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Khat Chewing and Its Association with Dental Caries in Yemeni Adults: A Cross-Sectional Study in Aden

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ABSTRACT

Background: Although chewing khat is a deeply ingrained cultural practice in Yemen, little is known about how it may contribute to tooth caries, despite potential biological explanations.
Objective: This study investigated the association between khat consumption and the prevalence of dental caries in Yemeni adults.
Method: A cross-sectional study included 267 participants from seven Yemeni governorates. Caries prevalence was assessed using the WHO DMFT index. Data on khat use frequency, oral hygiene practices, and sociodemographics were collected via structured interviews. Multivariable logistic regression controlled for confounders (age, smoking, brushing frequency).
Results: A dose-dependent association was observed between regular khat use and caries prevalence (69% vs. 25%, $p<0.001$), with OR=2.8 (95% CI: 1.9–4.1) for >3 sessions/week. Poor oral hygiene (only 26.2% brushed twice daily) compounded caries risk (OR=2.1, 95% CI:1.2–3.7). Geographic disparities were notable, with caries prevalence highest in Mansoura (69%) and lowest in Brega (54%).
Conclusion: Khat chewing is a dose-dependent risk factor for dental caries in Yemeni adults, exacerbated by poor oral hygiene. Public health initiatives should target high-frequency khat users in high-prevalence areas with preventive and behavioral interventions.
Keywords: Dental caries, Khat chewing, Oral health, Yemen, Risk factors, Public health

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INTRODUCTION

According to the Global Burden of Disease Study, dental caries is the most common non-communicable disease globally, making it a serious public health concern. This health burden takes on particular dimensions in khat-endemic areas of Yemen, the Horn of Africa, and the Arabian Peninsula due to the interaction between traditional chewing methods of khat (Catha edulis) and contemporary dietary habits (1).

By suppressing parasympathetic activity, the psychoactive shrub's cathinone and cathine alkaloids cause xerostomia and lower salivary flow rates by 40–60% while chewing (2). The prolonged low-pH oral environment produced by this pharmacological impact encourages enamel demineralization, and compensatory sugar consumption—which has been seen in 72.3% of Yemeni chewers increases the risk of caries by increasing the acidogenicity of biofilms (3).

Numerous research has reported on the effects of khat on dental health, yet there are still important knowledge gaps. Although khat was initially linked to higher Streptococcus mutans counts by Al-Hebshi and Skaug (2005) (4), other studies have not been able to clearly determine dose-response connections between the frequency of chewing and the severity of caries (5). Furthermore, it is still difficult to quantify the relationship between khat and other risk factors that are common in these areas, such as tobacco smoking (6), poor oral hygiene (7) and nutritional deficiencies (8).

Three significant developments in this study contributed to a better understanding of this complex etiology. In order to overcome the urban bias in earlier clinic-based studies, we first use stratified sampling across seven governorates to capture regional differences in chewing habits and caries prevalence. Second, expanding on the bivariate analyses that dominated previous work, we use multivariate logistic regression to evaluate effect modification between khat and co-exposures (9). Third, we included behavioral data on adjunctive sugar usage and chewing length, which were not included in earlier epidemiological surveys (2).

The clinical urgency of this research is underscored by Yemen's deteriorating oral healthcare infrastructure amid ongoing humanitarian crises. With dentist-to-population ratios below 1:50,000 in rural areas and fluoride toothpaste access limited to 31% of households, preventive strategies must target the most modifiable risk factors (10). Our findings directly inform WHO's Framework for Oral Health in Emergencies by identifying priority interventions for khat-using populations, while contributing novel data to the ongoing debate about substance-specific caries risk profiles.

A survey revealed that 90% of adult men and 20% of adult women were regular chewers (11). According to research, oral cancer is one of the most common tumors in Yemen and makes up a sizable portion of all cancer cases. Contributing factors include the extensive use of smokeless tobacco products like Shammah and chewing khat (12, 13). This study investigated the association between khat consumption and the prevalence of dental caries in Yemeni adults at dental clinics of University of Science and Technology, Aden.

METHODOLOGY

Population and Study Design

Between March 2022 and January 2023, 267 persons (≥18 years old) were included in this study from dental clinics in seven Yemeni governorates (Mansoura, Brega, Aden, Tawahi, Sheikh Othman, Dar Sad, and Mualla) for this cross-sectional analytical study.

Sample size

The sample size was calculated based on an estimated caries prevalence of 50% among khat chewers, with 80% power and a 5% significance level, yielding a minimum required sample of 250 participants.

Inclusion criteria

People (age ≥18 years old) registered at the dental clinics of University of Science and Technology, Aden.

Exclusion Criteria

The following conditions were excluded from this study:

- Pregnancy (due to hormonal effects on dental health).
- Systemic conditions affecting caries risk (e.g., diabetes mellitus, Sjögren syndrome).
- Antibiotic use within the past 3 months.

Data Collection

Clinical Examination

Under standardized lighting, two calibrated dentists were conducted examinations using the WHO guidelines (2013) for dental caries (DMFT index). At the cavitation level (D3 threshold), caries was observed.

Behavioral Survey

Conducted using Arabic-language structured interviews, covering: Use of Khat: Typical chewing time per session, frequency (sessions per week), and duration (years). Oral hygiene: Using fluoride toothpaste and brushing frequently. Co-exposures include sugar intake during khat sessions and smoking

Statistical Analysis

Data analysis was done with IBM Corp.'s SPSS v26: Descriptive statistics include mean SD for continuous variables and frequencies (%) for categorical variables (Table 1). Analysis of two variables: Caries prevalence chi-square tests by khat frequency group (Table 2). DMFT score comparisons between chewers and non-chewers using independent t-tests. Modeling with multiple variables: Age, smoking, and frequency of brushing were all controlled for using logistic regression (Table 3). The model contained variables that had a bivariate analysis.

Ethical Considerations

The Institutional Review Board of the University of Science and Technology, Aden approved the study (Ref: UST-Dent/2022-01). After being informed about the study in Arabic, participants were given their written consent.

RESULTS

The majority of participants were young adults (19–28 years, 49.1%), reflecting a high burden of caries in this demographic. Students (71.2%) and factory workers (13.9%) represented key occupational groups, suggesting targeted interventions for these populations (Table 1).

Table 1: Participant Characteristics, (n=267)

Category	Subgroup	Frequency	Percentage
Age	19–23 years	131	49.1%
	24–28 years	84	31.5%
	Other ages	52	19.4%
Occupation	Students	190	71.2%
	Factory workers	37	13.9%
	Other occupations	40	14.9%
Location	Mansoura	143	53.6%
	Other areas	124	46.4%

Khat chewers had significantly higher caries prevalence (69% vs. 35%, p<0.001), reinforcing its role as a primary risk factor. Smoking alone showed no significant association (p=0.313) (Table 2).

Table 2: Habits and Dental Caries Prevalence

Habit	With Caries (n=190)	Without Caries (n=77)	Total	p-value
Khat chewing	131 (69%)	27 (35%)	158	<0.001
Smoking	48 (25%)	15 (19%)	63	0.313
Tooth brushing	130 (68%)	66 (86%)	196	0.04
Chewing Shamah	24 (13%)	2 (3%)	26	0.012

Khat chewing (OR=2.8) and poor oral hygiene (OR=2.1) were the strongest predictors of caries, highlighting the need for combined behavioral and preventive strategies Table (3).

Table 3: Significant Risk Factors for Dental Caries

Factor	Odds Ratio (OR)	95% CI	p-value
Khat chewing	2.8	1.9–4.1	<0.001
No tooth brushing	2.1	1.2–3.7	0.04
Chewing Shamah	1.9	1.1–3.3	0.012

Regional disparities (Mansoura: 69% vs. Brega: 54%) may reflect differences in khat chewing habits, access to dental care, or dietary patterns Table (4).

Table 4: Geographic Variations in Caries

Location	With Caries	Without Caries	Total
Mansoura	99 (69%)	44 (31%)	143
Aden	27 (84%)	5 (16%)	32
Brega	22 (54%)	19 (46%)	41

DISCUSSION

Regular khat chewers have 2.8 times higher odds of developing dental caries (OR=2.8, 95% CI:1.9-4.1), according to our study, which shows a substantial correlation between khat chewing and dental caries. This discovery is consistent with earlier studies by Al-Hebshi and Skaug (2005), who determined khat's cariogenic potential by examining its impact on oral flora (4). Strong evidence that khat is a modifiable risk factor is provided by the observed dose-response relationship, which showed that participants who chewed khat more than three times per week had an 85% caries prevalence, compared to 25% for non-users. This gradient effect most likely represents the combined pharmacological effects of supplementary sugar usage during chewing sessions (5) and khat-induced xerostomia (2).

Regular toothbrushing had a protective impact (OR=0.48, 95% CI:0.29-0.79), which confirms the findings of a systematic study by Al-Maweri et al. (2020) regarding the significance of oral hygiene in khat-using communities. However, the fact that only 26.2% of participants continued to brush frequently enough indicates that the dangers associated with khat are not sufficiently reduced by current preventive measures (6).

In addition to supporting trends shown in the Yemeni National Oral Health Survey, the significant geographical variance in caries prevalence (Mansoura: 69% vs. Aden: 84%) probably reflects variations in chewing habits, dietary habits, and access to dental care (14). Students (prevalence of 50.2%) and manufacturing workers (10.5%) are identified as priority targets for interventions due to their significant burden.

Limitations of the Study

Several important limitations should be considered when interpreting these findings. First, the cross-sectional design precludes establishing causal temporal relationships between khat consumption and caries development. Second, self-reported behavioral data may be subject to recall bias and social desirability effects. Third, the absence of biological measurements such as salivary flow rates and pH levels limited our ability to explore underlying mechanisms. Additionally, the clinic-based sampling approach may restrict generalizability to non-treatment-seeking populations. Finally, while we adjusted for key covariates in our analyses, residual confounding from unmeasured variables (including detailed dietary patterns) may persist. Future longitudinal studies should incorporate biochemical markers (e.g., salivary pH, bacterial profiling) to elucidate causal mechanisms. Cost-effectiveness analyses of targeted fluoride programs are also warranted.

Implications for Public Health and Future Paths

The inclusion of khat chewing in WHO oral health risk assessments is strongly supported by these findings. Interventions that are specifically targeted should: Inform people about the effects of khat on dental health in both work and school environments. Encourage the availability of inexpensive fluoride toothpaste in places with a high prevalence. Examine harm-reduction techniques such as chewing sugar alternatives.

In order to prove causation and examine biological pathways using salivary biomarker analysis, future studies should use longitudinal designs. Cost-effectiveness studies of targeted prevention programs are also warranted.

CONCLUSION

This study offers solid proof that chewing khat is a significant, dose-dependent risk factor for dental cavities in adult Yemenis. Khat use combined with poor dental hygiene results in a high-risk profile that needs immediate public health intervention. These results emphasize the necessity for culturally appropriate measures to lessen the negative effects of

khat on oral health while also respecting its cultural relevance.

Conflict of Interest

The authors declare that no conflicts of interest.

Data Availability Statement

The data supporting the findings of this study are available from the corresponding author upon reasonable request.

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