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NUTRITIONAL STATUS OF *KHAT* (*CATHA-EDULIS*) CHEWING ADULT MALES IN NAKAWA DIVISION, KAMPALA CITY, UGANDA

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ABSTRACT

Khat (*Catha edulis*) also known as *"Mairungi"* in Uganda, is a green shrub whose leaves are chewed in social gatherings and designated hotspots mainly for its euphoric effect. The socio-economic and health impacts of *khat* have been previously reported. However, the nutritional implications of *khat* chewing need to be investigated. A cross-sectional study with a descriptive approach was done to assess the nutritional status of adult male users of *khat* in the Nakawa division, Kampala city. Using chain sampling, *khat* users and hot spots were mapped, identified, and listed. Using simple random sampling, 100 *khat* users were targeted to consent for structured interviews and an assessment of nutritional status over a 3-month persuasion period. Anthropometric data were used to compute the Body Mass Index (BMI) and dietary information was assessed based on food groups consumed and thresholds of Recommended Dietary Allowances (RDA). The degree of relationship among variables was statistically evaluated using, chi-square analyses and the ANOVA test. Statistical significance was considered at $P < 0.05$. Confidentiality was observed by the use of anonymous questionnaires and coded datasheets. The majority of *khat* users chewed *khat* daily 56.0% and mixed *khat* chewing with other intoxicants such as alcohol 35.0%, cigarettes 15.0%, and cannabis 12.0%. The main driver towards *khat* chewing in Nakawa was peer pressure 60.0%. The Dietary Diversity Score (DDS) was low, medium and high among 20.0%, 57.0% and 23.0% of *khat* users, respectively. The DDS was significantly associated with the hours spent on *khat* chewing $X^2(4)$ 10.156, $P = 0.025$ with most users spending more than four hours, and the frequency of *khat* chewing $X^2(4)14.423$, $P = 0.038$. Of the 100 respondents, 26.0% were underweight and 3.0% were overweight. The BMI was significantly associated with age $P = 0.029$, marital status $P = 0.023$, frequency of *khat* chewing $P = 0.038$, the number of meals $P = 0.013$ and the dietary diversity scores $P < 0.001$ in khat users. *Khat* chewing and its associated habits predispose *khat* users to a double jeopardy of malnutrition and non-communicable diseases (NCDs). There should be tighter control of *khat* use through policy and legislation with community-based measures to regulate its demand and supply.

Key words: *Khat* Chewing, Mairungi, Nutritional Status, Body Mass Index, Nakawa, Uganda

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INTRODUCTION

Khat (*Catha edulis*), also known as *Mairungi* in Uganda is a green shrub mainly cultivated and consumed in eastern Africa and the Arabian Peninsula [1]. During a trip to Egypt and Yemen in 1761–1763, Peter Forskal discovered *khat* as *Catha-edulis* from where it was distributed across other nations [2]. A recent study reported that *khat* is native to Ethiopia [3]. About 44 different types of *khat* are available in eastern Africa and the Arabian Peninsula regions [4]. An estimated 100g of fresh *khat* leaves contain 36 mg of Cathinone, 120 mg of Cathine, and 8 mg of Norephedrine [5]. As with coca leaves in South America and betel nuts in Southeast Asia [6], *khat* leaves are chewed with sweet chewing gum and the juice is swallowed after which the residual pulp is spat [7]. Groundnuts, sesame and carrots are also being used to counteract the bitter taste of the leaves in Ugandan users. Up to five hours of chewing are spent to achieve euphoric effects such as increased alertness and activity [8]. Besides its euphoric effects, *khat* chewing is also linked to adverse nutritional and socio-economic consequences including inappropriate dietary practices, poor appetite, weight loss and income loss because of the addictive nature of its chewing [9, 10, 11]. Moreover, *khat* chewing has been reported to significantly increase the risk of undernutrition by 53% among adult *khat* users in Ethiopia [12].

In Uganda, *khat* chewing was unknown until the Somali-Uganda interactions. The first *khat* consumers in Uganda were diaspora Yemenis from the northern highlands, the Hadhramaut and Somali migrants [13]. Currently, the highest producers of *khat* in Uganda are found in Kasenge and Butambala districts [14]. However, *khat* is available in all towns and cities across Uganda including in Bushenyi and Kampala despite attempts such as the introduction of a by-law to crack down on its consumption [15,16]. In light of the evidence linking *khat* chewing and its associated practices to malnutrition and non-communicable diseases, there was an apparent need to deepen understanding of the usage of *khat* and other associated narcotic intoxicants in Uganda. Whereas a few studies have been conducted on *khat* usage, the focus has not been on the nutritional status of *khat* users. In addition, the exponential increase in the number of users indicates a dearth of awareness of the adverse consequences of *khat* chewing on nutrition. Given this gap, the study aimed to assess the nutritional implications of the habit of *khat* chewing among adults in the Nakawa division of Kampala city in Uganda.

MATERIALS AND METHODS

Study setting and design

The study was cross-sectional and descriptive with both qualitative and quantitative approaches given that the hypothesis that *khat* chewing affects the nutritional

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status of *khat* users was being investigated. The study targeted adult male users of *khat* in Nakawa division, Kampala city, Uganda. The division is bordered by Kira Municipality to the east, Kampala Central to the west, Makindye division across Murchison Bay to the southwest, and Lake Victoria to the south.

Sample size determination and selection of participants

A *khat* use prevalence of 7.9% among primary and secondary school students in Uganda has been reported [17]. This was used to calculate the sample size using the formula:

$$N = Z^2P(1-P)/D^2$$

Where: N = Sample size, Z = Statistic for level of confidence (1.96), P = Known prevalence (7.9% = 0.079 ~ 0.1), D = Precision/margin of error (0.05):

N = (1.96) ² x (0.1) x (1-0.1) / (0.05) ² = 138.3. Therefore, 138 individuals were targeted. However, given that the study investigated an underground habit associated with the use of an illicit drug, some potential study participants declined participation despite 3-months of persuasive reach out. Using chain sampling, 10 hotspots of *khat* users were mapped in the Nakawa division of Kampala city. Using simple random sampling, at least 10 users per hotspot were targeted hence a total of 100 were able to consent for structured interviews and an assessment of nutritional status.

Data collection

Face-to-face interviews with probing and guiding close-ended questions on socio-demographic data, patterns of *khat* use, and dietary data were used. Weight was taken by an electronic scale and recorded to the nearest 0.1 kg while the height was measured by a stadiometer and recorded to the nearest 0.1 cm. Structured questionnaires with sections on the required data were used. The Food Frequency Questionnaire (FFQ) and the 24-hour recalls were embedded as part of the questionnaires.

Data analysis

The height and weight data were used to compute BMI using the BMI calculation formula;

BMI (kg/m^2) = weight (kg) / height (m)^2. The body mass index was categorized according to the World Health Organization (WHO) cut-offs [18]. Information from the FFQs and the 24-hour recalls was analysed to report DDS (as low for three or fewer food groups, medium for four to five food groups and high for more than six), total protein and calories. In addition, actual intake levels were computed with the aid of food composition tables based on 100g edible portions of the food items.

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Statistical analysis

Statistical analysis was done using the Statistical Package for Social Sciences software version 23 (SPSS Institute, Inc). Descriptive statistics such as the frequencies, means and standard deviations were calculated. The degree of relationship among variables and other factors was statistically evaluated using chi-square analyses and the ANOVA test. Statistical significance was reported at the $P < 0.05$ level.

Ethical considerations

The study was approved by the Kyambogo University Department of Nutritional Science and Dietetics with a letter that was presented to local authorities in Nakawa Division. Respondent participation was voluntary and written informed consent was obtained from eligible persons. Confidentiality was observed by the use of anonymous questionnaires and coded datasheets.

RESULTS AND DISCUSSION

Characteristics of the *khat* users and patterns of chewing

The mean age of the assessed *khat* users was 26.7 years (Table 1). The minimum and maximum ages of *khat* users were 19 and 52, respectively. More than two-thirds of the assessed *khat* users were single. A similar pattern was observed among *khat* users in Mekelle town, Ethiopia [19].

The majority 61.0% of the respondents chewed *khat* for leisure while the rest chewed *khat* for other reasons. Of these, a large majority, 88.0%, chewed one handful. On average, at least five hours were spent in a *khat* chewing session which validates the findings of previous studies [20,21].

More than half 56.0% of the study participants chewed *khat* daily mostly with a special preference for the faint-red coloured leaves. A similar pattern was observed in a study at a University in Ethiopia [22]. The daily chewing of *khat* could be because of the addictive nature of the practice [3]. Peer pressure 60.0% was the main driving factor in *khat* chewing. Similarly, the majority of *khat* users in the Gurage zone, southern Ethiopia chewed *khat* because of peer pressure [23]. This might have been because the majority of the assessed *khat* users were below 24 years old, time of life associated with excitement and explorations of the various ways of life. Chi-square tests showed that the frequency of *khat* use was significantly associated with the use of an additional substance during the chewing session $X^2(4)20.161$, $P = 0.010$, and the type of substance used $X^2(4)12.912$, $P = 0.012$ to counteract the bitter taste. In addition, the main driver of *khat* chewing was significantly associated with the use of other substances X^2 (12)23.712, $P = 0.022$,

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the reported benefit of chewing *khat* $X^2(9)20.733$, P = 0.014 and the occupation of *khat* users X^2 (9)18.327, P = 0.032 (Table 2).

In this study, alcohol 35.0% and cigarettes 15.0% were the most mixed substances in *khat*. A similar pattern was observed among *khat* users elsewhere [24,25]. The concurrent use of alcohol or cigarettes with *khat* has been linked to the desire to neutralize the effects of *khat* and or to achieve more pleasure [26].

Dietary characteristics of *khat* users

Meal frequency and preparation

The majority 64.0% of *khat* users had eaten three meals in the previous 24 hours while 13.0% and 23.0% had eaten two or less and four or more meals, respectively. In addition, the majority 96.0% ate a snack the previous day while 4.0% did not. Regarding the main source of the meal, 58.0% bought the meals, while 33.0% and 9.0% either home-prepared or received food as gifts, respectively. Fried foods 46.0% were the most consumed, followed by boiled 43.0% and stewed foods 11.0%. Fast foods constituted a large proportion of the diet of study participants. This might have been because the majority of the assessed *khat* users were single and chewed *khat* for long hours, which did not allow them time to plan and prepare balanced meals. This might predispose the study participants to non-communicable diseases such as dyslipidaemia [27].

Dietary diversity of khat users

The majority of *khat* users 57.0% had a medium DDS while 20.0% and 23.0% had a low and high DDS, respectively. As shown in Figure 1, the foods eaten include; cereals 80.0%, starchy roots, tubers and plantain 60.0%, leafy vegetables 30.0%, milk and milk products 14.0%, poultry and eggs 35.0%, refined sugars and sweets 72.0%, fats and oils 62.0%, non-alcoholic beverages 42.0%, carbonated/fizzy drinks 15.0%, meats 20.0% and fruits 8.0%.

Chi-square results revealed significant associations of the DDS with the hours spent in *khat* chewing $X^2(4)$ 10.156, P = 0.025 and the frequency of *khat* chewing $X^2(4)14.423$, P = 0.038 (Table 3). Similarly, ANOVA results revealed significant mean differences in the DDS by the frequency of *khat* chewing F=3.253, P=0.043 and the hours spent in *khat* chewing F = 4.093, P = 0.009. As shown in Table 4, daily 4.6±1.1, P = 0.043 and weekly users 4.5±0.035 had significantly lower dietary diversity scores compared to the monthly users 5.8±0.4 of *khat*. Persons who spent more than six hours in the *khat* chewing sessions had significantly lower DDS 3.8±0.8 compared to *khat* users who spent one to two hours 5.2±0.9, P = 0.008, three to four hours 4.6±1.1, P = 0.051 and those who spent five to six hours 4.7±1.1, P = 0.035. This shows that the more frequently one uses *khat*, the more inclined they become to consume fewer food varieties.

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Refined sugars and sweets were consumed by more than two-thirds of the assessed *khat* users. A similar pattern was observed in a study on *khat* users in Saudi Arabia [27]. This might have been because of the non-pleasant taste of the leaves, that causes *khat* users to use sweet chewing gum and sweet drinks to counteract the bitter taste of the leaves. In this study, fruits were the lowest-eaten foods by the *khat* users. Fruits are important sources of phytochemicals and antioxidants which play an important role in cancer prevention and protection given their ability to remove free radicals [28]. Therefore, a lack of adequate fruits and vegetables in the diet of *khat* users would predispose them to cancer given that the majority combined *khat* chewing with alcohol, cannabis, cigarettes and other chewable tobacco-containing substances such as *mijaj* locally called *kuber* in Uganda.

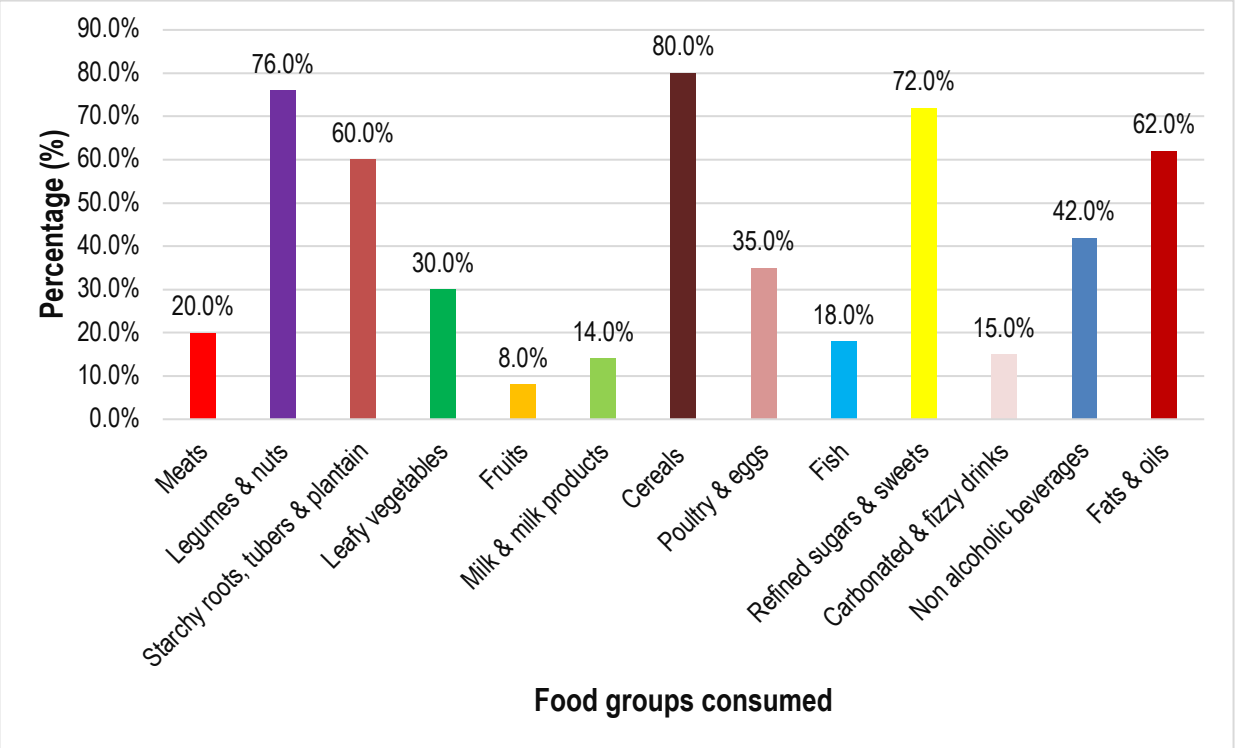

Figure 1: The different food groups consumed by *khat* users

Nutrient intake of *khat* users

Regarding nutrient intake in the previous 24 hours before the interview, 63.0% consumed proteins less than 56g while 37.0% consumed proteins above 56g. The majority 52.0% had less than 2500 kilo calories (Kcals) while 48.0% had more than 2500 Kcals. Analysis of variance tests showed significant mean differences in total calories based on the use of an additional substance P = 0.001. As shown in Table 5, total calorie intake was significantly higher among users of cannabis 2593.1 Kcals, P = 0.002 and other substances 2528.4 Kcals, P = 0.026 compared to

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alcohol users indicating that the groups that used cannabis and other substances during the *khat* chewing sessions required more calories or ate more food or ate more frequently.

Nutritional Status of *Khat* users in the Nakawa division by the BMI

The mean (SD) BMI was 20.1 ±2.7 kgm² with more than two-thirds of the assessed *khat* users being within the normal range of BMI. A similar pattern was observed in a sampled Yemeni male population [29]. The majority 71.0% of the *khat* users were of normal nutritional status while 26.0% and 3.0% were underweight and overweight, respectively.

The proportion of underweight in the current study is higher than the 11.11% reported among men in Kampala while the prevalence of overweight in the study is lower than the 17.2% reported in the Uganda Demographic and Health Survey (UDHS) [30]. This discrepancy might be attributed to the fact that the current study assessed a smaller population compared to the UDHS. The high proportion of underweight in the current study could also be attributed to the poor dietary intake exhibited by the majority of the *khat* users. Slightly more than one-quarter 26.0% of the assessed *khat* users were underweight, which is higher than the one-tenth proportion of under-nutrition reported among *khat* users in the Gurage zone, Ethiopia [23]. This discrepancy is linked to the observed differences in the study designs, the current study was cross-sectional while the study in the Gurage zone was comparative and recruited a relatively higher number of study participants. On the other hand, the proportion of undernourished *khat* users in the current study is lower than that reported in a study that assessed *khat* chewing patients entering HIV treatment programs in another place in Ethiopia [31]. In this study, a very small proportion of the *khat* users were overweight 3.0% but not obese This proportion is lower than that documented in a study that used a different methodology to assess *khat* chewing Yemeni males [29]. In addition, the ANOVA test in Table 6 showed significant mean differences in the BMI of *khat* users based on the age categories $F = 3.149$, $P = 0.029$, marital status $F = 3.916$, $P = 0.023$, dietary diversity $F = 40.044$, $P < 0.001$ and the frequency of *khat* chewing $F = 3.378$, $P = 0.038$. As shown in Table 7, the BMI was significantly higher among *khat* users with a high DDS 23.2 kg/m², $P < 0.001$ and those with a medium DDS 19.4 kg/m², $P < 0.001$ compared to the *khat* users with a low DDS 18.3 kgm², $P = 0.083$. This implies that the more food groups the *khat* users ate, the higher their chances of having a normal BMI or even higher nutritional status (overweight or obese).

The BMI was also significantly lower among the individuals who chewed *khat* daily 19.9 kg/m², $P = 0.049$ compared to the monthly or occasional 22.5 kg/m² and the weekly users 20.4 kg/m². This implies that in more frequent *khat* users, there is a possibility of them having a lower BMI and undernutrition. This might be because of

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the frequent loss of income to *khat* and lack of time to plan and prepare appropriate meals given that a large amount of time is lost in the lengthy *khat* chewing sessions along with skipping meals while chewing *khat*.

CONCLUSION AND RECOMMENDATIONS FOR DEVELOPMENT

Overall, the study revealed that poor nutrition was of concern and a problem among *khat* users. Given that the habit involves long hours of group/community chewing sessions, the practice deprives users of the opportunity to have meals on time and this has exposed them to lower dietary diversity scores. By the nature of the bitter taste of *khat*, users also often chewed it with chewing gum, refined sugars and sweets which constitutes inappropriate dietary behaviour. Consumption of fruits and vegetables was inadequate among users who seemed to prefer fast foods. These poor dietary habits are associated with NCDs that could potentially add a strain to Uganda's healthcare system given the expensive cost of NCD management.

The study findings also highlighted the use of multiple drugs and other substances characterised by the term *"mixers."* Whereas this study focused on *khat* users, the overbearing magnitude of *mixers* implies deeper public health and social problems in the community. Moreover, there seems to be a lack of awareness and outreach focus on the negative adverse effects of *khat* and other psychotropic substances on the nutritional and health well-being of Ugandans.

The implications of this study point to wider public health and nutrition concerns emanating from *khat* use, especially among urban dwellers in Uganda. Whereas proxy indicators of anthropometry and dietary assessment were used, advanced analysis of biomarkers and psychosocial assessments among *khat* users are necessary to understand the potentially negative effect of psychotropics on nutritional biochemistry, nutrient bioavailability, physiological health and mental wellbeing. Tighter controls of *khat* use in policy and legislation need to be enforced effectively through community empowerment mechanisms that regulate the demand and supply chains of illicit drugs and other substances to mitigate their negative consequences on public health and nutrition.

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Table 1: Socio-demographic and lifestyle characteristics of *khat* users

Characteristic	N=100	%	Mean (SD)
Marital status			
Single	68	68.0 %	
Married	32	32.0 %	
Education status			
Tertiary	14	14.0 %	
Secondary	63	63.0 %	
Primary/below	23	23.0 %	
Age category (years)			
18 to 24	51	51.0 %	
25 to 34	35	35.0 %	26.68 (±7.2)
35 and above	14	14.0 %	
Occupation			
Employed	74	74.0 %	
Un-employed	26	26.0 %	
Chewing frequency			
Daily	56	56.0%	
Weekly	39	39.0 %	
Occasionally	5	5.0 %	
Years of chewing *khat*			
< 1	10	10.0 %	5.48 (±2.9)
2 to 3	21	21.0 %	
≥4	69	69.0 %	
Number of handfuls chewed per session			
One	88	88 %	1.09 (±0.3)
One and a half	3	3.0 %	
Two or more	9	9.0 %	
Expenditure on *khat* per session in Uganda shillings			
< 5000	35	35.0 %	
5000 to 7000	44	44.0 %	6243.0
8000 to 10000	14	14.0 %	
> 10000	7	7.0 %	
Hours of *khat* chewing per day			
1 to 2 hours	11	11.0 %	
3 to 4 hours	29	29.0 %	4.98 (±1.7)
5 or more hours	60	60.0 %	
The main driver for *khat* chewing			
Peers	60	60.0%	
Neglect	26	26.0%	
Others	14	14.0%	

N-number of respondents assessed, %-Percentage, SD-Standard deviation

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Table 2: Variations in *khat* use with socio-demographic and *khat* chewing patterns

Characteristic	Frequency of *khat* chewing n (%)				Main driving factor n (%)			
	Daily	Weekly	Rarely	P-value	Peers	Stimulation	Others	P-value
Other substances used with *khat*								
Alcohol	17 (48.6)	18 (51.4)	0 (0.0)	**0.010**	18 (51.4)	8 (22.9)	9 (25.7)	**0.022**
Cannabis/cigarette	11 (40.7)	12 (44.4)	4 (14.8)		15 (55.6)	9 (33.3)	3 (11.1)	
Others *e.g mijaj*	10 (90.9)	1 (9.1)	0 (0.0)		9 (81.8)	2 (18.2)	0 (0.0)	
Substance used								
Chewing gum	35 (70.0)	12 (24.0)	3 (6.0)		26 (52.0)	18 (36.0)	6 (12.0)	0.274
Sim-sim	7 (43.7)	9 (56.3)	0 (0.0)	**0.012**	11 (68.8)	4 (25.0)	1 (6.2)	
Groundnuts	14 (41.2)	18 (52.9)	2 (5.9)		21 (61.8)	6 (17.6)	7 (20.6)	
Chewing benefit								
Stress relief	12 (52.2)	9 (39.1)	2 (8.7)	0.081	11 (47.8)	10 (43.5)	2 (8.7)	**0.014**
Stay awake	9 (56.3)	7 (43.7)	0 (0.0)		8 (50.0)	5 (31.3)	3 (18.7)	
Leisure	35 (57.4)	23 (37.7)	3 (4.9)		41 (67.2)	11 (18.0)	9 (14.8)	
***Khat* chewing hot-spot location**								
Nakawa east	30 (50.8)	28 (47.5)	1 (1.7)	**0.039**	37 (62.7)	14 (23.7)	8 (13.6)	0.729
Nakawa west	26 (63.4)	11 (26.8)	4 (9.8)		23 (56.1)	12 (29.3)	6 (14.6)	
Age category								
18 to 24	33 (64.7)	16 (31.4)	2 (3.9)		38 (74.6)	9 (17.6)	4 (7.8)	0.171
25 to 34	19 (54.3)	13 (37.1)	3 (8.6)	0.064	14 (40.0)	13 (37.1)	8 (22.9)	
35 and above	4 (28.6)	10 (71.4)	0 (0.0)		8 (57.1)	4 (28.6)	2 (14.3)	
Education level								
Tertiary	5 (35.7)	8 (57.1)	1 (7.2)		5 (35.7)	5 (35.7)	4 (28.6)	0.345
Secondary	42 (66.7)	18 (28.6)	3 (4.7)	0.085	42 (66.7)	12 (19.0)	9 (14.3)	
Primary or below	9 (39.1)	13 (56.5)	1 (4.4)		13 (56.5)	9 (39.1)	1 (4.4)	
Occupation								
Unemployed	14 (53.8)	11 (42.3)	1 (3.8)	0.073	21 (80.8)	3 (11.5)	2 (7.7)	**0.032**
Salary or wages	36 (61.0)	20 (33.9)	3 (5.1)		30 (50.8)	21 (35.6)	8 (13.6)	
Others	6 (40.0)	8 (53.3)	1 (6.7)		9 (60.0)	2 (13.3)	4 (26.7)	

n (%) is frequency (percentage) P values in bold are statistically significant

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Table 3: Variations in DDS by socio-demographic and *khat* chewing patterns

Characteristic	Dietary diversity n (%)				P-value
	N	Low	Medium	High	
Age (years)					
18 to 24	51	11 (21.0)	31 (60.8)	9 (17.4)	0.759
25 to 34	35	7 (20.0)	19 (54.2)	9 (25.7)	
35 and above	14	2 (14.3)	7 (50.0)	5 (35.7)	
Marital status					
Married	32	5 (15.6)	14 (43.8)	13 (40.6)	**0.016**
Non-married	68	15 (22.1)	43 (63.2)	10 (14.7)	
Chewing frequency					
Daily	56	13 (23.2)	32 (57.1)	11 (19.6)	**0.038**
Weekly	39	7 (17.9)	24 (61.5)	8 (20.5)	
Occasionally	5	0 (0.0)	1 (20.0)	4 (80.0)	
Hours spent chewing					
One to two	11	1 (9.0)	5 (45.5)	5 (45.5)	
Three to four	39	7 (17.9)	20 (51.3)	12 (30.8)	**0.025**
Five to six	34	5 (14.7)	23 (67.6)	6 (17.7)	
More than six	16	7 (43.8)	9 (56.2)	0 (0.0)	
Substance chewed with					
Chewing gum	50	9 (18.0)	30 (60.0)	11 (22.0)	0.325
Simsim	16	6 (37.5)	8 (50.0)	2 (12.5)	
Groundnuts	34	5 (14.7)	19 (55.9)	10 (29.4)	
Expenditure on *khat* chewing in Uganda shillings					
< 5000	35	8 (22.8)	19 (54.3)	8 (22.9)	0.918
5000 to 10000	58	10 (17.3)	34 (58.6)	14 (24.1)	
> 10000	7	2 (28.6)	4 (57.1)	1 (14.3)	

DDS were considered low for ≤ 3 food varieties, medium for 4 to 5 food varieties and high for ≥ 6 food varieties, P values in bold are statistically significant

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Table 4: Differences in DDS by khat chewing frequency and time spent chewing *khat*

Variable	(Percentage)	Mean (SD)	Covariates	P-value
Khat chewing frequency				
Daily	(56.0%)	4.6 (±1.1)	Weekly	0.955
			Monthly	**0.043**
Weekly	(39.0%)	4.5 (±1.1)	Monthly	**0.035**
Monthly	(5.0%)	5.8 (±0.4)		
Time spent chewing *khat*				
1 to 2 hours	(11.0%)	5.2 (0.9)	3 to 4 hours	0.454
			5 to 6 hours	0.577
			> 6 hours	**0.008**
3 to 4 hours	(39.0%)	4.6 (1.1)	5 to 6 hours	0.994
			> 6 hours	0.051
5 to 6 hours	(34.0%)	4.7 (1.1)	> 6 hours	**0.035**
> 6 hours	(16.0%)	3.8 (0.8)		

P values in bold are statistically significant

Table 5: Differences in total calories by additional substance abuse

Substance used in addition to *khat*	(Percentage)	Mean (SD) Calories	Covariates	P-value
Alcohol use	(35.0%)	2250.0 (±318.4)	Cannabis	0.002
			Cigarettes	0.192
			Others	0.026
Cannabis	(12.0%)	2593.1 (±232.8)	Cigarettes	0.517
			Others	0.978
Cigarettes use	(15.0%)	2430.4 (±213.4)	Others	0.886
Others e.g. *mijaj*	(11.0%)	2528.4 (±178.6)		

The calories contributed by alcohol were not included" P values in bold are statistically significant

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Table 6: Table of differences in the BMI of *khat* users

Characteristic	Percentage	Means	SD	P-value
Marital status				
Single	55.0%	19.9	±2.2	
Married	32.0%	20.8	±3.2	0.023
Others	13.0%	18.5	±2.1	
Chewing frequency				
Daily	56.0%	19.0	±2.4	
Weekly	39.0%	20.4	±2.7	0.038
Occasionally	5.0%	22.1	±4.1	
Dietary diversity				
Low	20.0%	18.3	±1.9	
Medium	57.0%	19.4	±1.7	0.000
High	23.0%	23.2	±2.6	
Age category				
18 to 24	51.0%	19.6	±2.0	
25 to 34	35.0%	20.5	±2.9	0.029
35 and above	14.0%	21.3	±3.8	

% is the percentage, SD is the standard deviation, P values in bold are statistically significant

Table 7: Differences in the BMI by DDS and *khat* chewing frequency

Variable	(Percentage)	Means (SD) BMI	Covariates	P-value
Dietary diversity scores				
Low	(20.0)	18.3 (±1.9)	Medium	0.083
			High	**0.000**
Medium	(57.0)	19.4 (±1.7)	High	**0.000**
High	(23.0)	23.2 (±2.6)		
Khat chewing frequency				
Daily	(56.0)	19.6 (±2.4)	Weekly	0.325
			Monthly	**0.049**
Weekly	(39.0)	20.4 (±2.7)	Monthly	0.204
Monthly	(5.0)	22.5 (±4.1)		

P values in bold are statistically significant

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