

## Prevalence and Predictors of Harmful Khat Use Among University Students in Ethiopia

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**ABSTRACT:** Comprehensive assessment of harmful khat use is lacking because often researchers rely on a simple tool for studying it. The aim of this study was to determine the prevalence and predictors of harmful khat use among Ethiopian university students by developing a comprehensive scale based on Alcohol Use Identification Test, Severity of Dependency Syndrome scale, and International Classification of Diseases definition of harmful substance use. Logistic regression was performed to identify predictors of harmful khat use. One in five current khat user students were identified as harmful khat users [20.6% (95% CI: 14.3–22.3)]. Harmful khat use in this study was strongly associated with chewing at commercial places [adjusted odds ratio (AOR) = 2.32 (95% CI: 1.01–5.33)], and having non-student friends accompanying the khat-chewing ceremony [AOR = 3.77 (95% CI: 1.09–13.03)]. Students who started chewing khat at the age of 20 years or later [AOR = 0.19 (95% CI: 0.07–0.55)] and those who preferred to study in the library [AOR = 0.31 (95% CI: 0.12–0.81)] were less likely to be harmful khat users. The university authorities, in addition to provision of student guidance on substance-use prevention, need to work in collaboration with the surrounding community and responsible public authorities in order to reduce harmful use of khat by their students.

**KEYWORDS:** khat, harmful substance use, college students

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### Introduction

Khat is a shrub-like plant that grows and is consumed mostly in East Africa and the Arabian Peninsula including Ethiopia where it is consumed traditionally for socialization and during spiritual rituals. It is often consumed by chewing fresh leaves in a group and in moderation. It has spread outside the region by migrant populations. Khat leaf has an amphetamine-like effect when chewed and is believed to have a potential to be addictive.<sup>1,2</sup> In some European countries, khat is classified as an illicit substance.<sup>3</sup>

Prolonged and excessive use of khat is linked with several health problems. Mental health problems are prominent leading to cognitive impairment, learning difficulties,<sup>4</sup> and behavioral changes.<sup>5</sup> Other health-related problems such as dental health problems,<sup>6,7</sup> cardiac abnormalities,<sup>8–10</sup> and

elevated blood pressure<sup>11,12</sup> were reported with prolonged use of khat.

Khat is currently recognized as one of the substances that are of concern in Ethiopian universities.<sup>13</sup> The prevalence of khat among Ethiopian university students have been reported between 9% and 32% by different researchers.<sup>14–16</sup> In other countries, khat chewing among college students ranges from 19% in Saudi Arabia to 54% in Yemen.<sup>17</sup>

There was no consensus on how khat use is measured. Researchers used their judgment to classify khat chewers into different categories using ad hoc procedures and mostly focused on the frequency of chewing. For instance, current khat use has been defined as chewing in the last 1 month,<sup>18</sup> 1 year,<sup>16</sup> and 2 years<sup>19</sup> by different researchers. Frequency of khat use was also assessed based on the number of days khat



chewed in a week.<sup>7,19</sup> The “dose” of khat was measured by asking the time they spent on chewing per day or how much they chew.<sup>20,21</sup> To date, the different approaches used to measure khat use are not standardized.

Both Diagnostic and Statistical Manual of Mental Disorders (DSM)<sup>22</sup> and International Classification of Disease (ICD) did not recognize khat as one of the substances related to health problems.<sup>23</sup> However, both manuals have “other/unspecified substances” categories where khat might fit in. The ICD have been indicated to identify harmful substance use better when compared with the DSM criteria, as it included more-detailed questions.<sup>24</sup> Previously Khat Severity Dependence Syndrome (KSDS) scale, which is based on DSM-IV criteria for dependence, has been used to assess the severity of khat dependency among Yemeni residents in the United Kingdom.<sup>25,26</sup> The KSDS is a 5-item scale adopted from Substance Dependence Syndrome (SDS) scale previously developed to detect severity of dependence among other substance users.<sup>27</sup> KSDS contains questions that measure psychological addiction (dependence), but did not measure frequency of use, dose, or social, health and financial consequences.

In Ethiopia, khat cultivation and use were traditionally limited to some parts of the country and certain population group. However, in the last two to three decades, widespread khat cultivation and use have been documented in all corners of the country.<sup>28,29</sup> Its use among young people has hugely increased. Students use it to stay awake/alert during long periods of studying due to heavy academic work load, especially during examinations.<sup>14</sup> A comprehensive assessment of the harmful use of khat is important to help efforts to reduce undesired consequences of khat chewing among university students. Thus, the objective of this study is to determine the prevalence and predictors of harmful khat use among Ethiopian university students using a comprehensive scale.

## Methods

**Study setting.** The study was conducted at Bahir Dar University which is one of the 31 public universities in Ethiopia. The university is located 564 km North-west of the capital city of Addis Ababa. The university had around 15,500 regular undergraduate students at the time of the study. More than 90% of the students use the full boarding on campus services, accommodation, and meal provided by the university. Khat chewing in the university campus is prohibited.

**Study design.** A cross-sectional study was conducted in June 2012 among regular undergraduate students. Sample size was determined for estimating prevalence and factors associated with khat chewing. The required sample was then allocated to departments proportional to their size and sex composition. Then, study participants were selected using a simple random sampling procedure from the department’s active student list. Students selected for the study were asked to fill a self-administered questionnaire.

**Questionnaire development.** The questionnaire for this study was developed by drawing on elements from KSDS scale,<sup>18</sup> Alcohol Use Disorder Identification Test (AUDIT),<sup>30</sup> the Cannabis Use Disorder Test (CUDIT),<sup>31</sup> and ICD-10 criteria of harmful substance use.<sup>23</sup> While KSDS measures only dependency syndrome, AUDIT and CUDIT include additional questions that measure “harmful” substance used based on ICD criteria. Additional questions that were not included in the three tests were added based on the ICD-10 recommendation. The scale used for this study included questions on the frequency of use, amount of use, tolerance, dependence, and health and social harms.

The questionnaire was pre-tested among Gondar University students, a public university with similar set up located 180 km north of Bahir Dar University. Some language and formatting adjustments were made based on the pre-test findings.

**Data analysis.** The data were double entered and cleaned using EPI Info™ 3.5.3 statistical software. The cleaned data were then transferred to STATA version 12 for analysis.

Initially, a total of 15 items were included in the instrument to measure khat-chewing pattern, dependence, and overall social, financial and health-related problems. Questions relating to chewing pattern are retained automatically as they are peculiar to khat-related problems. Exploratory factor analysis with varimax rotation was performed on the remaining items that measure dependence, social, financial, and health harm. A total of six factors were retained of which only two factors that had eigenvalue >1 were selected following Kaiser rule. Items with low loading (variance <0.4) or significant loading on more than one factor were excluded. Finally, 11 items were retained to construct the “harmful khat use scale.” The final scale had high internal consistency (Chronbac’s alpha = 0.87) (Table 1).

To determine the appropriate cutoff point for the scale, we used a holdout cross-validation technique, where we have used 67% of the data to determine cutoff point and 33% of the data to validate the determined cutoff point. Items were assessed on a scale of 0–4, thus the maximum possible score was 44. We then calculate sensitivity and specificity of frequent khat use to calculate the area under receiver operating characteristics (ROC) (Fig. 1).<sup>24</sup> Since we did not have a true gold standard to measure harmful khat use, we have used self-reported frequent khat use (khat chewing at least twice in a week) as a reasonable proxy in the absence of an established gold standard, as evidences show that health and social problems are more common among frequent khat users. Similar technique has been used to assess cigarette smoking status.<sup>33</sup> The ROC curve indicated a cutoff point for harmful khat use to be 11 out of the possible 44 points. Students who scored below 11 were classified as non-harmful khat chewers, whereas the remaining were classified as harmful khat chewers.

Binary and multivariable logistic regressions were used to identify socio-demographic factors and other substance

**Table 1.** Items included in the harmful khat use scale among Bahir Dar University students, June 2012.

| QUESTION  |  | SCORE  |
|---|--|--|
| <b>Items included in the final scale</b>                |  |  |
| 1.  | During the current semester, <sup>1</sup> how frequently have you chewed khat?                       | 0, Never; 1, at least once in a month; 2, at least once in a week; 3, more than once in a week; 4, daily |
| 2.  | How often have you chewed khat more than once in a single day?                                       | 0, Never; 1, rarely; 2, sometimes; 3, often; 4, always   |
| 3.  | What time do you usually chew khat? <sup>2</sup>   | 4, In the morning before noon; 0, any other time   |
| 4.  | During the current semester, how often have you had a strong desire or urge to chew khat?            | 0, Never; 1, rarely; 2, sometimes; 3, often; 4, always   |
| 5.  | During the current semester, did you ever feel that your khat chewing was out of control?            | 0, Never; 1, rarely; 2, sometimes; 3, often; 4, always   |
| 6.  | During the current semester, did the prospect of not chewing any khat make you anxious or worried?   | 0, Never; 1, rarely; 2, sometimes; 3, often; 4, always   |
| 7.  | How difficult would you find it to stop or go without khat chewing?                                  | 0, Never; 1, rarely; 2, sometimes; 3, often; 4, always   |
| 8.  | During the current semester, how often has your khat chewing has led to health problem?              | 0, Never; 1, rarely; 2, sometimes; 3, often; 4, always   |
| 9.  | During the current semester, how often has your khat chewing has led to social problem?              | 0, Never; 1, rarely; 2, sometimes; 3, often; 4, always   |
| 10.   | During the current semester, have you ever tried and failed to control, cut down or stop using khat? | 0, Never; 1, rarely; 2, sometimes; 3, often; 4, always   |
| 11.   | During the current semester, how often have you failed to do what was normally expected of you?      | 0, Never; 1, rarely; 2, sometimes; 3, often; 4, always   |
| <b>Items excluded after exploratory factor analysis</b> |  |  |
| 1.  | Do you worry about your khat-chewing habit?  | 0, Never; 1, rarely; 2, sometimes; 3, often; 4, always   |
| 2.  | Do you wish you could stop chewing khat?   | 0, Never; 1, rarely; 2, sometimes; 3, often; 4, always   |
| 3.  | During the second semester, how often has your khat chewing has led to financial problem?            | 0, Never; 1, rarely; 2, sometimes; 3, often; 4, always   |
| 4.  | Has a friend or relative or anyone else ever expressed concern about your khat chewing?              | 0, Never; 1, rarely; 2, sometimes; 3, often; 4, always   |

**Notes:** <sup>1</sup>Semester refers to 4 months period at the time data collection for this study. This time reference was put to help students remember the events correctly and thus reduce recall bias. <sup>2</sup>Khat chewing in the morning is a sign of dependence. In Ethiopia, the practice is referred as "Ejabina" which means "eye-opener."

use-related factors that are associated with harmful khat use. Variables with very small cell count and those with  $P > 0.2$  were not included in the multivariable logistic regression, which is used to calculate adjusted odds ratio (AOR). Those variables with  $P < 0.05$  in the AOR have been identified as having a significant association with harmful khat use.

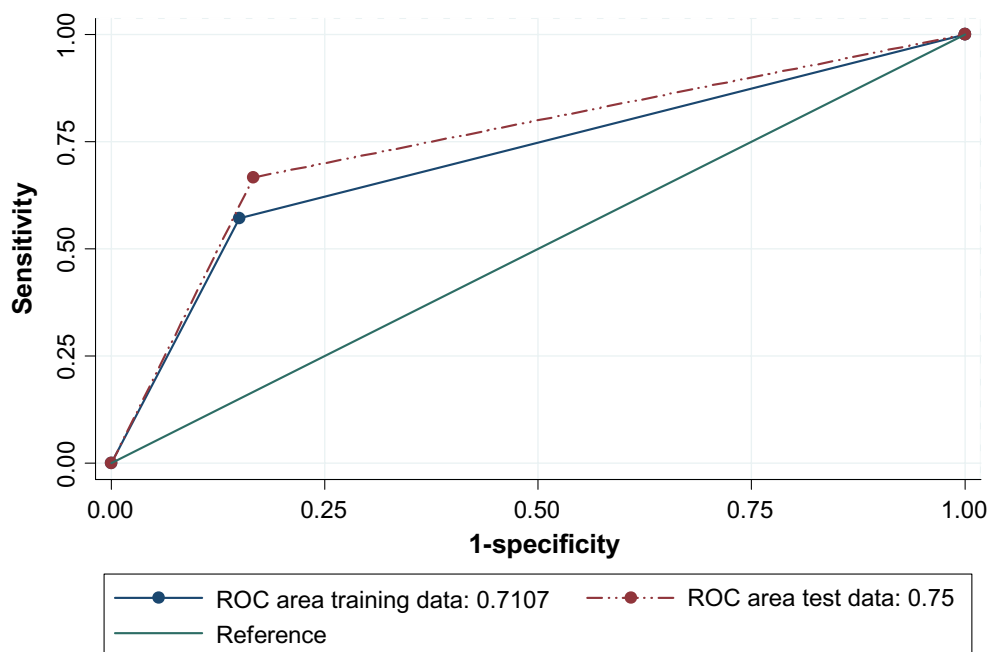
**Ethical issues.** The study protocol was approved by the Ethical Review Board of Bahir Dar University. Informed consent was obtained from each participant and participation was fully voluntary. Information obtained for the study was kept confidential. Data were processed in a secure room and only the researchers had access to the raw data. Study participants were offered small refreshment at the student café on the university campus.

## Result

A total of 3872 students were invited to participate in the study, of which 3268 filled and returned the self-administered questionnaire. Three hundred ninety-eight students reported

chewing khat in the 9 months preceding the survey. Of the 398 respondents, 360 have fully completed the questionnaire and thus were included in the analysis. Questionnaires with significant missing values on key questions were excluded from the analysis. Of the 360 students who reported khat use during the 9 months period preceding the survey, 74 [20.6% (95% CI: 14.3–22.3)] were classified as harmful khat users, all but four were male.

Harmful khat chewing was more likely to be practiced among students who were originally from small towns [AOR = 2.17 (95% CI: 1.12–4.22)], who go to commercial khat-chewing places [AOR = 3.28 (95% CI: 1.48–7.29)], who chew khat with non-student friends [AOR = 5.74 (95% CI: 1.56–21.00)], and among simultaneous cigarette smokers [AOR = 2.91 (95% CI: 1.23–6.88)]. On the other hand, students were less likely to have harmful khat-chewing practice, if khat chewing was started late, at age  $\geq 18$  years [AOR = 0.19 (95% CI: 0.07–0.55)], and if the preferred place to study was library [AOR = 0.31 (95% CI: 0.12–0.81)] (Tables 2 and 3).



**Figure 1.** Comparison of ROC curve for training and test data. Training data (67% of the total observation) were used to determine cutoff for harmful khat use scale. The cutoff was validated on the test data (33% of the total). The difference in the areas indicates how accurate the predicted cutoff is. The process was repeated vice versa.

## Discussion

About one in five currently khat-chewing students, almost all males, have harmful khat-chewing practice. Harmful khat chewing is more likely among students chewing at commercial khat-chewing places, those who chew with non-student friends, and those who are originally from small town, whereas it is less likely among students who have started chewing khat at older age and those who prefer to study in the library.

This study used a comprehensive tool to identify harmful khat-chewing practice among university students in Ethiopia. The development of the tool followed recommended steps for adopting a new tool into a new culture and set up.<sup>34,35</sup> We have used statistical techniques to select items and determine cutoff points. This study was based on self-reported substance use, which may be prone to recall bias. To minimize this problem, we used academic landmarks such as the beginning of the current academic year and current semester that helped students respond to the questions more accurately. Due to lack of a known gold standard in assessment of harmful khat use, we have used self-reported frequent khat chewing as a reasonable proxy to set the cutoff point for our scale. This scale is not compared against already existing khat-dependency measures such as KSDS. Although further work might be needed to widely use the scale, we believe it is fairly valid to warrant the conclusions made in this study. In this study, almost all harmful khat users were male students. Social norms and expectation that impose negative attitude toward women using substance may have protected female students from indulging into harmful khat-chewing practice. Previous studies have

also reported that some gender-specific norms are associated with lower level of substance use among women.<sup>36,37</sup>

Circumstances of khat chewing were found to be the most important predictors of harmful khat use in this study. Peer pressure and environmental factors are important contributing factors to harmful substance use among young people.<sup>38,39</sup> Since khat chewing is prohibited in the university campuses,<sup>13</sup> students would not be at ease to use khat on campus because of fear of being caught and dismissed. Thus, university students are likely to mingle with the local community and establish new friends who provide a safer place to regularly chew khat with no restrictions<sup>40</sup> or else go to commercial places. Khat chewers often prefer to chew khat with friends, it is in fact very uncommon to observe someone chewing khat alone.<sup>41</sup> Young people who have substance user friends or friends who approve substance use are more likely to abuse substances.<sup>38,39</sup> The association of cigarette smoking with harmful khat use is consistent with a previous study that shows harmful polysubstance use.<sup>41,42</sup> Student's expectation of khat to help them in their study may facilitate khat chewing in group during study session.<sup>14</sup> Ethiopia has expanded tertiary education by opening new universities and by hugely expanding the admission capacity of existing universities in the decade preceding this study. The accumulation of high number of students, up to 20,000–25,000 per university, has created new business opportunities for the local economy. Some businesses are essential for students, whereas others such as drinking places and substances (khat and marijuana) selling shops raised serious concerns to the well-being of students.

**Table 2.** Logistic regression for harmful khat use by sociodemographic factors among Bahir Dar University student, June 2012.

|  |                  | HARMFUL KHAT USE |     | CRUDE OR (95% CI) | ADJUSTED OR (95% CI)     |
|--|------------------|------------------|-----|-------------------|--------------------------|
|  |                  | YES              | NO  |                   |                          |
| Year of study  | Year 1           | 16               | 66  |                   |                          |
|  | Year 2           | 19               | 75  | 1.44 (0.61–3.41)  | 0.61 (0.24–1.58)         |
|  | Year 3           | 16               | 68  | 1.12 (0.44–2.82)  | 0.86 (0.33–2.20)         |
|  | Year 4 and above | 28               | 72  | 1.80 (0.79–4.14)  | 1.15 (0.47–2.84)         |
| Childhood residence                                  | Rural            | 10               | 48  | 1.00              | 1.00                     |
|  | Small town       | 39               | 107 | 2.12 (0.87–5.18)  | <b>2.17 (1.12–4.22)</b>  |
|  | Urban            | 29               | 125 | 1.04 (0.41–2.63)  | 1.22 (0.41–3.63)         |
| Off campus housing                                   | No               | 57               | 234 |                   | 1.00                     |
|  | Yes              | 19               | 35  | 2.23 (1.19–4.18)  | 1.47 (0.62–3.53)         |
| <b>Preferred place to study</b>                      |                  |                  |     |                   |                          |
| Library  | No               | 61               | 169 | 1.00              | 1.00                     |
|  | Yes              | 17               | 109 | 0.34 (0.17–0.71)  | <b>0.31 (0.12–0.81)</b>  |
| Dormitory  | No               | 44               | 173 |                   | 1.00                     |
|  | Yes              | 34               | 105 | 0.93 (0.52–1.69)  | 0.65 (0.25–1.65)         |
| Space  | No               | 64               | 207 |                   | 1.00                     |
|  | Yes              | 14               | 71  | 0.81 (0.40–1.62)  | 0.46 (0.17–1.30)         |
| In group rented houses                               | No               | 68               | 263 | 1.00              | 1.00                     |
|  | Yes              | 10               | 15  | 3.24 (1.28–8.25)  | 1.48 (0.40–5.51)         |
| <b>Circumstance of khat chewing</b>                  |                  |                  |     |                   |                          |
| Chew alone   | No               | 61               | 218 | 1.00              | 1.00                     |
|  | Yes              | 17               | 62  | 0.89 (0.44–1.80)  | 1.59 (0.55–4.60)         |
| Chew in group with other students                    | No               | 24               | 81  | 1.00              | 1.00                     |
|  | Yes              | 54               | 180 | 1.05 (0.56–1.96)  | 1.62 (0.57–4.55)         |
| Chew in group with other people who are not students | No               | 68               | 251 | 1.00              | 1.00                     |
|  | Yes              | 10               | 10  | 3.65 (1.40–9.56)  | <b>5.74 (1.56–21.00)</b> |
| Chew in khat chewing places                          | No               | 9                | 104 | 1.00              | 1.00                     |
|  | Yes              | 62               | 148 | 6.59 (2.53–17.16) | <b>3.28 (1.48–7.29)</b>  |

**Note:** Emboldened results are significant at  $P = 0.05$ .

Substance use prevention strategies for colleges students require comprehensive management of the environment that influences substance use.<sup>43</sup> Moving beyond the individual substance user and including peers and the environment are recommended.<sup>44</sup> Current activities to prevent substance use in Ethiopia are only focused on prevention of use on campus. However, the level and pattern of harmful khat use observed in this study call for a strong multisectoral involvement including local administrative bodies, health services providers, and non-governmental organizations.

In conclusion, this study revealed a high level of harmful khat use among current khat users. Harmful khat use habit is associated mainly with chewing khat outside the campus and having khat-chewing friends who are not studying at the

university. This study clearly showed that factors outside the university environment are more important determinants of khat use. Thus, universities need to work with the surrounding community closely to prevent harmful use of khat and avoid its negative consequences.

### Author Contributions

Conceived and designed the study: EG, YB, AW. Analyzed the data: EG. Wrote the first draft of the manuscript: EG. Contributed to the writing of the manuscript: YB, AW. Agree with manuscript results and conclusions: EG, YB, AW. Jointly developed the structure and arguments for the paper: EG, YB, AW. Made critical revisions and approved final version: EG, YB. All authors reviewed and approved the final manuscript.

**Table 3.** Logistic regression for harmful khat use by substance use status among Bahir Dar University student, June 2012.

|                                  |                    | HARMFUL KHAT USE |     | CRUDE OR (95% CI) | ADJUSTED OR (95% CI)    |
|----------------------------------|--------------------|------------------|-----|-------------------|-------------------------|
|                                  |                    | Yes              | No  |                   |                         |
| Year of study                    | Year 1             | 16               | 66  | 1.00              | 1.00                    |
|                                  | Year 2             | 19               | 75  | 1.44 (0.61–3.41)  | 1.19 (0.38–3.66)        |
|                                  | Year 3             | 16               | 68  | 1.12 (0.44–2.82)  | 1.12 (0.35–3.61)        |
|                                  | Year 4 and above   | 28               | 72  | 1.80 (0.79–4.14)  | 1.79 (0.63–5.03)        |
| Childhood residence              | Rural              | 10               | 48  | 1.00              | 1.00                    |
|                                  | Small town         | 39               | 107 | 2.12 (0.87–5.18)  | 2.46 (0.61–9.88)        |
|                                  | Urban              | 29               | 125 | 1.04 (0.41–2.63)  | 0.73 (0.17–3.05)        |
| Off campus housing               | No                 | 57               | 234 | 1.00              | 1.00                    |
|                                  | Yes                | 19               | 35  | 2.23 (1.19–4.18)  | 2.29 (0.89–5.93)        |
| Age at first khat chewing        | Less than 18 years | 38               | 81  | 0.34 (0.18–0.66)  | 1.00                    |
|                                  | 18–19 years        | 16               | 100 | 0.29 (0.14–0.61)  | <b>0.36 (0.15–0.83)</b> |
|                                  | 20 years or older  | 11               | 80  |                   | <b>0.19 (0.07–0.55)</b> |
| Have close friends who chew khat | No                 | 8                | 27  | 1.00              | 1.00                    |
|                                  | Yes                | 69               | 237 | 0.98 (0.43–2.26)  | 0.33 (0.07–1.67)        |
| Have dormmates who chew khat     | No                 | 17               | 76  | 1.00              | 1.00                    |
|                                  | Yes                | 61               | 190 | 1.44 (0.79–2.61)  | 1.66 (0.61–4.50)        |
| Concurrent smoking               | No                 | 20               | 153 | 1.00              | 1.00                    |
|                                  | Yes                | 52               | 103 | 3.86 (2.18–6.85)  | 2.24 (0.85–5.87)        |
| Concurrent drinking              | No                 | 10               | 72  | 1.00              | 1.00                    |
|                                  | Yes                | 62               | 184 | 2.43 (1.18–4.99)  | 2.34 (0.72–7.64)        |
| Concurrent shisha use            | No                 | 38               | 172 | 1.00              | 1.00                    |
|                                  | Yes                | 35               | 62  | 2.56 (1.48–4.40)  | 0.92 (0.40–2.13)        |
| Simultaneous smoking             | No                 | 47               | 230 | 1.00              | 1.00                    |
|                                  | Yes                | 32               | 30  | 5.22 (2.90–9.40)  | <b>2.91 (1.23–6.88)</b> |
| Simultaneous drinking            | No                 | 49               | 197 | 1.00              | 1.00                    |
|                                  | Yes                | 30               | 63  | 1.91 (1.12–3.27)  | 2.19 (0.96–5.01)        |
| Simultaneous shisha use          | No                 | 64               | 242 | 1.00              | 1.00                    |
|                                  | Yes                | 15               | 18  | 3.15 (1.51–6.59)  | 0.90 (0.28–2.88)        |

**Note:** Embolden results are significant at  $P = 0.05$ .

#### DISCLOSURES AND ETHICS

As a requirement of publication the authors have provided signed confirmation of their compliance with ethical and legal obligations including but not limited to compliance with ICMJE authorship and competing interests guidelines, that the article is neither under consideration for publication nor published elsewhere, of their compliance with legal and ethical guidelines concerning human and animal research participants (if applicable), and that permission has been obtained for reproduction of any copyrighted material. This article was subject to blind, independent, expert peer review. The reviewers reported no competing interests.

#### REFERENCES

- Manghi RA, Broers B, Khan R, Benguettat D, Khazaal Y, Zullino DF. Khat use: lifestyle or addiction? *Journal of psychoactive drugs*. Mar 2009;41(1):1–10.
- Brenneisen R, Fisch H, Koelbing U, Geissshusler S, Kalix P. Amphetamine-like effects in humans of the khat alkaloid cathinone. *British journal of clinical pharmacology*. 1990;30(6):825–8.
- Griffiths P, Lopez D, Sedefov R, et al. Khat use and monitoring drug use in Europe: the current situation and issues for the future. *Journal of ethnopharmacology*. 2010;132(3):578–83.
- Colzato LS, Ruiz MJ, Wildenberg WPMvd, Hommel B. Khat Use Is Associated with Impaired Working Memory and Cognitive Flexibility. *PLoS one*. 2011;6(6):e20602.
- Al-Habori M. The potential adverse effects of habitual use of Catha Edulis (Khat) *Expert Opin. Drug Saf*. 2005;4(6):1145–54.
- Al-Kholani AI. Influence of Khat Chewing on Periodontal Tissues and Oral Hygiene Status among Yemenis. *Dental research journal*. Winter;7(1): 1–6.
- Al-Hebshi NN. Qat Chewing as an Independent Risk Factor for Periodontitis: A Cross-Sectional Study. *International journal of dentistry*. 2013;2013.
- al'Absi M, Khalil NS, Al Habori M, Hoffman R, Fujiwara K, Wittmers L. Effects of chronic khat use on cardiovascular, adrenocortical, and psychological responses to stress in men and women. *The American Journal on Addictions*. 2013;22(2):99–107.
- Al-Shami M, Al-Motarreb A. Association of khat chewing with significant coronary artery disease in patients presenting with heart failure. *Journal of the Saudi Heart Association*. 2013;25(2):149–50.



10. Al-Motarreb A, Briancon S, Al-Jaber N, et al. Khat chewing is a risk factor for acute myocardial infarction: a case-control study. *Br J Clin Pharmacol*. May 2005;59(5):574–81.
11. Getahun W, Gedif T, Tesfaye F. Regular Khat (*Catha edulis*) chewing is associated with elevated diastolic blood pressure among adults in Butajira, Ethiopia: a comparative study. *BMC public health*. 2010;10:390.
12. Tesfaye F, Byass P, Wall S, Berhane Y, Bonita R. Association of smoking and khat (*Catha edulis* Forsk) use with high blood pressure among adults in Addis Ababa, Ethiopia, 2006. *Prev Chronic Dis*. Jul 2008;5(3):A89.
13. Federal Democratic Republic of Ethiopia. Education Sector Development Program IV (ESDP IV) 2010. In: Ministry of Education, ed. Addis Ababa, Ethiopia 2011.
14. Kebede Y. Cigarette smoking and Khat chewing among college students in North West Ethiopia. *Ethiop J Health Dev*. 2002;16(1):9–17.
15. Eshetu E, Gedif T. Prevalence of Khat, Cigarette and Alcohol Use Among Students of Technology and Pharmacy, Addis Ababa University. *Ethiopian Pharmaceutical Journal*. 2006;24(2):116–24.
16. Deressa W, Azazh A. Substance use and its predictors among undergraduate medical students of Addis Ababa University in Ethiopia. *BMC public health*. 2011;11(1):660.
17. Laswar AK, Darwish H. Prevalence of cigarette smoking and khat chewing among Aden university medical students and their relationship to BP and body mass index. *Saudi journal of kidney diseases and transplantation: an official publication of the Saudi Center for Organ Transplantation, Saudi Arabia*. Sep 2009;20(5):862–6.
18. Colzato LS, Ruiz MJ, Van Den Wildenberg WP, Bajo MT, Hommel B. Long-term effects of chronic khat use: impaired inhibitory control. *Front Psychol*. 2010;1.
19. Alsanosi R, Bani I, Ageely H, et al. Socio-medical problem of the habituation of Khat chewing in Jazan region in Southern Saudi Arabia. *Eur J Sci Res*. 2011;63(1):122–33.
20. Odenwald M, Neuner F, Schauer M, et al. Khat use as risk factor for psychotic disorders: a cross-sectional and case-control study in Somalia. *BMC medicine*. 2005;3:5.
21. Griffiths P, Gossop M, Wickenden S, Dunworth J, Harris K, Lloyd C. A trans-cultural pattern of drug use: qat (khat) in the UK. *The British Journal of Psychiatry*. 1997;170(3):281–4.
22. American Psychiatric Association. Diagnostic and statistical manual of mental disorders: DSM-IV-TR<sup>®</sup>. Arlington, VA: American Psychiatric Association; 2000.
23. World Health Organization. *The ICD-10 classification of mental and behavioural disorders: diagnostic criteria for research*. Geneva, Switzerland: World Health Organization; 1994.
24. Andrews G, Slade T, Peters L. Classification in psychiatry: ICD-10 versus DSM-IV: Royal College of Psychiatrists British Journal of Psychiatry 17 BELGrave Square, London SW1X 8PG, England; 1999.
25. Kassim S, Croucher R, al'Absi M. Khat dependence syndrome: A cross sectional preliminary evaluation amongst UK-resident Yemeni khat chewers. *Journal of ethnopharmacology*. 2013.
26. Kassim S, Islam S, Croucher R. Validity and reliability of a Severity of Dependence Scale for khat (SDS-khat). *Journal of ethnopharmacology*. 2010;132(3):570–7.
27. Gossop M, Darke S, Griffiths P, et al. The Severity of Dependence Scale (SDS): psychometric properties of the SDS in English and Australian samples of heroin, cocaine and amphetamine users. *Addiction*. 1995;90(5):607–14.
28. Ambaye GG. Production and consumption trends of khat in Ethiopia: A big business or a big worry. *Advances in Agriculture, Sciences and Engineering Research*. 2012;2(10).
29. Feyisa TH, Aune JB. Khat expansion in the Ethiopian highlands: Effects on the farming system in Habro district. *Mountain Research and Development*. 2003;23(2):185–9.
30. Saunders JB, Aasland OG, Babor TF, Grant M. Development of the alcohol use disorders identification test (AUDIT): WHO collaborative project on early detection of persons with harmful alcohol consumption-II. *Addiction*. 1993;88(6):791–804.
31. Adamson SJ, Sellman JD. A prototype screening instrument for cannabis use disorder: the Cannabis Use Disorders Identification Test (CUDIT) in an alcohol-dependent clinical sample. *Drug and alcohol review*. 2003;22(3):309–15.
32. Fawcett T. An introduction to ROC analysis. *Pattern recognition letters*. 2006;27(8):861–74.
33. Murray RP, Connett JE, Lauger GG, Voelker H. Error in smoking measures: effects of intervention on relations of cotinine and carbon monoxide to self-reported smoking. The Lung Health Study Research Group. *American journal of public health*. 1993;83(9):1251–7.
34. Gjersing L, Caplehorn J, Clausen T. Cross-cultural adaptation of research instruments: language, setting, time and statistical considerations. *BMC medical research methodology*. 2010;10(1):13.
35. Matsuzaki M, Haruna M, Ota E, Yeo S, Murayama R, Murashima S. Translation and cross-cultural adaptation of the Pregnancy Physical Activity Questionnaire (PPAQ) to Japanese. *Bioscience trends*. 2010;4(4):170.
36. Brady KT, Randall CL. Gender differences in substance use disorders. *Psychiatric Clinics of North America*. 1999;22(2):241–52.
37. Lewis MA, Neighbors C. Gender-specific misperceptions of college student drinking norms. *Psychology of Addictive Behaviors*. 2004;18(4):334.
38. Barrett AE, Turner RJ. Family structure and substance use problems in adolescence and early adulthood: examining explanations for the relationship. *Addiction*. 2006;101(1):109–20.
39. Dishion TJ, Owen LD. A longitudinal analysis of friendships and substance use: bidirectional influence from adolescence to adulthood. *Developmental psychology*. 2002;38(4):480.
40. Alsanusy R, El-Setouhy M. Why would khat chewers quit? An in-depth, qualitative study on Saudi khat quitters. *Substance Abuse*. 2013(just-accepted).
41. Gebreslassie M, Feleke A, Melese T. Psychoactive substances use and associated factors among Axum university students, Axum Town, North Ethiopia. *BMC public health*. 2013;13(1):693.
42. Mahfouz MS, Alsanosy RM, Gaffar AM, et al. The role of family background on adolescent khat chewing behavior in Jazan Region. *Annals of general psychiatry*. 2013;12(1):16.
43. DeJong W, Langford LM. A typology for campus-based alcohol prevention: Moving toward environmental management strategies. *Journal of studies on alcohol and drugs*. 2002(14):140.
44. Perkins H. Social norms and the prevention of alcohol misuse in collegiate contexts. *Journal of studies on alcohol and drugs*. 2002(14):164.