

# Caries with Dental Fluorosis and Oral Health Behaviour Among 12-Year School Children in Moderate-Fluoride Drinking Water Community in Quetta, Pakistan

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## ABSTRACT

**Objective:** To determine the prevalence of dental caries and its relationship with dental fluorosis, oral health behaviour and dietary behaviour among 12-year school children in moderate-fluoride drinking water community in Quetta, Pakistan.

**Study Design:** Cross-sectional study.

**Place and Duration of Study:** Government and private schools of Quetta, from November 2012 to February 2013.

**Methodology:** A total of 349 children aged 12-year from 14 randomly selected schools were included. The data collection was done on questionnaire designed for children. Dental caries status was examined by using WHO criteria.

**Results:** Dental caries was found in 81 children (23.2%) with mean DMFT 0.61. Boys had 1.6 times more chance to have dental caries than girls. Dental fluorosis was found in 63.6% of children with majority of moderate degree (50.5%). Dental fluorosis status was found significantly associated with dental caries status in children. The children who had mild, moderate and severe fluorosis, had 4 times more chances to develop caries than those who did not have fluorosis. There was no significant association between children's caries status and use of paste, brushing habit, miswak, and visit to the dentist. The use of pastries and juices had a direct relation with the children's dental caries status.

**Conclusion:** Dental caries in children of Quetta is not so much frequent as compared to the fluoride deficient countries. However, the high prevalence of moderate dental fluorosis and consumption of pastries and juices resulted in dental caries.

**Key Words:** Dental caries. Oral health behaviour. Dental fluorosis.

## INTRODUCTION

Dental caries is one of the most common dental public health problems throughout the world.<sup>1</sup> The prevalence of dental caries is expected to increase in developing countries due to inadequate oral health services, limited access to the healthcare facilities, illiteracy and sweets consuming behaviour.<sup>2</sup> Rehman *et al.* found strong correlation of dental caries with snacking in between meals and frequency of sugar intake, while oral hygiene index had no correlation with decayed, missed and filled teeth (DMFT).<sup>3</sup> The prevalence of dental caries seems to be high in countries with inadequate fluoride contents in drinking water and other food materials. The countries like Japan, Norway and Iceland, where no water and salt fluoridation done, had DMFT of 1.7, 1.7 and 1.4, respectively.<sup>4</sup>

Khan *et al.* found fluoride in drinking water of Quetta,

Pakistan at a level 0.91 ppm (recommended level 0.35 ppm),<sup>5</sup> and fluorosis in 65% and DMFT 0.60 in 12 years school children. Siddiq *et al.* in his study in Harnoli Pakistan revealed that prevalence of fluorosis was 98% and DMFT recorded was 3.3.<sup>6</sup> Moderate to severe fluorosis was observed in 62% and the mean DMFT recorded in this group was 5.0. In 2008, Shekar *et al.* revealed highest dental caries prevalence (71.3%) in below optimal fluoride area and the lowest caries prevalence (24.3%) in optimal fluoride area;<sup>7</sup> however, dental caries prevalence (68.1%) was recorded in very high fluoride area. In Malaysia, dental fluorosis prevalence was (46%), while dental caries prevalence was 48% in water fluorinated area and as well as with provision of dental healthcare facilities.<sup>8</sup> Leuckel *et al.* reported that ingestion of naturally fluorinated water in Iran seems to have negligible effect on caries prevention but resulted in high prevalence of dental fluorosis.<sup>9</sup>

In our region, the fluoride concentration in drinking water is 0.91ppm, while the recommended level is 0.35 - 0.40 ppm.<sup>5</sup> The DMFT recorded was 1.38.<sup>10</sup> There are certain other factors which need to be addressed. The present study designed to explore the caries experience, dental fluorosis, oral health behaviours, and dietary behaviour among 12-year-old school children in moderate-fluoride drinking water community in Quetta, Pakistan, and determine association between caries and fluorosis.

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## METHODOLOGY

This cross-sectional study on 12-year school children was conducted in Quetta, Pakistan, from November 2012 to February 2013. The 2008 population census of Quetta was recorded to be 1.14 million.<sup>11</sup> The registered government schools in Quetta district was 478. There were 79,012 boys and 61,558 girls (total 140,570) in government schools; while private schools had 35,092 boys and 14,457 girls (total 49,549).<sup>12</sup> The sample size calculated was 349.<sup>13</sup>

A stratified two-stage cluster sampling was performed to select children from government and private schools. The government and private schools ratio was 2.5:1, therefore 10 government and 4 private schools were randomly selected. Simple random sampling was performed to select government school students (n=249) and private school students (n=100). The government schools boys and girls ratio was 0.9:1, while private schools had 1.17:1. The sample selection was made randomly by 5 boys and 5 girls of government schools with selection of 124 boys and 125 girls randomly; while from 4 private mix schools, 54 boys and 46 girls were randomly selected. Twenty-five students were selected from each school, except 24 students from one government boys school.

This study was done under the guidance of Community Dentistry Department, Faculty of Dentistry, Mahidol University. The approval for study was taken by the Institutional Review Board (MU-DT/PY-IRB 2012/062.2012), while school permission was taken from director of schools. The data collection process was preceded by the procedure of informed consents from parents and child assent form. The selected children were briefed about the study plan of oral examination and questionnaire administration. The assent form was signed by the willing children. The information collected was kept confidential. The study participants were 12-year children both from government and private schools from Quetta, Pakistan. Children with known chronic diseases like hemophilia, leukemia and diabetes mellitus were excluded.

The data collection procedure was face-to-face interview and oral examination of children performed by the investigator. The oral examination under good sunlight was performed using WHO recommended dental probe and dental mirror. The number of tooth decay, filled and missed in each quadrant was recorded. The dental caries were examined by WHO criteria. Significant caries index (SiC),<sup>14</sup> was calculated in three steps. In the first step, the DMFT values of every study participant was recorded. Then, one-third participants with highest caries scores were selected. Finally, subgroups mean DMFT was calculated. The teeth were examined for dental fluorosis, according to Dean's Index.<sup>15</sup> The statistical tool (SPSS version 18) was used for data

analysis. Descriptive statistics were used to determine frequency and percentage distribution of gender, food and drinking habits, oral health behaviour, dental fluorosis, dental caries, DMFT and SiC. Bivariate analysis including odd ratio, confidence interval and Chi-square test were used to determine the association among the dental behaviour, dietary factors and dental caries. The level of significance was < 0.05.

## RESULTS

This study was conducted on 12-year school children of both genders in equal proportion. The government school children constituted about 71%, while private school children were 29%. The educational status of parents were mostly primary school level [143 fathers (41%) and 205 mothers (58.7%)] followed by high school level [114 fathers (32.7%) and 103 mothers (29.5%)] respectively. The monthly family income of 15,000-30,000 Pak rupees (150 - 300 \$US) was recorded in approximately half of the families (n=179, 51.3%). Tubewell was the main source of drinking water in almost all participants.

Eighty-one children (23.2%) had dental caries with mean DMFT 0.61, ranging from 0-6. The significance of caries (SiC) was 1.86. Two hundred and twenty-two children (63.6%) had dental fluorosis. The majority of children had moderate fluorosis (50.45%) followed by mild fluorosis (43.24%), and severe fluorosis in 3.2%. The community fluoride index was 1.6. The daily routine of cleaning the teeth, once a day in the morning, was found in 313 children (90%). Use of brush and paste for cleaning the teeth was recorded in majority of children (n=324, 93%). The habit of using *Miswak* weekly was recorded in 146 (42%) children. The majority of children rarely used or some children never used dental powder, dental floss and chewing gum. The knowledge and awareness of use of fluoride containing toothpaste was lacking in majority of children (335, 96%). There was no significant association between children's caries status and brushing habit, use of paste, *Miswak*, and visit to the dentist, as shown in Table I.

Eating bread/chapati, biscuits and cake, daily was recorded in 325 (93%), 293 (84%) and 268 (77%), respectively. Vegetables and dry fruits were consumed daily by children at 222 (64%) and 232 (67%), respectively. Majority of the children disliked non-sweet milk and rarely consumed it. The most frequently daily routine of drinking recorded was milk-tea by 265 (76%), green tea by 205 (59%), and black tea with sugar by 195 (56%). Fresh juice drinking was recorded in 145 (42%) children daily. The children who weekly-daily consumed fresh juices and pastries had 1.7 times and 1.68 times more likely to have dental caries than those who reported never or rarely consumed it, respectively. The dental caries status had no significant association with dietary factors (Table II).

Forty-nine (27.5%) male and 32 (18.7%) female school children had dental caries. The male children had 1.6 times more chance to have dental caries than female children (95% CI: 1.0-2.73). One hundred and forty (78.7%) male and 82 (48%) female school children had dental fluorosis. The males had 4 times more fluorosis than females (95% CI: 2.50-6.40). School types (government and private) were not significantly associated with children's fluorosis (p= 0.692) and caries

status (p= 0.536). Mild, moderate, and severe fluorosis was found in 215 (61.60%) followed by very mild type of dental fluorosis in 7 (2.00%), while 127 (36.4%) had no fluorosis. The children who had mild, moderate, and severe fluorosis had 4 times more chance to develop caries than those who did not have fluorosis (normal teeth). Dental fluorosis status was found significantly associated with dental caries status in these children. The children who had very mild fluorosis had 1.46 times more chances to develop caries than those who did not have fluorosis (normal teeth), but it was found insignificant.

**Table I:** Dental caries association with oral health behaviours among 12-year-old school children (n=349).

Oral health behaviour	Caries		OR	95%CI	p-value
	Yes	No			
Use of Miswak					
Weekly-daily	35 (22.2%)	123 (77.8%)	0.9	0.54-1.48	0.67
Never-rarely	46 (24.1%)	145 (75.9%)			
Brushing habits					
Regular	75 (22.9%)	252 (77.1%)	0.79	0.30-2.10	0.641
Not regular	6 (27.3%)	16 (72.7%)			
Use of paste					
Regular	74 (22.6%)	254 (77.4%)	0.58	0.227-1.50	0.257
Not regular	7 (33.3%)	14 (66.7%)			
Visit to dentist					
No	67 (24.6%)	205 (75.4%)	1.47	0.77-2.79	0.237
Yes	14 (18.2%)	63 (81.8%)			

**Table II:** Dental caries association with dietary factors in 12-year-old school children (n=349).

Oral health behaviour	Caries		OR	95%CI	p-value
	Yes	No			
Pastries					
Weekly-daily	33 (29.7%)	78 (70.3%)	1.68	1.00-2.81	0.049
Never-rarely	48 (20.2%)	190 (79.8%)			
Fresh juice					
Weekly-daily	59 (26.8%)	161 (73.2%)	1.78	1.03-3.0	0.03
Never-rarely	22 (17.1%)	107 (82.9%)			
Pack juice					
Weekly-daily	47 (22.2%)	165 (77.8%)	0.86	0.5-1.4	0.56
Never-rarely	34 (24.8%)	103 (75.2%)			
Black Tea					
Weekly-daily	58 (24.0%)	184 (76.0%)	1.15	0.6-1.9	0.61
Never-rarely	23 (21.5%)	84 (78.5%)			
Milk tea consumption					
Weekly-daily	65 (22.4%)	225 (77.6%)	1.28	0.6-2.4	0.43
Never-rarely	16 (27.1%)	43 (72.9%)			
Sugar sweeten tea					
Weekly-daily	50 (21.4%)	184 (78.6%)	0.74	0.4-1.2	0.24
Never-rarely	31 (27.0%)	84 (73.0%)			
Dry fruit					
Weekly-daily	69 (22.8%)	233 (77.2%)	0.86	0.4-1.7	0.68
Never-rarely	12 (25.5%)	35 (74.5%)			
Citrus fruit					
Weekly-daily	9 (31.0%)	20 (69.0%)	1.55	0.67-3.5	0.29
Never-rarely	72 (22.5%)	248 (77.5%)			
School lunch					
High sweeten	11 (28.9%)	27 (71.1%)	0.73	0.33-1.5	0.37
Low sweeten	70 (22.5%)	241 (77.5%)			

## DISCUSSION

In the present study, dental caries was recorded in 81 children (23.2%) with mean DMFT 0.62. The significance of caries (SiC) was 1.86. The caries prevalence in this study was much lower than in previous study of fluorosis-endemic children.<sup>7</sup> The low level of dental caries is due to natural protection of high level of fluoride contents in the drinking water.<sup>5</sup> Baloch found that 81% of 12-year children in Quetta had dental caries with DMFT of 1.38.<sup>10</sup> In the present study, boys were 1.20 times (95% CI=1.03-1.41) more likely to have dental caries than girls. Similar results were found in other studies; while Rehman found that female students had significantly higher prevalence of caries than males.<sup>3</sup>

Dental fluorosis among the study participants was recorded in 63.6% children. Moderate fluorosis was observed in 50.45% followed by mild fluorosis in 43.24%. The community fluoride index was 1.6. The source of community drinking water was from the tube-well (97.3%), which contained very high fluoride level (0.91 ppm), which could be related to dental fluorosis among children. Children who had mild, moderate, and severe fluorosis had 4 times more chance to develop caries than those who did not have fluorosis (normal teeth). In our society, the knowledge and awareness regarding the dental caries and fluorosis among children are low. Esa found a high prevalence of low to moderate caries in children with mild fluorosis.<sup>8</sup> Similarly in 2008, Shekar recorded high dental caries (68.1%) in very high-fluoride area.<sup>7</sup>

The use of brush and paste once a day was the most frequent habit among the children, however only a few children (4%) brushed twice a day. Peterson also found low percentage of children (22%) with twice brushing habit.<sup>16</sup> Majority of children had no knowledge of use of fluoride containing paste. The regular practice of oral health behaviour regarding brushing, use of paste and visit to dentist had less dental caries.

The use of pastries and juices has a direct relation with the children's dental caries status. In our society, children are very fond of these items. In a previous study by Abdullah,<sup>17</sup> candies, bread and sugar-sweetened tea

were related with dental caries in Pakistani children. In the present study, 77.9% of children never visited the dentist, which was higher than a survey by Baginska,<sup>18</sup> who found that 42.8% never visited the dentist at the age of 3 - 4 years. The large number of children who never visited the dentist in this study may be due to the low educational level of parents in this study, unable to bear the cost of dental treatment, and the limited provision of state dental healthcare facilities in Balochistan.<sup>15</sup>

In the present study, the knowledge of caries was limited. The main source of knowledge was television (41%), parents (29%), and friends or relatives (14%). In a study conducted by Baginska, the knowledge of caries was received from dentists (82.1%), magazines (65.7%), and educational books (45.0%).<sup>18</sup> Even though the best knowledge may be provided by the dentist because he/she has the technical knowledge about the dental issues as compared to others, but the chance to receive information from dentists is low due to few dental visits in our society. The dentists and oral hygienists may advocate and involve more in mass media campaign in order to disseminate the information about dental caries and oral healthcare.

The present study on 12-year school children highlighted few common possible etiological factors of dental caries. The role of hereditary factors, microbacteria and saliva in dental caries were not discussed. The study, conducted on 12-year school children of Quetta city in few government and private schools, was not generalized for making a uniform policy to all 12-year Pakistani children. However, the present study described the behaviour and dietary factors associated with dental caries. The association of dental caries and fluorosis was also highlighted. The results and inferences drawn by the study will definitely help streamline the possible strategy in starting the primary prevention campaign against the dental caries in future.

## CONCLUSION

The children who had mild, moderate, and severe fluorosis had four times more chance to develop caries than those who did not have fluorosis. Dental caries had no association with brushing habit, use of paste, use of *Miswak*, and dental visit. Children's dental caries was associated with habit of daily consumption of pastries and fresh juices. Mild, moderate, and severe dental fluorosis also had a significant association with dental caries.

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