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Prevalence and factors associated with khat use among minibus workers in northern Tanzania

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BACKGROUND
Khat use is a growing public health concern. Chewed for its stimulant effect, khat can have serious negative social, economic, psychological and health consequences. Little is known about the epidemiology of khat use in Tanzania. This study aimed to determine prevalence and factors associated with khat use among minibus workers in Moshi Municipality, northern Tanzania.

METHODS
A cross-sectional study was conducted among 254 minibus workers between May and July 2015 in Moshi Municipality, Kilimanjaro region, northern Tanzania. Respondents were sampled from commuter bus stations and interviewed. Multivariable logistic regression models were used to determine factors associated with khat use.

RESULTS
Prevalence of khat use among minibus workers in Moshi Municipality was found to be 46.5%. Age (OR= 4.68, 95% CI 1.47-14.92), hazardous alcohol use (OR=3.39, 95% CI 1.09-10.53), current cigarette smoking (OR=10.41, 95% CI 2.99-36.26) and having multiple sexual partners (OR=1.92, 95% CI 1.04-3.53) were factors associated with khat use.

CONCLUSION
Nearly half of minibus workers used khat. Age, hazardous alcohol use, cigarette smoking and having multiple sexual partners were associated with khat use. These findings call for awareness creation about health and social consequences of khat use in line with other risk behaviors like alcohol consumption and cigarette smoking, especially when linked with public transportation services.

Key words: *Khat use, minibus workers, prevalence, risk factors, Tanzania*

BACKGROUND

Khat use is growing as an issue of public health concern. Khat is a green shrub (from Catha edulis plant) commonly cultivated and used in Ethiopia, East Africa and the southern Arabian Peninsula (El-Menyar, Mekkodathil, Al-Thani, & Al-Motarred, 2015; Mahfouz, Rahim, Solan, Makeen, & Alsanosy, 2015; Njuguna, Olieva, Muruka, & Owek, 2013). People chew khat for its stimulant effect (Alsanosy, Mahfouz, & Gaffar, 2013). A number of studies on khat use have been conducted among secondary school and college students in Saudi Arabia and Ethiopia. Prevalence of about 21% was reported in Jazan region in Saudi Arabia (Alsanosy et al., 2013) while in Ethiopia it ranged from 9.6% in University of Gondar (Sinshaw, Messele, & Kssa, 2014) to 24% in Bahir Dar University (Gebrehanna, Berhane, & Worku, 2014). Almost two-thirds (68%) of

men in Masalani town, northeastern Kenya chewed khat, and half of these did so on a daily basis (Njuguna et al., 2013). In Tanzania, population-based estimates are scarce. Prevalence among injection drug users aged 18-59 years in Dar es Salaam, Tanzania, was reported to be 10.4% among men and 7.2% among women (Ross et al., 2008). However, these findings may not reflect khat use among the general population.

Several demographic, sexual and substance use factors have been found to be associated with khat use. Factors associated with khat use include: staying alert for a long time (El-Menyar et al., 2015; Nigussie, Gobena, & Mossie, 2013), age, sex (i.e. high among males compared to females), alcohol use, cigarette smoking, having a friend who uses khat, perceived increased academic performance, having unprotected sex, initiation of sexual activity and having multiple sexual partners (Alsanosy et al., 2013; Birhanu, Bisetegn, & Woldeyohannes, 2014; Haile & Lakew, 2015; Kassim, Rogers, & Leach, 2014; Njuguna et al., 2013; Ross et al., 2008; Sinshaw et al., 2014; Tilahun & Ayele, 2013). Family history of substance use "(i.e. alcohol or smoking or khat use)" has also been associated with khat use (Birhanu et al., 2014). A recent mixed methods study in Ethiopia has associated problematic khat use with the risk of psychoactive substance use, especially harmful drinking (Mihretu, Teferra, & Fekadu, 2017).

Consumption of khat can have serious health and economic consequences (Haile & Lakew, 2015). For instance, regular khat use has been associated with increased risk of hypertension, elevated diastolic blood pressure (Getahun, Gedif, & Tesfaye, 2010; Mateen & Cascino, 2010), acute coronary syndrome (Mateen & Cascino, 2010), gastrointestinal disorders (Nigussie et al., 2013), psychological dependence on the substance (Dhaifalah & Santavý, 2004; Kassim et al., 2014), and mental distress (Damena, Mossie, & Tesfaye, 2011; Njuguna et al., 2013). Mental health issues such as depression, anxiety, and even psychoses have been associated with habitual use of khat (Reda, Moges, Biadgilign, & Wondmagegn, 2012).

Driving under the influence of khat is reported to be one of the major contributors of road fatalities because of drivers' impairment (Awadalla & Suwaydi, 2017; Eckersley, Salmon, & Gebru, 2010; Gebremichael et al., 2017; Hayley, Downey, Shiferaw, & Stough, 2016). Despite this evidence, the burden of khat use among drivers in Tanzania is not known. Furthermore, because consumption of khat has been associated with the use of other substances and increase in other risk behaviors, it is important to document the burden of this problem to inform appropriate interventions. This study aimed to determine prevalence and factors associated with khat chewing among minibus workers in Tanzania.

METHODS

This was an analytical cross-sectional study conducted from May to July 2015 in Moshi Municipality, northern Tanzania. Moshi is one of seven districts of Kilimanjaro Region, with a total population of 184,292 and an area of 59km2 (National Bureau of Statistics (Tanzania) & Office of Chief Government Statistician (Zanzibar), 2016). Over 90% of the population depends on income-generation activities in the informal, micro and small-scale enterprises, with the major sources of income being from private, public and self-employment. The municipality is a business center and a town containing a main bus stand as well some other small bus stands serving different routes within and outside the municipality. This study included minibus workers from the available 8 commuter bus routes within the municipality streets, i.e. Kiboroloni, Majengo, Pasua, Kilimanjaro Christian Medical Center (KCMC), Mailisita, Memorial, Soweto and Bonite. Minibuses are the most common form of transportation within the Municipality. The population of minibus workers was selected under the assumption that they might be engaging in high-risk behaviors.

Study participants and sample size

Sample size was calculated by using the formula for estimating a single proportion (Lemeshow, Hosmer, Klar, Lwanga, & WHO, 1990). Assuming the proportion of khat use of 20% among minibus workers, the margin of error of 5% and the standard normal value (1.96) under the 95% confidence limit, the required sample size was 246. Allowing for 5% of non-response, the minimum required sample size was estimated to be 260 participants. We excluded minibus workers whose routes were outside the municipality. An average of 30 minibus workers were recruited from each of the 8 stations. Minibus workers included drivers, conductors and touts – individuals who persistently, repeatedly and competitively persuade passengers to board a specific minibus. This population comprises a mixture of adolescents and youths as well as adults.

Variables

In this study, khat use was the main outcome. Khat use was defined as ever chewing the khat substance in the three months preceding the interview. Participants were asked how many times they chewed khat in the past three months. Responses were computed as a binary variable.

Independent variables included socio-demographic variables such as age, education, area of residence, marital status, current occupation, alcohol use and smoking status. Education level was categorized into primary, secondary and above secondary; area of residence as urban and rural; occupation as driver, conductor and tout; and marital status as single, married or cohabiting with a partner, and widowed, separated or divorced. Smoking status was categorized as never, former smokers, and current smokers (smoking cigarette in the past three months) and alcohol use as never drinkers, non-hazardous drinkers, and hazardous drinkers. Hazardous alcohol use was defined as

a pattern of alcohol consumption that increases the risk of harmful consequences for the user or others (Babor, Higgins-Biddle, Saunders, & Monteiro, 2001). This was calculated based on the WHO AUDIT score, which is a 10-item questionnaire with a range of possible scores from 0 to 40 which is used to assess risk drinking (Babor et al., 2001; Bazargan-Hejazi, Gaines, Bazargan, Seddighzadeh, & Ahmadi, 2012). A score of 1 or more indicated consumption at a hazardous level.

We also analyzed risky sexual behavior variables such as age at first sexual intercourse (in years), condom use during the first sex, condom use during the last sexual intercourse, multiple sexual partners (defined as having two or more sexual partners in the past three months preceding the interview), alcohol use before sexual intercourse, and khat use before sexual intercourse.

Data collection

Data collection was conducted by two trained doctor of medicine students at Kilimanjaro Christian Medical University College. Face-to-face interviews were conducted using a questionnaire. Each questionnaire was assigned a unique identification number. As the commuter buses arrived at the stations during the day, respondents were approached, administered informed consent, and recruited (if they had consented) consecutively until the required sample size was reached.

Statistical analysis

Data was entered and cleaned using Statistical Software for Social Sciences (SPSS) (SPSS Inc., Chicago, IL) version 20.0, checked and corrected for any errors or inconsistencies every day after the interviews, and analyzed using STATA® software (Stata Corp LP) version 13.1. Frequency and percentages were used to describe prevalence of khat use. Numeric variables were summarized using mean (standard deviation) or median (interquartile range). Odds ratios (ORs) with 95% confidence intervals (CIs) for factors associated with khat use were estimated using a multivariable logistic regression model while controlling for potential confounders. A p-value of less than 0.05 was considered to be statistically significant. We also tested for interaction between alcohol consumption and cigarette smoking on khat use. We found statistical evidence ($p<0.05$) for interaction (results not presented here); the final model took this into consideration.

Ethical clearance

Ethical clearance was obtained from Kilimanjaro Christian Medical University College Research and Ethics Review Committee. Permission to carry out the study was obtained from Moshi Municipal Authority. Verbal and written informed consent were obtained from minibus workers prior to the interviews. Confidentiality and privacy were maintained by using unique identification numbers instead of names. Each participant was interviewed individually in a private location around the bus station.

RESULTS

Background characteristics of study participants

A total of 254 minibus workers out of 260 participated in this study. The mean age of participants was 26.9 years (standard deviation 6.5; Table 1). About two thirds (62.6%) were aged between 20 and 29 years. Over half (55.9%) of those interviewed were drivers. The overall prevalence of khat use was 46.5%. Of all study participants, 115 (45.5%) drank alcohol at hazardous levels and 125 (49.2%) were current cigarette smokers.

Table 1. Background characteristics of minibus workers in Moshi Municipality (N=254)

Characteristics	n	%
Khat use		
Never used	136	53.5
Ever used	118	46.5
Age in years		
Mean (SD)	26.9	(6.5)
15 – 19	25	9.8
20 – 29	159	62.6
30+	70	27.6
Education		
Primary	179	70.5
Secondary	58	22.8
Above Secondary	17	6.7
Area of residence		
Urban	191	75.2
Rural	63	24.8
Religion		
Muslim	92	36.2
Christian	162	63.8
Current occupation		
Driver	142	55.9
Conductor	83	32.7
Tout (tin noise maker)	29	11.4
Marital status		
Single	126	49.6
Married/Cohabiting	120	47.2
Widowed/Separated/ Divorced	8	3.2
Alcohol use*		
Never	89	35.2
Non-hazardous	49	19.4
Hazardous	115	45.5
Smoking status		
Never	100	39.4
Ever smokers	29	11.4
Current smokers	125	49.2

*One person missing alcohol use information

Risky sexual behaviors of the study participants

The median age at first sexual encounter was 17 years (interquartile range 15 to 19; Table 2). Over half (52.8%) of participants reported having two or more sexual partners in the three months preceding the interview. Prevalence of condom use during first sex was 23.9% while prevalence of condom use in the last sexual intercourse was 21.9%. Of all study participants, 37 (14.7%) used khat before last sex.

Table 2. Sexual behaviors of minibus workers in Moshi Municipality

Sexual behaviors	n	%
Age at first sex		
Median (IQR)	17	(15,19)
Never	3	1.2
12-14	32	12.6
15-19	166	65.4
20+	28	11.0
Don't know/when married	25	9.8
Condom use during first sex		
No	191	76.1
Yes	60	23.9
Number of partners, past three months		
None	16	6.3
1 Partner	104	40.9
2+ Partners	134	52.8
Alcohol use before last sex		
No	126	50.2
Yes	125	49.8
Condom use during last sex		
No	196	78.1
Yes	55	21.9
Khat use before last sex		
No	214	85.3
Yes	37	14.7

Factors associated with khat use

In the crude analysis, age, hazardous alcohol use, smoking status, and number of sexual partners showed a statistically significant association ($p<0.05$) with higher odds of khat use (Table 3). Significantly higher odds of khat use were observed among adolescents (aged 15-19 years) (OR=2.78, 95% CI 1.09, 7.89) and among those aged 20-29 years (OR=2.32, 95% CI 1.28, 4.20) compared to adults aged 30 years and above. Likewise, higher odds of khat use were observed among hazardous alcohol drinkers (OR=1.91, 95% CI 1.09, 3.36) compared to never drinkers, current smokers (OR=3.08, 95% CI 1.78, 5.35) compared to those who had never smoked, and among participants who reported having multiple sexual partners in the past three months (OR=2.14, 95% CI 1.27, 3.62) compared to those with only one sexual partner.

Table 3. Characteristics associated with khat use among minibus workers in Moshi Municipality

Characteristics	Total	Ever use (%)	cOR* (95% CI)	aOR** (95%CI)
Age in years				
15-19	25	14 (56.0)	2.78 (1.09, 7.89)	4.68 (1.47, 14.92)†
20-29	159	82 (51.6)	2.32 (1.28, 4.20)	2.01 (1.02, 3.98)†
30+	70	22 (31.4)	1.00	
Education				
Primary	179	84 (46.9)	1.26 (0.46, 3.47)	-
Secondary	58	27 (46.6)	1.24 (0.42, 3.72)	-
Secondary+	17	7 (41.2)	1.00	
Current occupation				
Driver	142	66 (46.5)	1.00	
Conductor	83	34 (41.0)	0.80 (0.46, 1.38)	-
Tout	29	18 (62.1)	1.88 (0.83, 4.28)	-
Marital status				
Single/never married	126	65 (51.6)	1.00	
Married/	120	49 (40.8)	0.65 (0.39, 1.07)	-
Separated	8	4 (50.0)	0.94 (0.22, 3.92)	-
Alcohol use				
Never	89	36 (40.4)	1.00	
Non-hazardous	49	16 (32.7)	0.71 (0.34, 1.48)	-
Hazardous	115	65 (56.5)	1.91 (1.09, 3.36)	-
Smoking status				
Never	100	32 (32.0)	1.00	
Ever smokers	29	12 (41.4)	1.50 (0.64, 3.51)	-
Current smokers	125	74 (59.2)	3.08 (1.78, 5.35)	-
Age at first sex				
Never	3	-	-	-
12-14	32	17 (53.1)	2.64 (0.72, 5.76)	-
15-19	166	80 (48.2)	1.67 (0.73, 3.84)	-
20+	28	10 (35.6)	1.00	
Don't know/ when married	25	11 (44.0)	1.41 (0.47, 4.27)	-
Number of sexual partners, past 3 months††				
1 partner	104	38 (36.5)	1.00	
2+ partners	134	74 (55.2)	2.14 (1.27, 3.62)	1.92 (1.04, 3.53)†
Alcohol use before last sex				
No	126	56 (44.4)	1.00	
Yes	125	62 (49.6)	1.23 (0.75, 2.02)	-
Condom use during last sex				
No	196	95 (48.5)	1.00	
Yes	55	23 (41.8)	0.76 (0.42, 1.40)	-

*cOR – Crude odds ratio; **aOR – Adjusted odds ratio, adjusted for age, alcohol use, number of sexual partners, and smoking status; ††excluded those who never had sex; †p<0.05; ‡p<0.001.

After adjusting for confounding effects, age, hazardous alcohol use, smoking status and having multiple sexual partners remained significantly associated with khat use. Compared to minibus workers aged 30 years and above, those aged 15-19 years had about 5 times higher odds of using khat (OR=4.68, 95% CI 1.47, 14.92), while over 2 times higher odds of khat use were observed among those aged 20-29 years (OR=2.01, 95% CI 1.02 – 3.98). Minibus workers with multiple sexual partners had 92% higher odds of khat use (OR=1.92, 95% CI 1.04, 3.53) compared to those with only one sexual partner (Table 3).

We also performed a test for interaction due to the documented co-morbidity between alcohol use and smoking status (Hurley, Taylor, & Tizabi, 2012) and found a significant interaction effect ($p<0.05$). The odds of khat use were over three times higher (OR=3.39, 95% CI 1.09, 10.53) among hazardous alcohol drinkers (but never smokers) compared to never drinkers. Current smokers (but never drinkers) had over ten times higher odds of using khat compared to never smokers (OR=10.41, 95% CI 2.99, 36.26). On the other hand, participants who were non-hazardous drinkers but current smokers had lower odds of khat use (OR=0.18, 95% CI 0.04, 0.76) compared to never drinkers (Table 4).

Table 4. Results of interactions* between alcohol use and smoking status

		Alcohol use		
		Never drinkers	**Non-hazardous drinkers**	**Hazardous drinkers**
Smoking status	**Never smoke**	1.0	1.29 (0.39, 4.26)	3.39 (1.09, 10.53)
	Ever smokers	3.17 (0.74, 13.70)	1.80 (0.19, 17.12)	0.31 (0.05, 2.03)†
	Current smokers	10.41 (2.99, 36.26)†	0.18 (0.04, 0.76)†	0.50 (0.16, 1.58)

*Odds ratios (95%CI) adjusted for age and number of sexual partners; †$p<0.05$

DISCUSSION

Nearly half of the minibus workers included in this study in Moshi municipality chewed khat. This is much higher than that reported among injection drug users in Dar es Salaam (10% among males and 7% among females) (Ross et al., 2008) and among secondary school and college students (10% to 24% in Ethiopia and 21% in Saudi Arabia) (Alsanosy et al., 2013; Gebrehanna et al., 2014; Sinshaw et al., 2014). However, prevalence was lower than that reported among men (68%) in northeastern Kenya (Njuguna et al., 2013). Adolescents had higher odds of khat use in this study, which agrees with findings reported in Ethiopia (Birhanu et al., 2014; Reda et al., 2012). Adolescence is a period when the khat use habit starts, and khat is often introduced by peers who are also users, possibly resulting in higher odds of khat use (Alsanosy et al., 2013; Gebrehanna et al., 2014).

In the current study, the effect of alcohol consumption on khat use differed by levels of smoking status. Hazardous alcohol users but never smokers had significantly higher odds of khat use compared to never drinkers, similar to findings in Ethiopia (Kassa, Wakgari, & Taddesse, 2016; Mihretu et al., 2017; Tilahun & Ayele, 2013; Tsegay & Esmael, 2013). Minibus workers who were current cigarette smokers but were never drinkers had higher odds of khat use compared to never smokers, which agrees with findings among men in Kenya (Njuguna et al., 2013) and among school students in Jazan region, Saudi Arabia (Alsanosy et al., 2013). Participants who were non-hazardous drinkers but were current smokers had lower odds of khat use. Other studies have indicated that one of the most common consequences of khat chewing is tobacco uptake (Kassim et al., 2014; Mihretu et al., 2017). This may be true in our study because current smoking status increased the odds of khat use. The combined effect of khat, alcohol and tobacco use leads to serious health consequences (Hurley et al., 2012; Reda et al., 2012).

Minibus workers with multiple sexual partners were more likely to be khat users in our study. Similar findings were reported among secondary school youths in Ethiopia (Menna, Ali, & Worku, 2014). Repeated khat use has been reported to increase the odds of high-risk sexual behaviors (Hoffman & Al'Absi, 2010; Kebede et al., 2005), hence increased risk of sexually transmitted infections including HIV/AIDS (Malaju & Asale, 2013). The link between multiple sexual partners and khat use may be explained by the high proportion of alcohol use, which is reported to be associated with high-risk sexual behavior (Bello et al., 2017). Therefore, interventions to address high-risk sexual behaviors and substance use should go in hand with addressing khat use.

Khat is recognized as one of the major contributors to road traffic accidents because it increases a driver's confidence and excessive speed while also making drivers irritable and impairing their concentration (Awadalla & Suwaydi, 2017; Eckersley et al., 2010; Gebremichael et al., 2017; Hayley et al., 2016). Minibus workers who used khat in this study were likely to be drinking at hazardous levels and be current smokers, which could explain the influence of khat use on road traffic accidents. Driving under the influence of psychoactive substances such as alcohol and khat is likely to have a negative impact on road transport safety, especially increased road traffic accidents.

Our study had some limitations which need to be taken into consideration. Khat use was estimated based on minibus workers' ability to recall for the past three months, hence there was a potential for recall bias. However, the questions about khat use were detailed enough to help participants remember how frequent they used this substance. Furthermore, minibus workers are a distinct population, so findings from this study may not be generalizable to the broader population.

In summary, nearly half of the minibus workers in this study used khat, and age, hazardous alcohol use, current cigarette smoking and having multiple sexual partners

were all associated with khat use. We recommend raising awareness about the health and social consequences of khat use in line with other risk behaviors like alcohol consumption and cigarette smoking, particularly among those working in public transportation services. Efforts should be made to reduce substance use including khat among those directly involved in public transportation services. More studies should be conducted in Tanzania to determine the epidemiology of khat use in relation to other substances of abuse among adolescents, the general population and other population subgroups. Also, additional studies should be done to explore the link between khat use (and its related risk behaviors) and road traffic accidents.

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CONFLICT OF INTEREST

The authors declare that there is no conflict of interest related to this manuscript.

AUTHORS' CONTRIBUTIONS

FM designed the study, data collection, data analysis and interpretation of the results and drafted the manuscript. JC designed the study, collected the data, participated in data analysis and reviewed the manuscript. BJ participated in data analysis and reviewed the manuscript. NRM participated in designing the study and reviewed the manuscript. IBM designed the study, data analysis and interpretation of findings and reviewed the manuscript. All authors read and approved the final version of the manuscript.

REFERENCES

Alsanosy, R. M., Mahfouz, M. S., & Gaffar, A. M. (2013). Khat Chewing Habit among School Students of Jazan Region, Saudi Arabia. *PLoS ONE, 8*(6). https://doi.org/10.1371/journal.pone.0065504

Awadalla, N. J., & Suwaydi, H. A. (2017). Prevalence, determinants and impacts of khat chewing among professional drivers in Southwestern Saudi Arabia. *Eastern Mediterranean Health Journal = La Revue de Sante de La Mediterranee Orientale = Al-Majallah Al-Sihhiyah Li-Sharq Al-Mutawassit, 23*(3), 189–197. https://doi.org/10.26719/2017.23.3.189

Babor, T. F., Higgins-Biddle, J. C., Saunders, J. B., & Monteiro, M. G. (2001). *AUDIT: The Alcohol Use Disorders Identification Test. Guidelines for use in primary health care. Geneva: World Health Organization*(Vol. 2).

Bazargan-Hejazi, S., Gaines, T., Bazargan, M., Seddighzadeh, B., & Ahmadi, A. (2012). Alcohol Misuse and Multiple Sexual Partners. *Western Journal of Emergency Medicine, 13*(2), 151–159. https://doi.org/10.5811/westjem.2011.6.6676

Bello, B., Moultrie, H., Somji, A., Chersich, M. F., Watts, C., & Delany-Moretlwe, S. (2017). Alcohol use and sexual risk behaviour among men and women in inner-city Johannesburg, South Africa. *BMC Public Health, 17*(Suppl 3). https://doi.org/10.1186/s12889-017-4350-4

Damena, T., Mossie, A., & Tesfaye, M. (2011). Khat Chewing and Mental Distress: A community Based Study, in Jimma City, Southwestern Ethiopia. *Ethiopian Journal of Health Sciences, 21*(1), 37–45.

Dhaifalah, I., & Santavý, J. (2004). Khat habit and its health effect. A natural amphetamine. *Biomedical Papers of the Medical Faculty of the University Palacký, Olomouc, Czechoslovakia, 148*(1), 11–15. https://doi.org/10.5507/bp.2004.002

Eckersley, W., Salmon, R., & Gebru, M. (2010). Khat, driver impairment and road traffic injuries: A view from Ethiopia. *Bulletin of the World Health Organization, 88*(3), 235–236. https://doi.org/10.2471/BLT.09.067512

El-Menyar, A., Mekkodathil, A., Al-Thani, H., & Al-Motarred, A. (2015). Khat Use: History and Heart Failure. *Oman Medical Journal, 30*(2), 77–82. https://doi.org/10.5001/omj.2015.18

Gebrehanna, E., Berhane, Y., & Worku, A. (2014). Khat chewing among Ethiopian University Students-a growing concern. *BMC Public Health, 14*(1198), 1–7. https://doi.org/10.1186/1471-2458-14-1198

Gebremichael, M., Guta, M., Gedefaw, M., Bekele, A., Shiferaw, F., Gelibo, T., … Bekele, A. (2017). Prevalence and determinants of road traffic injuries in Ethiopia: Based on the 2015 STEPS survey findings. *Ethiopian Journal of Health Development, 31*(Specialissue1), 340–347.

Getahun, W., Gedif, T., & Tesfaye, F. (2010). Regular Khat (Catha edulis) chewing is associated with elevated diastolic blood pressure among adults in Butajira, Ethiopia: a comparative study. *BMC Public Health, 10*(390), 1–8. https://doi.org/10.1186/1471-2458-10-390

Haile, D., & Lakew, Y. (2015). Khat chewing practice and associated factors among adults in Ethiopia: Further analysis using the 2011 demographic and health survey. *PLoS ONE, 10*(6), 1–11. https://doi.org/10.1371/journal.pone.0130460

Hayley, A. C., Downey, L. A., Shiferaw, B., & Stough, C. (2016). Amphetamine-type stimulant use and the risk of injury or death as a result of a road-traffic accident: A systematic review of observational studies. *European Neuropsychopharmacology, 26*(6), 901–922. https://doi.org/10.1016/j.euroneuro.2016.02.012

Hoffman, R., & Al'Absi, M. (2010). Khat Use and Neurobehavioral Functions: Suggestions for Future Studies. *Joural of Ethnopharmacol, 132*(3), 554–563.

https://doi.org/10.1016/j.jep.2010.05.033.Khat

Hurley, L. L., Taylor, R. E., & Tizabi, Y. (2012). Positive and Negative Effects of Alcohol and Nicotine and Their Interactions: A Mechanistic Review. *Neurotoxicity Research, 21*(1), 57–69. https://doi.org/10.1007/s12640-011-9275-6.Positive

Kassa, A., Wakgari, N., & Taddesse, F. (2016). Determinants of alcohol use and khat chewing among Hawassa university students, Ethiopia: A cross sectional study. *African Health Sciences, 16*(3), 822–830. https://doi.org/10.4314/ahs.v16i3.24

Kassim, S., Rogers, N., & Leach, K. (2014). The likelihood of khat chewing serving as a neglected and reverse "gateway" to tobacco use among UK adult male khat chewers: A cross sectional study. *BMC Public Health, 14*(1), 1–11. https://doi.org/10.1186/1471-2458-14-448

Kebede, D., Alem, A., Mitike, G., Enquselassie, F., Berhane, F., Abebe, Y., … Gebremichael, T. (2005). Khat and alcohol use and risky sex behaviour among in-school and out-of-school youth in Ethiopia. *BMC Public Health, 5*, 1–8. https://doi.org/10.1186/1471-2458-5-109

Lemeshow, S., Hosmer, D. W., Klar, J., Lwanga, S. K., & WHO. (1990). *Adequacy of Sample Size in Health Studies*.JOHN WILEY & SONS.

Mahfouz, M. S., Rahim, B. E. E. A., Solan, Y. M. H., Makeen, A. M., & Alsanosy, R. M. (2015). Khat chewing habits in the population of the Jazan Region, Saudi Arabia: Prevalence and associated factors. *PLoS ONE, 10*(8), 1–11. https://doi.org/10.1371/journal.pone.0134545

Malaju, M. T., & Asale, G. A. (2013). Association of Khat and alcohol use with HIV infection and age at first sexual initiation among youths visiting HIV testing and counseling centers.*BMC International Health and Human Rights, 13*(10). https://doi.org/10.1186/1472-698X-13-10

Mateen, F. J., & Cascino, G. D. (2010). Khat chewing: A smokeless gun? *Mayo Clinic Proceedings, 85*(11), 971–973. https://doi.org/10.4065/mcp.2010.0658

Menna, T., Ali, A., & Worku, A. (2014). Prevalence of "HIV/AIDS related" parental death and its association with sexual behavior of secondary school youth in Addis Ababa, Ethiopia: A cross sectional study. *BMC Public Health, 14*(1), 1–8. https://doi.org/10.1186/1471-2458-14-1120

Mihretu, A., Teferra, S., & Fekadu, A. (2017). Problematic khat use as a possible risk factor for harmful use of other psychoactive substances: A mixed method study in Ethiopia. *Substance Abuse: Treatment, Prevention, and Policy, 12*(1), 1–7. https://doi.org/10.1186/s13011-017-0132-3

National Bureau of Statistics (Tanzania), & Office of Chief Government Statistician (Zanzibar). (2016).*Basic demographic and socio-economic profile, Kilimanjaro region: 2012 population and housing census.*

Nigussie, T., Gobena, T., & Mossie, A. (2013). Association between khat chewing and gastrointestinal disorders: a cross sectional study. *Ethiopian Journal of Health Sciences, 23*(2), 123–30.

Njuguna, J., Olieva, S., Muruka, C., & Owek, C. (2013). Khat Consumption in Masalani Town, Northeastern Kenya. *Journal of Psychoactive Drugs, 45*(4), 355–359. https://doi.org/10.1080/02791072.2013.825516

Reda, A. A., Moges, A., Biadgilign, S., & Wondmagegn, B. Y. (2012). Prevalence and determinants of khat (Catha edulis) chewing among high school students in eastern ethiopia: A cross-sectional study. *PLoS ONE, 7*(3), 3–7. https://doi.org/10.1371/journal.pone.0033946

Ross, M. W., McCurdy, S. A., Kilonzo, G. P., Williams, M. L., & Leshabari, M. T. (2008). Drug use careers and bloodborne pathogen risk behavior in male and female Tanzanian heroin injectors. *American Journal of Tropical Medicine and Hygiene, 79*(3), 338–343. https://doi.org/79/3/338 [pii]

Sinshaw, A., Messele, A., & Kssa, H. (2014). Prevalence and Associated Factors of Khat Chewing Among Atse Fasil Campus Students, University of Gondar, North West Ethiopia June 2013. *Journal of Psychology & Clinica Psychiatry, 1*(6), 1–8. https://doi.org/10.15406/jpcpy.2014.01.00040

Tilahun, M., & Ayele, G. (2013). Factors associated with Khat use among youths visiting HIV testing and counseling centers in Gamo Gofa, Southern Ethiopia. *BMC Public Health, 13*(1199). https://doi.org/10.1186/1471-2458-13-1199

Tsegay, G., & Esmael, A. (2013). Psychoactive Substances Use (Khat , Alcohol and Tobacco) and Associated Factors among Debre Markos University Students, North-West Ethiopia, 2013. *Journal of Defense Management, 4*(1), 1–7. https://doi.org/10.4172/2167-0374.1000118