminergic activity in cortical and subcortical mesolimbic areas (Martel *et al.*, 2016). In addition to dopamine, many preclinical studies have shown that neuroadaptations of the brain oxytocin (OT) systems (whether preexisting or substance induced or both) may be, at least partially, responsible for certain behavioral, cognitive, and emotional deficits that are present in active and in abstinent users and may be associated with drug cues,

drug-seeking behavior, and relapse (Georgiou *et al.*, 2016). Despite a growing body of preclinical evidence demonstrating OT's effects on opioid tolerance, withdrawal, and self-administration in rodents (Sarnyai and Kovács, 2014), studies investigating OT's effects in humans with opioid use disorder are sparse.

The role of OT as a neurotransmitter and neuromodulator in the brain has recently received increasing attention. OT-producing neurons located in the hypothalamus innervate brain regions associated with stress, reward, mood, fear, emotionality, and drug-seeking behavior, such as the amygdala, septum, nucleus accumbens, and the bed nucleus of stria terminalis, where OT receptors are expressed (Zanos *et al.*, 2017).

The location of OT's receptors throughout the mesocorticolimbic dopamine system places OT in an ideal position to influence a wide range of motivated behaviors (Burkett and Young, 2012). Traits such as impulsiveness and negative emotionality which are linked to social functioning in several psychiatric disorders such as substance use disorders seem to be associated with endogenous plasma OT levels (Bendix *et al.*, 2015). Although OT system is regarded as being of relevance for social interaction, very few studies have investigated the relationship between OT and personality traits in clinical psychiatric populations. The hypothesis of this study is that patients with active opioid dependence have dysfunctional personality traits to a greater degree than abstinent patients and controls, and personality traits are related to the degree of craving and serum OT level. The aim of the work is to assess the personality traits among patients with active opioid dependence in comparison with abstinent patients and healthy controls and to assess its relation to degree of craving and serum OT level.

Patients and methods

Design

This was a cross-sectional comparative study that included a convenient sample of male Egyptian patients with opioid dependence. Enrollment of patients started in January 2018 and was completed in September 2018.

Participants

Participants of this study were included in three matched groups aged 20–60 years, with 30 male participants in each group. Participants of the first

group (group 1) were patients who met DSM-V criteria for opioid dependence seeking treatment with current active opioid intake of minimum 3–6 days. The second group (group 2) included patients fulfilling DSM-V criteria for opioid dependence with at least 6-month abstinence who had already started the treatment program and with negative urine screening test result for substances of abuse. Patients of this group were attending the day-care service in Kasr Al-Ainy Psychiatry and Addiction Hospital after completion of 30-day detoxification in the inpatient department. Participants of both groups were consecutively included, and we excluded patients with psychiatric comorbidities, chronic medical illnesses, organic brain disease, patients with either intoxication or withdrawal symptoms, and current substance dependency other than opioids (diagnosed by both clinically and by urine screening test). The control group (group 3) consisted of 30 visitors at the outpatient clinics of Kasr Al-Ainy Hospital with no history of substance abuse and negative urine screening test result for any substance of abuse. All participants were asked to sign an informed consent before joining the research.

Ethical approval was obtained from the ethical committee of the Department of Psychiatry, Faculty of Medicine, Cairo University, before beginning the clinical work.

Measures

Structured clinical interview for Diagnostic and Statistical Manual of Mental Disorders-IV-TR axis I disorders (First et al., 2002)

A structured interview was used to determine DSM-IV axis I disorders (major mental disorders). There are many published studies in which structured clinical interview DSM was the diagnostic instrument used. The structured clinical interview DSM is broken down into separate modules corresponding to categories of diagnoses. The Structured Clinical Interview for DSM-V (American Psychiatric Association, 2013) substance use disorders section was not used to diagnose or exclude the substance use disorders as the Arabic version is not available yet. The diagnosis was made by the researchers of the study.

Serum oxytocin level

Serum OT was measured using EIAab, an immunoassay kit that allows for the in-vitro quantitative determination of general OT concentrations in serum, plasma, tissue homogenates, cell culture supernatants, and other

biological fluids. Overall, 2 ml of blood was drawn from participants through aseptic venipuncture in an EDTA tube. Specimens were stored at 2–8°C and delivered to the Kasr Al-Ainy Teaching Hospitals Clinical Pathology laboratories within 30 min of collection. Samples were centrifuged at 1600g for 15 min at 4°C and then frozen at –20°C till extraction was performed. Detection range was 31.2–2000 pg/ml.

Addiction severity index (McLellan et al., 1992)

This scale was applied to the patients of the patient group and abstinent group only. The addiction severity index (ASI) is a semistructured interview designed to provide a multidimensional assessment of problems presented by patients with SUDs to guide initial treatment planning and to allow monitoring of patient progress over time. It is designed for use in inpatient and outpatient alcohol and drug abuse treatment settings. It is composed of seven subscales, which measure the severity of medical, occupational, alcohol and drug use, legal, and family/social and psychiatric problems.

Brief substance craving scale (Heinz et al., 2006)

The scale is used to assess the craving experienced by the patients. It includes a 14-item Likert-type scale rating the intensity, frequency, and length of their craving to opioids. Ratings were then scored on a scale of 0–12 (0 means no cravings and 12 means severe cravings).

Personality Inventory for Diagnostic and Statistical Manual of Mental Disorders-V-brief form (Krueger et al., 2013) Arabic Version (Shahin et al., 2018)

This Personality Inventory for DSM-V-brief form (PID-5-BF) is a 25-item self-rated personality trait assessment scale for adults age 18 years and older. It assesses five personality trait domains including negative affect, detachment, antagonism, disinhibition, and psychoticism, with each trait domain consisting of five items. The measure is completed by the individual before a visit with the clinician. Each item on the PID-5-BF asks the individual to rate how well the item describes him or her generally.

Each item on the measure is rated on a four-point scale (i.e. 0=very false or often false; 1=sometimes or somewhat false; 2=sometimes or somewhat true; and 3=very true or often true). The overall measure has a range of scores from 0 to 75, with higher scores indicating greater overall personality dysfunction. Each trait domain ranges in a score from 0 to 15, with higher scores indicating greater dysfunction in the

specific personality trait domain. The scale was translated and backtranslated into Arabic.

Statistical analysis

IBM SPSS software package, IBM SPSS Statistics for Windows (2017), version 25.0 (IBM Corp., Armonk, New York, USA) was used for data analysis. Data were summarized using mean, SD, median, minimum, and maximum in quantitative data and using frequency (count) and relative frequency (percentage) for categorical data. Comparisons between quantitative variables were done using Mann–Whitney tests. For comparing categorical data, χ^2 test was performed. Correlations between quantitative variables were done using Spearman correlation coefficient. *P* values less than 0.05 were considered statistically significant, and less than 0.01 were considered highly significant.

Results

The three groups in this research were matched regarding age, education, occupation, and marital status ($P=0.565$, 0.455 , 0.159 , and 0.271 , respectively) (Table 1). Tramadol was the drug of choice in both patient groups (22 patients in each group); however, this choice did not differ from the two other choices, heroin and tramadol, significantly ($P=0.639$) (Table 1). Patients in recovery had used lower doses of opioids for fewer years than those in the opioid-dependence group ($P=0.280$ and 0.001). The mean abstinence period from opioids in group 2 was 318 days (10.6 months) (Table 1). Patients in groups 1 and 2 showed significant differences in all the ASI modules except legal status and family status ($P=0.394$ and 0.344 , respectively) (Table 1). Most patients in group 1, consisting of active addicts, had moderate to severe medical problems, occupational problems, and psychiatric disorders (83, 86.7, and 86.7%, respectively), compared with 36.3, 48, and 63.3%, respectively, in group 2, consisting of recovering addicts, whereas all the opioid-dependent patients (100%) had moderate to severe drug and social problems compared with 70% in group 2 with social problems. Group 1, consisting of active dependent patients, had the highest total personality trait PID-5-BF scores of 44.03, indicating greater overall personality dysfunction, followed by group 2 with a total personality trait score of 34.40, whereas group 3, consisting of healthy controls, showed the lowest total personality trait score of 28.03. The difference was significant ($P<0.000$) (Table 1). Post-hoc test shown in Table 2 shows that there was a statistically significant difference between the patient group and both the abstinent group and the control group, with a

higher difference between the patients and the controls. There was no significance between the abstinent group and the controls. There was a statistically significant difference among the three groups regarding all the specific personality trait domains of PID-5-BF ($P<0.001$, for detachment, antagonism, and disinhibition; $P=0.004$, for negative affect; and $P=0.02$, for psychoticism) (Table 1). Active dependent patients had higher scores than both abstinent group and controls, indicating greater dysfunction in the specific personality trait domains.

Group 2 had a much lower brief substance craving scale score (1.50) compared with group 1 (9.37). The difference was significant ($P<0.001$) (Table 1). A statistically significant difference was found among the three groups regarding the serum OT level ($P=0.013$): the control group had the highest level (550.14 pg/ml), followed by patients in recovery (359.11 pg/ml) and much lesser in patients in group 1 (235.66 pg/ml) (Table 1). There was no correlation between PID-5-BF and OT in both the patient group and the abstinent group (Table 3).

A positive correlation between total personality dysfunction and all the five traits by PID-5-BF and craving was found; this correlation was statistically significant ($P<0.05$) for negative effect, antagonism, and psychoticism, whereas it was highly statistically significant ($P<0.001$) for disinhibition and the total personality dysfunction PDI-5-BF (Table 4, Fig. 1).

Discussion

This work aimed at studying the dysfunctional personality traits in patients with active opioid dependence and its relation to craving and serum OT level. The three groups were matched regarding age, marital status, education, and occupation. The mean age range is in agreement with other studies of Egyptian patients with substance use (Mobasher *et al.*, 2008; Shahin *et al.*, 2018). Concerning education, within the three groups, about only 20% of all the participants completed university education and 40% of patients did not achieve secondary education compared with 20% of controls and 13% of abstinent patients. These findings go in line with the studies of Abdel-Wahab and Ezzat (2014) and Jessica *et al.* (2011). This might be related to the hazards of the substance on the executive functions of the brain or as a part of comorbid conduct or behavioral disorder (Kriegler *et al.*, 2019). It might also be explained by the low socioeconomic level of participants related to the catchment area this study was performed in, in addition to the negative social and

Table 1 Demographics, clinical characteristics, personality traits, craving and serum oxytocin level

	Group 1 (active dependent group)	Group 2 (abstinent group)	Group 3 (healthy controls)	P
Age (mean/SD)	30.83/7.33	32.30/7.11	30.47/6.25	0.565
Marital status (n/%)				
Single	15/50.0	16/53.3	17/56.7	0.455
Married	13/43.3	9/30.0	12/40.0	
Divorced	2/6.7	5/16.7	1/3.3	
Total	30/100	30/100	30/100	
Education (n/%)				
Primary/preparatory	12/40.0	4/13.3	6/20.0	0.159
Secondary/diploma	12/40.0	19/63.3	18/60.0	
University	6/20.0	7/23.3	6/20.0	
Total	30/100	30/100	30/100	
Occupation (n/%)				
No job	3/10.0	6/20.0	1/3.3	0.271
Unskilled	2/6.7	0/0.0	3/10.0	
Skilled	23/76.7	20/66.7	23/76.7	
Professional	2/6.7	4/13.3	3/10.0	
Total	30/100	30/100	30/100	
Drug of choice (n/%)				
Tramadol and heroin	22/73.3	22/73.3	x	0.639
Tramadol	6/20	4/13.3	x	
Heroin	2/6.7	4/13.3	x	
Both	30/100	30/100	x	
Dose of opioids/d (mean/SD) (g)	4.92/	3.70/3.20	x	0.28
Duration of opioid dependence (mean/SD) (years)	9.37/5.39	5.33/3.64	x	0.001
Abstinence duration (mean/SD) (days)	0.00/0.00	317.87/159.35	x	0.000
ASI: medical status (mean/SD)	5.93/2.30	2.73/3.47	x	<0.001
ASI: employment (mean/SD)	6.57/2.50	3.93/2.49	x	<0.001
ASI: alcohol and drug status (mean/SD)	6.50/1.17	0.00/0.00	x	<0.001
ASI: legal status (mean/SD)	1.83/2.97	2.20/2.41	x	0.394
ASI: family status (mean/SD)	2.17/2.64	2.87/1.96	x	0.355
ASI: social status (mean/SD)	6.73/1.23	4.03/1.69	x	<0.001
ASI: psychiatric status (mean/SD)	6.40/1.90	4.27/1.76	x	<0.001
PID-5-BF (mean/SD)	44.03/11.32	34.40/10.00	28.03/9.08	<0.001
PID-5-BF domains (mean/SD)				
Negative affect	10.31/3.44	8.87/3.36	7.37/2.93	0.004
Detachment	8.79/2.37	7.00/3.29	5.40/2.66	<0.001
Antagonism	7.34/2.84	5.17/2.78	4.30/2.61	<0.001
Disinhibition	11.03/2.54	7.13/2.57	5.87/2.69	<0.001
Psychoticism	8.07/3.18	6.23/3.01	5.10/3.32	0.02
Brief substance craving scale craving score (mean/SD)	9.37/3.05	1.50/2.27	x	<0.001
Serum oxytocin level (mean/SD) (pg/ml)	235.66/146.25	359.11/328.26	550.14/427.47	0.013

ASI, addiction severity index; PID-5-BF, Personality Inventory for Diagnostic and Statistical Manual of Mental Disorders-V-brief form; x, not applied. P value less than 0.001 is considered highly significant. P value less than 0.05 is considered significant.

Table 2 Post-hoc comparison of total personality inventory scores between each two groups

P value	
Control group-abstinent group	0.058
Control group-patient's group	<0.001
Abstinent group-patient's group	0.003

P value less than 0.001 is considered highly significant. P value less than 0.05 is considered significant.

economic effects of substance use. Regarding occupation, 10% of patients were unemployed compared with only 3.3% of the control group. This

can be explained by the hazardous effect of the substance on the patients which leads to profound functional deterioration of the substance users. It was also noted that 20% of abstinent patients did not work, which is the highest among the three groups. This can be explained by the fact that most abstinent patients go through rehabilitation programs that require them to stay away from any jobs where they may find drugs. There were high statistically significant differences between patient and abstinent group regarding the medical, occupational, drugs, social, and psychiatric subscales of the ASI, representing

Table 3 Correlation between personality traits and serum oxytocin in groups 1 and 2

	Group 1 (patients group) oxytocin (pg/ml)	Group 2 (abstinent group) oxytocin (pg/ml)
PID-5-BF		
Correlation coefficient	-0.142	0.084
P value	0.453	0.660
N	30	30
Negative affect		
Correlation coefficient	0.195	0.323
P value	0.312	0.081
N	30	30
Detachment		
Correlation coefficient	0.037	0.021
P value	0.851	0.913
N	30	30
Antagonism		
Correlation coefficient	-0.194	0.066
P value	0.314	0.729
N	30	30
Disinhibition		
Correlation coefficient	0.178	0.023
P value	0.357	0.902
N	30	30
Psychoticism		
Correlation coefficient	0.081	-0.115
P value	0.675	0.546
N	30	30

PID-5-BF, Personality Inventory for Diagnostic and Statistical Manual of Mental Disorders-V-brief form. P value more than 0.05 is considered not significant.

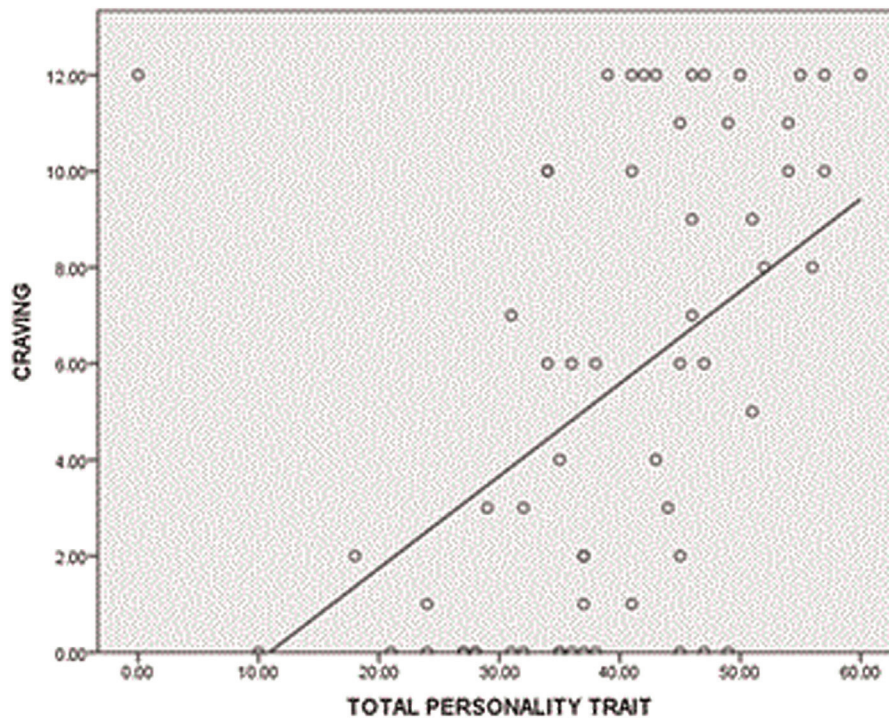
Table 4 Correlation between personality traits and craving in both groups (groups 1, 2)

Craving	
PID-5-BF	
Correlation coefficient	0.539
P value	<0.001
N	30
Negative affect	
Correlation coefficient	0.361
P value	0.005
N	30
Detachment	
Correlation coefficient	0.440
P value	<0.001
N	30
Antagonism	
Correlation coefficient	0.385
P value	0.003
N	30
Disinhibition	
Correlation coefficient	0.599
P value	<0.001
N	30
Psychoticism	
Correlation coefficient	0.331
P value	0.10
N	30

PID-5-BF, Personality Inventory for Diagnostic and Statistical Manual of Mental Disorders-V-brief form. P value less than 0.001 is considered highly significant. P value less than 0.05 is considered significant.

the extreme difference in a person's life before and after being abstinent. Abstinent patients reported a marked improvement in the medical status after stopping substance use. This is consistent with the studies of Verdejo-García *et al.* (2005), and Manning *et al.* (2019), who found that the medical subscale was significantly higher in active user group than abstinent patients. Similarly, abstinent patients reported a marked improvement in their work performance and commitment compared with patients. This goes in line with the study of Manning *et al.* (2019), who demonstrated the effect of substance use not only on employment probability but also on employment quality. Concerning legal problem subscale, there was no statistically significant difference between the two groups; this may be explained by that abstinent patients experienced their legal problems before they became abstinent. It also shows that substance use is associated with a higher risk of falling into legal problems. This result supported the results of Easton *et al.* (2000), and Abdel-Wahab and Ezzat (2014), who found moderate to severe legal problems associated with substance use and reduction of adherence to treatment. Patients had more severe problems with family and social relationships when compared with the abstinent group ($P<0.001$). This might be related to the social

Figure 1



Correlation between personality traits and craving in both groups (active dependent and abstinent group).

stigma associated with addiction in Egypt, not only to the patients but also to their families. Egyptian culture fosters a strong family-based social life, which makes addiction-related problems a major source of family conflict (Hamdi *et al.*, 2016). Another explanation might be the low level of OT in the patient group. A variety of studies reported before in animal and human studies the importance of OT in social functions (Neumann, 2008; Takayanagi *et al.*, 2005; Jin *et al.*, 2007; Liu *et al.*, 2008; Yamasue *et al.*, 2009; Husarova *et al.*, 2016). The study of Robinson *et al.* (2017) showed that OT increases positive social behaviors in the form of inducing and retaining proximity-seeking behavior. Husarova *et al.* (2016), in their study on autistic children, found significantly lower plasma OT levels and that dysfunction in OT system is related particularly to social impairments in autistic. Psychiatric problem subscale was significant higher in patients compared with abstinent group ($P < 0.001$). Most of the problems were impulsive, depressive, and anxiety symptoms related to withdrawal of the substance but not fulfilling diagnostic criteria for DSM-V for any type 1 psychiatric disorder. Patients with psychiatric disorders were excluded in this study. Shahin *et al.* (2018), found that most patients with substance use disorders experienced a depressive disorder and had a higher risk of suicide. In our study, total personality dysfunction measured by PID-5-BF was found to be higher in the

patient group compared with the abstinent and control group. Along with other studies, the relationship of personality traits and drugs of choice by cocaine addicts and heroin addicts found that personality dysfunctions are higher among patients who are addicts (Moraleda *et al.*, 2019). In the study by Shahin *et al.* (2018), Egyptian patients with substance use disorders had a higher level of personality dysfunction compared with controls. The total personality dysfunction among the abstinent patient group in our study was lower than patients and higher than the control group, yet there was no statistical significance when compared with controls. This may be explained by either the extremely negative effect that opioids have on an individual or by the positive effect of the treatment programs those patients go through. We found that to be consistent with Piedmont (2001), who reported an improvement in polysubstance abuser's personality profiles following rehabilitation. To further support our results, we found that several studies discussing illicit drug use and the risks associated with it involved personality traits. Some studies not only studied these traits as a risk factor for developing opioid dependence but also studied traits that may help patients stay away from opioids and drugs in general (Zaaijer *et al.*, 2014). In a meta-analysis by Saulsman and Page (2004), and studies by Kotov *et al.* (2010), Sutin *et al.* (2013), and Raketec *et al.* (2017), people with various substance use disorders seemed to have a common personality profile: high neuroticism, low

conscientiousness, and low agreeableness. The high negative effect and disinhibition among substance users in our study were consistent with the high neuroticism and low conscientiousness, respectively, found in previous studies. High neuroticism is associated with irrational ideas, reduced impulse control, and poor management of stress (Costa and McCrae, 1992). The high level of antagonism found in the results of our study was consistent with the low agreeableness level in the study conducted by Ball about personality traits among substance users (Ball and Widiger, 2002). Agreeableness is associated with positive interpersonal qualities such as altruism and positive attitudes toward others. These traits are not commonly associated with the hardened life of drug addicts (Dubey *et al.*, 2010). Psychoticism is characterized by tough-mindedness, nonconformity, hostility, and impulsivity (Eysenck *et al.*, 1985). High psychoticism among opioid users found in our study is supported with similar results by Flory *et al.* (2002), and Shin *et al.* (2013), respectively. The highly statistically significant difference in craving levels between the patient group and the abstinent groups is consistent with many studies that investigated craving in drug use. A recent study by Aboul Magd *et al.* (2019), also found that craving levels were much less in heroin patients after at least 1-year abstinence compared with current heroin addicts. Similarly, it was found that compared with short-term, long-term abstinence manifests less serious craving and withdrawal symptoms, and significantly decreased neural responses to heroin-related cues in brain regions as measured by fMRI (Lou *et al.*, 2012). In our study, the difference in craving levels may be attributed to the difference in serum OT levels. OT was found to inhibit opioid tolerance, reduce opiates self-administration, and decrease craving and stress response (Moeini *et al.*, 2019). Moreover, it may also explain the improvement in a patient's social relationships and psychiatric symptoms that was measured by the ASI after becoming abstinent. Craving levels correlated positively with total personality dysfunction and all the five traits. Previous studies of cue-reactivity provided some insight into the relationship between personality and craving with reports of a positive correlation between level of reactivity and neuroticism and introversion in alcoholics (McCusker and Brown, 1991). High impulsiveness and novelty seeking were associated with craving in individuals with alcoholism and cocaine use (Papachristou *et al.*, 2012) and also nicotine-dependent and opiate-dependent patients (Reuter and Netter, 2001). In another recent study in alcoholics, a positive correlation was found between craving scores and detachment, antagonism, and disinhibition (Ciccarelli *et al.*, 2019). Regarding serum OT levels, results of this study showed that there was a statistically significant difference among

the three groups, with the control group having the highest value. The results are consistent with decreased OT that was found following chronic morphine administration in rodents (You *et al.*, 2000). In contrast to our study, Gerra *et al.* (2017), investigated OT serum levels in abstinent heroin-addicted patients in comparison with healthy controls; OT serum levels were unexpectedly significantly higher among patients affected by drug use disorders than those measured in healthy controls. This may be owing to the different points of time at which the samples were taken, as in Gerra's, study samples were drawn 3 months after drug abstinence as opposed to our study which took the samples at least 6 months after abstinence. Given the withdrawal hyperexcitation that was found in OT neurons and excessive OT secretion in previous studies (Gerra *et al.*, 2017), further research is required to understand whether serum OT levels change over time after opioid abstinence. The personality traits showed no correlation with serum OT level in our study. These results are in contrast to the study by Andari *et al.* (2014), who found a positive correlation between plasma OT and extraversion scores, a dimension that captures social affiliative tendencies. Moreover, an inverse correlation between plasma OT and the volume of the right amygdala and the right hippocampus was found, which are brain areas relevant for emotion regulation (Andari *et al.*, 2014). In the study of Lin *et al.* (2015), a negative association between OT and novelty seeking was found in patients in methadone maintenance therapy clinic. A large body of evidence in animals and humans supports the role of OT in social behavior and attachment (Meyer-Lindenberg *et al.*, 2011). Our results were supported by the study by Andari and colleagues, where plasma OT levels did not correlate with the agreeableness dimension. Agreeableness encompasses different prosocial attitudes such as 'trust,' 'empathy,' and 'altruism.' Although OT promotes prosocial behaviors, its role in empathy and altruism remains ambiguous in the literature. Moreover, the study by Bendix *et al.* (2015), showed that plasma OT levels did not differ between medication-free psychiatric outpatients with or without personality disorders. Although OT appears to be promising via its involvement in treating opioid-dependent patients, further studies and clinical research regarding the exact doses, effects, and side effects of it are needed (Zanos *et al.*, 2017). Conclusion of this study is that opioid-dependent patients have significant greater personality dysfunction than both abstinent opioid users and healthy controls; dysfunctional personality traits are positive correlated with craving. Although serum OT is significant higher in opioid users than both groups abstinent and control, no correlation between personality traits and serum OT could be detected. Individual differences among

substance abusers can play an important role in the choice of treatment options. Recently, more attention has been focused on personality trait effects on the efficacy of different treatment plans to tailor therapeutic interventions to individual needs. More research is needed to fully evaluate how personality assessment can be useful in the choice of treatment plans. Findings in this study are limited by the relatively small number of patients in each group, to males only, and to only a specific type of substance. Further studies involving a larger number of patients of both sexes and using different types of substances are recommended.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

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