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Original Article

Prevalence of Dental Fluorosis Amongst Patients Attending the Tertiary Care Hospital, Peshawar, Pakistan

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ABSTRACT

Pakistan is a developing country where peoples drink any available water. In Pakistan water sources are limited and drinking water contains a high level of fluoride, which causes both dental and skeletal fluorosis. **Objectives:** To evaluate the prevalence of dental fluorosis among patients who visits the tertiary care hospital, Peshawar, and to assess the level and distribution of fluorosis. **Methods:** The study was carried out at the Dental unit of Khyber Teaching Hospital Peshawar, from January 2021 to December 2021. All the samples were collected after the research was approved by the ethical committee. Written informed consent was taken from all the participants prior to collecting the data. Moreover, Dean's Fluorosis Index was used to rank the extent of Dental Fluorosis. For statistical analysis SPSS, version 26 was used. **Results:** Among 2433 participants, females 1451/2433(59.6%) were more as compared to male (n=982/2433 (39.3%) while the dental fluorosis was more prevalent in males 414/982 (42.1%) as compared to females 568/1451 (39.1%) The fluorosis was more prevalent in the age group 11-20 year 874 (89%) while only two individuals were found with dental fluorosis in age groups more than 40 years. In addition, the participants who used tap water were more affected with dental fluorosis 568 (56.9%), while the incidence of fluorosis was less in individuals drinking treated as well as other sources of water 2 (1.2%). Furthermore, 620 (63%) individuals were found with local fluorosis, while 362 (37%) were found with generalized fluorosis. According to Dean's Fluorosis Index 365 (15%) of individuals were found with very mild fluorosis while only 37 (1.5%) individuals were affected by a severe type of fluorosis. **Conclusions:** In this study, the fluorosis incidence in Pakistan was prevalent and needs continual monitoring, and sources contributing to total fluoride intake in Pakistan need further investigation. Furthermore, for fluorosis prevention education and community awareness are necessary, and prompt conciliation to relegate the effects on dental health.

INTRODUCTION

The element fluorine is a natural element found in many minerals. Its quantity in drinkable water may increase due to meteorological events and volcanoes [1]. For teeth, bones, and other hard tissues, fluorine is vital to the mineralization process. Dental formation and normal bone mineralization require small quantities of fluorine. Foods such as seafood, cheese, and tea contain fluorine. Experiencing high fluoride concentrations for an extended period of time leads to toxicity, and elevated serum fluoride concentrations can weaken the skeletal system [2,3]. Overexposure to fluoride can cause a sluggish, but progressive disease called fluorosis [4], which is reduced by drinking milk. In many Asian countries, it is considered a major health threat [5]. Studies have shown little connection between fluorosis and periodontal health, but there are some epidemiological studies reporting high levels of inflammation in fluorosis areas as compared to non-fluorosis areas [6]. Some studies do not show any

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relationship between fluoride and periodontal health [7], whereas other studies show better periodontal health in high fluoride areas [8]. Recent studies demonstrate that the presence of fluoride ions reduces bacteria and microbes, which has an indirect effect on the periodontal status by reducing inflammation, similar to nutraceuticals, TGF-β (transforming growth factor-β), VEGF (vascular endothelial growth factor), and ADMA (asymmetric dimethylarginine). Having an adequate ionic level of fluoride in saliva reduces enamel demineralization [9]. The WHO recommends that the fluoride level is highest level must not surpass 1.5 mg/l to prevent bone and tooth issues. In dental fluorosis, the fluoride persistency affects both tooth appearance and formation. Mineralization and enamel development are disrupted both intracellularly and extracellularly by fluorosis [10], and the presence of such lesions are linked to the consumption of substantial amounts of fluoride within the critical phase (postsecretory or early maturation) when the actual growth of the tooth comes about. Microscopically, fluorosis damages enamel by making it porous. In consequence, if there is a high level of fluoride, the enamel will be more porous [11]. Porosity increases as the inter-crystalline space increases [12]. The structural arrangement of enamel crystals is normal but the inter-crystalline space is increasing [13]. These symptoms are associated with other systemic diseases according to many epidemiological studies [14]. The susceptibility and severity of dental fluorosis varied from population to population. Genetic variations may play a role in this. A Matrix Metallo Protease (MMP20) gene variation was associated with the less severe phenotypes of dental fluorosis in populations with high exposure to fluoride in drinking water. Children can develop fluorosis from infancy to the age of eight years, and they can experience aesthetic issues with their teeth from birth to six years of age. Premolars are typically more susceptible to the problem and sustain a greater amount of damage [15]. The clinical presentation of enamel fluorosis is often characterized by white spots or lines on the tooth's surface, or by a white sheet of parchment. Food consumption has sometimes been associated with persistent fluorosis, and brown stains can develop due to the absorption of extrinsic stains. Fluorosis, particularly at higher fluoride doses accompanied by intrinsic stains, is also associated with discrete pitting. The severity and distribution of fluorosis vary [16]. In mild cases, teeth that are in the posterior part of the mouth are less likely to need treatment, but in certain cases, especially those that are within the aesthetic limit, treatment is required. Treatment options include microabrasion technique and bleaching or resin covering, or full or partial coverage (veneer, full crown, etc.) [16]. There is still no clear evidence of any significant relationship between dental caries, fluoride and fluorosis in patients. This area requires further investigation. Fluoride concentration is not monitored in the drinking water in Pakistan, where the issue is prevalent. This study is aimed at observing the fluorosis incidence among Pakistan residents and comparing the results with those of previous studies conducted in the alike and surrounding regions to ensure or deny the motif that occurred in recent years with elevated fluoride consumption in toothpaste, food and fertilizers etc.

METHODS

The study comprised of 2,433 participants in Peshawar, Pakistan who were seeking the dental care unit of Khyber Teaching Hospital from January 2021 to December 2021. Patient consent was obtained in written form by the operator. During the course of 12 months, multiple dentists performed examinations. Through the use of a uniform index and by using patients sample reexamined by numerous dentists, we standardized and calibrated the learning and examination procedures among the examiners. Additionally, a month after, the same patients were reassessed by a similar dentist, who was previously examined to ascertain reliability. During a questionnaire, patients submitted demographic information including their names, ages, genders, social security numbers, and water source. Keeping in view the standard guidelines of infection control, for evaluation, we use a mouth mirror, all recordings were collected in natural daylight. To assess dental fluorosis, we used the revised Dean's Fluorosis Index [17].

i. An unaffected tooth appears to have translucent enamel, and a smooth, glossy surface. This type of tooth is white or pale in color.

ii. Questionable. The enamel in this instance shows some changes from that discussed above. Occasionally, a white spot or fleck may be visible on the enamel. It was designed to apply in cases where "definitive determination of mild fluorosis was not justified and a classification of unaffected was not justified."

iii. Very mild. “On some tooth surfaces, small opaque paper-white areas are visible, but they do not cover more than 25% of the tooth surface.”

iv. Mild: "This white opaque area is more extensive than 50% of the surface but is not as extensive as a smear."

v. Moderate: White opaque patches cover 50% of the surface.

vi. Severe: The entire enamel of the tooth is affected. A discrete or confluent pit can be seen in this category.

The statistical analyses were done using SPSS 26 (Chicago, IL, USA), a statistical package for social science. Additionally, the study employed descriptive statistics to

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examine the occurrence, risk factors, and severity of dental fluorosis.

RESULTS

Out of 2,433 participants, 982(40.4%) were males and 1,451(59.6% were females. The prevalence of Fluorosis was 982 (40.4%), and the majority of these were males 414/982 (42.1%) as compared to females 568/1451 (39.14%) (Table1). The prevalence of fluorosis is highest among individuals aged 11-20 years 874/982 (89%) while only two individuals aged over 40 years had dental fluorosis (Table 2). Fluorosis can also affect people who drink water from various sources. Fluorosis is significantly more common in those who drink tap water 568 (56.9%), whereas people who drink treated or other sources of water were 2 (1.2%) (Table. 3). Moreover, depending on the location, 620 (63.1%) individuals were found with localized fluorosis while 362 (36.9%) were found with generalized one (Table. 4). Only 37(1.5%) individuals were affected by severe types of fluorosis, according to Dean's Fluorosis Index (Table 5).

	Male	Female	Total
Fluorosis	414 (42.1%)	568 (39.14%)	982 (40.4%)
No Fluorosis	568 (57.9%)	883 (60.8%)	1451 (59.6%)
Total	982 (100%)	1451 (100%)	2433 (100%)

Table 1: Gender Wise incidence of Dental Fluorosis

Age Groups	No Fluorosis	Fluorosis	Total
11-20 years	590	874 (89%	1464
21-30 years	417	91 (9.3%)	508
31-40 years	290	15 (1.5%)	305
>41 years	154	02(0.2%)	156
Total	1,451 (59.6	982 (40.4%)	2,433 (100%

Table 2: Age Group wise distribution of Dental Fluorosis

Fluorosis status	Tap Water	Treated Water	Well, / hand plumb Water	Mixed	Total
No Fluorosis	430(43.1%)	688(71.1%)	171(56.4%)	162 (98.8%)	1451(59.6%)
Fluorosis	568(56.9%)	280(28.9%)	132(43.6%)	2(1.2%)	982(40.4%)
Total	998(100%)	968(100%)	303(100%)	164(6.7%)	2433(100%)

Table 3: Sources of Drinking Water and Distribution of Fluorosis

Fluorosis Status	Localize	Generalize	Normal	Total
No Fluorosis	0	0	1451	1451
Fluorosis	620 (63.1%)	362 (36.9%)	0	982
Total	620	362	1451	2433

Table 4: Location-based distribution of Dental Fluorosis

	Fluorosis Index						
	Normal	Questionable	Very Mild	Mild	Moderate	Severe	Total
Percentages	1451 (59.6%)	275 (11.30%)	365 (15%)	204 (8.4%)	101 (4.2%)	37 (1.5%)	2433 (100%)

Table 5: Dean's Fluorosis Index and Distribution of Dental Fluorosis

DISCUSSION

This study evaluated the incidence of fluorosis in Peshawar, Pakistan and the distribution of fluorosis by gender, source of drinking water, as well as the effect of these factors on its extent and influence. It isn't surprising that fluorosis is on the rise with the increase of the contents in drinking water. Furthermore, fluorosis rates were high in optimal areas. Despite this finding, the incidence of fluorosis was similar in this study to research in Mexico and America, showing an increase in fluorosis incidence [18]. The water source in this area has not undergone any major improvements. The number stood at 80% in 1989, according to Fraysse et al. That is a significant difference from the results documented in the study under discussion. Based on data from other South Asian countries, in the current study the fluorosis incidence variate apparently. According to Rugg-Gunn et al., a study conducted on in Riyadh revealed 83% enamel mottling among participants [19]. Among Saudi Arabian school children, Akpata et al. found a result of 90% [20]. When looking at fluoride deficient areas in Kuwait, Vigild et al. revealed a 6% prevalence [21]. That is significantly lower than the results of this study. There is an endemic of dental fluorosis in Sudan. The problem persists regardless of the level of fluoride in the area. A study conducted by Ibrahim, et al. found that results for low areas ranged from 91% to 100%, while results for high ones were 100% [22]. A difference in prevalence may be due to different diagnostic criteria, sampling methods, or quantities of fluoride consumed from different sources. It appears that fluorosis is on the rise today compared to the period between the 1940s and 2010s [23]. When it comes to climate changes and seasons, temperature variation has an impact on severity. Whenever the temperature reaches a high point, that is also when the water intake rises [24]. If temperatures rise to a mean of 23°C, children may also drink more water. The simplest way to handle temperature extremes is to consume water, as it is inexperienced and readily available, unlike other solutions. The consumption of substances by children may be influenced by this aspect. Fluorosis severity and prevalence are impacted by this factor significantly. Fluorides are released as solids and gases in industrial zones. Particles are formed when they are in solid form, while gases are produced when they are in the gaseous state. The respiratory system of humans can eventually be affected by plants' fluoride particles on its surface or by plants that have absorbed it as a gas. The majorities of Pakistanis are poor and belong to lower-income groups. In liquids, after water the children mostly consume tea and they consume it in large quantities. Children will consume more fluoride if this is the case. According to Fraysse, the high mean temperature of the study was related to the 80% result, as it caused an increase in water intake and therefore supplement the

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fluoride intake [25]. Adding tea to a child's diet on a daily basis can add up to 2.7 milligrams of fluoride to their diet. Studies have shown that females are more vulnerable to fluorosis than males. Additionally, fluorosis is most prevalent among 12-to 20-year-olds [26]. In addition to causing enamel pitting and porosity, fluorosis alters tooth surfaces, causing germs to adhere, resulting in gingival inflammation, and the formation of hyper-cementosis in roots can hamper scaling and root planning [27]. By reducing bacteria growth and gingival inflammation, optimal fluoride levels have a positive impact on periodontal health . Patients with dental fluorosis can be well aware of its cosmetic effects according to severity and location. Many studies regarding treatment for edentulous teeth still have some controversy with alternatives ranging from conservative measures (like micro-abrasion and bleaching)to non-conservative measures(like veneers and full crowns). Finally, there are alternatives (like resin coatings) or even no treatment at all for patients with mild cases or when the affected teeth are away from the aesthetic zone[29].

CONCLUSION

It is concluded that the prevalence of fluorosis in Pakistan must be monitored continuously, and its sources must be investigated further. Fluoride intake is primarily caused by drinking water, but we must also consider other sources like toothpaste and industrial wastes and pollution. To reduce the effects on dental and periodontal health, fluorosis prevention education and community awareness are essential.

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