Original Article

The Psychometric Properties of the Desires for Drug Questionnaire (DDQ) among Iranians Methamphetamine Abusers

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Abstract

Introduction: Drug-craving as a multidimensional subjective experience recently has been accepted as an addiction hallmark. Desire for Drug Questionnaire or DDQ is a well-known questionnaire for measurement of drug craving severity. This study aimed to investigate the psychometric properties of the DDQ among Iranian methamphetamine abusers.

Method: DDQ was translated from English into Farsi by language experts. The questionnaire was then used for evaluation of craving among 50 male methamphetamine abusers. Then, DDQ questionnaire' scores was subjected to an exploratory principal components factor analysis. To assess construct validity of DDQ, the model was evaluated using confirmatory factor analysis. Internal consistency was examined by calculating cronbach's alpha.

Results: Finally, the Persian version of DDQ was verified with 13 items and three factors. Three factors with high eigenvalues were identified by (PCA) that accounted for 70.63% of the total variance. Given the relative fit of the confirmatory factor model, the construct validity of the DDQ was verified. Cronbach's alpha coefficient of the total score of the questionnaire was 0.86.

Conclusion: The Farsi-translated version of DDQ questionnaires had good psychometric properties. The questionnaire could be considered as a valid and reliable instrument for the assessment of drug craving level in Iranian methamphetamine abusers.

Declaration of Interest: None

Keywords: Desires for Drug Questionnaire; Drug craving; Methamphetamine.

Introduction

Craving has been described as the subjective experience of a desire or urges to use substances (1). In recent addiction theories, craving plays an important role (2). Importantly, craving is considered as a hallmark in the maintenance of substance abuse, a prominent precursor of relapse. The significance of craving in addictive behavior is also recognized by classification systems, which accounts as one of the criteria for defining substance use disorders (3). Finally, craving is often used as an outcome measure in treatment studies (4), pointing to the centrality of craving in addiction. Drug-craving could be explained as a multi-dimensional subjective experience that may change dynamically from an intentional irresistible desire to a compulsive wanting (5). So far, its definitions have been changing extensively. Hence, reliable, valid, and easy-to-administer measures of craving are important for treatment and research purposes.

Because of its subjective nature, trying to find objective methods such as electroencephalographic measurements (6) and physiological reactions such as heart rate, blood pressure, and salivation (7) have not been accepted yet and self-report questionnaires remained unrivaled until now. Although originally viewed as a one-dimensional construct, the conviction is growing that craving consists of multiple dimensions (8, 9). The process of craving involves physical, emotional, cognitive, and behavioral characteristics that have been well documented in the literature (10). Besides, cravings can continue for months and even years after the cessation of drug use (11). For example, Tiffany et al. (12) criticized the one-dimensional

approach and argued that a single-item questionnaire is not sufficient to assess all features of craving. Moreover, these authors argued that drug users categorize their subjective experiences into various semantic categories that cannot be measured by a single item. Support for this line of reasoning was found by Skinner & Aubin (13) who reviewed 18 theories on craving, concluded that it is impossible to describe the complex construct of craving in terms of one one-dimensional factor. Craving is viewed as a subjective experience and therefore is assessed with self-report scales. Kraus & Rosenberg (14) provided a comprehensive review of the self-report assessment tools of the craving and concluded that single-item ratings that focus on the intensity, frequency, or duration of craving may fail to assess urges and craving if drug users attribute the feelings to another psychological or physiological state. Hence, a single-item rating of subjective craving may not well manifest the nature of craving. Moreover, assessing different dimensions of craving may predict different types of outcomes (15).

Another aspect of the discussion is the time frame of craving (16). A distinction can be made between general craving which refers to a chronic desire for the drug over a longer time and instant or reactive craving which pertains to the acute desire for the drug and thus occurs within a fairly short timeframe. Differences in the assessment of the time frame of craving may have important repercussions for the prognosis of the course of the addiction. For example, Franken and colleagues (17,18) showed that craving measured over a longer time (i.e. 1 week) appeared a better predictor of

attention bias for drug cues as compared to reactive craving measured instantly after being triggered by drug cues. Recently, two questionnaires have been developed for measuring craving from a multidimensional perspective within the context of heroin dependence: the Obsessive Compulsive Drug Use Scale (OCDUS) intends to measure general craving for heroin during a longer time (the past week), while the Desires for Drug Questionnaire (DDQ) intends to assess instant (now, at this moment) craving for this drug (16). The DDQ was subjected to a psychometric evaluation in a clinical population of 102 heroin-dependent inpatients and exploratory factor analyses revealed a multiple-factor structure for the questionnaire (19). In short, the data showed that the DDQ consisted of containing three factors of instant craving: Desire and intention, Negative reinforcement, and Control. It was found that all DDQ subscales displayed good reliability and concurrent validity as established via correlations with an alternative index of craving (16). As the DDQ is a suitable and psychometrically sound instrument for measuring various aspects of heroin craving in heroin-dependent individuals, we wondered whether these scales could also be employed within the context of another prevalent type of drug problem, namely methamphetamine dependency. Thus, we constructed methamphetamine versions of these questionnaires in which the word ''heroin'' was replaced by ''methamphetamine and tested their psychometric properties. The present study was conducted to evaluate the psychometric qualities of the methamphetamine versions of the DDQ in Iranian methamphetamine Abusers.

Now after about 2 decades these two tests are wildly accepted and retested for many drugs such as Alcohol, Amphetamine, Marijuana, and Caffeine and disordered habits such as eating and gambling in various nations. Because of the increasing prevalence of Meth-dependency in Iran, validation of such world-wide approved questionnaires is highly needed.

Method

A total of 50 male methamphetamine abusers at an outpatients from addiction treatment centers in Tehran were the participants of this study. Participants were recruited through simple sampling, convenient method, only among the methamphetamine abuser. Multi-drug abusers were excluded from this study. To obtain generalized results, the sampling was made at different clinics in culturally and socioeconomically different areas of this metropolis. Also, the study was conducted irrespective of the patients' demographic characteristics and different addiction-related dimensions. First, the DDQ questionnaire was translated from English into Persian by the psychological evaluation laboratory research team at the National Center for Drug Addiction Studies, and then each questionnaire was adapted for methamphetamine abuse. For more affirmation we translated the questions two times, by two different translator groups first from English to Persian and then Vice versa, to see if there would not be any ambiguity in the text. Then the participants answer the translated questionnaire. The next process was analyzing the obtained data.

Instruments:
INCAS Substance Abuse Profile (ISAP):
Iranian National Center for Addiction

Studies (INCAS) is a comprehensive drug abuser's profile which is designed to evaluate demographic characteristics and different addiction-related dimensions (20). It consists of 6 sections. Basic demographic information such as age, gender, marital status, level of education, etc. is registered in the first portion. The second section assesses the history of drug abuse, and the third one investigates a history of drug abuse treatment. The patient's high-risk behaviors and the medical and psychological information are evaluated in the fourth and fifth segments. The patient's family relations and social status are mentioned in the last part. This Standard profile used in the present study.

Desires for Drug Questionnaire (DDQ): DDQ is a well-known questionnaire for the evaluation of instant drug craving. This questionnaire has been designed around drug craving as a motivational state (21). It is presented by Franken & Hendriks that includes 13 questions and provide measurement and evaluation for three main components. (21). The first components reflected the desire and intention to use heroin with seven questions. In this section, the questions explain try to measure the strongest of the desire. The second one with included four items assessed the relief of negative states. The goal of this component is to know if consuming is occurred because of fearing withdrawal or not. It was labeled ''negative reinforcement.'' The third factor named ''control,'' and had two questions. The last part measures the participants' self-estimated ability in controlling the urge of drug use. Participants answered DDQ on a seven-scale Likert-point system. The items were rated as follows: (1) not at all, (2) mild, (3) mild to moderate, (4) moderate, (5) moderate to severe, (6) severe, and (7) approximately complete.

Data Analysis

Construct validity was assessed through exploratory and confirmatory factor analyses. Exploratory factor analysis was conducted using the Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy and Oblimin rotation. Factors were extracted using principal component analysis with varimax rotation, and the number of factors were determined using a scree plot of eigenvalues. An eigenvalue is an amount that determines the variance explained by a factor throughout a dataset. Therefore, the greater the eigenvalue of a factor has the higher its explanatory power of the variance. The factor analysis method examines the internal relationship between variables and is used to extract categories of items that are most strongly related to each other. In this analysis, items with factor loadings of less than 0.3 were considered candidates for removal. Items with factor loadings of 0.3–0.5 were kept in or removed from the instrument at the research team's discretion. After extracting factors and expressions therein, their consistency with the dimensions of the original questionnaire was examined. To assess the structure of extracted factors from exploratory factor analysis, the model was evaluated using confirmatory factor analysis. The goodness of Fit Index (GFI) was used to assess the exploratory model fit. To verify the model, the following indices were determined as follows: Root Mean Square Error of Approximation (RMSEA) < 0.08, the Standardized Root Mean Square Error of Approximation (SRMSEA) < 0.08, Comparative Fit Index (CFI) ≥ 0.90,

Tucker-Lewis Index (TLI) ≥ 0.95, and normed chi-square (x^2 / df) < 5.0. Reliability of the questionnaire was determined using the internal consistency. Internal consistency was examined by calculating Cronbach's alpha.

A total of 50 male methamphetamine abusers were the participant of this study. The mean participant age were 29.3±7.3 years old. Other characteristics are shown in Table 1.

Results

Table1. Demographics and Drug Abuse Characteristics of Participants (n=50)

Age (years)		29.3±7.3
Education (years)		10.2±3.1
Marital status	Married	(26) 52%
	Single	(15) 30%
	Separated	(3) 6%
	Widow	(1) 2%
	Divorced	(5) 10%
History of drug injection		(9) 18%
Imprisonment	Lifetime	(13) 26%
	Last year	(4) 8%
Drug dealing	Lifetime	(11) 22%
	Last month	0
Age of onset (years)		23.2±5.1
Addiction duration (years)		4.8±2.6
Methamphetamine abuse (last month)		(50) 100%
Cigarette abuse (last month)		(47) 94%

Construct validity

Exploratory factor analysis was performed on 20 items through the principal component analysis method. The KMO value was calculated as .876. Bartlett's test achieved a value of 6371.146 at a significant level of less than .001, justifying the implementation of factor analysis on the sample based on the correlation matrix (Table 2).

Table2.KMO and Bartlett's Test

KMO	Bartlett's Test of Sphericity		
Sampling Adequacy	Chi-Sq. Statistic	df	p
.876	6371.146	129	0.001

The number of factors were determined using a scree plot of eigenvalues. Results demonstrated that the highest percentage of the total variance (70.63%) was explained by the first, two, and three factors. Accordingly, three factors with high eigenvalues were identified by this method that accounted for 70.63% of the total variance. Using the scree plot method, three factors were located on the first descending slope. Therefore, using this method, three factors were confirmed. In this study, Item 7 with a factor loading of less than 0.3 was removed. Finally, the

Persian version of the questionnaire was verified with 13 items and three factors (Table 3). Our first component with five questions is labeled "Pleasure and control" include questions number 3, 6, 8, 10, and 13). The second one named, "tendency to use drugs and negative reinforcement" with four questions (4, 5, 9, and 11), and the third one is "desire and intention to drug use" that include four questions (1, 2, 12 and 14).

Table3. Factor loadings of the Desires for Drug Questionnaire (DDQ)

| Item	Factor 1	Factor 2	Factor 3
DDQ 1			.861
DDQ 2			.757
DDQ 3	1.041		
DDQ 4		.791	
DDQ 5		.554	
DDQ 6	.668		
DDQ 8	.896		
DDQ 9		.804	
DDQ 10	.699		
DDQ 11		.580	
DDQ 12			.873
DDQ 13	.668		
DDQ 14			.369

Given the values of indices in Table 4, the x^2/df ratio was smaller than 5, and the RMSEA value was smaller than .08, verifying the model validity. Moreover, the GFI and AGFI were greater than 0.9, demonstrating the verifiability of their factor structure and the acceptable model fit (Table 4). Given the relative fit of the confirmatory factor model and the significant item-scale relationship, the results of the exploratory factor model were supported by confirmatory patterns, and the construct validity of the scale was verified (Fig. 1).

Table4. Confirmatory factor analyses fit Index of the Desires for Drug Questionnaire

X^2	df	P	X^2/df	RMSEA	GFI	AGFI	CFI	TLI	IFI	NFI
14.27	5	<.01	3.85	.04	.94	.91	.90	.88	.93	.94

x2/dfx2/df: Normed chi-square; *RMSEA* Root Mean Square Error of Approximation, *GFI* Goodness of Fit Index, *AGFI* Adjusted Goodness of Fit Index, *NFI* Normed Fit Index, *IFI* Incremental Fit Index, *TLI* Tucker-Lewis Index, *CFI* Comparative Fit Index
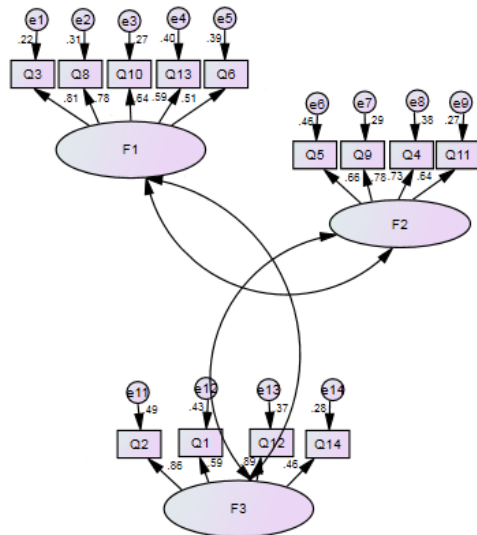
CFA factor loading for Desires for Drug Questionnaire (DDQ) Fig. 1

Reliability

Cronbach's alpha coefficient of the questionnaire items was calculated .89 for first components (pleasure and control), .80 for the second component (tendency to use drugs and negative reinforcement), and .76 for three-component (desire and intention to drug use) (Table 5). Cronbach's alpha coefficient of the total score of the questionnaire was .86.

Table5. Cronbach's alpha coefficient of DDQ

DDQ	Cronbach's alpha
1. Pleasure and control	.89
2.Tendency to use drugs and negative reinforcement	.80
3.Desire and intention to drug use	.76
4.Total	.86

Discussion

The present study was conducted to assess the psychometric properties of the DDQ in a sample of Iranian methamphetamine abusers. The results showed that the Persian version of the DDQ is a valid and reliable instrument for assessing thee desire and the impulsive dimension of craving among Iranian methamphetamine abusers. The construct validity and internal consistency reliability of the instrument were confirmed. To the best of our knowledge, this study is the first study to translate and validate the DDQ in Farsi language among methamphetamine abusers in Iran.

Based on exploratory analysis, seven items were removed from the Persian version on account of their low factor loadings. As predicted, 13 questions from 14 original DDQ's do get the eigenvalues more than 70% to their appropriate component. The result of exploratory factor analysis and internal consistency of each component of the questionnaires are in good conformity with the corresponding results from the original English version of Franken & Hendriks (21). In this study, extraction of components with eigenvalues more than 1 led to the extraction of three components in the DDQ questionnaires, namely "Pleasure and control", "Tendency to use drugs and negative reinforcement" and "Desire and intention to drug use" of methamphetamine abuse. These three components are consistent with Franken & Hendriks (21). Besides, DDQ was previously translated into the Persian language by Hassani-Abharian et al. (22) in heroin dependents and it showed good validity and internal consistency as well.

The cumulative variance in this study was 70.63% with the extraction of three factors. This indicates that 70.63% of the item variances were explained by the three extracted factors. Most of the literature

reported that in exploratory factor analysis, there was no specific figure of variance levels (23). Internal consistency of the Farsi-translated version of DDQ reported good Cronbach's Alpha values. The Cronbach's Alpha coefficient was .86 for total items, .89 for component 1, .80 for component 2, and .76 for component 3. In general, the higher the value of Cronbach's Alpha, the higher the internal consistency. However, Schmitt (24) reported that the value should not exceed more than able .95 as it indicates that the items were redundant. Most of the literature suggests that the value of Cronbach's Alpha should be more than 0.7 (23, 24). Component 3 reported the lowest alpha coefficient compared to total items and other components. This higher reliability for component 1 is mainly due to the component consists of 5 items. This study showed that the value of Cronbach's Alpha did not improve much even by removing individual items. Thus, none of the items in the DDQ were removed.

Up to existent researches, Tiffany (25) was the first one who initiated a 29-item questionnaire to measure the cigarette craving. Questionnaire on smoking urges (QSU) had two factors, the first one with 15 questions reflected the "primarily intention and desire to smoke, and anticipation of pleasure from smoking" and the second one which is labeled as "anticipation of relief from negative affect and nicotine withdrawal, and urgent and overwhelming desire to smoke" has 11 items. (26); then he validated a new version of it for Cocaine which has 45-items (27). After that, James et al. (28), West (29), and Heishman et al (30) validated desires for Speed Questionnaire (DSQ), Questionnaire of Caffeine

Cravings (QCC) and Marijuana Craving Questionnaire (MCQ) with relatively common items. But all of them had a common problem, which was a large number of questions and time-consuming. Mo et al. (31) made DAQ-6 by two factors named 'expectancy of negative reinforcement' and 'strong desires and intentions', which contained only three questions for each one. Franken should be respected as the founder of the modern version of Craving self-report questionnaires for opiate named Desires for Drug Questionnaire (DDQ) in 14 items and three factors: "desire and intention", "negative reinforcement", and "control" (21). He intelligently added a new component which is named "control". Recently DDQ has public interest is validated and re-tested by fore-coming researchers for Cocaine and Heroin (32).

The present study was designed to validate the latest version of DDQ for Persian speaking Meth-dependent people, which is the most popular self-report questionnaire for Drug-craving. In this process, we could validate a more balanced DDQ in three components. We proposed that these differences may be related to its craving timeline that differs from other drugs. Additionally, we suggest new sub-categorization for discovering a new dimension of craving which could be studied in the future.

References

1- Ray LA, Roche DJ. Neurobiology of Craving: Current Findings and New Directions. Current Addiction Reports. 2018;5(2):102-9.

2- Drummond DC. Theories of drug craving, ancient and modern.Addiction. 2001;96(1):33-46.

3- Gu X, Filbey F. A bayesian observer model of drug craving.JAMA psychiatry. 2017 Apr 1; 74(4):419-20.

4- Parvaz MA, Moeller SJ, Goldstein RZ. Incubation of cue-induced craving in adults addicted to cocaine measured by electroencephalography. JAMA psychiatry. 2016; 73(11):1127-34.

5- Bahr SJ, Hoffmann JP. Social scientific theories of drug use, abuse, and addiction.The handbook of drugs and society. 2016:197-217.

6- Bu J, Ma R, Fan C, Sun S, Cheng Y, Piao Y, Zhang P, Liu C, Zhang X. Low-Theta Electroencephalography Coherence Predicts Cigarette Craving in Nicotine Addiction. Frontiers in psychiatry. 2019;10-18.

7- Smolka MN, Bühler M, Klein S, Zimmermann U, Mann K, Heinz A, Braus DF. Severity of nicotine dependence modulates cue-induced brain activity in regions involved in motor preparation and imagery. Psychopharmacology. 2006;184(3-4):577-88.

8- Tiffany ST, Carter BL, Singleton EG.Challenges in the manipulation, assessment and interpretation of craving relevant variables.Addiction. 2000 Aug;95(8s2):177-87.

9- Sayette MA, Shiffman S, Tiffany ST, Niaura RS, Martin CS, Schadel WG. The measurement of drug craving.Addiction. 2000;95(8s2):189-210.

10- Pombo S, Figueira ML, Walter H, Lesch O. Motivational factors and negative affectivity as predictors of alcohol craving. Psychiatry research.2016; 243:53-60.

11- Kavanagh DJ, Statham DJ, Feeney GF, Young RM, May J, Andrade J, Connor JP. Measurement of alcohol craving.Addictive Behaviors. 2013;38 (2):1572-84.

12- Tiffany ST, Singleton E, Haertzen CA, Henningfield JE.The development of a cocaine craving questionnaire.Drug and alcohol dependence. 1993;34 (1):19-28.

13- Skinner MD, Aubin HJ. Craving's place in addiction theory: contributions of the major models. Neuroscience &Biobehavioral Reviews. 2010; 34(4):606-23.

14- Kraus S, Rosenberg H. The pornography craving questionnaire: Psychometric properties. Archives of sexual behavior. 2014; 43(3):451-62.

15- Goodyear K, Haass-Koffler CL. Opioid Craving in Human Laboratory Settings: a Review of the Challenges and Limitations. Neurotherapeutics. 2019; 5: 1-5.

16- Franken IHA, Hendriks VM, Van den Brink W. Initial validation of two opiate craving questionnaires: the Obsessive Compulsive Drug Use Scale and the Desires for Drug Questionnaire. Addict Behav 2002; 27:675–685.

17- Franken IHA, Kroon LY, Hendriks VM. Influence of individual differences in craving and obsessive cocaine thoughts on attentional processes in cocaine abuse patients. Addict Behav 2000;25: 99–102.

18- Franken IHA, Kroon LY, Wiers R, Jansen A. Selective cognitive processing of drug cues in heroin dependence. J Psychopharmacol 2000;14: 395–400.

19- Love A, James D, Willner P. A comparison of two alcohol craving questionnaires. Addiction 1998;93: 1091–1102.

20- Talabari ZK, Khajavi MN, Rafiei H. Reasons of Methadone Maintenance Therapy Drop out in Clients of Iranian National Center for Addiction Studies (INCAS): A Qualitative Study. Iranian Journal of Psychiatry & Clinical Psychology. 2013;18(4).

21- Franken IHA, Hendriks VM, Van den Brink W. Initial validation of two opiate craving questionnaires: The Obsessive-Compulsive Drug Use Scale (OCDUS) and the Desires for Drug Questionnaire (DDQ). Addict Behav. 2002; 27(5):675-6.

22- Hassani-Abharian P, Mokri A, Ganjgahi H, Oghabian MA, Ekhtiari H. Validation for persian versions of "desire for drug questionnaire" and "obsessive compulsive drug use scale" in heroin dependents.

Archives of Iranian Medicine. 2016; 19 (9):33-45.

23- Williams B, Onsman A, Brown T. Exploratory factor analysis: A five-step guide for novices. Australasian Journal of Paramedicine. 2010;8 (3):69-75.

24- Schmitt N.Uses and abuses of coefficient alpha. Psychological Assessment. 1996;8: 350-363.

25- Tiffany ST. A cognitive model of drug urges and drug-use behavior: Role of automatic and nonautomatic processes. Psychological Review. 1990; 97(2): 147-168.

26- Stephen T, Tiffany A, Drobe DJ. The development and initial validation of a questionnaire on smoking urges. British Journal of Addiction. 1991; 86(11): 1467-1476.

27- Stephen T, Tiffany A, Singletonb E, Charles A. Haertzenb, Jack E. Henningfield. The development of a cocaine craving questionnaire. Drug and Alcohol Depend. 1993; 34:19-28.

28- James D, Davies G, Willner P. The development and initial validation of a questionnaire to measure craving for amphetamine.Addiction. 2004; 99(9):1181-1188.

29- West O, Roderique-Davies G. Development and initial validation of a caffeine craving questionnaire. Journal of Psychopharmacology. 2008; 22(1):80-91.

30- Heishman SJ, Evans RJ, Singleton EG, Levin KH, Copersino ML, Gorelick DA. Reliability and validity of a short form of the Marijuana Craving Questionnaire. Drug and alcohol dependence. 2009 Jun 1; 102(1-3):35-40.

31- Mo C, Deane FP, Lyons GC, Kelly PJ. Factor analysis and validity of a short six-item version of the Desires for Alcohol Questionnaire. Journal of substance abuse treatment. 2013;44(5):557-64.

32- Lievaart M, Erciyes F, van der Veen FM, van de Wetering BJ, Muris P, Franken IH. Validation of the cocaine versions of the Obsessive Compulsive Drug Use Scale and the Desires for Drug Questionnaire.The American journal of drug and alcohol abuse. 2015; 41 (4):358-65.