Research Article

ISSN 2639-9490

Oral Health & Dental Science

Effect of Khat Consumption on Oral Health: Study Carried Out in Djibouti City

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Received: 10 January 2021; **Accepted:** 05 February 2021

Citation: Bennani A, Mohamed SI. Effect of Khat Consumption on Oral Health: Study Carried Out in Djibouti City. Oral Health Dental Sci. 2021; 5(1); 1-8.

ABSTRACT

Introduction: *The purpose of the present investigation is to determine the oral effects of regular khat consumption in Djibouti by placing risk factors and symptoms related to consumption as a contribution to the ongoing scientific discourse.*

Materials and Methods: *A cross-sectional epidemiological survey was carried out on 129 patients consulting in a health center affiliated to the CNSS, located in the capital of the Republic of Djibouti, Djibouti-City from August to October 2017. The support of the survey is a questionnaire including an interview and a clinical examination. The subjects are divided into regular khat consumers (CK) and non-khat consumers (NCK).*

Results: *Our sample is divided into 48.1% CK and 51.9% NCK. 80.7% of CK and 38.8% of NCK are male. 58.1% of CK and 88.1% of NCKs report a frequency greater than or equal to 2 brushings / day. 62.9% of CK and 4.5% of NCK are tobacco users (CT). 77.4% of CK and 20.9% of NCK are consumers of sweetened beverages.*

62.9% of CK and 16.4% of NCKs report symptoms of dry mouth. 38.7% of CK and 16.4% of NCK suffer from TMJ pain. 32.3% of CK and 14.9% of NCK complain of changes in taste perception. 29% of CK and 4.5% of NCK have burning sensations in the tongue or other parts of the oral cavity. 24.2% of CK and 7.5% of NCK report loss of prosthetic restorations and / or strides.

The plate indices of CK and NCK are 1.6 (+/- 0.13) and 1.4 (+/- 0.13), respectively. The gingival indices of CK and NCK are respectively 1.64 (+/- 0.13) and 1.57 (+/- 0.09).

24.2% of CK and 1.5% of NCK have whitish lesions of leucoplastic appearance. 79% of CKs and 23.9% of NCKs have recessions.

22.6% of CKs and 6% of NCKs suffer from spoiled restorations. 24.2% of CK and 9% of NCK suffer loss of fixed prosthetic restorations.

Discussion: *Similar to studies in Yemen and Israel, there is a slight predominance of NCKs in our sample. The consumption of khat is also significantly associated with the male sex. A number of articular, mucosal and dental symptoms are significantly associated with khat consumption. Ethiopian, Yemeni and Israeli studies are in agreement with our results.*

In agreement with a Yemeni study but in contradiction with a Kenyan study, there is a significant association between khat consumption, poor oral hygiene and increased plaque index. Nevertheless, an association between khat consumption and gingival inflammation is not established.

In agreement with Israeli and Yemeni studies, there is a significant association between khat consumption, whitish mucosal lesions of leucoplastic appearance and gingival recessions. Regular consumption of khat is also significantly associated with the loss of prosthetic and / or striated restorations. Our results are confirmed by a Saudi study.

Conclusion: *Regular consumption of khat is significantly associated with a number of oral disorders. Future prevention campaigns should focus on the male population and the concomitant use of tobacco.*

Keywords
Khat, Oral health, Djibouti,

Introduction
The khat refers to the leaves of Catha edulis Forsk; a dicotyledone shrub of the Celastraceae family [16]. It is an evergreen shrub cultivated as a bush with an average height between 2 and 10 meters [21]. There is also an expansion beyond endemic areas due to the immigration of consumers, which makes it a national and international health issue [18,20].

In addition to the reported systemic effects [6,12] how the plant is consumed determines the location of the observed oral conditions. Fresh leaves are chewed and as more are added, a chew is formed and stored at the vestibule. In 1966, Rosenzweig et al. [31] were the first to suggest that khat could be a causal factor in periodontal diseases in Israel. They find that an ethnic group from Yemen has higher need for periodontal treatments, plaque index and attachment loss than others ethnic groups, which they believe is related to a pre-immigration khat use. Other clinical pathological signs are detailed in subsequent studies, comparing a group of consumers and non-consumers. They include leukoplakia, gingival inflammation, mucosal ulcerations, erosions, loss of restorations and teeth; recessions and losses of attachment, at significantly higher rates among consumers. A higher rate of cervical decay is also reported.

However, other studies contradict the deleterious effects of khat on oral health [26]. In addition to these contradictions, the majority of studies do not investigate risk factors such as cigarette consumption, oral hygiene, socio-economic variables or history of consumption. Subjective symptoms [7,15] affecting the well-being of consumers are also reported. Finally, there are no surveys and databases on the association between khat use and oral effects in Djibouti, which are necessary for effective preventive campaigns.

In light of these contradictory results and the absence of oral references in relation to khat, the objective of this investigation is to determine the oral effects of regular khat use in Djibouti by placing risk factors and symptoms related to consumption as an input to current scientific discourse.

Materials and Methods
A cross-sectional survey was conducted on 129 subjects randomly consulting at the odontostomatology service of a care center affiliated to the CNSS, in the capital of the Republic of Djibouti [17,24,25] Djibouti-City, from August 25, 2017 to October 15, 2017.

Are included regular KC and non-regular KC who agreed to participate to the study? Is defined as regular KC, any subject who has been using khat for at least 3 years, at least once a week. Any subject who has never consumed khat is defined as NKC.

We excluded non-regular KCs, subjects under 20 years of age, subjects with general pathologies and subjects under medical treatment. Any subject who has consumed khat for less than 3 years and/or less than once a week shall be considered as non-regular KC.

The data were collected on the basis of a standardized questionnaire adjusted following a pre-survey involving 15 patients. It is divided into two main parts: interrogation and clinical examination. Interrogation includes questions about age, sex, occupation, education, lifestyle (khat, brushing frequency, smoked tobacco, sugary drinks, chewed tobacco, alcohol, water pipe). Then, KC and NKC answered a series of 8 closed questions related to specific oral symptoms which are dental pain, temporo-mandibular joint pain, oral dryness, sensation of tongue burns or other part of the oral cavity, halitosis, modification in taste perception, gingival bleeding and prosthetic/restorative failures. These elements were adapted from a study conducted by Locker and Miller in 1994 [28]. Special precautions are observed for women, who are interviewed in an empty room.

During clinical examination, oral hygiene is determined by the Silness and Loe plaque index (1964). Examination of the superficial periodontal determines the degree of gingival inflammation of subjects, by using the gingival index of Loe and Silness (1967). The examination of the jugal, labial, palatine, lingual and gingival mucosal membranes is carried out to thoroughly investigate any whitish lesion with a leukoplastic aspect. The examinator used a mirror, a tongue-depressor and a pin-tweezers without distinction on the chewing or non-chewing side. The review of recessions was conducted using a mirror and periodontal Marquis Probe. There is a recession when there is displacement of the marginal gum at least 1mm from the amelo-cemental junction for 4 posterior sextants of the oral cavity. The different sextants with a recession were coded as follows according to the size of the recession: type I = less than or equal to 3mm and type II = more than 3 mm. The first focus of the dental examination was the prosthetic or restorative failures. Carious lesions and tooth loss are also examined. The examination of cavities was based on the classification of carious lesions by Lasfargues and Coll [27]. A tooth is considered to be extracted when coronary destruction cannot allow restoration when there is a mobility of degree 4.

Patients requiring treatments have been oriented after clinical examination. Data's were entered using Microsoft Excel 2013 and analyzed using the Epi Info 7 software. Qualitative variables are presented as frequencies and percentages; quantitative variables are presented as means and standard deviations. The chi2 test for the qualitative variables and the Student T-Test for the quantitative variables were used. A $p < 0.05$ was considered to be statistically significant.

Results
There are 50 men (80.6%) in KC group; 27 KC (43.5%) have a high school or university level. NKC group include 26 men (38.8%) and 39 NKC (58.2%) also report a high school or university level.

25 KC (40.3%) and 22 NKC (32.8%) are unemployed. 2 KC (3.2%) and 8 NKC (11.9%) are students. 35 KC (56.5%) and 37 NKC (55.3%) are functionaries. The sample contains 42 (32.6%) TC subjects (Tobacco Consumers) of which 39 KC (62.9%) and 3 NKC (4.5%). 48 KC (77.4%) and 14 NKC (20.9%) are SBC (consumers of sugary beverages).

Table 1: Comparison of CK and NCK groups by socio-demographic data and lifestyle.

	NKC (N = 67)		KC (N = 62)		P
	N	%	N	%	
Sex					
Male	26	38,8	50	80,6	<0,001*
Female	41	61,2	12	19,4	
Age (year)					
< 40	*49*	*73,1*	28	45,2	0,001*
≥ 40	*18*	*26,9*	34	54,8	
Level of instruction					
None/Primary	28	41,8	35	56,5	0,096
Secondary/Universitary	39	58,2	27	43,5	
Occupation					
Unemployed	22	32,8	25	40,3	0,161
Students	8	11,9	2	3,2	
Functionaries	37	55,3	35	56,5	
Brushes frequency (brush/day)					
<2	*8*	*11,9*	26	41,9	<0,001*
≥2	*59*	*88,1*	36	58,1	
Tobacco					
NTC	*64*	*95,5*	23	37,1	<0,001*
TC	*3*	*4,5*	39	62,9	
Sweet beverages					
NSBC	*53*	*79,1*	14	22,6	<0,001*
SBC	*14*	*20,9*	48	77,4	

**P<0, 05 is considerated as statistically significant.*

When comparing KC and NKC groups by brushing frequency, 26 (41.9%) KC and 8 (11.9%) NKC report less than 2 brushes/day. In KC, 28 (56%) men and 8 women (66.7%) have a frequency equal to or greater than 2 brushes/day.

Table 2: Comparison of CK brushing frequency by sex.

		male KC		female KC		P
		N	%	N	%	
Brushing frequency	< 2	*22*	*44*	4	33.3	0,501
	≥ 2	*28*	*56*	8	66.7	

**P<0,05 is considerated as statistically significant.*

45 KC (72.5%) and 40 NKC (59.7%) report tooth pain. 24 KC (38.7%) and 11 NKC (16.4%) report pain to TMJ. 39 KC (62.9%) and 11 NKC (16.4%) report symptoms of oral dryness. 18 KC (29%) and 3 NKC (4,5%) report burning sensations. 21 KC (33.9%) and 15 NKC (22.4%) report halitosis. 20 KC (32.2%) and 10 NKC (14.9%) report a change in taste perception. 33 KC (53.2%) and 38 NKC (56.7%) report episodes of gingival bleeding. 15 KC (24,2%) and 5 NKC (7.5%) report losses of prosthetic and/or trailing restorations.

Table 3: Comparison of CK and NCK by reported symptoms.

Symptômes	CK		NCK		P
	N	%	N	%	
Dental pain	45	72,5	40	59.7	0,123
TMJ pain	24	38,7	11	16.4	0,004*
Oral dryness	39	62,9	11	16.4	<0,001*
Burning sensation	18	29	3	4.5	<0,001*
Halitosis	21	33,9	15	22.4	0,146
Change in taste perception	20	32,3	10	14.9	0,020*
Gingival bleeding	33	53,2	38	56.7	0,690
Prostheses or restorations failure	15	24,2	5	7.5	0,009*

**P<0,05 is considerated as statistically significant.*

The respective mean plaque indices of KC, NKC, subjects reporting frequencies less than 2 brushes/day and greater than or equal to 2 brushes/days are: 1.6 (+/- 0.13), 1.4 (+/- 0.13), 1.6 (+/- 0.13), 1.4 (+/- 0.13), 1.4 (+/- 0.14 KC who report less than 10 years and greater than or equal to 10 years of khat consumption have mean plaque indexes of 1.5 (+/- 0.10) and 1.6 (+/- 0.14).

The respective mean gingival indices of KC, NKC, subjects reporting frequencies less than 2 brushes/day and greater than or equal to 2 brushes/days are: 1.64 (+/- 0.13), 1.57 (+/- 0.09), 1.66 (+/- 0.13) and 1.57 (+/- 0.10). KC who report less than 10 years and greater than or equal to 10 years of khat consumption have mean gingival indices of 1.60 (+/- 0.11) and 1.67 (+/- 0.13). The mean gingival index for female and men KC are 1.61 (+/- 0.08) and 1.66 (+/- 0.14), respectively.

Table 4: Comparison of plaque and gingival indices according to khat consumption, previous period and brushing frequency.

	Mean	Standard-deviation	P
Plaque index			
Khat consumption			
NKC	1,4	0,13	<0,001*
KC	1,6	0,13	
Prior period of khat consumption (year)			
< 10	1,5	0,10	0,006 *
≥ 10	1,6	0,14	
Brushing frequency			
<2	1,6	0,13	<0,001*
≥2	1,4	0,14	
Gingival Index			
Khat consumption			
NKC	1,57	0,09	<0,001*
KC	1,64	0,13	
Prior period of khat consumption (year)			
< 10	1,60	0,11	0,129
≥ 10	1,67	0,13	
Brushing frequency	1,66	0,13	<0,001*
	1,57	0,10	

**P<0,05 is considerated as statistically significant.*

15 KC (24.2%) 1 NKC (1.5%) have whitish lesions of leukoplastic appearance. 14 (93.3%) KC with these lesions was consumed khat over 10 years or more and 14 (93.3%) were TC. In KC without

these lesions, 21 (44.7%) have consumed khat for 10 years and 25 (53.2%) are TC. The jugal mucosa has whitish lesions in the 16 subjects (100%). 6 subjects (37.5%) have additional damage to the gum attached to the adjacent premolar and alveolar zone.

Table 5: Comparison of CK and NCK by condition of mucosal membranes.

	NKC (N = 67)		KC (N= 62)		P
	N	%	N	%	
Whitish lesions					
None	66	98,5	47	75.8	<0,001*
Presence	1	1,5	15	24.2	
Global recessions					
None	51	76,1	13	21	<0,001*
Presence	16	23,9	49	79	
Type					
I	7	10,5	5	8	0,003*
II	9	13,4	44	71	

**P<0,05 is considerated as statistically significant.*

It is also noted that 49 KC (79%) and 16 NKC (23.9%) have recessions. 44 KC (71%) and 9 NKC (13.4%) have type II sextants.

13 KC (21%) and 20 NKC (29.8%) have restorations. 48 KC and 47 NKC have no restorations of which 14 KC (28.6%) and 4 NKC (8.5%) have restorative failures. No KC or NKC subjects have fixed prosthetic restorations of which 15 KC (24.2%) and 6 NKC (9%) have fixed prosthetic restoration failures.

Table 6: Comparison of CK and NCK according to restorations status.

	NCK (N = 67)		CK (N = 62)		P
	N	%	N	%	
Restorative reconstructions					
None	47	70,2	49	79	0,248
Presence	20	29,8	13	21	
Prosthetis reconstructions					
None	67	100	62	100	-
Presence	0	0	0	0	
Prosthetis failures					
None	61	91	47	75.8	0,019*
Presence	6	9	15	24.2	
Restorative failures					
None	47	100	48	100	0,007*
Presence	4	8,5	14	28.6	

**P<0,05 est considéré comme statistiquement significatif*

The KC and NKC groups respectively have a mean of 6.1 (+/- 3.7) and 1.7 (+/- 1.6) carious lesions.

Table 7: Comparison of CK and NCK according to the carious Index.

	NCK		CK		P
	Mean	Standard-deviation	Mean	Standard-deviation	
Carious lesions	1,7	1,6	6,1	3,7	<0,001*

**P<0,05 est considéré comme statistiquement significatif.*

Discussion

Although oral effects of khat are described in many countries, the lack of surveys and therefore prevention campaigns in Djibouti is the main objective for this study.

Discussion of the Protocol

Choice of the location

Our survey was conducted in the capital of Djibouti, Djibouti Ville. From a demographic point of view, the capital has a half of the country's population, with 567,602 in 2017 [37]. Medical and sanitary infrastructures are also located in the capital. We chose a care center affiliated with the CNSS. In 2014 Universal Health Insurance is implemented. A new mass of insured individuals have been able to benefit from the care provided by the CNSS. In effect, the insured of the public sector (conventioned, retired, employed) private sector, the self-employed and their rights holders are henceforth insured for their care. The insurance plan student launched at the university entrance 2016-2017 also allowed welcoming students. The institution thus welcomes a large part of the Djiboutian population. For all these reasons and because of the absence of university hospital structure in Djibouti, the choice of the framework of our investigation is taken to this care center.

Sampling method

The size of our sample is dependent on capacity of the structure itself. Our survey took place in a care center with a single dental chair and a single dentist. Most investigations on the subject, in Yemen [10,11,13,14], Saudi Arabia [32,33] Israel [22] Kenya [26] and Ethiopia [15] were conducted in academic or hospital structures. It has been difficult to drain a large flow of patients, while meeting time requirements necessary for proper management and a large sample size. The structure receives an average of 20 patients per working day. In average, 8 patients were surveyed per day over 1 month and half. This allowed us to obtain a sample of 129 subjects.

We did not have any recent statistical sources concerning the consumption of khat in Djibouti, hence the impossibility of calibrating our sample based on these data's. Therefore, we selected patients who randomly consulting in the oral service from August to October 2017 and agreed to participate in the study. A survey conducted in 2007 [4] and other more recent studies [7,9,11,13] use the same sampling mode. Other authors [10,14] based their sampling on previous prevalence estimating Khat consumption in the population (in Yemen).

Criteria for inclusion

We only retain regular KCs so that the observed oral effects can be linked to the khat. We have defined as regular KC any subject using khat for at least 3 years. A study carried out in 2010 [7] and other studies [1,15,22] use this same prior period to define the status of the regular consumers. However, Maweri et al. in 2017 [10] used a previous period of five years old.

Regular KCs are also defined as consuming khat at least once a week. A study carried out in 2017 in Saudi Arabia [1] and

other studies in Yemen [2,10,14] and in Ethiopia [15] use this weekly frequency in their definition of the regular KC status. For comparative reasons, our study includes a NKC group, who never consumed khat. The majority of studies selected validate this definition.

Criteria for exclusion

For the reasons mentioned above, non-regular KCs have not been retained. To ensure a previous consumption time of khat subjects whose age is less than 20 years are excluded from our survey. Two studies conducted in Yemen in 2017 [10] and 2013 [14] also take this minimum age into account as a criterion A study carried out in Yemen in 2017 [5] on students whose age is less than 20 years highlights as a limit a short previous period of khat consumption. Nevertheless, two surveys in Yemen in 2013 [11] and 2014 [9] do not set a minimum age to their sample size. Subjects with general pathologies or under drug products treatment have been excluded. This allows eliminating oral manifestations of systemic diseases and therefore confounding factors. A study carried out in Saudi Arabia in 2017 [32] other studies in Yemen [3,4,10,14] take these two criteria into account. Other study carried out in Yemen in 2010 and in Ethiopia in 2015 does not mention it [7,15].

Occupation and level of education

A survey carried out in Ethiopia in 2016 [16] links consumption of khat and socio-economic level. It's relevant to include issues related to occupation and level of education. The three occupations selected are adapted from a study socio-demographic achieved by the World Bank in 2011 in Djibouti [17].

Previous period and weekly frequency of consumption of khat

Epidemiologically, if we suggest a relationship between a causal factor and a disease, the risk of developing this disease should increase when exposure to the risk factor increases. In our study, regular KCs are questioned to determine if their prior period of khat consumption is less, greater or equal to 10 years. A study carried out in 2017 [10] also uses this distribution. Other studies [13,22] compare the variables according to the mean years of khat consumption. Other studies do not consider this criterion [7,9-11,15].

KC subjects are also asked about their weekly frequency of khat consumption. Subjects consuming less than 4 days/week are considered regular weekly consumers. Subjects consuming more than 4 days/week are regular daily consumers. A study carried out in 2011 [13] and other studies [4,10] note this distinction. A study carried out in 2010 [7] only retains regular KCs with a frequency greater than or equal to 4 days/week. Two studies carried out in 2010 [3] and 2017 [32] compare the variables according to average days. Other studies conducted in 2013 [11] and 2014 [9] do not study this criterion.

Frequency of brushing

Our study takes into account oral hygiene of subjects as a factor that may have adverse effects on dental health and periodontal. Two studies in Yemen [14,17] and one in Saudi Arabia [32] also study this variable. A survey [10] considers not evaluating the brushing frequency as a limit.

Consumption of tobacco products

Subjects are also asked about other habits that may influence oral mucosa such as tobacco use. Indeed, a study carried out in 2016 [30] shows a correlation between consumption of khat and cigarettes in Yemen. A study carried out in 2007 [4] and other studies on oral effects of khat [7,11,14,15,22] include tobacco consumption as variable. A study carried out in 2017 [10] identifies not controlling tobacco use as a limit. The previous period of tobacco use of subjects is also studied, in correlation with the previous period of consumption of khat. Two studies carried out in 2004 [22] and 2013 [14] also refer to the previous period of tobacco use.

As an indicator, the subjects were also asked about the number of cigarettes consumed per day: less than 10, between 10 and 20 and more than 20 cigarettes/day. A study carried out in 2007 [4] mentions it in contrast to a study conducted in 2011 [13].

Consumption of sweet beverages

The astringent taste of khat is described in the literature [36]. The consumption of sweet beverages counteracts this effect [19]. Our investigation therefore includes a question on the consumption of sugary drinks.

Chewed tobacco, water pipe and alcohol

Our survey also includes chewed tobacco water pipe and alcohol. A 2014 study [9] and other studies [4,13,15,32] also study these variables. Nevertheless, a study carried out in 2017 [10] and other studies [3,7] do not mention it.

Choice of symptoms studied

KC and NKC answered a series of 8 yes/no questions related to specific oral symptoms that are pain dental, TMJ pain, dryness mouth, sensation of burns in the tongue or another part oral cavity, halitosis, change in taste perception, gingival bleeding and loss of prosthetic and restorative reconstructions. These elements were adapted from the 1994 study by Locker and Miller [28]. A 2014 study [15] assessing the association between consumption of khat and expression of oral symptoms uses this subjective assessment method.

The study of symptoms was limited to the subjective expression and not supplemented by an examination of the quality and quantity of saliva.

Criteria of examination

Choice of indices

A study carried out in 2013 [14] uses the Community Periodontal Index (CPI). A 2010 study [7] uses the Greene and Vermilion Oral Hygiene Index (ODI). A 1992 study [8] concluded that the CPI could be used as a general indicator of bleeding and pocket depth but not as an indicator of plaque presence. As for HBI, amendments

have been proposed on several occasions to increase the relevance of the oral hygiene status [23].Our survey uses the Loe and Silness plaque index [29] and gingival index [34] as indicators of plaque presence and of gingival inflammation. Various studies studying oral hygiene and periodontal health according to khat consumption [3,10,26] also use these indices.

Choice of terminology

The leukoplastic lesion is defined as a whitish lesion, not detachable, which can appear on all mucous membranes (keratinized or not keratinized) and not clinically related to a disease known [35]. As no histopathological examination could be carried out, under reserve of the diagnosis of leukoplasia, all suspected lesions will be noted as whitish mucosal lesions of leukoplastic appearance.

Studies on a Yemeni population in 2014 [9] and 2011 [13] and Israeli in 2004 [22] do not carry out a review histopathology. On the other hand, a study carried out in Yemen in 2013 [11] use it if necessary.

Examination of recessions

It is determined that there is a recession when there is a shift in marginal gum at least 1mm from the amelo-cemental junction. A study carried out in Yemen in 2017 [10] and two other studies [4,7] validate this definition.

Only the posterior sextants are retained in this examination preferentially involved in chewing khat. Two studies carried out in Yemen in 2017 [10] and 2007 [4] study the same sectors. The study carried out in 2010 [7] does not mention the sectors studied.

Choice of restorative and prosthetic reconstruction study

Our investigation takes into account the presence and failure of prosthetic and restorative reconstructions as well as the carious prevalence and loss of teeth. A study carried out in 2017 in Saudi Arabia [32] also studies restoration failures. This survey cites the carious Index and losses of teeth's as factors that may promote restoration failures at the KC's.

Discussion of the Results

Consumption of khat

Distribution of the sample

Sex:

Our survey includes both sexes. A survey conducted in 2011 [13] and other studies [4,7,9,11,14] also include men and women. Other surveys [3,10,22] consider only male sex.

Comparison by sex of subjects

The consumption of khat is significantly associated with male sex with 80.6% of men in the KC group. A survey carried out in Yemen in 2013 [9] also highlights the masculine nature of khat consumption.

Comparison by occupation and level of education

Any positive association was found between the consumption of khat, a professional activity or a particular level of education. Our results contradict a socio-demographic study carried out in Ethiopia in 2016 [16] which showed higher socio-economic and education levels.

Reported symptoms

Our analysis suggests a significant association between khat use and symptoms including:

-joint level: TMJ pain

-At the level of the mucosal membranes: sensations of dryness of the mouth, of burns at the level of the tongue or another part of the oral cavity, modification of the taste perception.

- At the dental level: losses of prosthetic and/or restorative reconstructions. Our results are consistent with studies on a younger population in Ethiopia in 2015 [15] and of similar age in Yemen [7] and Israel [22].

A survey carried out in 2017 in Saudi Arabia [1] reveals temporo-mandibular disorders and consumption of khat. The astringent taste of khat is described in the literature [36]. This could explain the change in taste perception and the use of sugary drinks significantly associated with KCs, used to compensate for taste.

A study carried out in Yemen in 2014 [2] determined a reduced pH and salivary flux and a higher salivary viscosity in KCs. These elements could explain the reported oral dryness.

Oral hygiene

Our results show a significant association between khat consumption and increased plaque level. Our results are in line with a study carried out in Yemen in 2017 [10] but in contradiction with a Kenyan study carried out in 1990 [26].

A long period of khat consumption is significantly associated with increased dental plaque. These data are also consistent with the Yemeni study [10].

Different risk factors specific to KC subjects could explain this difference. Indeed, the increase in the amount of plaque is also significantly associated with a low brushing frequency. In our sample, KCs report a significantly lower brushing frequency than NKCs. The contradiction with the study in Kenya [26] could be explained by the fact that the authors do not notice this difference.

Gingival inflammation

KC subjects have significantly more gingival inflammation than NKC. Our study agrees with a study carried out in 2010 [7] and disagrees with a study carried out in 2017 [10].

Subjects reporting a better brushing frequency have a significantly lower gingival index. This could explain the difference between KK and KCN. In fact, KCs have worse oral hygiene than NKCs. Regarding sex; there is no significant variation in gingival index between men and women KC with a similar brushing frequency.

This would reduce or exclude the role of khat in gingival inflammation. Oral hygiene would be one of the main factors responsible for gingival inflammation in our investigation. An experimental survey, carried out in 2010 [3] on the in vivo development of gingivitis in male subjects KC and NKC with similar age and whose brushing frequency has been checked, shows that KC subjects have lower gingival index values than NKC. Finally, the Kenyan study shows significantly better gingival index values in KCs [26].

Whitish lesions of leukoplastic appearance

The presence of whitish mucosal lesions [35] is significantly associated with the consumption of khat. 24.2% of KC present these lesions compared with only 1.5% of NKC. Two studies in Yemen in 2013 (11) and Israel in 2004 [22] also determine this significant association.

A longer prior period of khat consumption is also significantly associated with these lesions. A 2011 study in Yemen [13] and the Israeli study [22] found these results.

Finally, the site of the lesions seems to correspond to the mode of consumption of the plant. The lesions examined are confined exclusively to the chewing site of the khat, namely the jugal mucosa with an extension to the vestibular gum in 40% of cases.

A study carried out in Yemen in 2014 [9] suggests that the absence of these lesions at other sites in the oral cavity could confirm the role of khat as a major risk factor for the onset of these lesions. Yet our results show that almost all of the KC with lesions is also TC. A long prior period khat use is significantly associated with smoking. In addition, in our sample, 71.8% of KC TC has a smoking period of 10 years or more. 61.5% of KCTC use more than 20 cigarettes per day. We must therefore reduce or eliminate the involvement of tobacco in order to confirm our deductions.

State and extent of recessions

The periodontal examination shows a significant association between khat consumption and the presence of recessions in molar and premolar groups. KC group also has higher recession values among. Our results are in line with the studies carried out in Yemen in 2010 [7], 2013 [13] and 2017 [10]. A study carried out in 2007 evokes the role of khat in the onset of recessions by chronic vertical trauma [4].

Dental status

Although KCs have a significantly higher number of carious lesions, there is no significant difference in restored teeth between KCs and NKCs. In addition, there are no individuals with prosthetic reconstructions that are functional in the mouth despite the loss of prostheses. This contradicts a recent study carried out in Saudi Arabia in 2017 [32] and raises the question of the supply of oral care in Djibouti. World Health Organization recency in 2011, 0.2 dentists per 10,000 populations.

There is a significant association between restorative and prosthetic reconstructions failure and consumption of khat. Several KC factors could explain this result. On the one hand, KCs have a significantly higher consumption of sugary drinks than NKCs. KC also has a worse oral hygiene than NKC. These two factors may explain the high rate of cavities observed in KCs. A study conducted in 2017 [33] found that khat causes dental attrition and carious lesions. The same authors determine in another study in 2017 [32] that losses of prosthetic and restorative reconstructions are also associated with recurrences of cavities. The occlusal forces involved in khat chewing can also explain our results.

Recommendations

Future studies should as much as possible:
- Conduct pre-interview clinical examination.
- Integrate more NKC tobacco consumers.
- Incorporate a qualitative and quantitative examination of saliva.
- Conduct histopathological examinations to confirm the precancerous nature of the whitish lesions detected in the clinical examination.
- Incorporate a periodontal pocket exam.

Conclusion

Our results show more need for oral treatment and khat consumption in the male group. Consumption of khat in Djibouti also seems to be an element that transcends socio-economic barriers.

Our study also suggests a number of oral disorders that may be associated with khat: plaque accumulation, leukoplastic mucosal lesions and recessions, loss of prosthetic and restorative reconstructions, high carious index, and subjective joint, mucous and dental symptoms. However, significantly worse oral hygiene in KCs would be the factor responsible for greater gingival inflammation.

In addition, it is necessary to eliminate or decrease the impact of tobacco consumption to confirm the effect of khat on the appearance of mucosal lesions of leukoplastic aspect. Finally, histopathological examinations and a similar survey investigating the role of khat in the development of periodontal pockets could be carried out.

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