Awareness and Knowledge of the Adult Population in Saudi Arabia On teeth Discoloration and Treatment Options: A Cross-Sectional Study

Abstract:

Background: Tooth discoloration is a common condition. Discoloration can be a major aesthetic concern for some people and it can indicate pathology, so it needs to be addressed. The success of treatment of tooth discoloration is largely dependent on the knowledge and attitude of people towards it. Hence the aim of this cross-sectional questionnaire-based study was to evaluate knowledge and awareness of the adult Saudi population about the causes of tooth discoloration and its treatment options.

Materials and Methods: An online close-ended questionnaire consisting of 21 questions about tooth discoloration causes and treatment options were uploaded in Google Forms and was sent to 2000 adults in Saudi Arabia via email and social media websites. The questions were designed to evaluate patients' knowledge about the various causes of tooth discoloration.

Results: A total of 1041 participants responded to our questionnaire. The study included 560 females (53.79%), and 448 participants aged between 18 and 24 years (43.04%), 192 (18.44%) between 25 and 35 years, 246 (23.63%) between 36 and 51 years, and 155 (14.89%) above 51 years. Most of the participants (n= 649; 62.34%) had a bachelor's degree. The most common answer to the type of teeth discoloration was internal and surface discoloration (n= 511; 49%). There was a positive response to the effect of diet, smoking, aging, and bacteria on tooth discoloration. 79% of the participants did not know what dental fluorosis is. The response to the effect of drugs on teeth discoloration split between "Yes" and "I don't know," and 688 of the

participants (66.09%) did not know which drugs cause teeth discoloration. The personal effort was the most common way to obtain information about teeth discoloration (n= 678; 65.13%).

Conclusion: Within the limitations of this study, the level of knowledge about tooth discoloration was more concentrated on extrinsic factors, and the majority of the participants demonstrated poor knowledge about the intrinsic causes of tooth discoloration. The preferred treatment option of teeth discoloration was in office bleaching.

Keywords: Dental Stains, Dental fluorosis, Knowledge, Perception, Tooth discoloration.

Introduction:

A large number of people are concerned about the appearance of their teeth and actively seek dental treatments to enhance their teeth in terms of shape or color. The color of teeth is usually considered to be of great esthetic importance and can definitely boost one's confidence if the appearance is up to the acceptable level and patient is satisfied with the appearance. The color of teeth can be an important feature in determining the overall attractiveness of the face [1]. Anterior tooth discoloration is one of the most frequent reasons for seeking dental treatment according to Amarlal D et al [2].

Stains or discoloration can occur intrinsically, extrinsically or both; and this is an important distinction since treatment options differ dramatically based on the discoloration origin, either being external on the tooth surface or internal from within the tooth body [3]. Extrinsic discolorations include discolorations caused by the diet (tea, coffee, etc), smoking, and mouthwashes containing chlorhexidine. Extrinsic discoloration are usually brown to black stains that can be removed by routine scaling and polishing procedures [3].

According to Hattab FN et al [3] intrinsic discoloration occurs following a change to the structural composition or thickness of the dental hard tissues. Metabolic diseases, genetic diseases and systemic factors are known to affect the color of the developing teeth. Some examples of intrinsic discolorations include: Amelogenesis imperfecta and dentinogenesis imperfect [4]. On the other hand, dentinogenesis imperfecta is a dentin defect that can be associated with a systemic disorder. The teeth are usually bluish or brown in color, and demonstrate opalescence on trans-illumination [4].

Dental fluorosis is a developmental disturbance which is characterized by hypo-mineralization of the dental enamel and caused by excessive exposure to high concentrations of fluoride in water. This condition has multiple stages of severity, ranging from mild to severe [5].

Traumatic injuries to the teeth have been found to induce intrinsic discoloration. Discolorations are varied depending on the pulpal condition [6]. Tetracycline staining, which is an intrinsic discoloration, is seen in children born when their mothers were taking tetracycline medications at the time of pregnancy [3,7]

Dental materials can also discolor teeth. For example, corrosion products from amalgam restoration discolor the teeth by the formation of silver sulfide, a grayish-black stain that can reflect through the enamel [4,8].

A research on the knowledge and attitude to tooth discoloration of patients visiting health centers in Nairobi was conducted by Kakarla KVV et al [9]. It was found out that majority of the respondents (40.6%) were informed about tooth discoloration from the internet. Majority of the respondents (72.8%) believed that diet was not a cause of tooth discoloration. As a conclusion, it was found that the respondents had sufficient knowledge regarding tooth discoloration. An

overview [3] on dental discoloration details the etiology and clinical presentation of dental stains and outlines treatment options. It was said that tooth discoloration was a frequent dental finding associated with clinical and esthetic problems. It differs in etiology, appearance, composition, location, severity, and firmness in adherence to the tooth surface. Basically, there were two types of tooth discolorations: those caused by extrinsic factors and those caused by intrinsic congenital or systemic influence. The intensity of stains may be worsened if there are enamel defects. Tooth discoloration presents two major challenges to the dental team. The first challenge is to ascertain the cause of the stain; the second is its management. The present study was conducted with the aim to explore knowledge and attitude towards dental stains and its treatment options among patients in Saudi Arabia.

Material and Methods:

This cross-sectional study utilized an electronic close-ended online questionnaire through the Google Forms website and was sent out via email and social networking apps. It consisted of 21 questions targeting the adult population of Saudi Arabia. The questions were directed to assess the knowledge and awareness of the population in Saudi Arabia about causes of teeth discoloration and treatment options.

Sample size calculation:

We calculated the sample size before conducting the survey. We distributed the survey to 2000 participants, with an expected response rate of 50%. The sample's proportion with the expected outcome was 50% (the margin error is 0.5, and the confidence level is 95%). The estimated sample size was 645 participants.

Inclusion and Exclusion criteria:

Inclusion: Arabic-speaking male or female living in Saudi Arabia and 18 years older or above.

Exclusion: Those who could not speak Arabic or who were under 18 years of age.

Statistical analysis:

The questionnaire was validated using a pilot test, in which the questionnaire was distributed to 20 people, and were asked for feedback and to report any form of ambiguity in the questions. Binary and nominal data were described in the form of frequencies and percentages. The Chi-square test was used to compare categorical variables, and Fisher exact test was used if the expected frequency was less than 5. The survey's internal consistency was assessed using the Cronbach's alpha test, and the coefficient was 0.74. Stata 16.1 was used to perform the analysis (Stata Corp, College Station, TX, USA), and a *P*-value of less than 0.05 was considered statistically significant.

Ethical Considerations:

The study was conducted after it was approved by the Ethical Committee at the research center of Riyadh Elm University (Institutional Review Board-IRB). The aim of the study was explained to all participants, and they were informed that by submitting their filled surveys it would be considered an expression of their consent to participate in the study.

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Results:

Table 1: Socio-demographic data (Data are presented as number and percent)

	Total (n= 1041)	Females (n= 560)	Males (n= 481)
1. Age groups			

- 18-24 (y) - 25-35 (y) - 36-50 (y) - 51 (y) and above	448 (43.04%) 192 (18.44%) 246 (23.63%) 155 (14.89%)	214 (38.21%) 113 (20.18%) 134 (23.93%) 99 (17.68%)	234 (48.65%) 79 (16.42%) 112 (23.28%) 56 (11.64%)
2. Level of education - High school degree (or less than that) - Bachelor's degree - Diploma - Higher education (Master, PhDs)	 241 (23.15%) 649 (62.34%) 87 (8.36%) 64 (6.15%)	 124 (22.14%) 367 (65.54%) 46 (8.21%) 23 (4.11%)	 117 (24.32%) 282 (58.63%) 41 (8.52%) 41 (8.52%)

A total of 1041 participants responded to the questionnaire. The study included 560 females (53.79%), and the age of 43% of the participants ranged from 18- 24 years. Most of the participants (n= 649; 62.34%) had a bachelor's degree. The age and educational levels differed significantly between males and females. (Table 1)

Table 2: Participants' responses to the questionnaire of types of tooth discoloration

	Total (n= 1041)
1-Do you know what dental fluorosis is? - Yes - No	 217 (20.85%) 824 (79.15%)
2-What are the causes of dental fluorosis? (Multiple choices) - Toothpaste that contains fluoride - Well water - Bottled water - Mouthwashes - I don't know	 296 (28.43%) 343 (23.34%) 128 (12.30%) 153 (14.70%) 559 (53.70%)
3-What are the colors of dental fluorosis? - White - Dark brown - White and dark brown - Yellow - Color doesn't change - I don't know	 63 (6.05%) 57 (5.48%) 133 (12.78%) 215 (20.65%) 15 (1.44%) 558 (53.6%)
4-When a tooth receives a traumatic injury, will there be a change in its color? - Yes - No - I don't know	 518 (49.76%) 264 (25.36%) 259 (24.88%)

5-What are the possible colors we see on a tooth that received a traumatic injury? (Multiple choice)	
Red	103 (9.89%)
Pink	55 (5.28%)
Yellow	264 (25.36%)
Brown	384 (36.89%)
Color doesn't change	216 (20.75%)
I don't know	301 (28.91%)
6-Do some drugs cause a change in the tooth's color?	
- Yes	516 (49.57%)
- No	96 (9.22%)
- I don't know	429 (41.21%)
7-What are the drugs that might cause tooth discoloration?	
- Antibiotics	244 (23.44%)
- Analgesics (Painkillers)	68 (6.53%)
- Antihypertensive drugs	41 (3.94%)
- I don't know	688 (66.09%)

79% of the participants did not know what dental fluorosis and what its causes are. The majority agree that there is a change of teeth color after traumatic injury (n= 518; 49.76%). Responses varied on the color of the discolorations resulting from traumatic injuries, with (36.9%) saying brown and only (5.28%) saying pink. The response to the effect of drugs on teeth discoloration split between "Yes" and "I don't know," and 688 of the participants (66.09%) did not know what drugs cause teeth discoloration. (Table 2)

Table 3: Participants' responses to the questionnaire (Data are presented as number and percent)

	Total (n= 1041)
1-Is it possible for silver fillings to cause tooth discoloration?	
- Yes	405 (38.90%)
- No	223 (21.42%)
- I don't know	413 (39.67%)
2-Is it possible for white fillings to cause tooth discoloration?	
- Yes	233 (22.38%)
- No	404 (38.81%)
- I don't know	404 (38.81%)
3-Is it possible for root canal treatments to cause tooth discolorations?	
- Yes	344 (33.05%)
- No	281 (26.99%)
- I don't know	416 (39.96%)

4-In case you have teeth discolorations and wish to treat them, do you: - Visit the dentist - Try to treat the discoloration with home remedies	 854 (82.04%) 187 (17.96%)
5-In case you wanted to whiten your teeth, you: - Use home whitening or bleaching - Do whitening in the dental clinic - I don't want to whiten my teeth	 208 (19.98%) 575 (55.24%) 258 (24.78%)
6-To your knowledge, results of teeth whitening last for…? - 6 months to a year - A year to two years - Results are permanent	 764 (73.39%) 213 (20.46%) 64 (6.15%)
7-The source of your knowledge about tooth discoloration is? (Multiple choice) - Internet - Dentists - Friends and family - Personal effort	 325 (31.22%) 266 (25.55%) 243 (23.34%) 678 (65.13%)

Most of the responses towards the effect of different fillings on the teeth discoloration were "I don't know", and answering with "yes" (38.9%) for amalgam restorations, and (22.38%) for composite restorations, and (33%) for root canal treatments. The majority of the participants chose to visit the dentist in case they wanted to treat their teeth discolorations instead of using home remedies (n= 854; 82%). And the majority wished to do whitening at the dental clinics (55.24%). In regards to the duration of the teeth whitening results, most people answered correctly "6 months to a year" (73.39%). The personal effort was the most common way to obtain information about teeth discoloration (n= 678; 65.13%), and the internet as the second most common source (n= 325; 31.22%) (Table 3)

Table 4: Responses according to the gender (Data are presented as number and percent)

	Females (n= 560)	Males (n= 481)	*P*-value
1-What are the types of tooth discolorations? - Internal discolorations - Surface discolorations - Both - I don't know	 18 (3.21%) 156 (27.86%) 300 (53.57%) 86 (15.36%)	 15 (3.12%) 133 (27.65%) 211 (43.87%) 122 (25.36%)	<0.001

2-Does your diet affect tooth discoloration			0.24
- Yes	507 (90.54%)	420 (87.32%)	
- No	21 (3.75%)	22 (4.57%)	
- I don't know	32 (5.71%)	39 (8.11%)	
3-Does smoking cause tooth discoloration?			0.68
- Yes	545 (97.32%)	469 (97.51%)	
- No	5 (0.89%)	6 (1.25%)	
- I don't know	10 (1.79%)	6 (1.25%)	
4-Do teeth change color with aging?			0.84
- Yes	313 (55.89%)	267 (55.51%)	
- No	110 (19.64%)	101 (21%)	
- I don't know	137 (24.46%)	113 (23.49%)	
5-Do some mouthwashes cause tooth discoloration?			0.71
- Yes	185 (33.04%)	162 (33.68%)	
- No	98 (17.50%)	92 (19.13%)	
- I don't know	277 (49.46%)	227 (47.19%)	
6-Are there genetic diseases that cause tooth discoloration?			<0.001
- Yes	265 (47.32%)	172 (35.76%)	
- No	56 (10%)	87 (18.09%)	
- I don't know	239 (42.68%)	222 (46.15%)	
7-Are there types of bacteria that cause tooth discoloration?			0.30
- Yes	389 (69.46%)	320 (66.53%)	
- No	11 (1.96%)	16 (3.33%)	
- I don't know	160 (28.57%)	145 (30.15%)	

We compared the responses to the questionnaire between males and females. There was a significant difference in their response to the question about the types of tooth discoloration, and a larger proportion of the males responded with "I don't know" (P<0.001). Females (n= 265, 47.32%) responded that there is a genetic predisposition to teeth discoloration, which was significantly higher than males (P<0.001). (Table 4)

Table 5: Responses according to the gender (Data are presented as number and percent)

	Females (n= 560)	Males (n= 481)	*P*-value
1-In case you have teeth discolorations and wish to treat them, do you:			0.045
- Visit the dentist	447 (79.82%)	407 (84.62%)	
- Try to treat the discoloration with home remedies	113 (20.18%)	74 (15.38%)	

2-In case you wanted to whiten your teeth, you: - Use home whitening or bleaching - Do whitening in the dental clinic - I don't want to whiten my teeth	 122 (21.79%) 294 (52.50) 144 (25.71%)	 86 (17.88%) 281 (58.42%) 114 (25.8%)	0.13
3-To your knowledge, results of teeth whitening last for…? - 6 months to a year - A year to two years - Results are permanent	 429 (76.61%) 105 (18.75%) 26 (4.64%)	 335 (69.65%) 108 (22.45%) 38 (7.9%)	0.02
4-The source of your knowledge about tooth discoloration is…? (Multiple choice) - Internet - Dentists - Friends and family - Personal effort	 162 (28.93%) 140 (25%) 124 (22.14%) 382 (68.21%)	 163 (33.89%) 126 (26.20%) 119 (24.75%) 296 (61.54%)	 0.09 0.66 0.32 0.02

Females tend to treat discoloration at home (*P*= 0.045), and more females than males responded that whitening results last between 6 and 12 months (*P*= 0.02). (Table 5)

Table 6: Responses according to the age group (Data are presented as number and percent)

	18- 24 y (n=448)	25- 35 y (n= 192)	36- 50 y (n= 246)	> 51 y (n= 155	*P*-value
1-What are the types of tooth discolorations? - Internal discolorations - Surface discolorations - Both - I don't know	 9 (2.01%) 104 (23.21%) 209 (46.65%) 126 (28.13%)	 5 (2.6%) 55 (28.65%) 107 (55.73%) 25 (13.02%)	 11 (4.47%) 73 (29.67%) 127 (51.63%) 35 (14.23%)	 8 (5.16%) 57 (36.77%) 68 (43.87%) 22 (14.19%)	<0.001
2-Does your diet affect tooth discoloration - Yes - No - I don't know	 388 (86.61%) 27 (6.03%) 33 (7.37%)	 176 (91.67%) 4 (2.08%) 12 (6.25%)	 224 (91.06%) 9 (3.66%) 13 (5.28%)	 139 (89.68%) 3 (1.94%) 13 (8.39%)	0.15
3-Does smoking cause tooth discoloration? - Yes - No - I don't know	 434 (96.88%) 6 (1.34%) 8 (1.79%)	 186 (96.88%) 4 (2.08%) 2 (1.04%)	 243 (98.78%) 0 3 (1.22%)	 151 (97.42%) 1 (0.65%) 3 (1.94%)	0.39
4-Do teeth change color					<0.00

with aging? - Yes - No - I don't know	209 (46.65%) 110 (24.55%) 129 (28.79%)	116 (60.42%) 41 (21.35%) 35 (18.23%)	153 (62.20%) 37 (15.04%) 56 (22.76%)	102 (65.81%) 23 (14.84%) 30 (19.35%)	1
5-Do some mouthwashes cause tooth discoloration? - Yes - No - I don't know	161 (35.94%) 88 (19.64%) 199 (44.42%)	74 (38.54%) 35 (18.23%) 83 (43.23%)	65 (26.42%) 46 (18.7%) 135 (54.88%)	47 (30.32%) 21 (13.55%) 87 (56.13%)	0.02
6-Are there genetic diseases that cause tooth discoloration? - Yes - No - I don't know	183 (40.85%) 70 (15.63%) 195 (43.53%)	97 (50.52%) 15 (7.81%) 80 (41.67%)	100 (40.65%) 36 (14.63%) 110 (44.72%)	57 (36.77%) 22 (14.19%) 76 (49.03%)	0.06
7-Are there types of bacteria that cause tooth discoloration? - Yes - No - I don't know	323 (72.1%) 12 (2.68%) 113 (25.22%)	135 (70.31%) 3 (1.56%) 54 (28.13%)	154 (62.6%) 9 (3.66%) 83 (33.74%)	97 (62.58%) 3 (1.94%) 55 (35.48%)	0.08

We compared the response among different age groups. There was disagreement among different age groups about the types of tooth discoloration ($P< 0.001$). A lower proportion of participants between 18 and 24 years responded with "Yes" to the question about color change with aging compared to the other groups ($P< 0.001$). People aged 36-50 years old were found to be the most un-informed about discolorations caused by mouthwashes, with (n= 46, 18.7%) answering “No” and (n= 135, 54.8%) answering “I don’t know” ($P< 0.02$). (Table 6)

Table 7: Responses according to the age group (Data are presented as number and percent)

	18- 24 y (n= 448)	25- 35 y (n= 192)	36- 50 y (n= 246)	> 51 y (n= 155	*P*-value
1-In case you have teeth					0.28

discolorations and wish to treat them, do you: - Visit the dentist - Try to treat the discoloration with home remedies	363 (81.03%) 85 (18.97%)	151 (78.65%) 41 (21.35%)	209 (84.96%) 37 (15.04%)	131 (84.52%) 24 (15.48%)	
2-In case you wanted to whiten your teeth, you: - Use home whitening or bleaching - Do whitening in the dental clinic - I don't want to whiten my teeth	88 (19.64%) 243 (54.24%) 117 (26.12%)	50 (26.04%) 93 (48.44%) 49 (25.52%)	47 (19.11%) 144 (58.54%) 55 (22.36%)	23 (14.84%) 95 (61.29%) 37 (23.87%)	0.13
3-To your knowledge, results of teeth whitening last for…? - 6 months to a year - A year to two years - Results are permanent	312 (69.64%) 89 (19.87%) 47 (10.49%)	150 (78.13%) 35 (18.23%) 7 (3.65%)	179 (72.76%) 61 (24.8%) 6 (2.44%)	123 (79.35%) 28 (18.06%) 4 (2.58%)	<0.001
4-The source of your knowledge about tooth discoloration is…? (Multiple choice) - Internet - Dentists - Friends and family - Personal effort	169 (37.72%) 97 (21.65%) 110 (24.55%) 291 (64.96%)	73 (38.02%) 63 (32.81%) 50 (26.04%) 129 (67.19%)	61 (24.8%) 67 (27.24%) 54 (21.95%) 162 (65.85%)	22 (14.19%) 39 (25.16%) 29 (18.71%) 96 (61.94%)	<0.001 0.03 0.35 0.77

As for how long teeth whitening treatment lasts, 18–24-year-old participants answered with "Permanent" (n= 47, 10.49%) (P< 0.001). The internet was the primary source of information in participants aged 18- 24 and 25- 35 years. (Table 7)

Table 8: Responses according to the educational levels (Data are presented as number and percent)

	High school (n= 241)	Bachelor's (n= 649)	Diploma (n= 87)	Higher education (n= 64)	*P*-value
1-What are the types of tooth discolorations?					0.001

- Internal discolorations - Surface discolorations - Both - I don't know	10 (4.15%) 73 (30.29%) 91 (37.76%) 67 (27.8%)	15 (2.31%) 180 (27.73%) 343 (52.85%) 111 (17.1%)	5 (5.75%) 25 (28.74%) 40 (45.98%) 17 (19.54%)	3 (4.69%) 11 (17.19%) 37 (57.81%) 13 (20.31%)	
2-Does your diet affect tooth discoloration - Yes - No - I don't know	208 (86.31%) 9 (3.73%) 24 (9.96%)	585 (90.14%) 28 (4.31%) 36 (5.55%)	76 (87.36%) 5 (5.75%) 6 (6.9%)	58 (90.63%) 1 (1.56%) 5 (7.81%)	0.31
3-Does smoking cause tooth discoloration? - Yes - No - I don't know	234 (97.1%) 3 (1.24%) 4 (1.66%)	633 (97.53%) 7 (1.08%) 9 (1.39%)	84 (96.55%) 0 3 (3.45%)	63 (98.44%) 1 (1.56%) 0	0.61
4-Do teeth change color with aging? - Yes - No - I don't know	117 (48.55%) 64 (26.56%) 60 (24.9%)	371 (57.16%) 128 (19.72%) 150 (23.11%)	49 (56.32%) 8 (9.2%) 30 (34.48%)	43 (67.19%) 11 (17.19%) 10 (15.63%)	0.002
5-Do some mouthwashes cause tooth discoloration? - Yes - No - I don't know	86 (35.68%) 40 (16.6%) 115 (47.72%)	211 (32.51%) 130 (20.03%) 308 (47.46%)	24 (27.59%) 12 (13.79%) 51 (58.62%)	26 (40.63%) 8 (12.5%) 30 (46.88%)	0.23
6-Are there genetic diseases that cause tooth discoloration? - Yes - No - I don't know	91 (37.76%) 34 (14.11%) 116 (48.13%)	277 (42.68%) 91 (14.02%) 281 (43.3%)	34 (39.08%) 14 (16.09%) 39 (44.83%)	35 (54.69%) 4 (6.25%) 25 (39.06%)	0.23
7-Are there types of bacteria that cause tooth discoloration? - Yes	164	445	60 (68.97%)	40 (62.50%)	0.75

- No - I don't know	(68.05%) 5 (2.07%) 72 (29.88%)	(68.57%) 17 (2.62%) 187 (28.81%)	4 (4.6%) 23 (26.44%)	1 (1.56%) 23 (35.94%)	

We compared the participants' responses according to the educational levels. A higher proportion of higher education participants replied that the type of tooth discoloration is both internal and surface discoloration compared to other educational levels ($P< 0.001$). More than half the participants with higher education replied with "Yes" when questioned about teeth discoloration with aging ($P= 0.002$). (Table 8)

Discussion:

This cross-sectional study aimed to assess the population's knowledge on tooth discolorations matters and causes, and their attitude towards the treatments for discolorations. In this study, data was collected through self administered electronic questionnaire which was uploaded online through Google Forms and the link was distributed through different social media. This was considered the best option for mainly two reasons: the first is the fact that this study was conducted during the COVID-19 pandemic and an online survey was the only plausible safe choice for data collection. The second reason was: we wanted to ensure this survey reaches as many people as possible, since we're targeting the general adult population of Saudi Arabia, and there is no method better than doing an online survey, especially in this digital era.

The number of Internet users in Saudi Arabia has increased rapidly in the last years, whereas it has increased from 41% in 2010 to reach 80.4% by the end of 2020 (Communications and Information Technology Commission, 2020). The technology for online survey research is young but evolving. Today, online survey services make web-based studies much easier and faster. Advantages of web based-studies include ease of data collection, automation of data input and handling, minimal cost and time. The participants may find this type of survey more

convenient since they could respond to questions freely and honestly without worrying. However, one should consider the limitations and drawbacks of online studies such as fraud, absence of reviewer and inability of non-internet users to participate.

Patients' subjective evaluation of their teeth color could be influenced by media, cultural background, level of education and socioeconomic status while dentists rely on aesthetic principles for the ideal smile. In the current study, patients appear to be not sufficiently aware about intrinsic teeth discoloration and further educational efforts should be carried out in order to improve their awareness about etiology of intrinsic teeth discoloration. It could be proposed that patients in higher educational levels may have better knowledge than lower levels about teeth discolorations. Patients' knowledge about tooth discoloration seems to be more concentrated on extrinsic etiological factors, while their knowledge about the associated effects of some medications, childhood illnesses, and fluoride concentration on tooth discoloration is generally poor. This finding is expected since the media usually concentrates on the external causes of discoloration and little is shown about intrinsic etiology of tooth discoloration. Fluorosis is a common disorder in Saudi Arabia [10] especially in rural areas, where drinking water contains high levels of fluoride. In this study, only 20% of the patients knew what dental fluorosis is, and 23% of them were aware that excessive fluoride content in drinking water could cause tooth discoloration [11].

Furthermore, very few were aware that some medications could cause tooth discoloration when taken during tooth development. These results emphasize the need to educate patients about the different aspects, medications, and conditions that could affect the teeth during early childhood [12].

In this study, personal effort was the main source of information about tooth discoloration (65%), which is most likely highly influenced by the media, followed by the Internet and dentists, which had comparable percentages**.** Ideally, information should be delivered to patients by dental professionals either at the dental office or through properly oriented media programs. When searching Internet for information about teeth discoloration and treatment options, people find that most of their search results were commercially directed to pages that advertise specific products [13].

In this study, the patients who preferred bleaching performed at the dental office were more than those who preferred it done at home. Their choice was influenced by the fact that in-office bleaching would give fast results and would be under the control and supervision of the dentist [14].

One limitation in this study was the lack of correlation between the socioeconomic status, cultural background and teeth discoloration knowledge and non inclusion of veneer as a treatment option.

Conclusion and Recommendation:

Within the limitations of this study, the level of knowledge about tooth discoloration was more concentrated on extrinsic factors, and the majority of the participants demonstrated poor knowledge about the intrinsic causes of tooth discoloration. The preferred treatment option of teeth discoloration was in office bleaching.

Special education media programs designed by dental professionals should be implemented to increase the general population's awareness of tooth discoloration and treatment options.

COMPETING INTERESTS DISCLAIMER:

Authors have declared that no competing interests exist. The products used for this research are commonly and predominantly use products in our area of research and country. There is absolutely no conflict of interest between the authors and producers of the products because we do not intend to use these products as an avenue for any litigation but for the advancement of knowledge. Also, the research was not funded by the producing company rather it was funded by personal efforts of the authors.

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