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Self-reported oral health behavior and dental attendance pattern between smokers and non-smokers in Saudi Arabia: A cross-sectional study

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ABSTRACT

Introduction: This study aimed to determine smokers' and nonsmokers' self-reported oral health behavior and dental visiting patterns in Saudi Arabia. **Methods:** A structured, close-ended and self-reported questionnaire assessed the oral health behaviors and dental attendance patterns among study participants in Saudi Arabia. Descriptive statistics, chi-square tests and non-parametric tests were applied to the data. Hiroshima University Dental Behavioral Inventory (HUDBI), designed in Arabic and English, was shared on social media platforms to capture the data on oral health behavior among citizens and residents. **Results:** Seven hundred and thirteen subjects responded to the questionnaire, of which 486 (68.2%) were non smokers and (31.8%) were smokers. The mean HUDBI ranks of smokers ranged between 89.03 to 124.74, while for non smokers, it ranged from 202.70-265, indicating poor oral health behaviors of smokers. Smokers and non smokers showed a significant difference in having false teeth in old age ($p=0.033$), gum color ($p=0.002$) and worsening teeth despite regular cleaning ($p=0.011$). Similarly, more smokers than non smokers used hard tooth brush bristles ($p<0.001$). Most smokers than non smokers visit the dentist due to their dental problems. **Conclusions:** Smokers demonstrated poorer oral health behaviors than non smokers and visited the dentist whenever they had dental problems.

Keywords: Smokers, non-smokers, oral health behavior, HUDBI, dental visit pattern.

1. INTRODUCTION

Smoking (including passive smoking) has been recognized as the second leading cause of mortality and morbidity worldwide (GBD 2017 Risk Factor Collaborators, 2018). Smoking raises the possibility of cardiac disease, stroke and chronic lung disease; it is the leading cause of lung, larynx, esophagus,

mouth and bladder cancer; it has been related to cervix, pancreatic and kidney cancers (Ezzati et al., 2002). The detrimental consequences of tobacco smoking on dental health are widely recognized. This includes common and rare conditions, from benign to life-threatening diseases such as discoloration of teeth and dental restorations, bad breath, taste and smell disorders, impaired wound healing, periodontal disease, short-term and long-term implant success, oral mucosal lesions such as smoker's melanosis and smoker's palate, potentially malignant lesions and oral cancer (Reibel, 2003). A previous study in Saudi Arabia indicated a prevalence of current smoking range between 2.4-52.3%, which varied across different age groups and genders. It was pointed out that smoking is much higher in males than in females at different ages (Bassiony, 2009).

Health behavior is "the activities people undertake to protect, promote or maintain health and prevent disease (Steptoe et al., 1994). Since oral health is an essential part of human well-being (Badovinac et al., 2013; Ahmad et al., 2019), it is known that oral health behavior reflects the awareness of the individual about their oral health, which can be achieved by practicing oral hygiene techniques (Ali et al., 2016). Previous studies have revealed that gender, age, socioeconomic status and levels of education play a part in oral health-related behaviors due to their impact on an individual's oral hygiene maintenance (Almarek et al., 2017). Furthermore, the current disparity in oral health is also attributed to socioeconomic status, profession and even levels of education (Muthu et al., 2016). Therefore, to avoid oral diseases and attain good oral health, oral hygiene products, procedures and behaviors must be familiar to the population.

Kawamura created the HUDBI to evaluate patients' attitudes and behaviors toward oral health (Kawamura, 1988). In several countries, the HUDBI helped test attitudes and behaviors toward oral health and has shown adequate test-retest reliability, validity and cross-cultural adaptation. The translation of Japanese HUDBI to English and other languages was carried out to facilitate cross-cultural comparisons among dental students worldwide (Kawamura, 1992; Kawamura et al., 2000; Kawas et al., 2010; Almarek et al., 2017). Previous studies have identified associations between smoking habits and oral health and dental visits (Csikar et al., 2013; Awawdeh et al., 2021). The investigation identified the differences in perceived oral health between smokers and nonsmokers and the frequency of dental visits. Those who smoked, for instance, were irregular in visiting dental examinations and more likely to suffer from frequent dental problems and to visit the dentist symptomatically. There is scant information on assessing oral health behavior and dental attendance between smokers and non smokers utilizing the HUDBI questionnaire in Saudi Arabia. This study might be beneficial for exploring existing oral health behavior disparities and perceptions. It also helps to know oral health attitudes, behaviors and disease prevention. Moreover, it provides an opportunity to adopt anti-tobacco measures. Therefore, knowing about oral health attitudes, behavior and dental visits is paramount. Hence the present study aimed to determine the self-reported oral health behavior and dental visiting patterns of smokers and non smokers in Saudi Arabia.

2. MATERIALS AND METHODS

Study design

A cross-sectional survey was undertaken among Saudi citizens and residents to assess their smoking habits, oral health behavior and dental attendance pattern. The data was collected during the months of June-July 2022.

Sample size calculation

A minimum required sample of 377 subjects was estimated based on the margin error of 5%, confidence level of 95% and 50% response distribution to the survey questionnaire. However, to increase the power of the study, a total sample of (N=713) was considered. The sample size was estimated using the Raosoft online sample size calculator.

Inclusion and exclusion criteria

Saudi citizens and residents aged >15 years were considered in this study. In contrast, subjects <15 years of age were excluded from the study.

Study instrument

Khalid et al., (2016) translated an original HUDBI from English to Arabic produced by Kawamura, which was utilized to gather the data. HUDBI containing 20 questions in agree/disagree a format response has shown good reliability and validity in many studies. Apart from the main questionnaire items, socio demographic information of age, gender, nationality, year of education, smoking status, self-rated oral health and the dental visiting pattern was recorded for each participant.

Validity and reliability

The face validity of the questionnaire was established by taking the opinion of the experts in dental public health. The reliability of the questionnaire was measured using Cronbach's Alfa (0.82).

Questionnaire Administration

An electronic questionnaire was prepared in English and local Arabic using Google forms and the link was shared on social media platforms (WhatsApp, Twitter, Instagram and Facebook) to record the responses. All the responses analyzed using special statistical software.

Statistical analysis

All the data were analyzed using the statistical analysis software IBM-SPSS version 25 (Armonk, NY, USA). Descriptive statistics of frequency distribution and percentages were calculated for the categorical variables, while mean and standard deviations were calculated for the continuous variables. Normality tests indicated the non-normal distribution of the HUDBI data. Hence the Mann-Whitney U test and Kruskal-Wallis's test were applied to the variables. A value of $p < 0.05$ was considered significant for all the statistical tests.

3. RESULTS

A total of 713 subjects participated in this study. Most of them, 486 (68.2%), were nonsmokers and 227 (31.8%) were current smokers. Most 269(37.7%) participants aged 35– 44, had a university education level. Less than 312 (43.8%) of the study participants visited a dentist six months before and dental problems 81.3% were the main reason for the visit. Moreover, 50% rated their good oral health (Table 1). Multiple responses analysis of various types of smoking (N=252) among the study subjects indicated that the traditional cigarettes (43.3%) were common types of smoking, followed by hookah (29.3%), cigars (15.1%), E-cigarettes (10.7%) and pipe (1.6%).

Table 1 Demographic, smoking and oral health-related data of study subjects (N=713)

Variables		n	%	
Characteristics	Age (Year)	16-24	124	17.4%
		25 - 34	125	17.5%
		35– 44	269	37.7%
		45 –54	157	22.0%
		> 50	38	5.3%
	Education	Primary	8	1.1%
		Intermediate	27	3.8%
		Secondary	186	26.1%
		University	492	69.0%
Smoking-related variables	Current smoker	Yes	227	31.8%
		No	486	68.2%
	Frequency of smoking	Not a smoker	486	68.2%
		1/day	29	4.1%
		2-5/day	28	3.9%
		6-10/day	37	5.2%
>10/day	133	18.7%		
Utilization of dental services	Last visited dentist	Never visited	47	6.6%
		Before 6 months	312	43.8%
		Before 6-12 months	174	24.4%
		Before 24 months	77	10.8%
		More than 2 months	103	14.4%
	Reason	Regular check-up	133	18.7%
		Dental problem	580	81.3%

Self-rated oral health	Rate	Very good	227	31.8%
		Good	358	50.2%
		Poor	101	14.2%
		Very Poor	27	3.8%



Figure 1 Distribution of responses to the HUDBI items

The percentage distribution of the responses to the twenty HUDBI items by the study participants is shown in Figure 1. A large percentage (82.5%) of study participants were worried about the color of the teeth and (81.8%) of the respondents agreed to clean their teeth meticulously. While 83.7% of the survey participants were against using a stain to evaluate the cleanliness of teeth and 82.6% disagreed to cleaning of teeth using child’s tooth brush.

Table 2 HUDBI items between current smokers and non-smokers

Item No	HUDBI items	Responses	Smokers		Nonsmokers		p
			n	%	n	%	
1	I am not very concerned about going to the dentist.	Agree	111	48.90	201	41.40	0.059
		Disagree	116	51.10	285	58.60	
2	When I clean my teeth, my gums often bleed.	Agree	116	51.10	231	47.50	0.374
		Disagree ¹	111	48.90	255	52.50	
3	My teeth's color worries me.	Agree	181	79.70	407	83.70	0.190
		Disagree	46	20.30	79	16.30	
4	My teeth appear to be covered with few white sticky deposits.	Agree ¹	148	65.20	291	59.90	0.174
		Disagree	79	34.80	195	40.10	
5	I clean my teeth using a child's toothbrush.	Agree	45	19.80	79	16.30	0.242
		Disagree	182	80.20	407	83.70	
6	I believe it is inevitable that I will need false teeth when i get old	Agree	107	47.10	188	38.70	0.033*
		Disagree ¹	120	52.90	298	61.30	
7	I'm concerned about the appearance of the color of my gums.	Agree	150	66.10	374	77.00	0.002*
		Disagree	77	33.90	112	23.00	
8	I believe my teeth are deteriorating despite regular cleaning.	Agree	106	46.70	178	36.60	0.011*
		Disagree ¹	121	53.30	308	63.40	
9	I meticulously clean all my teeth.	Agree ¹	179	78.90	404	83.10	0.169
		Disagree	48	21.10	82	16.90	

10	I have never received professional instruction on how to clean my teeth.	Agree	144	63.40	303	62.30	0.779
		Disagree ¹	83	36.60	183	37.70	
11	I believe I can effectively brush my teeth without applying toothpaste.	Agree ¹	66	29.10	115	23.70	0.122
		Disagree	161	70.90	371	76.30	
12	I often examine my teeth in the mirror after brushing.	Agree ¹	160	70.50	352	72.40	0.591
		Disagree	67	29.50	134	27.60	
13	I am concerned about bad breath.	Agree	173	76.20	371	76.30	0.971
		Disagree	54	23.80	115	23.70	
14	It is difficult to avoid gum disease solely through brushing.	Agree	172	75.80	374	77.00	0.728
		Disagree ¹	55	24.20	112	23.00	
15	I avoid the dentist till I get toothache.	Agree	172	75.80	351	72.20	0.318
		Disagree ¹	55	24.20	135	27.80	
16	I have applied a stain to assess the cleanliness of my teeth.	Agree ¹	44	19.40	72	14.80	0.124
		Disagree	183	80.60	414	85.20	
17	I utilize a toothbrush with stiff bristles.	Agree	87	38.30	120	24.70	<0.001 *
		Disagree	140	61.70	366	75.30	
18	I do not consider my brushing to be effective until I use strong strokes.	Agree	110	48.50	204	42.00	0.104
		Disagree	117	51.50	282	58.00	
19	I sometimes feel that I spend more time brushing my teeth.	Agree ¹	106	46.70	233	47.90	0.756
		Disagree	121	53.30	253	52.10	
20	My dentist has informed me that I clean my teeth extremely well.	Agree	150	66.10	318	65.40	0.865
		Disagree	77	33.90	168	34.60	

Table 2 displays self-reported oral behaviors between smokers and non smokers. Most smokers than nonsmokers were not worried about visiting the dentist, complained of bleeding gums while brushing and observed whitish sticky coatings on teeth. Moreover, most smokers use child sized tooth brushes, thought placing artificial teeth in elderly age is inevitable and teeth get worse despite daily brushing. Similarly, many smokers have never been taught about tooth brushing by professionals and agreed to clean well without using tooth paste. Most smokers, compared to non smokers, used disclosing solutions to see the cleanliness of the teeth, used stiff bristles toothbrushes and brushed with strong strokes and were informed by the dentist about brushing very well. On the contrary, most nonsmokers were concerned with the color of teeth and gums and worried about having bad breath. In addition, non smokers believed that it is difficult to avoid gum disease with tooth brushing alone and felt that taking excessive time to brush their teeth. Smokers and non smokers demonstrated a significant difference with regards to having false teeth during old age (p=0.033), the color of gums (p=0.002) and teeth getting worse despite daily brushing (p=0.011). Similarly, a significantly more significant number of smokers than nonsmokers brushed their teeth with stiff bristles (p<0.001).

Table 3 Dental visiting pattern and oral health behavior of smokers and non smokers

Visiting pattern	Smokers (n=227)			Nonsmokers (n=486)		
	N	Mean Rank	p [¶]	N	Mean Rank	p [¶]
Never visited	15	109.57	0.102	32	229.09a	0.015
Before 6 months	102	124.74		210	265.45a	
Before 6-12 months	61	113.17		113	237.60ac	
Before 24 months	19	89.03		58	234.82ac	
More than 24 months	30	97.20		73	202.70bc	
¶Kruskal-Wallis test						

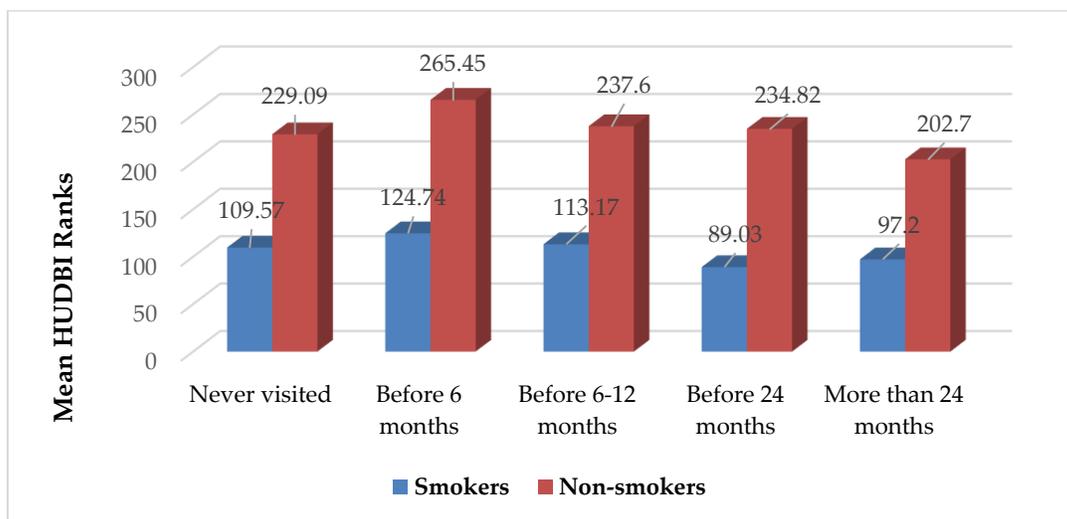


Figure 2 HUDBI mean ranks and dental visiting patterns between smokers and non-smokers

The mean HUDBI ranks of smokers ranged between 89.03 to 124.74. The smokers who visited the dentists within the last year demonstrated higher mean HUDBI ranks indicating better oral health behaviors than others. However, smokers' oral health behaviors did not differ significantly across visiting patterns. Contrarily, the mean HUDBI ranks of nonsmokers ranged from 202.70-265, which was relatively higher than smokers. A comparison of mean HUDBI ranks of nonsmokers across dentists' visiting patterns showed a statistically significant difference by the Kruskal-Wallis test ($p=0.015$). Non smokers who visited dentists for more than 24 months before demonstrated significantly lower mean HUDBI ranks than others indicate poor oral health behavior (Table 3 and Figure 2).

Table 4 Reason for a dental visit and oral health behavior of smokers and non smokers

Reason for visit	Smokers (n=227)			Nonsmokers (n=486)		
	N	Mean Rank	p [§]	N	Mean Rank	p [§]
Regular check-up	43	150.88	<0.001	90	298.09	<0.001
Dental problems	184	105.38		396	231.09	

§Mann-Whitney U test

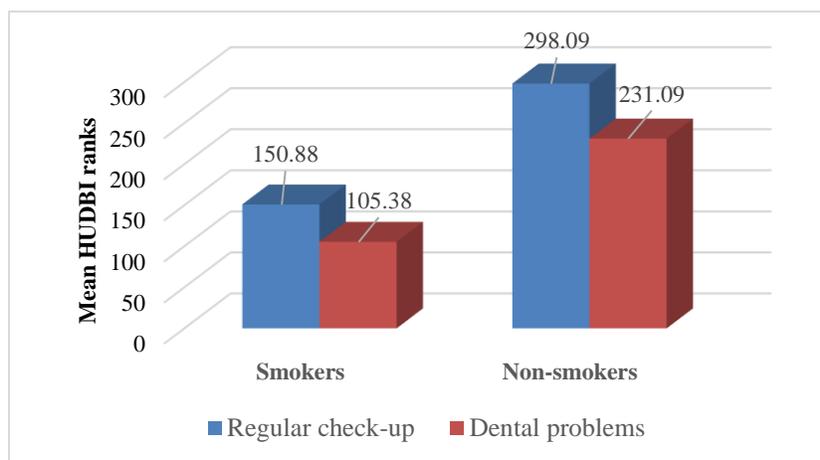


Figure 3 The mean HUDBI ranks and reasons for dental visit between smokers and non-smokers

Table 4 and Figure 3 show the reason for a dental visit and the oral health behaviors of smokers and non smokers. The mean HUDBI ranks of smokers who visited for a regular check-up (150.88) was significantly higher than those visited with dental problems (105.38) ($p<0.001$). Similarly, non smokers who sought regular check-ups showed a significantly higher mean HUDBI rank (298.09) than those who had visited the dentist due to dental problems (231.09) ($p<0.001$).

4. DISCUSSION

This study investigated smokers' and nonsmokers' self-perceived oral health behavior and dental attendance patterns in Saudi Arabia. Our study found that (31.8%) of the study participants were smokers, which is in line with the reported prevalence of smoking in Saudi Arabia, which ranges from 13.7% to 49.2% (Tobaiqy et al., 2020). The current study findings suggest that smoking was the strongest indicator of self-reported worse oral health and problem-based dental visits. These findings were supported by previous Saudi Arabian studies, which reported a higher prevalence of teeth sensitivity, dry mouth and perceived oral health concerns among smokers than non smokers (Shah and El Haddad, 2015; Al-Qurashi et al., 2016). Moreover, our study finding aligns with previous studies reported in England (Csikar et al., 2013; Csikar et al., 2016). The strength of the present study is that it was based on Saudi Arabian data obtained from the general public who were active on social media. Nearly 98% of the Saudi population uses the internet (GMI, 2022). Therefore, the current study instrument was shared on social media to obtain responses from the general public. Thus, it may help to improve the external validity of the study. In addition, the study's findings may be the basis for building an evidence base about self-reported oral health behaviors and dental care utilization patterns among smokers and non smokers in Saudi Arabia.

Our study findings suggest poor oral health outcomes among smokers. Of the 20 items of HUDBI, only four differed significantly between smokers and non smokers. Most smokers than non smokers perceived that they could not help having false teeth during old age and teeth getting worse despite daily brushing. Additionally, more smokers than non smokers tend to use tooth brushes with stiff bristles. This poor oral health behavior coincides with smokers being more than twice the non smokers to report poor dental health (Csikar et al., 2016). In line with our study findings, Miller and Locker observed that smokers more frequently report oral pain than non smokers. It was noticed that current and former smokers were at higher risk of orofacial pain than never smokers (Millar and Locker, 2007). On the contrary, non smokers than smokers were more concerned about the gum color, suggesting aesthetic concerns. In this study, oral health behavior was measured using the HUDBI scale. Smokers demonstrated lower HUDBI ranks across dental visiting patterns and reasons for visits indicating poor oral health behavior towards dentists and dental care. A higher score implies better oral health, while a lower score suggests poor oral health behavior. Some differences in perceived oral health behavior and dental attendance were observed between smokers and non smokers.

The current study's findings have implications for the dental professional's proficiency in accessing smokers and guiding them to quit smoking. The opportunities to carry out smoking cessation sessions are limited since most smokers seek dental care whenever they have dental problems, especially during dental pain. Smokers do not accept this move. Moreover, smokers' poor oral health behavior requires support, direction and clinical intervention to promote oral health. Tailored oral health information should be considered as part of continuous care for patients with smoking habits (Daly et al., 2013). Certain limitations can be identified in this study. Because the information on oral health behavior and seeking dental care were self-reported and the participants were volunteers, there is a possibility that the "self-selected" samples may not represent the general population. Self-reported assessments may underestimate or over state the need for treatment. Moreover, study participants who were active on social media during the data collection phase were only considered. Other socio-demographic variables considered in this study were not analyzed in connection with oral health behavior and dental visiting patterns. Hence future research should consider a relatively large and representative sample utilizing a proper sampling methodology. Analysis of the socio-demographic variables concerning the dental visiting pattern and smokers' oral health behaviors must be done to discern the differences.

5. CONCLUSIONS

Within the limitation of the study, it can be inferred that the smokers compared to non smokers, had poor oral health behaviors, and visited the dentist whenever they had dental problems. Hence dental professionals must be careful while addressing the oral health concerns of smokers, considering their behavior and dental visiting pattern.

Author contribution

Rabiya Basari Uppin-participated in protocol design analyzed the data and supervised the study.

Abdulrahman Farraj Aldawsari and Shahad Abdullah Alsulaiman-participated in protocol design, data collection, analyzed the data and the study.

Ibrahim Abdullah Alotaibi, Fahad Saad Almutairi-data collection, analyzed the data and the study.

All authors reviewed and approved the final manuscript.

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Ethical approval

The study was approved by the Research and Innovation Center of Riyadh Elm University, Saudi Arabia (SRP/2022/115/753/731).

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Conflict of interest

The authors declare that there is no conflict of interests.

Data and materials availability

All data sets collected during this study are available upon reasonable request from the corresponding author.

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