Original Article

KNOWLEDGE AND PERCEPTION OF IN-OFFICE AND HOME TEETH BLEACHING AND RELATED ADVERSE EFFECTS IN SAUDI ARABIA

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ABSTRACT

Teeth bleaching is more popular in Saudi Arabia. The purpose of the present study was to assess the knowledge of at-home and In-office teeth bleaching and its adverse effects among the general population of Saudi Arabia. This cross-sectional study used a structured, close-ended, self-administered and pretested online questionnaire to record the responses. Descriptive statistics, Chi-square, and Fisher's exact tests were applied to the data. Results showed that the participants in this study were 2065 people. The number of male and female respondents was 45.6% and 54.4%, respectively. Tea, coffee, smoking/tobacco, and shisha were mentioned by 88.2% of the study participants as all causes of teeth staining. 99.3% of the study participants had prior knowledge of teeth bleaching. Nearly 61.5% and 62.2% of study participants were aware of the adverse effects of home-based and dentist-supervised bleaching products. The knowledge of teeth bleaching and its adverse effects differed significantly across this study's demographic factors. This study showed adequate knowledge of teeth discoloration, bleaching protocols, and adverse effects. However, most study participants favored in-office bleaching rather than at-home bleaching.

Key words: Teeth whitening, In-office bleaching, At-home bleaching, Knowledge, Adverse effects.

Introduction

A dull smile has social repercussions. Demand for improved and beautiful smiles has become integral to dental procedures [1]. Many people, especially young females, are concerned about their smiles because the first thing people notice when meeting a new person is their smile [2]. In the present era, patients increasingly demand a perfect smile due to a shift in priorities and the impact of the media [3, 4].

Since teeth color is interrelated to each individual's aesthetics, teeth discoloration is frequently reported among patients seeking aesthetic treatment [5]. The practice of whitening the teeth is known as bleaching. Through bleaching, oxidation occurs within the enamel, making it look lighter than before [6]. Bleaching is a minimally invasive process used to treat discolored teeth [7].

The popularity of teeth whitening has climbed many-fold with the availability of over-the-counter bleaching agents. Recent advances in aesthetic dentistry have led to a wide selection of teeth whitening products. These include toothpaste, dentifrices, and gels. In addition, lifestyle habits like smoking, and consumption of black tea and coffee, may lead to darker-colored teeth [8]. Generally, bleaching products are classified into two categories, i.e., home and in-office bleaching products. Besides hydrogen peroxide, which is widely used as a bleaching agent, chlorides, peroxides, and chlorine are sometimes also used. Along with the active agent, inactive constituents such as glycerine to maintain moisture, gelling to enhance the viscosity, preservatives such as methyl or sodium benzoate to prevent bacterial growth, and flavoring agents to improve taste are also used in the product [9].

A past survey revealed that 25.6% of the dental patients used saline, and 10% used lemon as a home-based dental whitening agent [10]. Another study showed that the patients were inclined to choose advertised and home bleaching products compared to professional bleaching [1]. In addition, a survey of the association between age, sex, level of education, marital status, and type of work on the perception and knowledge of patients regarding teeth whitening products has been reported previously [5].

Despite the benefits of teeth bleaching, there are evident side effects such as increased teeth sensitivity [11], irritation of gingivae and mucous membrane [12], weakening of the dentin and enamel damage [13], and demineralization of the teeth surface [1] and most of Saudi Arabia's population is unaware of the adverse effects of teeth bleaching. Therefore, this cross-sectional study aims to assess the knowledge of at-home and In-office teeth bleaching and their adverse effects amongst the general population in Saudi Arabia.

Materials and Methods

This analytical cross-sectional survey-based study was designed and targeted across Saudi Arabia to measure the population's knowledge of at-home and in-office teeth bleaching. A non-probability convenience sampling method was adopted to collect the data from individuals aged ≥18 and collected from March 2021 to May 2021. Participation in this survey was voluntary. Informed consent was taken from the participants, and the purpose of this study was explained before participants' enrollment. The confidentiality of the participants was assured throughout the study without collecting personal identifier information. An online structured questionnaire was developed using Google forms. The authors of this study shared the survey link using e-mails, WhatsApp, and other social media applications with their contacts. The online questionnaire made it impossible to submit the form without filling in the entire field. Therefore, the participants were encouraged to roll out the survey further to achieve maximal participation. Ethical approval (FUGRP/2021/219/386/384) for the study was obtained from the Research and Innovation Center of Riyadh Elm University, Riyadh, Saudi Arabia.

This cross-sectional study with a snowball sampling method was conducted in all of Saudi Arabia. A modified close-ended questionnaire in Arabic/English was available for the participants. No personal data except gender, age, and level of education would be collected from the participants.

A modified questionnaire based on previous research conducted by Alshamrani and Wahid was used to meet the current research requirements [2]. The questionnaire comprised of three parts:
Part 1: Four questions related to socio-demographics (Age, gender, educational level and area)
Part 2: Five questions on causes of teeth discoloration and sources of information
Part 3: Seven items on knowledge about teeth bleaching, including at-home and in-office teeth bleaching methods.
Part 4: Six items on knowledge of adverse effects of teeth bleaching.

Pilot testing of the questionnaire demonstrated excellent reliability (Cronbach's alfa=0.91) and face validity.

Statistical analysis
Descriptive statistics of frequency distribution and percentages were calculated for all the categorical variables. The chi-square test assessed the relationship between categorical variables. A p-value of less than 0.05 was considered significant for all statistical purposes. Statistical analysis package IBM-SPSS version 25 (Armonk, NY: USA) was used for the data analysis.

Results and Discussion

A total of 2065 participated in this study. The number of male and female respondents was 45.6% and 54.4%, respectively. Nearly 64.3% of the study participants were aged between 20-30 years, and 44.7% of participants had a postgraduate level of education. Moreover, 47.9% of the subjects belonged to the central region of Saudi Arabia **(Table 1)**.

Table 1. Demographic variables of the study participants (n=2065)

Variables		n	%
Age (in years)	20-30	1327	64.3
	31-40	261	12.6
	41-50	257	12.4
	>51	220	10.7
Gender	Female	1124	54.4
	Male	941	45.6
Education	School	887	43
	Degree/Diploma	254	12.3
	Post-graduation	924	44.7
Area	Eastern	445	21.5
	Central	989	47.9
	Northern	121	5.9
	Southern	297	14.4
	Western	213	10.3

Knowledge of Causes of teeth discoloration

Table 2. Knowledge of teeth-discoloration causes among study participants

Variables		n	%
Drinks and Smoke	Tea	36	1.7%
	Coffee	60	2.9%
	Smoking/tobacco	95	4.6%
	Shisha	11	0.5%
	All of the above	1821	88.2%
	Don't know	42	2.0%
Antibiotics such as tetracycline and doxycycline	Yes	573	27.7%
	No	3	0.1%
	I don't know	1489	72.1%
Aging	True	1231	59.6%
	False	263	12.7%
	I don't know	571	27.7%
Intrinsic and extrinsic causes	True	1063	51.5%
	False	293	14.2%
	I don't know	709	34.3%

When asked about the causes of teeth staining, 88.2% of the study participants mentioned tea, coffee, smoking/tobacco, and shisha as all causes of teeth staining. In addition, nearly 27.7% and 59.6% of subjects agreed that antibiotics (tetracycline and doxycycline) and aging causes teeth staining. Moreover, more than half, 51.5%, of the participants attributed teeth staining to intrinsic and extrinsic causes **(Table 1)**.

Knowledge and source of information on teeth-bleaching among study participants

Almost 99.3% of the study participants were knowledgeable about teeth bleaching. The primary source of information for the study participants was advertisements (34%), followed by dentists (33.3%) and family friends **(Figure 1)**.

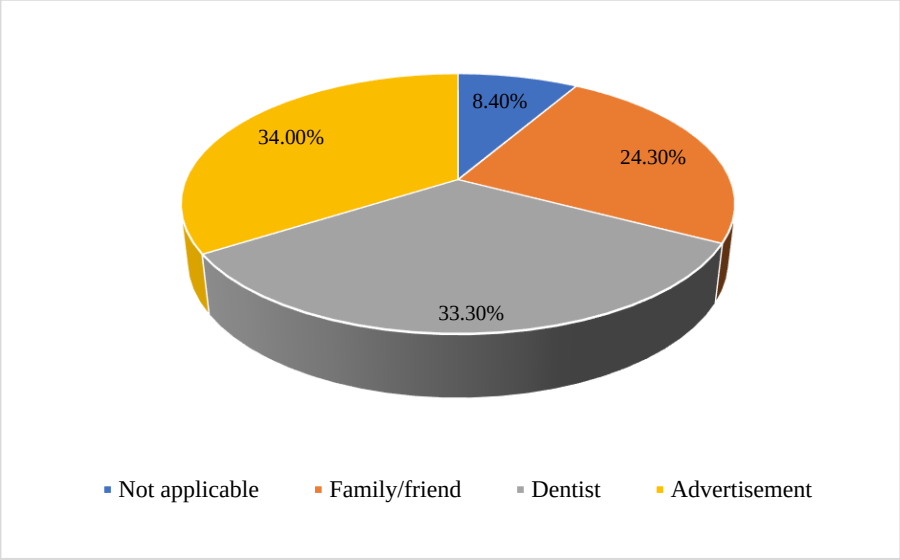

Figure 1. Source of information on teeth bleaching (N=2065)

Almost half (48.9%) of the respondents were aware of products (Toothpaste, White strips, and gels) used at home for teeth whitening. In addition, 89.1% of the study participants agree that dentist-supervised bleaching is more effective than home bleaching, and 41.5% knew that the beaching of teeth under dentist supervision is usually a one-day process. Moreover, 67.2% of subjects knew that dentist-

supervised bleaching concentrated bleaching agents are used compared to home-based bleaching products **(Table 3)**.

Table 3. Knowledge of teeth bleaching among study participants (N=2065)

Variables		n	%
Do you know about teeth bleaching?	Yes	2051	99.3%
	No	14	0.7%
How did you know about teeth bleaching?	Advertisement	703	34.0%
	Dentist	687	33.3%
	Family/friend	502	24.3%
	Not applicable	173	8.4%
Is teeth whitening/bleaching possible at home?	Yes	1731	83.8%
	No	5	0.2%
	I don't know	329	15.9%
What products can be used at home for teeth whitening?	Toothpaste	413	20.0%
	White strips	322	15.6%
	Gels	74	3.6%
	All of the above	1010	48.9%
	Don't know	246	11.9%
Is dentist-supervised bleaching more effective than home bleaching?	Yes	1840	89.1%
	No	14	0.7%
	I don't know	211	10.2%
Bleaching of teeth under dentist supervision is usually a one-day process.	True	857	41.5%
	False	610	29.5%
	I don't know	598	29.0%
In dentist-supervised bleaching, concentrated bleaching agents are used compared to home-based bleaching products	True	1387	67.2%
	False	151	7.3%
	I don't know	527	25.5%

Nearly 61.5% of the study participants mentioned that they know the adverse effects of home-based whitening/bleaching products. However, when asked about the adverse effects of the dentist's supervised whitening/bleaching products, 62.2% responded positively. In addition, study participants were knowledgeable about the temporary teeth-whitening of bleaching products (83.8%), teeth sensitivity (81.2%), wearing of enamel surface (60.7%), and gum and mucus membrane irritation (64.6%), following the bleaching treatment **(Table 4)**.

Table 4. Knowledge of adverse effects of teeth bleaching

Variables		n	%
Are there any adverse effects of home-based whitening/bleaching products?	Yes	1270	61.5%
	No	18	0.9%
	I dont know	777	37.6%
Are there any adverse effects of the dentist's supervised whitening/bleaching products?	Yes	1284	62.2%
	No	14	0.7%
	I don't know	767	37.1%
Do you know that the whitening of teeth using bleaching products is temporary?	Yes	1730	83.8%
	No	19	0.9%

	I don't know	316	15.3%
Do you know that teeth sensitivity usually follows after bleaching?	Yes	1676	81.2%
	No	10	0.5%
	I don't know	379	18.4%
Do you know that wearing of enamel surface occurs due to bleaching?	Yes	1253	60.7%
	No	26	1.3%
	I don't know	786	38.1%
Do you know that gums and mucus membrane irritants can also happen due to bleaching?	Yes	1335	64.6%
	No	14	0.7%
	I don't know	716	34.7%

Table 5. Knowledge of teeth bleaching and adverse effects across different demographic variables

Variables		Age				p	Gender		p	Education			p
		20-30	31-40	41-50	>51		Female	Male		School	Degree/ Diploma	PG	
		%	%	%	%		%	%		%	%	%	
Knowledge of bleaching	Yes	99.2	99.2	99.6	99.5	0.891	99.2	99.5	0.458	99.5	97.6	99.6	0.002
	No	0.8	0.8	0.4	0.5		0.8	0.5		0.5	2.4	0.4	
Home bleaching	Yes	61.3	66.7	60.7	57.3	0.439	65.7	56.5	<0.001	59.8	56.7	64.5	<0.001
	No	0.9	0.8	0.4	1.4		0.7	1.1		0.3	3.9	0.5	
	IDK	37.8	32.6	38.9	41.4		33.6	42.4		39.9	39.4	35.0	
Dentist supervised bleaching	Yes	63.5	58.6	58.0	63.2	0.138	63.6	60.5	0.263	62.5	58.7	62.9	0.301
	No	0.5	0.8	0.8	1.8		0.5	0.9		0.5	1.6	0.6	
	IDK	36.0	40.6	41.2	35.0		35.9	38.7		37.1	39.8	36.5	
Teeth whitening temporary	Yes	84.3	85.8	80.2	82.7	0.119	85.0	82.4	0.222	83.9	84.6	83.4	0.001
	No	1.1	0.4	0.0	1.8		1.0	0.9		0.7	3.1	0.5	
	IDK	14.7	13.8	19.8	15.5		14.1	16.8		15.4	12.2	16.0	
Teeth sensitivity	Yes	81.1	85.8	77.8	80.0	0.012	85.4	76.1	<0.001	79.5	82.3	82.5	0.031
	No	0.5	0.0	0.0	1.8		0.5	0.4		0.3	1.6	0.3	
	IDK	18.5	14.2	22.2	18.2		14.1	23.5		20.2	16.1	17.2	
Teeth wearing away	Yes	59.2	60.9	63.8	65.5	0.086	63.1	57.8	0.045	60.0	60.2	61.5	<0.001
	No	1.0	2.7	0.8	1.8		1.1	1.5		0.5	3.9	1.3	
	IDK	39.8	36.4	35.4	32.7		35.9	40.7		39.6	35.8	37.2	
Gum and mucosal irritation	Yes	66.3	60.9	61.1	63.2	0.178	68.2	60.4	0.001	66.6	61.0	63.7	0.005
	No	0.6	1.5	0.8	0.0		0.7	0.6		0.3	2.4	0.5	
	IDK	33.1	37.5	38.1	36.8		31.0	39.0		33.0	36.6	35.7	

IDK=I Don't Know, PG=Postgraduation

The knowledge of bleaching and its adverse effects are compared across different demographic variables, as shown in **Table 5**. Statistically significant differences were observed in teeth sensitivity across the different age groups of the study participants (p=0.012). Similarly, statistically significant gender differences were observed in home

bleaching (p<0.001), teeth sensitivity (p<0.001), wearing of teeth (p=0.045) and gum and mucosal irritation (p=0.001) after teeth bleaching. In addition, knowledge of bleaching (p=0.002), adverse effects of home bleaching (p=<0.001), teeth whitening is temporary (p=0.001), teeth sensitivity (p=0.031), wearing of the teeth (p <0.001) and gum and mucosal irritation (p=0.005).

People must be informed of the various kinds of bleaching procedures and products to make the best judgments about their treatments by considering the reason for teeth discoloration. Therefore, this study assessed knowledge and perception of the In-office and home teeth bleaching among study participants. The findings of this study showed that many participants knew about drinking (Tea and coffee) and smoking as the leading causes of teeth staining. However, Nomay *et al*. (2015) [14] reported that less than 20% of the study participants agreed to avoid tea, coffee, and smoking after bleaching. Moreover, over half of the participants attributed the causes of teeth staining to aging and intrinsic and extrinsic factors. However, the study participant's knowledge regarding the antibiotics such as tetracycline and doxycycline as the cause of teeth staining was poor. This study's finding aligns with Almassi *et al*.'s [15] report about the causes of teeth staining.

In this study, more than 99% of the study participants were aware of teeth bleaching. This result is similar to the study published by Nomay *et al*. (2015) [14], in which 18.3%, 40.2%, 28.7%, and 12.8% demonstrated excellent, good, fair, and poor knowledge of teeth bleaching. However, this knowledge of teeth bleaching varied significantly across different educational categories, with postgraduate participants demonstrating the highest awareness.

Previous studies in Saudi Arabia have indicated that the advertisements followed by friends, relatives, and dentists were the source of information about teeth bleaching [1, 15]. Our study finding is in line with previous studies in which advertisement is the primary source of information on teeth bleaching, followed by dentists, family, and friends.

When inquired about the possibility of teeth whitening/bleaching at home, 83.8% of the participants responded positively. Almost half of the participants used toothpaste, white strips, and gels as part of home bleaching. However, the use of home teeth whitening/bleaching differed significantly, with a substantially higher percentage of females than males preferring home teeth whitening/bleaching. Similarly, a higher rate of subjects with postgraduate education preferred home bleaching than other education categories. Contrarily, many respondents believed that dentist-supervised bleaching is more effective than home bleaching, and the bleaching of teeth under dentists' supervision is usually a one-day process. This finding suggests that most respondents preferred in-office teeth bleaching under the dentist's supervision [16, 17]. This finding could be supported by the fact that home bleaching requires full patient compliance and has a relatively low success rate [16]. Also, most of the study participants knew about using higher concentrations of the bleaching agent in dentist-supervised bleaching than in-home bleaching. Furthermore, when dentist-supervised bleaching was compared across different ages, gender, and educational levels of the study participants, no significant differences were observed.

Hydrogen peroxide (H_2O_2) is the active agent frequently used in most teeth-bleaching products of in-office techniques [18, 19]. Hence hydrogen peroxide tends to cause undesirable adverse effects in the oral cavity, such as teeth sensitivity, irritation of the oral mucosa, and wearing away of the enamel surface [20]. Our findings showed that most respondents were more knowledgeable about the adverse effects of in-office teeth bleaching than at-home bleaching products. In addition, a very high percentage of the study participants agreed that the whitening of teeth using bleaching products is temporary, and teeth sensitivity usually accompanies teeth bleaching. People must be aware of these side effects to prepare themselves, reducing the number of complaints about dental treatments. In-office bleaching is always the preferred method because it minimizes side effects and allows the patient to see immediate results [9]. Most of the study participants in our study knew teeth sensitivity was common after teeth bleaching. Contrarily, lower participants were knowledgeable that it could cause gingival irritation and wearing of the enamel if used incorrectly. This finding is in line with the study reported by Jaha and colleagues [17].

Adverse effects of bleaching showed significant variation across different demographic factors. Responses of the study participants on the non-permanent nature of teeth whitening differed significantly across educational categories. While responses to teeth sensitivity after bleaching differed across various age groups, gender and educational levels. Contrarily, teeth wearing and gum and mucosal irritation after teeth bleaching showed a statistically significant difference across different gender and educational level. This finding can corroborate the results reported by Al-Nomay and colleagues 14, which were in females, participants with a university degree and respondents aged < 30 tended to have increased knowledge of teeth bleaching.

Strength and limitations of the study

The larger sample size, high response rate and use of a reliable and valid questionnaire are the strength of this study. However, the use of cross-sectional design is a major limitation of the study. Further clinical studies on teeth bleaching and its adverse effects among patients are needed to confirm th current study findings.

Conclusion

This study showed adequate knowledge of teeth discoloration, bleaching protocols and adverse effects.

However, most study participants favored in-office bleaching rather than at-home bleaching. Study participants cited the media as the primary source of information about dental bleaching. Moreover, knowledge of teeth bleaching and its adverse effects were influenced by participants' age, gender and educational levels.

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