

## Caries prevalence among secondary school children in Riyadh and Qaseem

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هدفت الدراسة إلى وصف معدل انتشار النحر وشدته بين أطفال المرحلة الثانوية في منطقتي الرياض والقصيم، والربط بين شدة الإصابة ومستويات الفلور في مياه الشرب. شملت الدراسة ٧٣٤ من أطفال المدارس من مناطق تختلف فيها مستويات الفلور في مياه الشرب. بلغ عدد المشاركون في منطقة الرياض (٢٣٦ ذكراً و١٩٣ أنثى) وفي منطقة القصيم (١٦٣ ذكراً و١٤٢ أنثى). جرى فحص المشاركون باستخدام معيار منظمة الصحة العالمية لتشخيص النحر السنوية. بلغ معدل انتشار النحر في مدينة الرياض ٩١,١٪ وفي القصيم ٩٠,٥٪. بلغ متوسط نتيجة (نخر - فقد - حشو - معالجة) في مدينة الرياض ٧,٣٥ (انحراف معياري ٤,٩) حيث معدل (٤,٥٨) وحيث معدل نخر ٦,٠٢ وفقد ٠,٤٦. وحشو ٠,٥٦. لم يلاحظ أي اختلاف جوهري في متوسط نتيجة (نخر - فقد - حشو - معالجة) مع الاختلاف في مستوى الفلور في مياه الشرب. وعلى كل حال لوحظت قيم منخفضة من نتيجة (نخر - فقد - حشو - معالجة) ضمن مستويين من الفلور (٠,٨ - ٠,٦١ جزء بالمليون و ١,٥ - ٠,٨١ جزء بالمليون). وقد استنتج أن معدل انتشار النحر كان مرتفعاً جداً بين الطلاب المشمولين بالدراسة في منطقتي الرياض والقصيم، وعلى كل حال، لم تلاحظ أية علاقة خطية بين شدة الإصابة بالنحر النسبي ومستوى الفلور في مياه الشرب.

The aim of this study was to describe the caries prevalence and severity in secondary school children in Riyadh and Qaseem regions and, to correlate caries experience with fluoride levels in the drinking water. A total of 734, 15- to 19-year-old (Mean 16.4, SD 1.2 years) secondary school children from areas of various water fluoride levels were examined in Riyadh (236 male and 193 female) and Qaseem (163 male and 142 female), utilizing the World Health Organization (WHO) criteria for the diagnosis of dental caries. Results showed the prevalence of dental caries as 91.1% in Riyadh and 90.5% in Qaseem. The mean DMFT score in Riyadh was 7.35 (SD 4.99), with D component of 6.28, M component of 0.32 and F component of 0.75. The mean DMFT score in Qaseem was 7.05 (SD 4.58) with D component of 6.02, M component of 0.46 and F component of 0.56. The overall data showed no significant difference ( $P > 0.05$ ) in mean DMFT scores at various fluoride levels. However, low values of DMFT were found in two fluoride zones (0.61 - 0.80 ppm and 0.81 - 1.50 ppm). It was concluded that the caries prevalence was very high among the students studied in Riyadh and Qaseem regions. However, there was no linear correlation between the caries experience and water fluoride level in both Riyadh and Qaseem regions.

### Introduction

The role of fluoride in the prevention of dental caries is very well established.<sup>1,2</sup> Dean *et al.*<sup>3</sup> in 1942 reported an inverse relationship between caries prevalence and drinking water fluoride levels. Since then, a large number of studies have confirmed the beneficial effects of fluoride in the drinking water.<sup>4-7</sup>

Recent studies have reported an alarmingly high caries prevalence in Saudi preschool, primary and intermediate school children.<sup>8-10</sup> However, there have been no reports on the caries prevalence and severity in secondary school children aged 15-19 years.

A study was recently conducted to determine the fluoride level of drinking water in Riyadh and Qaseem regions, and fluoride levels were found to be between 0.00 and 6.2 parts per million (ppm).<sup>11</sup> An additional component of the survey was the examination of secondary school children for dental caries. The objective of this paper was to

determine the caries prevalence and severity in the secondary school children of Riyadh and Qaseem regions and, to correlate the caries experience with fluoride levels in the drinking water.

### Materials and Methods

The information about the population of secondary school children was obtained from the Ministry of Education and the Presidency of Girls' Education.<sup>12</sup> The students' sample size was determined utilizing the sample size formula for estimating mean.<sup>13</sup>

Utilizing a map prepared from the water analysis study,<sup>11</sup> zones with similar water fluoride concentrations were identified. The list of these zones was considered as the sampling frame for the subjects. Some municipalities were randomly selected in each zone to represent the population in each of the zones. One or more secondary schools for both boys and girls were then selected depending on the sample size requirement. All the subjects were Saudi nationals and permanent

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residents of the area. The distribution of the sample size between the different fluoride concentration zones was based on the percentage of population residing in each zone.<sup>11</sup>

All the selected students were examined for dental caries utilizing the WHO criteria for the diagnosis of dental caries.<sup>14</sup> The data were entered into a computer using FOXPRO software and a data file generated. The data were then analyzed utilizing Statistical Package of Social Sciences (SPSS). The one-way analysis of variance (ANOVA) and Student *t* test were used to test the difference between means. Each examiner was calibrated with one of the authors (ESA). Intra- and inter-examiner reliabilities were determined using Kappa statistics. A high degree of agreement (above 0.9) was demonstrated between the reference examiner and the five field examiners for DMFT. The intra-examiner reliability of all the field examiners was also high (above 0.9). A Kappa value of 0.8 and above indicates excellent agreement.

### Result

A total of 734 secondary school children were examined in Riyadh (236 male and 193 female) and Qaseem (163 male and 142 female) with the mean age of 16.4 (SD 1.2) years and a range of 15-19 years. The distribution of the sample between the different fluoride zones is shown in Table 1.

**Table 1.** Distribution of the student sample according to various fluoride levels in Riyadh and Qaseem regions

Fluoride Level (ppm)	Riyadh (%)	Qaseem (%)	Total (%)
0.00 - 0.30	334 (77.8)	23 (7.6)	357 (48.6)
0.31 - 0.60	23 (5.4)	190 (62.3)	213 (29.0)
0.61 - 0.80	45 (10.5)	16 (5.2)	61 (8.3)
0.81 - 1.50	16 (3.7)	31 (10.2)	47 (6.4)
1.51 - 2.50	11 (2.6)	33 (10.8)	44 (6.0)
> 2.50	0	12 (3.9)	12 (1.7)
Total	429 (100)	305 (100)	734 (100)

The prevalence of dental caries was 91.1% in Riyadh and 90.5% in Qaseem, respectively. The mean DMFT score in Riyadh was 7.35 (SD 4.99), with D component of 6.28, M component of 0.32 and F component of 0.75. The mean DMFT score in Qaseem was 7.05 (SD 4.58) with D component of

6.02, M component of 0.46 and F component of 0.57. There was no significant gender difference in terms of mean DMFT scores in Riyadh, whereas in Qaseem, the DMFT score was significantly higher ( $P < 0.05$ ) in male children compared to female children (Table 2).

**Table 2.** Caries experience (DMFT) of secondary school children in Riyadh and Qaseem regions in relation to gender.

Region	n	D	M	F	Mean DMFT (SD)
Male	236	6.53	0.22	0.60	7.35 (4.99)
Riyadh	193	5.98	0.44	0.93	7.35 (5.01)
Female	429	6.28	0.32	0.75	7.35 (4.99)
Total	163	7.28	0.15	0.17	7.60 (5.08)
Qaseem Male	142	4.58	0.82	1.03	6.43 (3.87)
Female	305	6.02	0.46	0.57	7.05 (4.58)

Qaseem: Male vs Female, *t* test  $P < 0.05$

Riyadh : Male vs Female, *t* test  $P > 0.05$

Table 3 describes caries experience (DMFT) of the children in relation to various water fluoride levels. The overall data showed no significant difference ( $P > 0.05$ ) in mean DMFT scores at various fluoride levels. However, low values of DMFT were found in two fluoride zones with fluoride concentration of 0.61 - 0.80 ppm and 0.81 - 1.50 ppm, respectively.

**Table 3.** Caries experience (DMFT) of secondary school children in relation to various fluoride levels

Fluoride Level	Riyadh		Qaseem		Total	
	Mean DMFT*	SD	Mean* DMFT	SD	Mean DMFT	SD
0.00 - 0.30	7.509 <sup>ab</sup>	4.967	3.652 <sup>a</sup>	3.588	7.261	4.977
0.31 - 0.60	8.434 <sup>ab</sup>	5.016	7.005 <sup>b</sup>	4.425	7.159	4.501
0.61 - 0.80	5.711 <sup>a</sup>		9.437 <sup>b</sup>			
0.81 - 1.50	5.437 <sup>ab</sup>	4.372	8.032 <sup>b</sup>	3.224	6.688	4.399
1.51 -	9.727 <sup>b</sup>	4.704	6.970 <sup>ab</sup>	5.231	7.148	5.158
	-		9.583 <sup>b</sup>			
	7.349	6.724	7.052	5.015	7.454	5.567
	.025		< 0.0001		0.582	

\* Different alphabetical letters indicate statistical difference

### Discussion

The caries prevalence was found to be very high among the students studied in Riyadh and Qaseem regions. The results were not surprising for Riyadh region as the majority of the study population lives in low water fluoride level areas.<sup>11</sup> However, the results were unexpected in Qaseem where a majority lives in the area of near optimum or high fluoride areas.<sup>11</sup> In Qaseem, the lowest DMFT score was found in children from lowest water fluoride level and higher DMFT from optimum water fluoride level. Several factors could possibly be responsible for the result. Caries related risk factors such as oral hygiene and dietary practices could have diluted the effects of fluoride exposure in high fluoride population.<sup>15</sup> The high fluoride exposure also results in higher incidence of dental fluorosis, which may make it difficult to distinguish between the tooth destruction caused by severe fluorosis and by dental caries. On the other hand, healthy oral hygiene and dietary habits in low water fluoride population may be responsible for low caries experience. Lack of knowledge about the actual source of drinking water in individuals may also be responsible for the lack of linear relationship between water fluoride level and caries experience. The sample in the present study was randomly selected, proportionally to the number of children from various fluoride levels, which might have affected the results.

Several studies have reported low caries experience with increasing level of fluoride in the drinking water,<sup>16,17</sup> However in the present study, a linear correlation could not be established between the caries experience and water fluoride level in both Riyadh and Qaseem regions. As mentioned earlier, the other caries risk factors such as diet and oral hygiene practices may have been superimposed upon the fluoride factor. The results of the present study rather showed high DMFT scores in high fluoride areas. Several other studies have also reported similar results in many parts of the world.<sup>17,18</sup> However, it must be mentioned that some researchers have concluded that a much greater protection against dental caries could result from higher fluoride concentrations (5-7 ppm) than is customarily recommended as best for prevention of dental caries.<sup>19</sup>

Dental decay was the major component of the DMFT scores in this study both in Riyadh and Qaseem. Several studies in younger children of Riyadh have also reported the D as the major

component of DMFT/dmft scores.<sup>8-10, 20</sup> Such a large proportion of untreated caries indicates very high restorative needs of the study population. A considerable effort will be required to provide restorative services to this population. A well-organized school dental health service could be a possible solution to the problem. Such a service will not only provide sufficient restorative services to these children, but will also constitute effective prevention programs for dental caries.

This study has provided important base-line data about caries experience and its relevance to various fluoride levels in secondary school children in Riyadh and Qaseem regions of Saudi Arabia. It is hoped that the results will help in planning an effective preventive and restorative services in the regions.

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### References

1. Craig GC. Fluoride and the prevention of dental decay: A statement from the Representative Board of British Dental Association. *Brit Dent J* 2000; 188:654.
2. Brambilla E. Fluoride is it capable of fighting old and new dental disease? An overview of existing fluoride compounds and their clinical applications. *Caries Res* 2001; 35:6-9.
3. Dean HT, Arnold FA, Evolve E. Domestic water and dental caries. V. Additional studies of the relation of fluoride in domestic water to dental caries experience in 4425 white children aged 12-14 years, of 13 cities in 4 states. *Public Health Reports* 1942; 57:1155-1179.
4. McClure FJ. Water fluoridation. The search for victory. Bethesda: National Institute of Dental Research, 1970.
5. Murray JJ, Rugg-Gunn AJ. Modes of action in reducing caries. In: Fluoride in caries prevention. *Dental Practitioner's Handbook* No. 20, 2<sup>nd</sup> ed. Boston, MS: Wright PSG, 1982: 222-232.
6. Newbrun E. Effectiveness of water fluoridation. *J Public Health Dent* 1989; 49: 279-289.
7. Ripa WL. A half century of community water fluoridation in the US. Review and commentary. *J Public Health Dent* 1993; 53:17-44.
8. Wyne A, Darwish S, Adenubi J, Battata S, Khan N. The prevalence and pattern of nursing caries in Saudi preschool children. *Int J Paediatr Dent* 2000; 11:361-364.
9. Khan NB, Al-Ghannam NA, Al-Shammery AR, Wyne AH. Caries in primary school children: Prevalence, severity and pattern in Al-Ahsa, Saudi Arabia. *Saudi Dent J* 2001; 13:71-74.

10. Wyne AH, Al-Ghoraibi BM, Al-Asiri Y, Khan NB. Caries prevalence in Saudi primary schoolchildren of Riyadh and their teachers' oral health knowledge, attitude and practices. *Saudi Med J* 2002; 23:77-81.
11. Al-Dosari AM, Akpata ES, Khan N, Wyne AH, Al-Meheithif A. Fluoride levels in drinking water in the central province of Saudi Arabia. *Annals Saudi Med* 2002. In press.
12. Statistical Department. Ministry of Education, KSA 1416-1417H (Personal Communication).
13. Weiss NA, Hassett MJ. *Introductory statistics*. 2<sup>nd</sup> ed. Reading, Massachusetts: Addison-Wesley, 1986 pp. 321.
14. World Health Organization. *Oral Health Surveys: Basic Methods*. 4th ed. Geneva: WHO, 1997.
15. Angelillo IF, Torre I, Nobile CG, Villari P. Caries and fluorosis prevalence in communities with different concentrations of fluoride in the water. *Caries Res* 1999; 33:114-122.
16. Pervianen K, Nordling H, Ainamo J. Occurrence of dental caries and gingivitis in low, medium and high fluoride areas in Finland. *Community Dent Oral Epidemiol* 1977; 5:287-291.
17. Cortes DF, Ellwood RP, O'Mullane DM, Bastos JR. Drinking water fluoride levels, dental fluorosis, and caries experience in Brazil. *J Public Health Dent* 1996; 56:226-528.
18. Grobleri SR, Louw AJ, van Kotze TJ. Dental fluorosis and caries experience in relation to three different drinking water fluoride levels in South Africa. *Int J Paediatr Dent* 2001; 11:372-379.
19. Englander HR, DePaola PF. Enhanced anticaries action from drinking water containing 5 ppm fluoride. *J Am Dent Assoc* 1979; 98:35-39.
20. Akpata ES, Al-Shammery AR, Saeed HI. Dental caries, sugar consumption and restorative dental care in 12-13-year-old children in Riyadh, Saudi Arabia. *Community Dent Oral Epidemiol* 1992; 20:343-346.