

Effects of khat chewing behaviours on health outcomes among male khat chewers in Bahir Dar, North West Ethiopia

Bizuayehu Walle Birhane^{1, *}, Muluken Walle Birhane¹, Kidest Reba Lebeta²

¹Medical physiology, Bahir Dar University, Bahir Dar, Ethiopia

²Adult Nursing, Bahir Dar University, Bahir Dar, Ethiopia

Email address:

tezeramolla@gmail.com (B. W. Birhane), ninawalle@yahoo.com (M. W. Birhane), atetawalle@yahoo.com (K. R. Lebeta)

To cite this article:

Bizuayehu Walle Birhane, Muluken Walle Birhane, Kidest Reba Lebeta. Effects of Khat Chewing Behaviours on Health Outcomes among Male Khat Chewers in Bahir Dar, North West Ethiopia. *American Journal of Biomedical and Life Sciences*.

Vol. 2, No. 4, 2014, pp. 89-97. doi: 10.11648/j.ajbls.20140204.15

Abstract: Khat is found in the evergreen tree or large shrub, consists of whole fresh leaves and buds of a plant known as *Catha edulis*. It is an indigenous tree to Ethiopia, Kenya, and Yemen and more than 20 different compounds are found in khat. Cathinone, which is the main active ingredient in Khat leave, is responsible for the pharmacological properties of Khat. Bahir Dar is a city that three percent of Ethiopia's total production of khat is originated from. There is no community based study that has been done in Bahir Dar city to determine effects of khat chewing behaviours on self rated oral health status and risk on elevated blood pressure. Therefore, this study aimed to determine the effects of Khat chewing behaviors on oral health status and blood pressure on chewers. A community based cross-sectional study was conducted from January to September 2013 among chewers of Bahir Dar city. A total of 422 male khat chewers were included in study, 422 respond to the questioners, giving a response rate of 100%. The study found that the mean age of participants with standard deviation was 30.31 ± 1.39 years old. Sixty two percent of participants reported oral health problems and started khat chewing at early age. Started khat chewing at early age was found to be statistically significantly associated with self rated oral health problem (AOR: 2.85, CI 95%:1.26-6.45). Frequent chewers were 7.58 times more likely to be affected by self rated oral health problem compared to those who chewed less frequently (AOR: 7.58, 95%CI:3.53-16.27). Chewers who chewed more than or equal to 100gms of khat per session were 4.33 times more likely to be affected by oral health problem compared to those who chewed less amount (AOR: 4.33, 95%CI: 2.49-7.53). As for the time period spent for Khat session, those who spent more than 6 hours in a khat session were 7.25 times more likely to have elevated systolic blood pressure compared to those who spent less than 6 hours, (AOR :7.25; 95%CI: 4.03-13.05). It was also found that those who spent more than 6 hours in a khat session were almost 9 times more likely to have elevated diastolic blood pressure compared to who spent less than 6 hours (AOR:8.99,95%CI:4.85-16.66).The risk of elevated systolic blood pressure was more than 5.26 times more likely among male chewers who reported increase amount of khat chewing compared to who reported decrease the amount in last 12 months, (AOR:5.26:95% CI: 2.76-10.15) and the risk of elevated diastolic blood pressure was more than 7 times more likely among chewers who reported increase amount of khat chewing in the last 12 months (AOR:7.25,95%CI:3.66-14.38).

Keywords: Khat Chewing, Health Outcomes, Bahir Dar, North West Ethiopia

1. Introduction

Khat (*Catha edulis*) is a large green shrub that grows at high altitudes in the region extending from eastern to southern Africa, as well as on the Arabian Peninsula [1]. Khat leaves are crimson-brown and chewing of khat leaves (*Catha edulis* Forsk) is widely practised in East Africa and parts of the Middle East, such as Yemen where it forms a deep-rooted social and cultural function [2, 3]. The pleasure

derived from khat chewing is attributed to the euphoric actions of its content of (-)-S-cathinone, a sympathomimetic amine with properties described as similar to those of amphetamine [3-5]. Cathinone enhances the releases of catecholamines from their storage areas resulting in CNS stimulation. Cathinone has also a variety of peripheral sympathomimetic activities [6, 7]. Users of khat report increased levels of energy, alertness and self-esteem, a sensation of euphoria, enhanced imaginative ability and a higher capacity to associate ideas and these effects have

been attributed to the khat's content in cathinone, a sympathomimetic amine with properties similar to those of amphetamine [8]. In Ethiopia khat is used for direct consumption, local sale and for export. It is estimated that 85 to 90% of khat production is for sell; the rest is used for local consumption [9].

The habit of khat chewing is believed to affect a large segment of the Ethiopian population, especially the productive age group i.e., it has negative impact on health, socioeconomic and political matters [10].

The description of khat chewing frequency in the literature is varied. For example; a study [11] reported current habitual khat chewing as daily, and more frequently as occasional. Another study also [12] reported khat chewing as once a week or less as occasional (16.2%), 2-3 days as light, 4-6 days frequent and every day as heavy. World Bank survey study result in Yemen [13] reported that khat chewing three and more days per week as 'addictive'. A study also [14] defined the pattern of khat chewing every day as regular and other patterns as once a week and occasional.

Study results shown the effect of khat chewing on body organ systems. For instance, the effect that accounts for the popularity of khat is its central nervous system stimulation, believed to be induced by cathinone; an active ingredient of khat leaves [15]. Several studies showed that the psycho stimulant effects induced by chewing khat include a moderate degree of euphoria and mild excitement resulting in promotion of social interaction and loquacity and these effects were found to be a maximum between 1.5-3.5 hours after starting to chew and they were progressively replaced by mild dysphonic, anxiety, reactive depression, insomnia and anorexia (loss of appetite) [16, 17]. In recent years khat induced psychosis (serious mental illness) including mania, paranoia and schizophrenia has become more common [18]. Furthermore khat chewing seems to complicate the management of pre-existing serious mental illness [19]. Recent work on Yemeni healthy adult volunteers provided evidence that khat chewing produced a significant rise in pulse rate and these changes run parallel with the changes in plasma cathinone levels during and after khat chewing [20]. It could be expected, therefore, that khat chewing carries a potential cardiovascular risk especially in patients with hypertension and heart disease, and might precipitate the occurrence of cardiovascular accidents (stroke) and myocardial infarction in susceptible individuals [21].

The study had shown that khat chewing delays gastric emptying of a semi-solid meal, probably as a result of the sympathomimetic action of cathinone in khat [22]. A common complaint of khat chewers is constipation, probably caused by a combination of the astringent properties of the chemical in khat, called tannins and the sympathomimetic properties of cathinone [23].

Studies again reported about the effect of both khat and nicotine dependence on trouble experiencing mouth infection after khat chewing and oral cancer (squamous cell carcinoma) [24-26].

Self rated health has been identified as an important indicator of the multi-dimensional construct, health [27]. The evaluation of health or subjective health is considered a legitimate/lawful indicator of overall health status, providing a valid reliable and cost effective means of health assessment particularly in studies in which other forms of health information are lacking, where questionnaire resources are limited and it is often used as a proxy measure of disease risk instead of more formal, but both invasive and costly, measures of physiological parameters [28-30].

Studies reported that self rated health condition (s) were found reliable and valid when compared with physician-reported medical histories [31-35]. Self reported oral health problem (s) such as periodontal diseases as alternative to the primary collection of clinical data has been reported in the current literature and this approach has been appraised as less time consuming, less expensive, consistent and complete, accessing a more representative sample including respondents who don't access care or don't have insurance [36].

Medical investigations have proven that the most important parameters are those that specify the work of heart and respiratory system. They best describe the human health state. Designing the overall monitoring system of health outcomes, it is necessary to assess not only importance of measured parameters but also techniques of their measurement and potentiality of implication in to practical system [37].

2. Methods and Materials

A study was conducted in Bahir Dar town, North West Ethiopia, from January to September 2013, using a cross-sectional design. The source population of this study was all Bahir Dar town khat chewers and the study population was sampled khat chewers of the town. Systematic random sampling technique was employed to select samples of khat sellers and cluster sampling technique was used to select study participants.

The sample size (n) was calculated by considering 95% confidence level, $p = 0.5$, margin error (d) 5% (0.05) and the estimated sample size of the study were 422. All voluntary khat chewers in the sampled khat sellers were included in the study.

The sample for this study was drawn from places of khat sales and systematic procedures were carried out to select the eligible khat chewers for the study, these were; identifying the kebeles/villages which sellers were highly populated, identifying or recruitment of khat sellers from a given kebele/village and selection of khat chewers from the recruited khat sellers. Sampling was conducted through sellers to sellers survey in which, every second khat sellers was selected through systematic random sampling and all khat chewers in selected sellers were included as the study participants. All volunteers in the sampled sellers were included in the study.

For data collection, a pretested questionnaire pertinent to

the study objectives were developed and used. The questionnaire was translated into Amharic and distributed to all sampled khat chewers. Medical equipments and materials such as sphygmomanometer with stethoscope, digital thermometer and others were used to measure the level of physiological parameters. Four trained nurses were involved in data collection, and supervision was carried out by the principal investigator.

Data entry, clearing and analysis were made using SPSS. To assess the effects of khat chewing

khat chewing on self rated oral health and physiological parameters, p-value, chi-square test, adjusted odds ratio (AOR) and confidence interval (95%CI) were calculated. A bivariate and multivariate logistic regression analysis were made to determine the statistically significant effects of khat chewing behaviours on self rated health status and its risk of elevated blood pressure.

Ethical clearance and permission were first obtained from the Ethical Review Boards of Bahir Dar University. The study participants were informed about the objective of the study and asked their consent to be involved in the study.

Confidentiality was also maintained.

The following operational definitions were used in this study:

Grams of khat: the amount of khat leaf sold by sellers to chewers in the study area during khat session.

Frequent chewers: those who chew khat for three and more days a week.

Less frequent khat chewers: those who chew khat less than three days a week.

Physiological parameters: are those that specify the work of heart and respiratory system.

Levels of physiological parameters: physiology books state the level of physiological parameters for systolic and diastolic pressure is 120 and 80mmHg respectively; breathing rate: 12-16 breath/minute; body temperature: 37°C; body mass index: <18 kg/m² under weight, 18-25 kg/m² normal and 26-30 kg/m² overweight; heart rate: 60-100 beat/minute.

Self rated health status: is a reliable and valid way of diagnosing patients when compared with physician-reported medical histories.

Oral health problems: including gum bleeding, tooth decay, decolorization of teeth, dental abscess, and soon.

Khat sellers: those who earning money from chewers by prepared a special place and setup for chewers and sold grams of khat for chewers during khat session.

Khat chewing behaviours: frequency of khat chewing per week and grams of khat chewed during khat session.

3. Results

3.1. Socio Demographic Characteristics

A total of 422 male khat chewers were included in this study, 422 of them were responded to the questioners, giving a response rate of 100%. The study found that the mean age

of participants with standard deviation was 30.31 ± 1.39 years old. More than half of the male chewers (58.1) were in age between 30-40 years old. Majority (71.6%) of participants were born in Bahir Dar city. Regarding educational status, 160(37.9%) 65 (15.4%) and 158 (37.4%) participants had completed high school, college diploma and university degree and above respectively. Out of the total male khat chewers, 59.2% were unemployed. With regard to marital status more than half of male khat chewers (62.8%) were single. Three hundred thirty (78.2%) of participant had no children (Table 1).

Table 1. Socio-demographic characteristics among male khat chewers in Bahir Dar city, 2013.

Variable	Frequency (N)	Percentage (%)
Age in years		
18-29	187	44.3
30-40	201	47.6
41-64	34	8.1
Place of birth		
Bahir Dar	302	71.6
Outside Bahir Dar	120	28.4
Educational status		
Illiterate	10	2.4
Primary school	29	6.9
Higher School	160	37.9
College diploma	65	15.4
University degree and above	158	37.4
Job title		
Employed	172	40.8
unemployed	250	59.2
Marital status		
Married	141	33.4
Single	265	62.8
Divorced	14	3.3
Widowed	2	0.5
Number of children		
None	330	78.2
One	42	10.0
Two	28	6.6
Three	10	2.4
More than 3	12	2.8

3.2. Khat Chewing Behavior among Chewers

This section describes the social and behavioral backgrounds of khat chewing, frequency of khat chewing, amount of khat chewing, any attempts to stop khat chewing, the reasons for re-starting chewing, education/information on khat impacts and a validation of self-reported khat chewing.

In this study found that thirty seven percent (37.2%) of the participants had already started khat chewing at the age of between 19 to 21 years old. Majority of the respondents (80.6%) started khat chewing in Bahir Dar.

Around 326 (77.3%) of them were initiated chewing for the first time by their own close friends. Many reasons were reported for khat chewing; most commonly help pass time (29.4%) and dependence (24.2%). Family khat chewing history was also explored; Thirty eight percent and 1.9% of participants' fathers and mothers were khat chewers. Fifty four percent of participant chewed khat in groups (with

friends). Most 375 (88.9%) of participants reported chewing khat for three days or more and only 3.6% chewed less than three days per week. With regarding to khat chewing cost 36% of khat chewers were coasted 101 Ethiopian birr and more during a khat session. The most commonly reported time for starting khat chewing was between 1.00 pm - 3.00 pm while a small percentage (3.6%) preferred between 4 pm-6 pm. Thrifty eight percent of the participants reported chewing 100 and more grams of khat per day during khat session. Fifty four percent of chewers had spent greater than or equal to six hours during a khat session.

Different aspects of khat chewing behaviours, including frequency and dose were also assessed. Out of the total participant majority (64.0%) of them were reported increases their khat chewing desire in the last 12 months while smallest percentage (10.4%) of participant decreases their desire (Table 2)

Table 2. Social and behavioral background of khat chewing among male khat chewers in Bahir Dar city, 2013.

Variable	Frequency (N)	Percentage (%)
Age of starting khat chewing		
From 7-15 years	56	13.3
From 16-18 years	106	25.1
From 19-21 years	157	37.2
22 years to older	103	24.4
Initiators of khat chewing		
Close friends	326	77.3
Family	24	5.7
By yourself	72	17.1
Reasons for chewing khat		
A habit	83	19.7
Need Social interaction	77	18.2
Help pass the time	124	29.4
Dependence	102	24.2
Increase concentration during study and work	28	6.6
Khat chewing setting		
Alone	6	1.4
With others	228	54.0
sometimes with others sometimes alone	188	44.5
Number of Days Chewing khat per Week		
< 3 days	47	11.1
≥3 days	375	88.9
Amount of money (in birr) coasted for a khat session		
From lowest up to 50 birr	135	32.0
51-100 birr	135	32.0
From 101 birr to above	152	36.0
Time Preferred for Starting Chewing		
4-6 local time	73	17.3
7-9 local time	334	79.1
10-12 local time	15	3.6
Amount of khat chewed		
25gm-50gm	118	28.0
51gm-100gm	143	33.9
≥100gm	161	38.2
Time period spend during a Khat Session		
Up to 6 hours	192	45.5
More than or equal to 6 hours	230	54.5

3.3. Health Outcomes and Related Behaviors

Almost all (96.7%) study participants had no history of illness. Amongst the participant who self reported a history of illness, 50% of them reported GI conditions (Gastritis) and 21.4%, 14.3%, 14% reported hypertension, diabetics and hemorrhoid respectively. With regard to self rated health condition, twenty four percent of participants self-rated very good and good health and sixty six percent rated fair, bad and very bad general health state.

Sixty two percent of participants reported oral health problems. Of the 262 self-reported oral problems; 78.6% had dental decay or tooth discoloration, 21.4% gum problems (inflammation, bleeding).

Table 3. Self rated health outcomes among male khat chewers in Bahir Dar city, 2014.

Variables	Frequency (N)	Percentage (%)
Illness history		
Yes	14	3.3
No	408	96.7
Self-rated health status		
V.good	71	16.8
Good	30	7.1
Fair	133	31.5
Bad	92	21.8
V. bad	96	22.7
Oral and dental health problem		
Tooth decay	206	48.8
Gum bleeding	56	13.3
No problem on both	160	37.9
Visit dentist before		
yes	14	3.3
No	408	96.7

3.4. The Levels of Physiologic Parameters

Table 4. Levels of physiological parameters among male khat chewers, Bahir Dar City, 2013.

Variable	Frequency (N)	Percentage (%)
SBP(mmHg)		
<120	142	33.6
≥120	280	66.4
DBP(mmHg)		
<80	139	32.9
≥80	283	67.1
Pulse pressure(mmHg)		
<40 mmHg	21	5.0
≥40 mmHg	401	95
Respiratory rate		
12-15 breath/minute	64	15.2
>15breath/minute	358	84.8
Heart rate		
60-100 beat/min	340	80.6
>100 beat/minute	82	19.4
Temperature(°c)		
<37	416	98.6
≥37	6	1.4
Body mass index (kg/m2)		
< 18	84	19.9
18-25	306	72.5
26-30	32	7.6

Out of the total respondents, majority, 85.3% and 67.1% of the participant were their systolic and diastolic blood pressure greater than 120 and 80mmHg respectively.

3.5. Factors Associated with Self Rated Oral Health Problem

Bivariate and multivariate logistic regressions were done to assess effects of khat chewing behaviors on self rated oral health problem. First all factors were analyzed by bivariate analysis, of them only three factors that had significant effects on self rated oral health problem, which had a P-value ≤ 0.2 , then those significant variables entered into multi variety logistic regression analysis. All three predictors were found to be statistically significant in multivariate logistic regression.

The multivariate analysis indicated that those male chewers who started khat chewing at age from 7-15 years old were 2.85 times more likely to be affected by oral health problem compared to those who started khat chewing at age 22 years old and above (AOR:2.85, CI 95%:1.26-6.45). With regard to frequency of khat chewing; those male chewers who chewed frequently (more than or equal to 3 days per week) were 7.58 times more likely to be affected by oral health problem compared to those who chewed less frequently (less than 3 days per week) (AOR: 7.58, 95%CI: 3.53-16.27).

Those male chewers who chewed 51gm-100gm and more than or equal to 100gm per khat session were 1.95 and 4.33 times more likely to be affected by oral health problem compared to those male chewers who chewed 25gm-50gm per session (AOR:1.95, 95% CI:1.16-3.30), (AOR: 4.33, 95% CI:2.49-7.53) respectively (Table 5)

Table 5. Factors associated with oral health problem among male khat chewers, in Bahir Dar city, 2013.

Variable	Oral health problem		COR(95%CI)	AOR(95%CI)	P-value
	Yes	No			
Age of starting khat chewing					
From 7-15 years	45	11	2.93(1.36-6.31)	2.85(1.26-6.45)*	
From 16-18 years	62	44	1.01(0.58-1.75)	0.96(0.53-1.76)	
From 19-21 years	95	62	1.01(0.66-1.82)	0.95(0.55-1.64)	0.04*
22 years to older	60	43	1.00	1.0	
Khat chewing frequency per week					
< 3 days	12	35	1.00	1.0	
≥ 3 days	250	125	5.83(2.93-11.63)	7.58(3.53-16.27)**	0.001**
Amount of khat chewed					
25gm-50 gm	52	66	1.00	1.00	
51gm-100gm	91	52	2.22(1.35-3.66)	1.95(1.16-3.30)**	0.001**
≥ 100 gm	119	42	3.59(2.17-5.96)	4.33(2.49-7.53)**	

3.6. Factors Associated with Self Reported Health Status

Bivariate and multivariate logistic regression was done to assess factors and self reported health status. First all factors were analyzed by bivariate analysis, of them only three factors that had significant effects on self rated oral health problem, which had a P-value ≤ 0.2 , then those significant variables entered into multi variety logistic regression analysis. Among these, two predictors were found to be statistically significant.

With regard to number of children; those male chewers' who has one to three children 0.4 times less likely to be compromised in their health status compared to those who has no children(AOR:0.40, 95%CI:0.24-.69).

Those male khat chewers who had oral health problems 1.67 times more likely to be compromised on their health status compared to those who had no oral health problems(AOR:1.67, 95%CI:1.03-2.69)(Table 6).

Table 6. Factors associated with self reported health status among male khat chewers, in Bahir Dar city, 2013.

Variable	State of health		COR(95%CI)	AOR(95%CI)	P-value
	Compromise	Not compromise			
Number of children					
None	262	68	1.00	1.0	
1 to 3 children	49	31	0.41(0.24-0.69)	.40(.24-.69)*	.003*
More than 3 children	10	2	1.29(0.28-6.09)	1.16(.24-5.58)	
Oral health problem					
No	111	49	1.00	1.0	
Yes	210	52	1.78(1.13-2.80)	1.67(1.03-2.69)*	.036*
Amount of khat chewed					
25gm-50 gm	85	33	1.00	1.0	
51gm-100gm	102	41	0.97(0.56-1.66)	0.89(0.51-1.57)	.072
≥ 100 gm	34	27	1.93(1.08-3.43)	1.69(.92-3.08)	

3.7. Factors Associated with Systolic Blood Pressure

The multivariate analysis result (Table-7) indicated that frequency of khat chewing, time period spend during a khat session, amount of khat chewing the last 12 month and difficulty to stop/ go without khat chewing were statistically significant with systolic blood pressure.

The multivariate analysis result revealed that the figure of having elevated systolic blood pressure among male chewers who chewed frequently was fourteen times more compared to who chewed less frequently (AOR:14.95,95% CI:5.49-40.66). There is statistically significant association between time period spend during a khat session and having elevated systolic blood pressure, it was found that those who spent more than 6 hours in a khat session were 7.24 times

more likely to have elevated systolic blood pressure compared to those who spent less than 6 hours, (AOR :7.24; 95%CI: 4.03-13.05). The risk of elevated systolic blood pressure was more than 5.26 times more likely among male chewers who reported increase amount of khat chewing compared to who reported decrease amount of khat chewing in last 12 months, (AOR:5.26:95% CI: 2.76-10.15).

With regard to difficulty to stop or go without khat chewing; those male chewers who reported impossible and very difficult to stop or go without khat chewing 3.83 and 9.91times more likely to have elevated blood pressure compared to those male chewers who reported not difficult to stop or go without khat (AOR: 3.83, 95%CI: 1.87-7.88) and (AOR: 9.91, 95% CI: 4.70-20.88) respectively.

Table 7. Factors associated with systolic blood pressure among male khat chewers, in Bahir Dar city, 2013.

Variable	SBP		COR(95%CI)	AOR(95%CI)	P-value
	≥120 mmHg	<120 mmHg			
Frequency of khat chewing					
< 3 days	12	35	1.00	1.00	0.001
≥3 days	268	107	7.31(3.65-14.61)	14.95(5.49-40.66)	
Time period spend during a khat session					
Up to 6 hours	78	114	1.00	1.00	0.001
More than or equal to 6 hours	202	28	10.54(6.47-17.19)	7.25(4.03-13.05)	
Amount of khat chewing the last 12 month					
Increase	218	52	5.52(2.83-10.77)	5.29(2.76-10.15)	0.001
Remain the same	43	65	0.87(0.43-1.77)	0.98(0.40-2.39)	
Decrease	19	25	1.00	1.00	
Difficult to stop or go without khat chewing					
Not difficult	76	102	1.00	1.00	0.001
Very difficult	57	23	3.29(1.87-5.81)	3.83(1.87-7.88)	
Impossible	147	18	10.85(6.12-19.25)	9.91(4.70-20.88)	

3.8. Factors Associated with Diastolic Blood Pressure

The multivariate analysis result, revealed that having elevated diastolic blood pressure among male chewers who chewed frequently was five times more compared to who chewed less frequently (AOR:5.43,95%CI:2.05-14.38). It was also found that those who spent more than 6 hours in a khat session were almost 9 times more likely to have elevated diastolic blood pressure compared to who spent less than 6 hours (AOR:8.99,95%CI:4.85-16.66). The risk of elevated diastolic blood pressure was more than 7 times more likely

among male chewers who reported increase amount of khat chewing compared to who reported decrease amount of khat chewing in last 12 months (AOR:7.25,95%CI:3.66-14.38). With regard to difficulty to stop or go without khat chewing; those male chewers who reported impossible and very difficult to stop or go without khat chewing 3.43 and 14.74 times more likely to have elevated diastolic blood pressure compared to those male chewers who reported not difficult to stop or go without khat (AOR: 3.43, 95%CI: 1.67-7.03) and (AOR: 14.74, 95%CI: 6.61-32.85) respectively. (Table 8)

Table 8. Factors associated with diastolic blood pressure among male khat chewers, in Bahir Dar city, 2013.

Variable	DBP		COR(95%CI)	AOR(95%CI)	P-value
	≥80 mmHg	<80 mmHg			
Frequency of khat chewing					
< 3 days	18	29	1.00	1.00	0.01*
≥3 days	265	110	3.88(2.07-7.28)	5.43(2.05-14.38)	
Time period spend during a Khat Session					
Up to 6 hours	77	115	1.00	1.00	0.001*
≥ 6 hours	206	24	12.82(7.68-21.38)	8.99(4.85-16.66)	
Amount of khat chewing the last 12 month					
Increase	223	47	6.24(3.18-12.25)	7.25(3.66-14.38)	0.001*
Remain the same	41	67	.805 (.39-1.64)	1.13(0.45-2.84)	
Decrease	19	25	1.00	1.00	
Difficult to stop or go without khat chewing					
Not difficult	75	102	1.000	1.00	0.001*
Very difficult	55	25	2.99(1.71-5.23)	3.43(1.67-7.03)	
Impossible	153	12	17.34(8.97-33.51)	14.74(6.61-32.85)	

4. Discussion

Studies on the effect of substance abuse and their health effects are scarce despite the ever-growing rate of substance use behaviours. Previous studies shown that, khat chewing had effects on the physical wellbeing of the society; therefore this study aims to investigate the association between health effects (oral health problems and the risk of elevated blood pressure) and that of khat chewing frequency, amount of khat chewed during khat session among male chewers. In this study the mean age of participants with standard deviation was 30.31 ± 1.39 years old.

According to this study 37.9%, 15.4% and 37.4% of khat chewers were completed a high school, college diploma and university degree and above respectively this is higher than study conducted in Jimma which was 8.5 % of the respondents were completed the high school and higher education programs.

The habit of khat chewing is more frequently in the age group between 16 and 21 years and less common above the age of 41. This is supported by study conducted in UK-resident Male Yemeni Khat chewers indicated that majority of khat chewers' age were in the productive age groups and more than half of the respondents were started chewing at the age of 18 [38, 40]

The probable difference might be due the presence of certain behavioral, lifestyle and personality variation.

In the present study showed that, majorities (77.3%) of chewers were initiated khat chewing for the first time by their own close friends, and their reason for khat chewing most commonly was for helping pass time and dependency. This study is in line with the study in Jimma University students reported that, khat chewing initiated for the first time by friends and family [41].

This study result showed that 38.2% of the respondents reported chewing 100 and more grams of khat per day during a khat session. 54.5% of chewers had spent six and more hours during a khat session and around 64% of the participants were reported increases their khat chewing desire in the last 12 months. This may due to lack of job opportunities in the city and absence of concerned bodies that tried to band khat chewing in the country.

In this study, 62.1% of participants reported oral health problem, 78.6% had dental decay or tooth discoloration and 22.4% gum problem (inflammation, bleeding). Similar study conducted in Yemen [22] reported that khat chewers were often complained inflammation of the mouth. These effects may be due to the presence of harsher chemical called tannins in khat and using sugar during khat session to minimize the bitterness of khat juice [42, 43]

In this study, multivariate analysis was done to determine the association of khat chewing and oral health status. The result shown that, starting khat chewing at early age were 2.85 times more likely to be affected by oral health problems compared to those who starte chewing lately (AOR: 285, 95% CI: 1.26-6.45), this is consistent study conducted in

Yemen indicated that In the gastrointestinal tract, the astringent characteristics of the tannins account for periodontal disease, stomatitis, oesophagitis and gastritis [86]. This might be the presence of harshest chemical called tannins in khat juice.

Frequent khat chewers were 7.58 times more likely to be affected by oral health problem compared to less frequent chewers (AOR: 7.58, 95% CI: 3.53-16.27) and those who chewed large amount of grams of khat during khat session were 4.33 times more likely to be affected by oral health problem compared to those who chewed less amounts (AOR: 4.33, 95% CI: 2.49-7.53). The probable reason may be due to the fact that chewing large amount of khat in gram during khat session and chewing frequently may increase the incidence of exposing chewers with chemicals that are found in khat called tannins and the pharmacological effects of these chemicals will be dominantly seen on frequent chewers and on chewers who chewed large amount during khat session than the rest.

Previous study that conducted in Yemen reported that khat chewing produced a significant rise in arterial systolic and diastolic blood pressure [20, 21]. In the present study also the risk of having elevated systolic blood pressure among frequent khat chewers was 14 times more compared to less frequent chewers (AOR: 14, 95%CI: 5.49-40.66).

Those chewers who spent more time on khat chewing during khat session were 7.24 times more likely to have elevated systolic blood pressure compared to chewers who spent less time (AOR: 7.24, 95% CI: 4.03-13.05).

The risk of elevated systolic blood pressure was also more than 5.26 times more likely among chewers who reportedly increases the amount of khat chewing for the last 12 months (AOR: 5.26, 95%: 2.76-10.15).

As for difficulty to stop or go without khat chewing, chewers who respond impossible and very difficult to stop or go without khat chewing were 3.83 and 9.91 times more likely to have elevated systolic blood pressure compared to those who reported not difficult to stop or go without khat.

The diastolic blood pressure is also significantly associated with that of the above chewing habits that affected the systolic blood pressure.

According to this study result, amount, frequency and chronic khat chewing was statistically significantly associated with that of the risk of elevation of arterial blood pressure. This may be due to the result of sympathetic like action of an active ingredient of khat known as cathinone [44].

5. Conclusion

This work and previous studies demonstrated that khat intake causes risks on cardiovascular problems such as hypertension and oral health problem. In addition to the cardiovascular effect, khat has influence on the respiratory center, which is expressed as quick breathing, marked hyperthermia and finally death.

Chronic khat chewing also produces direct effect on the

gastrointestinal system resulting in such disorders as esophagitis, stomatitis, gastritis, gastric and duodenal ulcer, enterocolitis, hepatitis, and pancreatitis.

Currently, the habit of khat chewing affects a large segment of the population, especially the productive age group and its negative impact on health; socioeconomic and political matters are reported enormously by different study findings. This is because the habit of khat chewing reinforces the development of other habits such as cigarette smoking, alcohol intake and addiction with narcotics.

This study had strengths and weaknesses. As strength, data were intensively collected from study populations by convincing the sampled khat sellers and scientific medical equipments were used to measure physiological parameters. It was better if the study covers many areas of the country and incorporates large sample sizes for better inference. However, due to the limitations of resources, this study was focused only on Bahir Dar city and this will be counted as a weakness for this article.

Recommendation

To sum up, using this as a preliminary study, further investigation should be continued to explain exhaustively the effect of chronic khat chewing on the mental health and detailed experimental work on the cardiovascular effect of khat. Khat chewing is also suspected to be the risk factor of peptic ulcer disease. This again needs careful observation. Health education about the adverse effect of khat chewing should be delivered to the community and health institutions. Based on this recommendation, policy makers should design strategies to control the production, usage and distribution of khat in Ethiopia.

Abbreviations

ABP= Arterial Blood Pressure
AOR=Adjusted Odds ratio,
CI=Confidence Interval
COR=Crude Odds Ratio;
UK=United Kingdom
PP= pulse pressure

Competing Interests

The authors declare that they have no competing interests.

Authors' Contributions

Bizuayehu Walle Birhane designed the study, conducted field work, analyzed data, interpreted findings, and wrote the manuscript. Muluken Walle Birhane and Kidest Reba Lebeta involved in the design, development of the proposal, assisted field work, in data analysis and manuscript writing. All authors of the manuscript have read and agreed to its content.

Acknowledgement

I would like to thank the Research and Publication Office of the Bahir Dar university college of medicine and health science for funding this study. I also thank Mr. Bekele (MSc. in general public health) for carefully revising this manuscript and forwarding constructive and timely comments for the success of this work. Finally this research would not have been realized without the strong commitment of the data collectors and khat sellers.

References

- [1] Saw air F. A., Al - Mutwakel A. Al - Eryani K., Al - Surhy A., Mar uyama S., Cheng J. , Al - Sharabi A., Saku T. High relative frequency of oral squamous cell carcinoma in Yemen: Qat and tobacco chewing as its aetiological back ground. *International Journal of Environmental Health Research*. 2007, 1 7(3): 185 – 1 95.
- [2] Drake PH. Khat-chewing in the Near East. *Lancet*. 1988, 8584:532–3.
- [3] Kalix, P. & Braenden, O. Pharmacological aspects of the chewing of khat leaves. *Pharmacological Reviews*. 1985, 37, 149-164.
- [4] Kalix, P. Khat: a plant with amphetamine effects. *Journal of Substance Abuse and Treatment*. 1988, 5, 163–169.
- [5] Kalix, P. Cathinone, a natural amphetamine. *Pharmacology and Toxicology*. 1992, 70, 77–86
- [6] Weir S. Qat in Yemen: consumption and social change London: *Published for the Trustees of the British Museum by British Museum Publications*. 1985,7:23-26
- [7] Kennedy JG. The flower of paradise: the institutionalized use of the drug qat in North Yemen Dordrecht; Lancaster: Reidel. 1987, 9:32-34
- [8] Kalix, P. Cathinone, a natural amphetamine. *Pharmacology and Toxicology*,1992, 70, 77–86
- [9] Dechassa, L. Khat (*Catha edulis*): Botany, Distribution, Cultivation, Usage and Economics in Ethiopia. UN Emergencies Unit for Ethiopia, Addis Ababa, 2001.
- [10] Yigzaw Kebede, Tefera Abula, Belete Ayele, Amsalu Feleke, Getu Degu, Abera Kifle, Zeleke Alebachew, En dris Mekonnen, and Belay Tessema. Substance Abuse For the Ethiopian Health Center Team: *Gonder University*. 2005: 7 - 19
- [11] Belew M, Kebede D, Kassaye M, Enquoselassie F. The magnitude of khat use and its association with health, nutrition and socio-economic status. *Ethiop Med J*, 2000, 38(1): 11-26.
- [12] Numan N. Exploration of adverse psychological symptoms in Yemeni khat users by the Symptoms Checklist-90 (SCL-90). *Addiction*. 2004, 99(1): 61-5.
- [13] World Bank. Yemen towards Qat demand reduction. 2007, 39738-YE.
- [14] Ayana AM, Mekonen Z (2004). Khat (*Catha edulis* Forsk) chewing, socio-demographic description and its effect on academic performance, Jimma University students. *Ethiop Med J*. 2002. 42(2): 125-36.

- [15] Kalix P. Pharmacological properties of the stimulant khat. *Pharmacol Ther.* 1990; 48: 397–416
- [16] Hassan NAGM, Gunaid AA, El Khally FMY, Murray-Lyon IM. The effect of Khat chewing leaves on the Human mood. *Saudi Med J.* 2002; 23(7): 850–853
- [17] Hassan NAGM, Gunaid AA, El Khally FMY, Murray-Lyon IM. The subjective effects of chewing qat leaves in human volunteers. *Annals of Saudi Medicine.* 2003; 22(1–2): 34–37
- [18] Pantelis C, Hindler CG, Taylor JC. Use and abuse of khat (*catha edulis*): a review of the distribution, pharmacology, side effects and a description of psychosis attributed to khat chewing. *Psychol Med.* 1989; 19: 657–668
- [19] Hassan NAGM, Gunaid AA, Ali MS, Shehab MMI. The effects of chewing qat leaves on psychotic patients. *The Journal of the Egyptian Society of Pharmacology & Experimental Therapeutics.* 2003; 23 (1): 179–190.
- [20] Halket JM, Karusu Z, Murray-Lyon IM. Plasma cathinone levels following chewing khat leaves (*Catha edulis* Forsk). *J Ethnopharmacol.* 1995; 46: 111–113.
- [21] Al-Motarreb AL, Al-Kebisi M, Al-Adhi B, Broadley KJ. Khat chewing and acute myocardial infarction. *Heart.* 2002; 87: 279–280.
- [22] Heymann TD, Bhupulan A, Zuriekat NEK, Bomanji J, Drinkwater C, Giles P, Murray-Lyon IM. Khat chewing delays gastric emptying of a semi-solid meal. *Aliment Pharmacol Ther.* 1995; 9: 81–83.
- [23] Gunaid AA, El Khally FMY, Hassan NAGM, Murray-Lyon IM. Chewing qat leaves slows the whole gut transit time. *Saudi Med J.* 1999; 20: 444–447.
- [24] Kassim S, Croucher R. Khat chewing amongst UK resident male Yemeni adults: an exploratory study. *Int Dent J.* 2006; 56(2):97-101.
- [25] Griffiths P, Gossop M, Wickenden S, Dunworth J, Harris K, Lloyd C : A transcultural pattern of drug use: qat (khat) in the UK. *Br J Psychiatry.* 1997, 170(281-4).
- [26] Fasanmade A, Kwok E, Newman L . Oral squamous cell carcinoma associated with khat chewing. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod.* 2007, 104(1): e53-5.
- [27] Cott CA, Gignac MA, Badley EM : Determinants of self rated health for Canadians with chronic disease and disability. *J Epidemiol Community Health.* 1999, 53(11):731-6.
- [28] Kaplan G, Baron-Epel O: What lies behind the subjective evaluation of health status? *Soc Sci Med.* 2003, 56(8):1669-76.
- [29] Locker D, Maggirijs J, Wexler E: What frames of reference underlie self-ratings of oral health? *J Public Health Dent.* 2009, 69(2):78-89.
- [30] Adams J, White M. Is the disease risk associated with good self-reported health constant across the socio-economic spectrum? *Public Health.* 2006, 120(1):70-5.
- [31] Dalstra JA, Kunst AE, Borrell C, Breeze E, Cambois E, Costa G, et al. Socioeconomic differences in the prevalence of common chronic diseases: an overview of eight European countries. *Int J Epidemiol.* 2005, 34(2):316-26.
- [32] Schaufelberger M, Rosengren A. Heart failure in different occupational classes in Sweden. *Eur Heart J.* 2007, 28(2): 212-8.
- [33] Goldman N, Lin IF, Weinstein M, Lin YH. Evaluating the quality of self-reports of hypertension and diabetes. *J Clin Epidemiol.* 2003, 56(2):148-54.
- [34] Kriegsman DM, Penninx BW, van Eijk JT, Boeke AJ, Deeg DJ . Self-reports and general practitioner information on the presence of chronic diseases in community dwelling elderly. *J Clin Epidemiol.* 1996, 49(12):1407-17
- [35] Schrijvers CT, Stronks K, van de Mheen DH, Coebergh JW, Mackenbach JP. Validation of cancer prevalence data from a postal survey by comparison with cancer registry records. *Am J Epidemiol.* 1994, 139(4):408-14.
- [36] Tomar SL. Public health perspectives on surveillance for periodontal diseases. *J Periodontol.* 2007, 78 (7):1380-6.
- [37] A. Dosinas, M. Vaitkūnas, J. Daunoras. Measurement of Human Physiological Parameters in the Systems of Active Clothing and Wearable Technologies. 2006;71: 27
- [38] Belew M, Kebede D, Kassaye M, Enquoselassie F (2000). The magnitude of khat use and its association with health, nutrition and socio-economic status. *Ethiop Med J* 38(1): 11-26.
- [39] Ayana A, Sharif H, Tekli Y (2002). Effects of khat (*Catha edulis* forsk) on blood pressure and heart rate, a community based study. *Ethiopian Journal Development* 16(3): 325-334.
- [40] Kassim S(2010). An Exploration of the Association between Khat Chewing and Health Outcomes in UK-resident Male Yemeni Khat Chewers, 22-62
- [41] Ayana AM, Mekonen Z (2004). Khat (*Catha edulis* Forsk) chewing, sociodemographic description and its effect on academic performance, Jimma University students 2002. *Ethiop Med J* 42(2): 125-36.
- [42] Fekade A, Challi J, Tadess M. Khat chewing among Agaro secondary school students. *Ethiop Medic J.* 1994;32:161-166.
- [43] Kalman S. Recent progress in khat chemistry: in chemical and pharmacological aspect of khat; international symposium of khat. 1983;13- 28.
- [44] Wilder P, Mathys K, Brenneisen R, Kalix P, Fisch HU. Pharmacodynamics and pharmacokinetics of khat: a controlled study. *Clin Pharmacol Ther.* 1994; 59:556- 562.