

# Parental views on fluoride tooth brushing and its impact on oral health: A cross-sectional study

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## Abstract

**Objective:** This study aimed to describe the current use and knowledge about fluoride toothpaste and children's oral hygiene habits among parents of Saudi children. **Materials and Methods:** In this cross-sectional study, the parents of children aged 7–12 years who visited the undergraduate pediatric dental clinics at the College of Dentistry in Riyadh, Saudi Arabia were interviewed. The interview included questions to assess the parents' level of fluoride knowledge, the dental appearance of their children, and any general dental health concerns and practices. **Results:** A total of 463 parents (women 55.5%, men 44.5%) were included. Over half (60.3%) of the participants reported that they were unhappy with the appearance of their child's teeth. Only 11.5% received high fluoride knowledge scores. The additive index for the level of fluoride knowledge was significantly lower among mothers than among fathers. The majority of the parents were not able to correctly report whether the toothpaste their children used contained fluoride. Furthermore, the majority of the respondents were unaware of the benefits of fluoride in preventing dental caries. **Conclusions:** There is a need to enhance parental knowledge regarding high fluoride intake and its harmful consequences on children's health. Both mothers and fathers should have higher levels of awareness regarding oral health promotion to maintain optimal oral health in their children.

**Key words:** Children, fluoride, oral health, perception, survey

## INTRODUCTION

Fluoride is a mineral that occurs naturally in many foods and water, and can help dental health to a large extent by strengthening the tooth enamel, making it more resistant to tooth decay. Although it provides protection against dental caries, fluoride consumed in large amounts during early childhood can have a negative impact on the teeth by causing dental fluorosis<sup>[1]</sup> and can cause both skeletal fluorosis (more than 6 mg/l) and deformation of bones in children and adults.<sup>[2]</sup> Dental fluorosis is defined as a developmental disturbance of dental enamel

caused by the consumption of excess fluoride during tooth development.<sup>[1]</sup> Whereas the positive effects of fluoride in preventing dental caries are primarily due to its topical effects after tooth eruption, its negative effects are due to systemic absorption during tooth development.<sup>[3]</sup> The levels and duration of fluoride exposure produce clinical results in terms of a patient's oral health.

Dental fluorosis is a developmental disturbance of the dental enamel that is primarily caused by exposure

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to a high concentration of fluoride, especially during tooth development.<sup>[4]</sup> There is evidence to support the hypothesis that exposure to fluoride at higher than the recommended limits will result in tooth enamel defects.<sup>[5]</sup> Dental fluorosis is usually an endemic condition, especially in regions with high fluoride concentrations in the drinking water. The optimal level of fluoride in drinking water is less than 0.9–1.0 ppm.<sup>[6]</sup> It is worthy noting that a child living in an area with a non-fluoridated water supply and low (<0.3 ppm) natural fluoride levels has a risk for developing an early childhood dental decay.<sup>[6]</sup> In addition, the total daily fluoride intake from all sources should not exceed 0.05–0.07 mg F/kg body weight in order to minimize the risk of dental fluorosis.<sup>[6,7]</sup> A mottled appearance of the teeth is common in individuals with dental fluorosis. Mild forms of dental fluorosis manifest as tiny, opaque, white speckles located randomly on the teeth. More moderate forms of enamel fluorosis appear as small white specks.<sup>[7]</sup>

In general, an increase in the opacity of tooth enamel is primarily due to an increase in porosity. The hypomineralized enamel is fragile, which results in damage to the tooth surface.<sup>[3,8]</sup> Prior to the introduction of water fluoridation in the 1960s, diet was the primary source of fluoride exposure worldwide. Other sources include air pollution, toothpaste, mouth rinses, medicines, anesthetics, fluoride supplements, and pesticide and herbicide residues.<sup>[9]</sup> The results of a fluoride mapping study performed in Saudi Arabia by Al-Dosari *et al.*<sup>[10]</sup> indicated that the highest mean fluoride level was in the Hail region, with a value of 1.27 ppm. The majority of the regions (69%) had fluoride levels lower than the recommended level of 0.9–1.0 ppm,<sup>[6]</sup> which indicates that fluoride supplementation through alternative sources may be beneficial in these populations. Another study by the same author<sup>[11]</sup> found that approximately 75% of the population in Riyadh and 6% of the population in the Qassim region were exposed to very low fluoride levels (0.00–0.03 ppm) and that less than 3% of the population in both regions was exposed to suboptimal fluoride levels ranging from 0.61 to 0.81 ppm. A larger percentage of the population in the Qassim region than in the Riyadh region (28.63% vs. 9.24%, respectively) was exposed to relatively high fluoride levels (>0.80 ppm).

Numerous studies have reported the relationships between the prevalence of dental fluorosis and the use of different fluoride sources, such as dietary fluoride supplements (lozenges, tablets),<sup>[12,13]</sup> fluoride

toothpaste, and fluoridated water.<sup>[14–16]</sup> An increase in the consumption of fluoridated water,<sup>[17]</sup> in addition to the use of these supplemental fluoride sources, has increased the prevalence of fluorosis in many countries. McKnight *et al.*<sup>[18]</sup> reported that fluorosis was noticeable and was regarded as unaesthetic, compared with various other dental conditions.

Reports state that moderate to severe forms of dental fluorosis are present among children who are exposed to low fluoride levels.<sup>[19]</sup> Although this level of dental fluorosis is not a major public health concern, efforts should be made to reduce the prevalence of dental fluorosis. In addition, changes in individual perceptions regarding the aesthetic acceptability of enamel fluorosis could influence the implementation of caries preventative measures. When evaluating the level of exposure to fluoride, it is important to consider the different sources of fluoride and their effects on different age groups.

There is evidence to support the hypothesis that although the mild form of dental fluorosis does not cause any major aesthetic problems, the more severe forms can result in emotional distress.<sup>[20]</sup> In a study that evaluated the psychosocial perceptions of dental fluorosis, the majority of the participants reported that individuals with stained teeth lacked social skills and exhibited low intelligence and poor psychological adjustment.<sup>[21]</sup> One study evaluated the perceived oral health status and its relationship with clinically assessed dental fluorosis among schoolchildren in Tanzania.<sup>[22]</sup> The results indicated that more than 50% of boys and 68% of girls were dissatisfied with the appearance of their teeth. Parental education and attitudes regarding fluoride consumption and harmful excessive intake are of great importance. However, there is no study on the parental views of dental fluoride published from Saudi Arabia, to the best of our knowledge.

## MATERIALS AND METHODS

In this cross-sectional study, the parents of children aged 7–12 years who visited the undergraduate pediatric dental clinics at the Riyadh College of Dentistry and Pharmacy were recruited randomly and equally from the three clinical campuses for a 6-month period beginning from October 2011. The three campuses are located in the areas of Riyadh City that have different socio-economic statuses but the same fluoride level in the water. The parents signed written consent forms, and ethical approval for the study was received from the College of Dentistry Research Center (CDRC) at King Saud University (no. NF 2348).

The study participants were interviewed in the waiting area by student interns. The interview included questions aimed at determining the parents' perceptions regarding fluoride and their knowledge about the harmful effects of excessive fluoride intake. An additive index (Qn11–Qn15) was used to measure the levels of fluoride knowledge among the mothers and fathers. A correct answer was coded as one, and an incorrect answer was coded as zero. On the basis of the additive indices, the scales were subsequently categorized into three levels of fluoride knowledge: Low (scores 0–2), middle (scores 3–5), and high (scores 6–7).<sup>[23]</sup>

The participants were asked to report the brand name of the toothpaste that their child had used during the last month. Information available from manufacturers was used to determine whether the reported brand contained fluoride, and this information was recorded as the actual use of toothpaste containing fluoride. The participants were also asked to report the type of toothpaste (fluoridated, non-fluoridated, or unknown fluoride status) that their child currently used, and these responses were recorded as the self-reported use of fluoride toothpaste. The data obtained were analyzed using SPSS 22.0 (Statistical Package for the Social Sciences for Windows®; SPSS Inc., Chicago, IL, USA), with  $P < 0.05$  as the cut-off level for significance.

## RESULTS

More than half (60.26%) of the participants reported that they were not happy with the appearance of their child's teeth in general (but not specifically the appearance related to fluorosis) [Table 1]. When asked about brushing habits, the majority of the participants (65.23%) reported that their child brushed once daily and with parental help only. The amount of toothpaste used varied among the respondents, but the largest group of respondents (47.73%) preferred half the length of the toothbrush bristles. Approximately 30% of the parents reported that their child used fluoride toothpaste. However, based on information obtained from the manufacturers of the toothpaste brands used by the children in the study, 55% were using fluoride toothpaste. More than half (54.3%) of the participants reported not being aware of the use of fluoride in toothpaste.

The majority of the parents (42.9%) who were familiar with the use of fluoride in toothpaste reported that their dentist had informed them of the advantages of the use of fluoridated toothpaste. Less than half (27.86%) agreed with the statement that “fluoride toothpaste is a type of toothpaste that contains fluoride.” Also, 52.23%

**Table 1: The frequency and distribution of oral hygiene habits and fluoride knowledge of parents**

Questions	N	%
Relationship to the child		
Father	206	44.5
Mother	257	55.5
Education of the parent		
Primary	5	1.1
Intermediary	25	5.4
High school	165	35.6
Bachelor's	201	43.4
Master's and above	67	14.5
When was the last time your child visited a dentist (not the current visit)?		
Less than 3 months ago	149	32.2
Three months ago or more	314	67.8
Are you happy with the appearance of your child's teeth?		
Yes	184	39.7
No	279	60.3
Frequency of tooth brushing of the child		
No brushing	23	5
Once per day	302	65.2
Twice per day or more	138	29.8
Do they brush by themselves?		
Self	157	33.9
Assisted	306	66.1
Do you/they brush all the surfaces of each tooth?		
Yes	228	49.2
No	235	50.8
Amount of toothpaste used for brushing (fraction of the head of the toothbrush)		
Less than 1/4	18	3.9
1/4–1/3	41	8.9
1/2	221	47.7
More than 1/2	163	35.2
Full head of the toothbrush	20	4.3
Actual type of toothpaste		
Fluoridated	259	55.9
Non-fluoridated	185	40
Unclear	19	4.1
Self-reported type of toothpaste		
Fluoridated	135	29.2
Non-fluoridated	197	42.6
Do not know	131	28.3
Have you heard about fluoride toothpaste?		
Yes	212	45.8
No	251	54.2
If yes, where have you heard about it?		
Mass media	58	27.4
Oral health education program	25	11.8
Dentist	91	42.9
Friends or relatives	38	17.9
Fluoride toothpaste is a type of toothpaste that contains fluoride		
True	129	27.9
False	236	51

Contd...

**Table 1: Contd...**

Questions	N	%
Do not know	98	21.2
Tooth brushing with fluoride toothpaste can prevent caries		
True	242	52.3
False	205	44.3
Do not know	6	1.3
Tooth brushing with fluoride toothpaste can reverse early-stage caries		
True	198	42.8
False	249	53.8
Do not know	16	3.5
Tooth brushing with fluoride toothpaste can strengthen the resistance of tooth surfaces		
True	108	23.3
False	279	60.3
Do not know	76	16.4
The proper amount of fluoride is helpful, but an excess amount of fluoride may be harmful to health		
True	123	26.6
False	197	42.6
Do not know	143	30.9
The amount of fluoride toothpaste should be less than pea size for young children		
True	233	50.3
False	192	41.5
Do not know	38	8.2

of the participants believed that brushing with fluoride toothpaste can prevent caries; however, 53.78% felt that the use of fluoride toothpaste cannot reverse early-stage caries. Nearly 60% disagreed with the statement that fluoride toothpaste can strengthen the resistance of tooth surfaces. Only one-quarter of the participants felt that the proper amount of fluoride could be helpful to health but that excess fluoride could be harmful to health. Only 11.45% of the parents received high fluoride knowledge level scores [Table 2]. The level of fluoride knowledge was significantly lower among the mothers than the fathers [Table 2]. More mothers than fathers were unaware of fluoride and its positive and negative effects.

## DISCUSSION

The most effective mode of administering fluoride is through the regular use of fluoride toothpastes. Knowledge about fluoride toothpaste among schoolchildren, parents, and schoolteachers has increased over the years.<sup>[23]</sup> However, the present results indicate that parents seem to have low awareness of fluoride and its effects on children’s oral health. The mothers who participated in this study exhibited a significantly lower knowledge level regarding the

**Table 2: Additive index of the fluoride knowledge level for questions 11-17**

Fluoride knowledge	Score	Fathers		Mothers		Total	
		n	%	n	%	n	%
Level	Low (0-2)**	60	29.1	151	58.8	211	45.6
	Medium (3-5)	114	55.3	85	33.1	199	43
	High (6-7)	32	15.5	21	8.2	53	11.5

\*\*P<0.05

effects of fluoride than did the fathers. The majority of the parents were not able to correctly report whether the toothpaste that their children used contained fluoride, which was evident from their responses to questions pertaining to the presence of fluoride in the toothpaste used by their children. The present results from Saudi Arabia are comparable to those reported in a study from Sweden.<sup>[24]</sup> In the study by Jensen *et al.*,<sup>[24]</sup> knowledge, attitudes, and behavior concerning tooth brushing and use of fluoride toothpaste were assessed in three age groups in a Swedish population. In this study,<sup>[24]</sup> a qualitative study design was used with the purpose of achieving a deeper understanding of the issue and pertinent information were collected using questionnaires. The results demonstrated that although participants had little knowledge about the reasons for and techniques of using fluoride toothpaste effectively, they described tooth brushing as important and the habit as a priority.<sup>[24]</sup> Moreover, it is pertinent to mention that in the present study, the knowledge and practice related to the quantity of toothpaste used was not in accordance with the World Health Organization (WHO) recommendations.<sup>[25]</sup> Approximately half of the parents felt that the amount of fluoride toothpaste should be less than the size of a pea for children. These results are in accordance with those of a questionnaire study, in which 3200 individuals from two municipalities in Sweden were included.<sup>[26]</sup> In this study, up to 94% of the respondents had a good toothpaste behavior identified as brushing at least twice a day, using at least 1 cm toothpaste. However, an expert group evaluated scientific reports and concluded that rinsing with water after brushing can reduce the benefits of fluoride toothpaste.<sup>[27]</sup> The majority of the respondents were unaware of the beneficial effects of fluoride in preventing dental caries. Many of those who were aware of these beneficial effects reported having gained this knowledge from their treating dentists, reinforcing the role of dentists in spreading awareness of the beneficial effects of fluoride among the population. Dental professionals should emphasize the appropriate use of fluoride to prevent caries while avoiding moderate/severe fluorosis.<sup>[14]</sup> Furthermore, it is evident that the



consumption of excessive fluoride is associated with acute and chronic toxicity. It affects several organs: Brain, bones, kidney, teeth, and thyroid. In India, the harmful effects on body, such as deformation of bones in children and adults, are reported in areas of high fluoride consumption.<sup>[2]</sup>

The advantages of fluoride use, especially in reducing the incidence of caries, need to be appreciated and compared with its negative effects.<sup>[28,29]</sup> The use of fluoride toothpaste can reduce the incidence of caries by 25%, compared with the use of non-fluoride toothpaste.<sup>[30]</sup> It has also been reported that usage of a small amount of water after brushing prolongs the retention time of fluoride in saliva and strengthens the anti-caries benefit of fluoride toothpaste.<sup>[31]</sup> Although a lack of fluoride intake does not produce caries, fluoride does help inhibiting the disease. Fluoride can reverse tooth decay, despite the reported parental belief that fluoride does not have this effect. This result highlights the level of ignorance among parents regarding the importance of fluoride in their children's dental health. Most parents also incorrectly believed that fluoride does not improve the condition of the teeth. Although too much fluoride can lead to weakening of the bones, including teeth, sufficient amounts contribute to strengthening the teeth and preventing dental caries. Thus, it is important to increase the awareness of the benefits of fluoride and to educate the population on the correct use of an adequate quantity of fluoride. The government and other stakeholders should also participate in the education process.

The relatively simple interview used in this study was assumed to be an adequate means of determining parental concern about the appearance of their child's teeth. The authors hypothesize that an increased knowledge about the benefits of fluoride toothpaste could positively affect an individual's behavior when using fluoride toothpaste. On the basis of this research, we conclude that there is a need to increase parental knowledge of oral hygiene methods among both mothers and fathers. There is also a need to enhance parental knowledge regarding excessive fluoride intake and its harmful consequences in children's health. Both parents need a greater level of awareness regarding oral health promotion to facilitate their role in the oral health of their children. Further research is necessary to determine the levels of awareness of the proper use of fluoride and attitudes toward fluorosis in populations that are exposed to particularly high levels of environmental fluoride.

## CONCLUSIONS

The level of knowledge about fluoride and its effect on children's oral health is poor among parents. Mothers had a significantly lower knowledge level regarding the effects of fluoride. The majority of the parents were not able to correctly report whether the toothpaste their children used contained fluoride. Furthermore, the majority of the respondents were unaware of the benefits of fluoride in preventing dental caries. There is a need to enhance parental knowledge regarding high fluoride intake and its harmful consequences on children's health.

Both mothers and fathers should have higher levels of awareness regarding oral health promotion to maintain optimal oral health in their children. Further research is recommended to explore the association between perceptions of fluorosis and exposure to high environmental fluoride levels, with the role played by parents in preventing this condition.

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## Conflicts of interest

There are no conflicts of interest.

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