

ORIGINAL ARTICLE

## Periodontal conditions and oral symptoms in *gutka*-chewers with and without type 2 diabetes

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### Abstract

**Objective.** The aim of the study was to investigate the periodontal conditions and oral symptoms among *gutka*-chewers in subjects with and without type 2 diabetes (T2D). **Material and methods.** Subjects aged between 45 and 64 years were included. “*Gutka*-chewers” were defined as subjects who had been chewing at least one sachet of *gutka* daily for at least 12 months. Subjects who reported never to have used tobacco in any form were categorized as “non-chewers”. Periodontal conditions (plaque index [PI], bleeding on probing [BOP], and probing depth [PD] [4 mm < 6 mm and ≥ 6 mm]), number of missing teeth, oral symptoms, reasons for *gutka* use, and random blood glucose levels were recorded. Exclusion criteria were smoking and use of antibiotics, non-steroidal anti-inflammatory drugs, and steroids. **Results.** Mean durations of *gutka* use in subjects with and without T2D were 10.5 (range 8.0–15.5 years) and 8.4 (range 6.0–20.2 years) years correspondingly. In subjects with T2D, *gutka*-chewers ( $n=29$ ) and non-chewers ( $n=44$ ) showed no difference in periodontal conditions, missing teeth, and gingival bleeding. In subjects without T2D, *gutka*-chewers ( $n=36$ ) had increased PI ( $p<0.01$ ), BOP ( $p<0.001$ ), PD (4 mm < 6 mm) ( $p<0.01$ ), number of missing teeth, and gingival bleeding ( $p<0.01$ ) compared to non-chewers ( $n=42$ ). Non-chewers in subjects with T2D had poorer periodontal conditions and increased oral symptoms compared to *gutka*-chewers and non-chewers in subjects without T2D. **Conclusion.** In subjects without T2D, *gutka*-chewers have severe periodontal conditions and oral symptoms compared to non-chewers. In subjects with T2D, the severity of these variables is related to glycemic levels rather than *gutka* consumption.

**Key Words:** *Gingival bleeding, gutka, oral symptoms, periodontal conditions, type 2 diabetes*

### Introduction

A *betel quid* is a blend of areca nut, slaked lime (aqueous calcium hydroxide paste), sweeteners, seeds, and sometimes tobacco wrapped in a betel leaf. A *betel quid* is also known as *paan*, meaning “leaf”. An areca nut is a fruit of *Areca Catechu* and is a major constituent in *betel quid*. It is used by approximately 600 million people worldwide [1]. *Betel quid* / areca nut is commonly used in South-East Asian countries, including Pakistan, India, Bangladesh, Sri Lanka, Malaysia, and Thailand [1,2]. The usage is also common in migrated communities in Europe and North America [2,3]. It has been reported that communities from Pakistan, India, Bangladesh, and Sri Lanka residing in the United Kingdom, commonly use *betel quid* [4].

Nearly three decades ago, a change occurred in the *betel quid* / areca nut use with the advent of “*gutka*” [5]. *Gutka* is a powdered mixture of areca nut, slaked lime, sandalwood, fragrance, and tobacco [2]. It is commercially available in tins and sachets. In India, *gutka* is popular among all socio-economic groups [3]. The same product without tobacco is known as *pan masala*. In India, the tobacco industry recorded a growth of up to \$500 million with the arrival of *gutka* and *pan masala* [2]. *Gutka* is initially placed between the maxillary and mandibular teeth and lightly chewed. It is then held against the buccal mucosa over a long period of time and continued to be gently chewed and sucked intermittently. The constituents may either be spat out or swallowed when desired.

A recent *in vitro* study demonstrated that arecoline (a major areca nut alkaloid) suppresses the growth of cultured gingival keratinocytes [6]. Areca nut extracts also repress the growth and protein synthesis in human periodontal fibroblasts [7]. These results suggest that *gutka* use (*gutka* contains areca nut as well as tobacco as chief components) may be associated with gingival and periodontal inflammation. Epidemiological surveys have associated *gutka* use with oral malignancy [2,3]; however, periodontal conditions in *gutka*-chewers have not yet been documented.

Diabetes is a metabolic disorder characterized by hyperglycemia due to defects in insulin secretion and/or insulin action [8]. It has been shown that oral inflammatory conditions are worse in subjects with type 2 diabetes (T2D) [9]. The prevalence of diabetes in urban versus rural areas of Pakistan is 6% in males and 3.5% in females and 6.9% in males and 2.5% in females correspondingly [10].

To our knowledge from the indexed literature, this is the first study in which clinical periodontal conditions as well as oral symptoms have been investigated in *gutka*-chewers and non-chewers with and without T2D. The hypothesis was that periodontal conditions are worse while oral symptoms are increased in *gutka*-chewers (with and without T2D) compared to non-chewers. Since T2D and *gutka* chewing are common in Pakistan, the present study aimed to investigate the periodontal conditions and oral symptoms in *gutka*-chewers in subjects with and without T2D.

## Material and methods

The Regional ethics review board in Stockholm, Sweden, and the ethics committee of Altamash Institute of Dental Medicine, Karachi, Pakistan, approved the study in accordance with the Helsinki Declaration of 1975 as revised in 1983. Written information printed in simple English and Urdu (native language of Pakistan) was given, which gave the purpose of the study and indicated that participation was completely voluntary.

### Study population

In the current study, the participants were recruited from the Punjab Colony, Karachi, Pakistan, which has a population of approximately 10,000 residents (as estimated in 2004 by the Clifton Cantonment Board, Karachi, Pakistan). A questionnaire survey was conducted in this colony in which 1000 adults (age range 45–64 years) were interviewed [9]. Individuals who reported having diabetes were requested to present their medical records and/or medical prescriptions; these acted as confirmation of their diabetes status. Every tenth subject without a medical diagnosis for diabetes was also included in

the study. If the tenth subject did not volunteer to participate, the invitation was offered to the next individual who did not have a diagnosis of diabetes. Of the 1000 individuals interviewed, 79 had medically diagnosed T2D. Out of the 100 subjects without T2D, one edentulous female (aged 62 years) was excluded at the time of measurement of random blood glucose level (RBGL) for being unaware of her impaired glycemic status (16.1 mmol/l). There were therefore 99 subjects without T2D.

Individuals with and without T2D were asked about their *gutka* chewing habits. “*Gutka*-chewers” were defined as individuals who had been chewing at least one sachet/pouch of *gutka* daily for at least 12 months. Twenty-nine subjects (14 M and 15 F) with T2D and 36 without T2D (17 M and 19 F) self-reported to be current habitual *gutka*-chewers. “Non-chewers” were defined as subjects with no history of tobacco use in any form and comprised 44 individuals (23 M and 21 F) with T2D and 42 subjects (22 M and 20 F) without T2D.

### Exclusion criteria

Smokers were defined as individuals smoking at least one cigarette daily for at least 6 months. Smoking [11], antibiotics [12], non-steroidal anti-inflammatory drugs (NSAIDs) [13], and steroids [14] influence oral inflammation. Therefore smokers and subjects with a current or recent medical history of NSAIDs, antibiotics, and/or steroid use were excluded. Edentulous subjects and individuals chewing betel-quids and/or areca nuts were also excluded. Other features of the exclusion criteria were self-reported Hepatitis B, Hepatitis C, infection with human immunodeficiency virus and acquired immunodeficiency syndrome.

### Questionnaire

Besides age and gender, the questionnaire also gathered information concerning *gutka* usage (yes/no), reasons for *gutka* use, frequency of *gutka* consumption, and duration of placement of *gutka* in the mouth.

### Oral symptoms

Individuals were also asked about their oral health status. Queries concerning oral health included information about current gingival bleeding, bad breath, and dry mouth.

### Measurement of RBGL

A glucometer (ACCU CHEK Advantage system/Sensor comfort strips; Roche Diagnostics, Mannheim, Germany) was used to record the RBGL for the subjects with and without T2D. Participants

Table I. Mean value and range for age, duration of T2D, and random blood glucose levels among *gutka-chewers* and non-chewers in subjects with and without T2D

	Subjects with T2D		Subjects without T2D	
	<i>Gutka-chewers</i> ( <i>n</i> = 29)	Non-chewers ( <i>n</i> = 44)	<i>Gutka-chewers</i> ( <i>n</i> = 36)	Non-chewers ( <i>n</i> = 42)
Age (years)	52.3	51	51.4	50.7
Range	45–64	46–63	45–60	45–64
Duration of T2D (years)	10.2	9.5	–	–
Range	8–12	7–11	–	–
RBGL (mmol/l)	16.4	15.4	6.3	7.2
Range	7.3–19.6	6.5–23.3	5.7–6.5	5.5–7.0

were instructed not to eat or drink in at least the 2 h before their RBGL was recorded [8].

#### *Periodontal examination and number of missing teeth*

Three calibrated examiners performed the periodontal examination, which included recording of the dental plaque index (PI), bleeding on probing (BOP), and probing depth (PD) (4 mm < 6 mm and ≥ 6 mm) [9] at four sites (mesial, distal, buccal, lingual/palatal) per tooth. Dental plaque was detected by gently moving the tip of a probe along the gingival margin of the four sides of each tooth. The PI and BOP were expressed as dichotomous variables, that is, the percentage of teeth surfaces covered by dental plaque and the percentage of sites that bled on probing. Teeth with embedded root remnants were categorized as “missing”. Maxillary and mandibular 3rd molars were excluded.

#### *Age, duration of T2D, and random blood glucose levels*

The mean ages, duration of T2D, and random blood glucose levels among individuals with and without T2D are given in Table I.

#### *Statistical analysis*

The statistical analysis was performed using *Statistica 7.1* (Statsoft, Inc. 1984–2005, Tulsa, Okla., USA). One way analysis of variance was used to determine whether the dependent variables (PI, BOP, PD [4 mm < 6 mm and ≥ 6 mm], number of missing teeth, and oral symptoms) were statistically significant with the independent variables. The

independent variables were transformed into dichotomous variables, for example, *gutka-chewers* in subjects with T2D, 1 versus non-chewers in subjects with T2D, 0; *gutka-chewers* in subjects without T2D, 1 versus non-chewers in subjects without T2D, 0. The presence or absence of oral symptoms (gingival bleeding, bad breath, and dry mouth) was dichotomized as “1” and “0” correspondingly. For multiple comparisons, the Bonferroni adjustment *post hoc* test was performed. *P*-values < 0.05 were considered statistically significant.

## Results

#### *Duration of use, placement in the mouth, and daily consumption of gutka*

The results concerning duration of use, placement in the mouth, and daily consumption of *gutka* by individuals with and without T2D are given in Table II.

#### *Periodontal conditions and number of missing teeth*

*Gutka-chewers* in subjects with T2D had a higher PI ( $p < 0.05$ ), BOP ( $p < 0.05$ ), PD (4 mm < 6 mm) ( $p < 0.01$ ), and PD (≥ 6 mm) ( $p < 0.001$ ) compared to *gutka-chewers* in subjects without T2D. Non-chewers in subjects with T2D also had a raised PI ( $p < 0.01$ ), BOP ( $p < 0.01$ ), PD (4 mm < 6 mm) ( $p < 0.001$ ), and PD (≥ 6 mm) ( $p < 0.001$ ) compared to *gutka-chewers* in subjects without T2D. Non-chewers in subjects with T2D had increased PI ( $p < 0.01$ ), BOP ( $p < 0.01$ ), PD (4 mm < 6 mm) ( $p < 0.01$ ), and PD (≥ 6 mm) ( $p < 0.001$ ) compared to non-chewers in

Table II. Mean value and range for duration of use, placement in the mouth, and daily consumption of *gutka* in subjects with and without T2D

	Subjects with T2D ( <i>n</i> = 29)	Subjects without T2D ( <i>n</i> = 36)
Duration of habit (years)	10.5	8.4
Range	8.0–15.5	6–20.2
Daily consumption (sachets/day)	4	8
Range	1–7	1–10
Duration of placement in the mouth (min)	5	20
Range	2–10	5–30

Table III. Mean value and range for periodontal parameters among gutka-chewers and non-chewers in subjects with and without T2D

	Subjects with T2D		Subjects without T2D	
	Gutka-chewers (n=29)	Non-chewers (n=44)	Gutka-chewers (n=36)	Non-chewers (n=42)
PI (% of sites)	79.8	76.4 <sup>†</sup>	58.2	31.1 <sup>‡</sup>
Range	60.0–99.5	56.4–83.7	41.1–70.5	22.3–40
BOP (% of sites)	80	78.7 <sup>•</sup>	53.2	21.1 <sup>•</sup>
Range	60–100	58.4–92.6	37.4–61.8	17.4–24.6
PD (4 mm < 6 mm) (% of sites)	65.3	67.5 <sup>‡</sup>	27.4	11.2 <sup>‡</sup>
Range	57.4–86.3	56.6–87.5	23.7–41.5	6.5–15.8
PD (≥6 mm) (% of sites)	17.6	14.5	4.5	2.3
Range	14.2–18.8	11.5–15.2	0.8–5.1	0.2–2.8

‡•†\* P<0.01, § P<0.001 #P<0.05

subjects without T2D. These parameters are given in Table III.

Gutka-chewers in subjects without T2D had more missing teeth (mean 11.2; range 6–14) compared to non-chewers in subjects without T2D (mean 5.2; range 3–10) (p<0.01). There was no difference in the number of missing teeth between gutka-chewers (mean 14.6; range 10–18) and non-chewers (mean 15.1; range 10–16) in subjects with T2D.

Oral symptoms

Gingival bleeding (p<0.01), bad breath (p<0.01), and dryness in the mouth (p<0.0001) were more often reported by gutka-chewers in subjects with T2D compared to gutka-chewers in subjects without T2D. Gingival bleeding (p<0.001) and bad breath (p<0.001) were more often reported by non-chewers in subjects with T2D compared to non-chewers in subjects without T2D. Bad breath (p<0.05) and dry mouth (p<0.001) were more often reported by non-chewers in subjects with T2D compared to gutka-chewers in subjects without T2D.

In subjects without T2D, gingival bleeding was commonly reported by gutka-chewers compared to non-chewers (p<0.01). There was no difference in gingival bleeding between non-chewers in subjects with T2D and gutka-chewers in subjects without T2D. There was no difference in oral symptoms between gutka-chewers and non-chewers in subjects with T2D. These results are given in Table IV.

Reasons for gutka usage

Mental stress was the most common reason for gutka consumption, which was reported by 52% of the

subjects with T2D and by 47% without T2D. Seventeen percent of the subjects with T2D and 28% without T2D reported that gutka helped to attain a fresh breath. Twenty-four percent of the subjects with T2D and 8% without T2D stated that gutka helped them in controlling hunger. Seven percent of the subjects with T2D and 17% without T2D did not provide any reason for gutka usage.

Discussion

Questionnaire studies, which are valid tools for epidemiological investigations [15], have shown an association between the gutka chewing habit and oral mucosal disorders [3]. Self-perceived subjective well-being is reliable and may be used to investigate general health status [16]. Self-rated oral health is also reliable and is in agreement with clinical dental health [17].

It has been reported that self-assessed gingival bleeding is an indicator of inflammation [18,19]. Among subjects without T2D, periodontal conditions and gingival bleeding were more severe in gutka-chewers compared to non-chewers. It has been reported that the gingival blood flow is increased in smokeless tobacco users [20]. An essential ingredient in gutka is slaked lime (aqueous calcium hydroxide), which has been associated with oral mucosal inflammation [21]. Extracts from areca nut (mainly arecoline) also suppress the growth of cultured gingival keratinocytes and periodontal fibroblasts [6]. This may be an explanation for the more severe periodontal conditions and oral symptoms in gutka-chewers compared to non-chewers in

Table IV. Mean percentages of oral symptoms reported by *gutka*-chewers and non-chewers in subjects with and without T2D

	Subjects with T2D		Subjects without T2D	
	<i>Gutka</i> -chewers (n=29)	Non-chewers (n=44)	<i>Gutka</i> -chewers (n=36)	Non-chewers (n=42)
Gingival bleeding (% of individuals)	72.4	63.1	54.8	28.3
Bad breath (% of individuals)	44.6	52.3	24.4	32.1
Dry mouth (% of individuals)	69.8	64.5	10.2	NR

† $p < 0.01$ ; \* $p < 0.001$ ; § $p < 0.05$ ; # $p < 0.0001$ . NR = Not reported.

subjects without T2D. There was no difference in periodontal conditions, number of missing teeth, and oral symptoms among *gutka*-chewers and non-chewers in subjects with T2D. The present study indicates that periodontal conditions and oral symptoms are more severe among *gutka*-chewers in subjects with T2D compared to *gutka*-chewers in subjects without T2D. All subjects with T2D had hyperglycemia, that is, their casual plasma glucose levels were  $>11.1$  mmol/l. A recent study has shown that hyperglycemic subjects with T2D have more severe periodontal inflammation compared to non-hyperglycemic subjects with T2D [22]. Hyperglycemia has been associated with the formation and accumulation of advanced glycation end products in the periodontal tissues [23]. These end products influence the inflammatory response by enhancing the production of proinflammatory cytokines and impairing the phagocytic activity of polymorphonuclear leukocytes [23]. There was no difference in gingival bleeding between non-chewers in subjects with T2D compared to *gutka*-chewers in subjects without T2D. However, the clinical evidence revealed that periodontal inflammation (clinically manifested as BOP) was worse among non-chewers in subjects with T2D compared to *gutka*-chewers in subjects without T2D. This reflects that oral symptoms should be verified clinically, since individuals may be unaware of their oral health status. It was noticeable that non-chewers in subjects with T2D had more severe periodontal conditions and oral symptoms compared to *gutka*-chewers and non-chewers in subjects without T2D. This may suggest that under hyperglycemic conditions periodontal inflammation is mainly influenced by T2D and the contribution of *gutka* is rather secondary. Therefore, it was difficult to nominate a single variable (either *gutka*-chewing or T2D) that may have been primarily associated with periodontal conditions among *gutka*-chewers and non-chewers in subjects with T2D.

## Conclusions

In subjects without T2D, *gutka*-chewers have severe periodontal conditions and oral symptoms compared to non-chewers. In subjects with T2D, the severity of these variables is associated with glycemic levels rather than *gutka* usage.

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**Declaration of interest:** We declare that we have no conflicts of interest. There was no external source of funding for the study.

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