

Level of khat dependence, use patterns, and psychosocial correlates in Yemen: a cross-sectional investigation

Motohiro Nakajima,¹ Richard Hoffman¹ and Mustafa al'Absi¹

مستوى إدمان القات وأنماط استخدامه وعوامل الارتباط النفسية الاجتماعية: تحقيق مقطعي موتوهيرو ناكاجيما، ريتشارد هوفمان، مصطفى العبيسي

الخلاصة: يقترن تعاطي القات المزمن بآثار صحية سلبية. إلا أنه لم تُجر أي دراسة توفر وصفاً وافياً لسيمات مدمني القات. وينظر هذا الاستعراض في العوامل الاجتماعية-السكانية والنفسية-الاجتماعية المرتبطة بإدمان القات في صفوف البالغين. وأجريت مقابلات مباشرة مع ما مجموعه 270 متعاطٍ للقات (منهم 129 امرأة) في اليمن، وقدّموا معلومات وبيانات سكانية عن أنماط تعاطي القات، والمزاج الشخصي، ونوعية النوم. واستُخدم "مقياس شدة الإدمان على القات" لتقييم مستوى الإدمان على القات. كما أُجريت سلسلة من تحليلات التباين. وثبت أن متعاطي القات يتعاطونه لمدة 5.2 ساعة يومياً في المتوسط (الانحراف المعياري = 2.3) ولمدة 5.7 يوماً في الأسبوع (الانحراف المعياري = 2.0). وأفاد الأفراد الذين أظهرت التحاليل نتائج إيجابية لإدمانهم القات بقضاءهم فترات زمنية أطول في جلسات القات يومياً، وتعاطي القات بوتيرة أعلى أسبوعياً، كما أبلغوا عن مستويات أعلى من المزاج السلبي واضطرابات النوم، وكانوا أكثر ميلاً لظهور أعراض بدنية عليهم بعد التعاطي ($P < 0.05$). وينبغي أن توضح البحوث المقبلة الآليات المسؤولة عن الكشف عن أعراض إدمان القات.

ABSTRACT Chronic khat use is associated with negative health consequences. However, no study has fully characterized individuals who are khat dependent. This paper examines socio-demographic and psychosocial correlates of adult khat dependence. A total of 270 khat users (129 women) in Yemen completed face-to-face interviews and provided demographic information and data on patterns of khat use, subjective mood, and sleep quality. The Severity of Dependence Scale-Khat (SDS-khat) was used to assess level of khat dependence. A series of analysis of variance was conducted. Khat users, on average, used khat for 5.2 hours a day (SD = 2.3) for 5.7 days a week (SD = 2.0). Individuals who screened positive for khat dependence reported longer duration of khat sessions per day, higher frequency of khat use per week, greater levels of negative mood and sleep disturbances, and were more likely to endorse physical symptoms after khat use ($P < 0.05$). Future research should elucidate mechanisms responsible for khat dependence symptomatology.

Niveau de dépendance au khat, modes de consommation, et corrélats psychosociaux au Yémen : enquête transversale

RÉSUMÉ La consommation chronique de khat est associée à des conséquences néfastes sur le plan de la santé. Cependant, aucune étude n'a permis une caractérisation complète des individus dépendants au khat. Le présent article se penche sur les corrélats socio-démographiques et psychosociaux de la dépendance au khat chez l'adulte. Au total, 270 consommateurs de khat (129 femmes) au Yémen se sont soumis à des entretiens en face à face et ont fourni des informations démographiques et des données sur les modes de consommation, l'humeur subjective et la qualité du sommeil. L'Échelle de la sévérité de la dépendance pour le khat a été utilisée pour évaluer le niveau de dépendance à cette substance. Une série d'analyses de variance a été réalisée. Les utilisateurs de khat en consommaient, en moyenne, pendant 5,2 heures par jour (ET = 2,3) 5,7 jours par semaine (ET = 2,0). Les individus dépistés positifs pour la dépendance au khat signalaient des séances de consommation de khat de durée plus longue par jour, une fréquence plus élevée de consommation par semaine, des niveaux plus importants d'humeur négative et de troubles du sommeil, et étaient davantage susceptibles de ressentir des symptômes physiques après en avoir consommé ($p < 0,05$). La recherche future devrait s'efforcer de déterminer les mécanismes responsables de la symptomatologie de la dépendance au khat.

¹University of Minnesota Medical School, Duluth, United States of America. (Correspondence to: Mustafa al'Absi: malabsi@umn.edu)

Received: 13/06/16; accepted: 12/03/17

Introduction

The burden of addiction and mental health problems continues to increase globally (1,2). Khat is used commonly in East Africa and the Arabian Peninsula (3), with reports indicating that 80–90% of East African males use khat daily and 10–60% of East African females use khat daily (4,5). Khat is also consumed by immigrants from these regions who reside in western countries, including the United Kingdom (UK) and the United States of America (6).

The primary psychostimulant component of khat is cathinone, which is released within 15–45 minutes during chewing and activates dopaminergic and noradrenergic transmission (7). Cathine or d-norpseudoephedrine has also been identified as a psychoactive ingredient in khat (7), although it has been noted to have more limited psychostimulant properties at roughly 7–10 times less potent than amphetamine (8). Khat ingestion produces several central nervous system effects that are similar to those of amphetamine, including increased motor stimulation, feelings of increased alertness, euphoria and a sense of excitement and energy (3). Following a khat session, the user may experience depressed mood, irritability, anorexia and difficulty falling to sleep (9). Habitual khat users and concurrent khat and tobacco users in Yemen have reported sleep problems, which were correlated with negative mood (10). Functional mood disturbances (anxiety and depression) have also been reported during khat sessions, but these are temporary and may disappear the next day (11). Evidence indicates that long-term or excessive khat use is a risk factor for progression of ongoing mental health problems (4,12,13).

In several countries it is reported that users of khat consume large quantities of tobacco, which may exacerbate the health burden associated with khat use (14), and we have observed previously that approximately 55% of all khat users

are also regular smokers (15,16). One study reported that 65% of their sample of UK resident Yemeni subjects were regular cigarette smokers and that khat users smoked to enhance the impact of their khat chewing (6). Increased severity of dependence correlated positively with nicotine dependence (6).

There is evidence of a khat withdrawal syndrome and low-level drug tolerance. Khat chewing has been found to induce increased sympathetic tone, and some degree of physiological tolerance to the sympathetic effects of khat as evidenced by increased blood pressure, increased respiratory rate, and increased body temperature in chronic khat users (17). Withdrawal symptoms after prolonged khat use are mild and may consist of lethargy, mild depression, slight trembling and recurrent nightmares (3,18). There is also evidence to indicate that khat users can develop a psychological dependence to khat (19,20) and a valid measure of khat dependence has been developed (21). Studies have found positive associations between khat dependence and khat-related biological measures (22), psychological and physical symptoms (23) and health problems (24). Another study found that khat dependence was higher in men than women and that a positive link between age and khat dependence in women only (20). This suggests that there are gender differences in the patterns of dependence symptomatology.

Associations between khat dependence and sleep disturbances or negative affect have not been examined, although this is an important question in light of studies showing insomnia (25) and negative mood (11) among khat users. This question is clinically relevant because insomnia and negative affect are related to one another (26,27) and both have implications for many health conditions (28,29). This study aimed to examine the extent to which psychological khat dependence was related to reported khat use, subjective sleep

quality, and negative affect as well as determine the role of gender differences in these relationships. It was hypothesized that greater levels of khat dependence would be associated with more frequent and intense khat use, higher levels of negative affect, and poorer subjective sleep quality. We also anticipated that the link between khat dependence and psychological and behavioral measures would be more pronounced in males than in females.

Methods

Subjects and study design

Using convenience sampling and cross-sectional methods, this study was conducted in two cities in Yemen, Taiz and Sana'a, between September and November 2012. Recruitment was conducted in markets and shopping centres around the two cities. Eligibility criteria were: aged 18 years and above, Yemeni, chewing khat at least once a week over the last 12 months, able to speak Arabic or English, and free from any major medical and psychiatric conditions. Trained and culturally competent interviewers approached potential participants in the community and asked if they were interested in participating in the study. Potential participants were informed that they were free to withdraw at any point from the study without consequences, and that their responses would be kept strictly confidential. Informed written consents were obtained from all participants prior to the interviews. Upon obtaining the consent the staff conducted face-to-face interviews on the spot that lasted 30–45 minutes. The Institutional Review Board in Taiz and Sana'a Universities gave ethical approval for this study. A total of 401 individuals completed this study.

Measures

The Severity of Dependence Scale (SDS) (30) is a widely used scale that

was developed to assess psychological dependence in illicit drug users. The SDS consists of 5 items with each response measured on a scale between 0 and 3, giving a total possible score of 15. It focuses on loss of control over drug use and preoccupation or anxiety about drug use (30). Predictive validity was demonstrated in relation to the need for treatment amongst drug users (30). The bilingual (Arabic and English) version of the Severity of khat dependence (SDS-khat) (21) was used in this study, and a total score of 6 was used as a cutoff to examine differences between those who are unlikely to be psychologically dependent on khat (total SDS-khat score = 5 or lower) and those who are likely to be khat dependent (total SDS-khat score = 6 or higher) (21).

The Pittsburgh Sleep Quality Index (PSQI) consists of 19 questions that evaluate qualitative and quantitative dimensions of sleep disturbances (31). These items are calculated into 7 component scores each with a range from 0 (good quality) to 3 (poor quality). The sum of these 7 component scores yields the global PSQI score, with the highest score of 21 indicating the worst subjective sleep quality (31). Internal consistency reported by the original authors was 0.83 (31). Good PSQI test-retest reliability has been reported (31). With the permission of the PSQI authors, we translated the original English version into Arabic and then back-translated into English (32). A total score was used in the current analysis.

In addition, we used a modified version of a subjective mood questionnaire (33), which asked participants to describe themselves as relaxed, depressed, sad, discontented, afraid, angry, anxious, or hungry during the past week. Participants rated each of these items on a scale of 1 (not at all) to 8 (extremely). Our preliminary analysis showed that reliability was highest when only negative mood items (i.e., depressed, sad, discontented, afraid, angry, and anxious) were included (Cronbach's $\alpha = 0.79$).

Therefore, mean scores of these 6 items were combined into one index, hereafter referred to as negative affect and used in the analysis. The items where subjects rated themselves as either relaxed or hungry were used in the analysis as two separate indices.

Demographic questions included age, gender, years of education since the first year of primary school, and marital status. Questions on khat consisted of use status (daily or occasional use), age of first exposure to khat, number of hours chewing per khat session, number of days chewing per week, whether the respondent had any physical symptoms (e.g., headache, tremor, drowsiness, and fatigue) after stopping khat use, whether the respondent had thought about quitting khat use in the past, and whether the respondent had attempted to quit khat. We also asked whether the respondent currently smoked tobacco products to determine concurrent khat and tobacco users and khat-only users. Those who mentioned current tobacco use were classified as concurrent khat and tobacco users. Self-report measures of major medical and psychiatric conditions (e.g., cardiovascular diseases, liver diseases, cancer, stroke, depression, anxiety disorder, substance use disorders) were also collected.

Data analysis

Descriptive statistics were conducted to check for data adherence to assumptions of the relevant tests as well as to report sample characteristics. A series of 2 khat dependence levels (unlikely to be psychologically khat dependent [UKD: SDS-khat score 5 or lower], likely to be psychologically khat dependent [KD: SDS-khat score 6 or higher]) by 2 gender analyses of covariance (ANCOVA) controlling for tobacco use was conducted on continuous measures of khat use, sleep disturbance (PSQI total scores), and mood measures (negative affect, relaxed, and hungry). These models were tested in light of a significant gender difference and no tobacco use

difference in SDS-khat found in this study (see below). If a significant khat dependence levels by gender interaction was found, a post-hoc analysis was conducted with the Bonferroni correction (P -value of 0.5/2 tests = 0.025 as a significant P -value). Chi-square tests were conducted to examine relationships between khat dependence levels and categorical measures of khat and tobacco use, as well as relationships between gender and categorical measures of khat and tobacco use. Demographic information was tested by 2 khat dependence levels by 2 gender ANOVAs (for age and length of education) and a chi-square test (for marital status). Analyses were conducted by SPSS version 22 (Chicago, IL, USA).

Results

Out of the 401 participants who were enrolled in the study, 292 (73%) identified themselves as khat chewers but 22 (5.5%) of them did not complete the SDS-khat. These individuals were excluded from the analysis, which left a final sample of 270 (67%) khat chewers (129 [47.8%] females and 141 [52.2%] males). Among the 270 participants, 110 khat users (41 females and 69 males) were included in KD group and 160 khat users (88 females and 72 males) were included in UKD group. Khat users, on average, used khat for 5.2 hours a day ($SD = 2.3$) for 5.7 days a week ($SD = 2.0$). SDS-khat scores did not differ between khat users who smoked tobacco (mean = 5.2, $SD = 3.2$) and khat users who didn't smoke (mean = 5.2, $SD = 2.3$; $F < 0.1$, n.s.).

As illustrated in Table 1, there was a significant khat dependence by gender interaction in age. A follow-up analysis with the Bonferroni correction (adjusted P value: 0.05/2 = 0.025) revealed that females were older than males in the KD group ($P = 0.001$); however, this gender difference was not found in the UKD group ($P = 0.56$). Men had

Table 1. Khat dependence and gender differences on demographic, khat use patterns, mood, and sleep disturbance.

	Unlikely to be khat dependent (UKD; n = 160)		Likely to be khat dependent (KD; n = 110)		Khat dependence effect F or χ^2	Gender effect F or χ^2	Khat / gender interaction F
	Female (n=88)	Male (n=72)	Female (n=41)	Male (n=69)			
Age (years)	29.8 (1.0)	30.7 (1.1)	35.1 (1.5)	28.5 (1.2)	1.54	5.54*	9.31**
Married (%)	60.2	55.6	68.3	52.2	0.00	2.19	–
Education (years)	12.0 (0.5)	16.0 (0.5)	12.2 (0.8)	14.4 (0.5)	1.56	26.8***	2.17
SDS-Khat total score	2.8 (0.2)	3.6 (0.2)	7.5 (0.3)	8.4 (0.2)	408.4***	12.0**	0.02
Regular khat use (%)	46.6	68.1	73.2	87.0	19.2***	15.0***	–
Age of first exposure to khat (years)	19.5 (0.5)	14.8 (0.6)	19.1 (0.8)	13.9 (0.6)	1.13	59.2***	0.18
Hours spent per khat session	4.5 (0.2)	5.8 (0.3)	4.3 (0.3)	5.7 (0.3)	0.39	26.1***	0.04
Days of khat use (week)	4.9 (0.2)	5.6 (0.2)	6.1 (0.3)	6.5 (0.2)	20.4***	5.20*	0.39
Have physical symptoms after khat use (%)	28.4	54.2	58.5	68.1	15.7***	14.3***	–
Thought about quitting khat (%)	46.6	73.6	56.1	72.5	1.60	15.7***	–
Tried quitting khat (%)	31.8	33.3	24.4	26.1	1.55	0.01	–
Tobacco user (%)	51.1	52.8	46.3	55.1	0.000	0.50	–
Negative effect	2.1 (0.1)	1.1 (0.1)	2.2 (0.2)	1.9 (0.1)	8.80**	15.9***	4.55*
Relaxed	3.5 (0.2)	3.8 (0.2)	3.7 (0.3)	3.5 (0.2)	0.01	0.08	1.17
Hungry	1.5 (0.2)	0.9 (0.2)	1.4 (0.3)	1.5 (0.2)	1.02	0.77	2.04
PSQI total score	6.3 (0.3)	5.2 (0.4)	7.9 (0.5)	6.8 (0.4)	15.3***	8.02**	0.002

KD = likely to be khat dependent; UKD = unlikely to be khat dependent.

Continuous measures are presented in mean and standard error of the mean with brackets. Categorical measures are presented as a percentage.

* $P < 0.05$, ** $P < 0.01$, *** $P < 0.001$.

F-values are shown for outcome measures that are continuous in nature. χ^2 values are shown for outcome measures that are presented in categories.

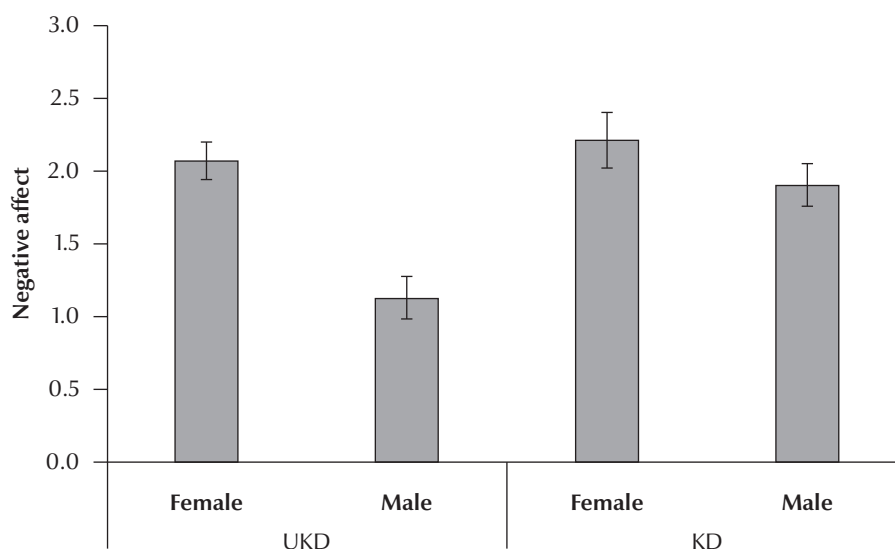
more years of education than women. Regarding influences of khat dependence, the KD group was more likely to use khat on a daily basis, hold more khat sessions during a typical week, and report having physical symptoms after stopping khat use than the UKD group. The KD group had greater levels of negative affect and poorer sleep quality relative to UKD group. With respect to gender differences, men were more likely than women to initiate khat use earlier in life, use khat longer in one session, hold more khat sessions per week, report having physical symptoms after stopping khat use, and to have thought about quitting khat use in the past. Sleep disturbance and negative mood were

higher in women than in men. No other khat dependence or gender main effects were found. A significant khat dependence by gender interaction in negative affect and a post-hoc analysis revealed greater levels of negative effect in women (mean = 2.1, SEM = 0.1) than in men (mean = 1.1, SEM = 0.1) among the UKD $F(1, 157) = 22.7, P = 0.001$; however, this was not the case among the KD group ($P = 0.19$; see Figure 1). No other interactions were observed.

Discussion

The observed prevalence rate for khat dependence in male subjects in this

study is 48.9%, which is consistent with prevalence rates previously reported of 51% in the UK (21), of 52% in Saudi Arabia (23), and of 44% in Australia (24). It is a clear public health concern that roughly half of male khat users sampled in four different countries are khat dependent and likely candidates for treatment intervention. Our study is the first to report the prevalence of screening positive for khat dependence in a sample of adult women from cities in Yemen. The observed prevalence rate for khat dependence in female subjects in our sample is 31.8%. Further investigation is needed to determine whether this is representative of the true prevalence rate for women, but this raises the



UKD = unlikely to be khat dependent; KD = likely to be khat dependent.

Figure 1. Negative affect as a function of khat dependence and gender. A gender difference was found in khat users who were unlikely to be khat dependent (UKD) but not in those likely to be dependent to khat (KD).

question of a need for specific treatment services for khat dependent women.

An average khat user chewed khat at a rate of about 5 hours per day and nearly 6 days a week. Severity of khat dependence was associated with greater frequency and intensity of khat use, impaired sleep quality, and increased negative affect. Khat dependence was also higher in males than in females. Problems with sleep and negative affect were greater in individuals who are clearly more psychologically dependent upon khat, and this should be a consideration in the design and implementation of treatment strategies for patients seeking treatment for khat dependence. Our findings also highlight the importance of the assessment of physical aspects of khat dependence.

The finding of increased negative affect in khat dependent individuals is consistent with reports of enhanced distress and emotional reactivity of khat users seen in a laboratory stress environment (34) as well as reports of verbal aggression and disruptive behaviour in some chronic khat users (4,17). This is also consistent with observational reports that khat chewers experience

a negative emotional state beginning 2 hours or so after the onset of a khat chewing session, a state that can last for several hours (34). It has been hypothesized that frequent khat chewers may experience multiple episodes of negative affect within and between khat chewing episodes, thereby increasing the likelihood of more persistent negative emotional states (34). Our results further suggest the role of khat dependence in the link between gender and negative affect since it was only found in non-dependent khat users. The mechanism responsible for these differences has not been defined and warrants future investigation.

The finding of an increased likelihood of impaired sleep in khat dependent individuals is consistent with clinical observations of khat users (10,17) as well as evidence from other investigations of habitual khat users (19,32). It is certainly possible that impaired sleep quality and/or sleep quantity may also increase the likelihood of negative affect in khat dependent individuals, therefore interacting in a synergistic manner.

Drug dependence produces serious mental and physical health burdens

especially in low- and middle-income countries (1). It has been reported that khat users, typically men, get together with their peers in the afternoon and chew khat for several hours, leading to financial and familial problems (35). Khat use has been linked to altered neurobiological mechanisms related to stress and emotion regulation (36), and there is evidence to suggest that khat is associated with worsening of ongoing psychopathology (4,5,13,37,38). Although concurrent and khat-only users in this study showed comparable levels of khat dependence, it is possible that variants of tobacco use (duration of use, exposure, and types of tobacco products such as cigarettes and shisha) could affect khat use patterns. More research on addiction, including khat use, and related conditions is clearly warranted in a global health context.

The use of face-to-face interviews in this study may have introduced a social desirability bias and thus constitutes a study limitation. The results of this study are also limited by the use of a cross-sectional method, in that one cannot infer causality relationships. The correlational relationship between khat

dependence and observed psychosocial factors should therefore be considered bi-directional and there should be no inferences made regarding the temporal sequence between the observed psychosocial factors and khat use/khat dependence. The present results on the rate of khat dependence may not represent the entire population in Yemen due to the use of convenience sampling. Future work should validate results of SDS-khat with standardized diagnostic tools such as the Diagnostic and

Statistical Manual of Mental Disorders (DSM) and the International Statistical Classification of Diseases and Related Health Problems (ICD)

In conclusion, severity of khat dependence was associated with greater frequency and intensity of khat use, increased negative mood, and poorer subjective sleep quality. Certain patterns of khat use may therefore increase the risk of a full-blown dependence syndrome. The mediating role of khat dependence in negative health consequences and

treatment outcomes should be elucidated in future research.

Funding: This study was supported by grants from Fogarty International Center (R03TW007219) and the National Institute of Health (NIH). The content is solely the responsibility of the authors and does not necessarily represent the official views of NIH. The study was also supported by the Khat Research Program.

Competing interests: None declared.

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