

Caries Prevalence, Severity, and Pattern in Preschool Children

Amjad H. Wyne, BDS, BSc, MDS, FASDC, FADI



Abstract

Aim: To determine caries prevalence, severity, and pattern in preschool children of Riyadh, Saudi Arabia.

Methods and Materials: A total of 789 randomly selected preschool children, 379 (48%) male and 410 (52%) female, with mean age of 4.7 (SD 0.5) years were examined for dental caries using World Health Organization (WHO) diagnostic criteria.

Results: The overall caries prevalence among the sample was 74.8%. The mean decayed, missing, and filled (dmft) score was 6.1 (SD 3.9) with a decay component of 4.66, a missing component of 0.54, and a filled component of 0.92. There was no significant difference ($p > .05$) in caries prevalence and severity in relation to gender of the children. However, the caries prevalence and severity were significantly higher ($p < .05$) among children from government preschools as compared to those from private preschools. Among the posterior teeth, mandibular second molars (54.3%), and among anterior teeth, maxillary central incisors (27.9%) had the highest caries prevalence. Among the molars, caries prevalence was generally high in lower molars while among the anterior teeth, upper teeth generally had a higher caries prevalence. The majority of the children (50.3%) had both posterior and anterior tooth caries, 42.2% had posterior tooth caries only, while very few (7.5%) children had only anterior tooth caries.

Conclusion: Caries prevalence and severity are very high in the study population, and most children have posterior tooth caries.

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Clinical Significance: Early measures such as fissure sealants, topical fluoride applications (as early as safely possible), and dietary fluoride supplements (where indicated) are needed to prevent caries of deciduous molars in high caries populations.

Keywords: Caries, prevalence, severity, preschool children, disease pattern

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Introduction

Information on caries prevalence and severity forms the basis for the magnitude and quality of caries prevention programs and treatment needs in a population. Therefore, a continuous need remains to field caries prevalence and severity information.

Reports from developed Western countries have historically shown a low caries prevalence and severity among preschool children.¹⁻² More recent studies from these countries still mostly report a low caries prevalence among this group of children.³⁻⁴ However, recent reports from developed countries indicate inequalities in caries prevalence among preschoolers, with a higher caries prevalence and severity in certain ethnic and immigrant groups.⁴⁻⁶ In contrast, caries prevalence and severity have historically been high in Middle East countries.⁷⁻⁸ Al-Mughery et al.⁷ in their study of preschool children reported a caries prevalence of 78% with a mean decayed, missing, and filled (dmft) score of 5.1 in the United Arab Emirates. Janson and Fakhoury⁸ reported a caries prevalence of 72% in Jordanian preschool children with a dmft of 4.0 or higher in 50% of the children. More recent reports in Middle East countries still show a high caries prevalence and severity in preschool children.⁹⁻¹⁰

Caries prevalence has also been very high among children in Saudi Arabia, including preschool children.¹⁰⁻¹² Several studies have reported caries prevalence among preschool children in various parts of Saudi Arabia.¹⁰⁻¹² Wyne et al.¹⁰ examined a random sample of preschool children in Al-Ahsa, in the Eastern Region of Saudi Arabia, and reported a caries prevalence of 62.7% with a mean dmft score of 2.9 in those children. Al-Malik et al.¹¹ reported a caries prevalence of 73% with a mean dmft score of 4.8 among a random sample of 2-5-year-old children



in Jeddah, located in the Western Region of Saudi Arabia. Paul¹² examined 5-year-old children in two nurseries in Al-Kharj, a small town in the Central Region of Saudi Arabia, and reported a caries prevalence of 83.5% with a mean dmft score of 8.5 among these children.

Wyne et al.¹³ reported a caries prevalence of 74.6% with a mean dmft score of 6.9 in a random sample of preschoolers in Riyadh, the Capital City of the Kingdom of Saudi Arabia, with a piped water fluoride level of 0.24 ppm.¹⁴ Since that study in 1996, no study has been conducted on the caries prevalence and severity in a random sample of preschool children in Riyadh. The objective of the present study was to determine present status of caries prevalence, severity, and pattern in a random sample of preschool children in Riyadh, Saudi Arabia.

Methods and Materials

A list of all preschools (government and private) as well as information about the total population of pre-school children in Riyadh was obtained from the Information and Computer Center of the General Directorate of Training and Education,

Riyadh Region, Saudi Ministry of Training and Education (Information Center).¹⁵ The list served as a sampling frame for the study. Ten preschools were randomly selected from the list to represent the preschool children population in Riyadh, and fulfill the sample size requirement. The sample size was determined utilizing the “sample size formula” for estimating a mean.¹⁶

All selected children were examined for dental caries by field examiners utilizing the World Health Organization (WHO) criteria for the diagnosis of dental caries.¹⁷ The two field examiners were trained and calibrated by the author, a senior faculty member in the King Saud University College of Dentistry (KSUCD). Inter-examiner calibration was carried out in KSUCD clinics, while about 5% of the sample was re-examined for the purpose of intra-examiner reliability. Intra- and inter-examiner agreement was determined using Kappa statistics. A very good degree of agreement (above 0.85) was demonstrated between the reference examiner and the field examiners. The intra-examiner agreement for the two field examiners was excellent (above 0.9).

The data were recorded on a form designed for the study. The data were entered into a computer using FOXPRO software and a data file was generated. The data were then analyzed utilizing

Statistical Package of Social Sciences (SPSS) Version #10 (SPSS, Inc., Chicago, IL, USA). The Pearson Chi-Square test was used to determine any association between caries prevalence, gender, and preschool type (private/government). Analysis of variance (ANOVA) was utilized to determine any difference in mean dmft scores in terms of gender and preschool type.

Results

A total of 789 preschool children, 379 (48%) male and 410 (52%) female, were examined for dental caries. Mean age of the children was 4.7 (SD 0.5) years ranging from three to five years. Three hundred and fifty one (44.5%) children were from government preschools and 438 (55.5%) from private preschools. The overall caries prevalence among the sample was 74.8%. There was no significant difference ($p>.05$) in caries prevalence in relation to gender of the children. However, the caries prevalence was significantly higher ($p<.05$) among children in government preschools as compared to children in private preschools (Table 1).

The prevalence of caries in all maxillary and mandibular teeth is given in Table 2. Among the posterior teeth, mandibular second molars had the highest caries prevalence (54.3%) followed by the mandibular first molars (41.7%) and the maxillary second molars (38.9%). In both upper and lower

Table 1. Caries prevalence in relation to gender and type of preschool.

Gender	Caries Free (%)	Caries Positive (%)	Total (%)	p-value
Male	101 (26.6)	278 (73.4)	379 (100)	>0.05
Female	98 (23.9)	312 (76.1)	410 (100)	
Total	199 (25.2)	590 (74.8)	789 (100)	
Preschool	Caries Free (%)	Caries Positive (%)	Total (%)	p-value
Private	152 (34.7)	286 (65.3)	438 (100)	<0.05
Government	47 (13.4)	304 (86.6)	351 (100)	
Total	199 (25.2)	590 (74.8)	789 (100)	

Table 2. Tooth-specific caries prevalence in preschool children.

Tooth Type	Maxillary			Mandibular		
	Right (%)	Left (%)	Total (%)	Right (%)	Left (%)	Total (%)
Central incisor	28.0	27.9	27.9	12.2	10.9	11.6
Lateral incisor	14.1	15.6	14.9	3.5	2.4	3.0
Canine	6.7	7.9	7.3	4.9	6.0	5.5
First molar	27.8	29.8	28.8	41.3	42.1	41.7
Second molar	40.2	37.5	38.9	54.0	54.6	54.3

jaws the second molars showed a higher caries prevalence than first molars. Among the anterior teeth, the maxillary central incisors had the highest caries prevalence (27.9%) followed by maxillary lateral incisors (14.9%) and mandibular central incisors (11.6%). Mandibular lateral incisors had the lowest caries prevalence (3.0%). In both upper and lower jaws the central incisors had higher caries prevalence as compared to lateral incisors. Among the posterior teeth, caries prevalence was generally high in lower teeth, while among the anteriors, upper teeth generally had a higher caries prevalence.

Among 590 children with caries, 297 (50.3%) children had caries in both posterior and anterior teeth, 249 (42.2%) only in posterior teeth, and 44 (7.5%) only in anterior teeth.

The mean dmft score of the sample was 6.1 (SD 3.9) with a decay component of 4.66 (SD 3.66), a missing component of 0.54 (SD 1.21), and a filled component of 0.92 (SD 2.05). Tooth “decay” was the major component (76.4%) of the mean dmft score. The mean dmft score of government preschool children (6.6 SD 3.9) was significantly higher ($p < .05$) as compared to private preschool children (5.6 SD 3.8). However, there was no difference ($p > .05$) in mean dmft scores in terms of gender of the children; with male children having a mean dmft score of 4.5 (SD 4.2) and female children a mean dmft score of 4.7 (SD 4.4).

Discussion

The present study provided information on caries prevalence and severity in preschool children

in Riyadh. Access to this young age group and dental examination of these children has always been a challenging task. The results of this study will be provided to authorities responsible for dental health services and preventive planning for preschool children.

No radiographs were taken for this epidemiological study for ethical reasons. As a result, some degree of underestimation of caries prevalence is expected with the broad and flat proximal contacts that exist between primary molars. The majority of caries studies in preschool children report higher caries prevalence among older preschool children as compared to younger preschool children.¹⁰⁻¹¹ However, the sample in the present study was concentrated around the age of five years and an unbiased conclusion was not possible in terms of comparing younger preschool children with older preschool children.

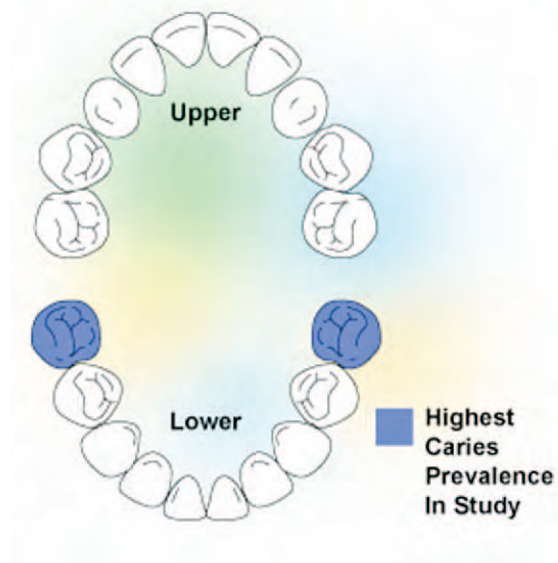
Three of every four children had caries in this study, which was similar to previous studies conducted in the central region of the Kingdom of Saudi Arabia.¹²⁻¹³ The caries prevalence was higher as compared to preschool children from Al-Ahsa,¹⁰ in the eastern region, and similar to those from Jeddah,¹¹ located in the western region of the Kingdom. The prevalence was much higher as compared to preschool children from Western developed countries such as Sweden,³ & Italy,⁴ and countries such as India,¹⁸ Mexico,¹⁹ Africa²⁰ and China.²¹

Only some studies of caries prevalence have reported gender difference, with male children

usually having a higher prevalence as compared to females.¹⁸ The present study showed no difference in caries prevalence in terms of gender which is in agreement with many recent studies in Saudi preschool children^{10,12} and other countries.¹⁹⁻²¹ Dietary and oral hygiene practices related to dental caries are mostly controlled by parents/care takers at this early age. As a result, it may be too early to develop any gender differences in preschool children.

Significantly more children from private preschools were caries-free; even those with caries had significantly lower mean dmft scores as compared to the children in government preschool. This was in agreement with previous similar studies in preschool children.¹⁰⁻¹¹ Probably children from higher socioeconomic strata go to private preschools. It is possible most of their parents are better educated and in a better position to be more conscious of or concerned about the diet and oral hygiene of their children. It is possible educated parents tend to seek preventive dental information and more likely these parents will comprehend prevention information provided in distributed literature or media.

Mandibular second molars showed the highest caries prevalence in the present study which is similar to a string of observations made on preschool children in various countries such as Hungary,²² United States,²³ Finland,²⁴ Japan²⁵ and Holland.²⁶ However, a previous study of Tanzanian preschool children reported mandibular first molars as having the highest caries prevalence among molars.²⁷ In both upper and lower jaws the second molars had a higher caries prevalence than first molars which may be attributed to the crown anatomy of second molars and lack of tooth brushing because they are the last teeth in the arch. Elfrink et al.²⁶ attributed higher caries prevalence in second primary molars to greater developmental disturbances in these teeth. Posterior teeth, especially second primary molars, are important teeth in the primary dentition as they play a major role in chewing food. Furthermore, first permanent molars may drift mesially if the second primary molars are prematurely lost. Therefore, it is important to inform parents/caretakers of preschool children to specially concentrate on second molars while brushing these children's teeth. Topical fluoride applications



and early fissure sealing of these teeth will also help in preventing caries in these teeth.

Among the anterior teeth, maxillary central incisors were the teeth with the highest caries prevalence in the present study and are similar to another study in Saudi preschool children¹⁰ and in Tanzanian preschool children.²⁴ Close interproximal contact between maxillary central incisors could be the reason for a high caries prevalence in these teeth. Direct exposure during intake and pooling of cariogenic fluids around these teeth may also contribute to high caries prevalence in these teeth. The above stated reasons may also be responsible for higher caries prevalence in central incisors as compared to lateral incisors in both upper and lower jaws.

Generally, caries prevalence was high in lower molars and upper incisors as compared to upper molars and lower incisors. Saravanan et al.¹⁸ reported a similar pattern in Indian preschool children. A lower caries prevalence in upper molars may be attributed to anatomy, closer proximity to the parotid salivary duct, and possibly to a pattern of tooth brushing. Lower incisors are prevented from direct exposure during intake of acidic drinks by the tongue and salivary flow from the sublingual salivary ducts dilutes the acidic environment around these teeth.²⁸

The majority of the children had both anterior and posterior tooth caries only while very few children had anterior tooth caries only. The proportions of

simultaneous anterior and posterior tooth caries, posterior caries only, and anterior caries only were similar to the study in Jeddah preschool children.¹¹ The result is also in agreement with reports from previous studies in Saudi Arabia stating most preschool children with anterior tooth caries also have posterior tooth caries.^{11,29} Such a high prevalence of posterior tooth caries is alarming and is indicative of a need for strong oral hygiene education among parents of preschool children and, even more importantly, continuous follow-up reinforcement.

The mean dmft score in the present study, although slightly lower than previous studies in Riyadh,¹⁰⁻¹² still remains very high. A high decay component of the dmft score indicates huge unmet treatment needs among this young population. It also indicates no change in the proportion of untreated carious teeth as in the previous studies of Riyadh preschoolers who also had a very high decay component in the dmft score.¹⁰⁻¹² A high proportion of decay component (untreated caries) in the dmft score among preschool children has also been reported in other countries.^{20,21}

The presence of caries in the primary dentition is the strongest predictor of caries in permanent dentition.^{30,31} Therefore, results of the present study have a number of preventive and management implications. A high caries prevalence and dmft scores call for a concentrated effort to decrease caries prevalence and severity in preschool children. A strict preventive program has to be implemented in these children including fluoride supplements, topical fluoride and fluoride varnish applications, dietary counseling, meticulous oral hygiene maintenance, and fissure sealants. Lower molars and maxillary incisors will need special attention during preventive efforts.

Caries is an infectious disease, and its effects include pain, inadequate nutrition, speech problems, sleep disturbances, orthodontic problems, and psychological effects on the children as well as the parents due to poor esthetics.³² Increased glucocorticosteroid

production due to pain, decreased growth hormone secretion caused by sleep disturbance, and inadequate nutrition could combine to retard the growth and development of these children.³³

As stated previously, children with carious primary molars are more prone to caries in their permanent molars.³⁰ Therefore, untreated carious teeth have to be restored as an urgent priority. Starting a preschool dental service has been previously recommended.¹⁰ Such a service will not only meet the huge treatment need in these young children presently but more importantly play a pivotal role in the prevention of dental disease in these children through direct contact by dental professionals with children and their parents. Such an effort needs to involve care takers and preschool teachers of these children in caries prevention programs.

Conclusions

1. The caries prevalence and severity were high in preschool children in Riyadh.
2. The caries prevalence and severity were significantly higher ($p < .05$) in government preschool children as compared to private preschool children.
3. Among posterior teeth, caries prevalence was generally high in mandibular teeth, while among the anterior, maxillary teeth generally had higher caries prevalence.
4. Simultaneous posterior and anterior tooth caries was the most dominant pattern followed by posterior tooth caries only. Only a few children had anterior tooth caries only.

Clinical Significance

Early measures such as fissure sealants, topical fluoride applications (as early as safely possible), and dietary fluoride supplements (where indicated) are needed to prevent caries of deciduous molars in high caries populations. The present study endeavored to provide the most recent information about dental caries in preschool children as well as a comparison with previous studies. It is expected the information provided by this study would help with improving the prevention and management of dental caries in preschool children.

References

1. Grindefjord M, Dahloff G, Ekstrom G, Hojer B, Modeer T. Caries prevalence in 2.5 year-old children. *Caries Res* 1993; 27:505-510.
2. Hinds K, Gregory JR. National diet and nutrition survey: children aged 1.5 to 4.5 years. Volume 2: Report of the dental survey. London (UK): HMSO; 1995. p 18.
3. Bankel M, Eriksson UC, Robertson A, Kohler B. Cares and associated factors in a group of Swedish children 2-3 years of age. *Swed Dent J* 2006; 30:137-147.
4. Ferro R, Besostri A, Meneghetti B, Olivieri A, Benacchio L, Tabaccanti S, Mazzoleni S, Favero G, Stellini E. Oral health inequalities in preschool children in North-Eastern Italy as reflected by caries prevalence. *Eur J Paediatr Dent* 2007; 8:13-18.
5. Foley J. Alternative treatment strategies for carious primary teeth: an overview of the evidence. *Eur Arch Paediatr Dent* 2006; 7:73-80.
6. Hallett KB, O'Rourke PK. Caries experience in preschool children referred for specialist dental care in hospital. *Aust Dent J* 2006; 51:124-129.
7. Al-Mughery AS, Attwood D, Blinkhorn AS. Dental health of 5-year-old children in Abu Dhabi, United Arab Emirates. *Community Dent Oral Epidemiol* 1991; 19:308-309.
8. Janson S, Fakhouri H. Dental health in suburban Jordanian preschool children. *Swed Dent J* 1993; 17:123-127.
9. Al-Hosani E, Rugg-Gunn AJ. The relationship between diet and dental caries in 2 and 4 year old children in the Emirate of Abu Dhabi. *Saudi Dent J* 2000; 12:149-155.
10. Wyne AH, Al-Ghannam NA, Al-Shammery AR, Khan NB. Caries prevalence, severity and pattern in preschool children. *Saudi Med J* 2002; 23:580-584.
11. Al-Malik MI, Holt RD, Bedi R. Prevalence and patterns of caries, rampant caries, and oral health in two- to five-year-old children in Saudi Arabia. *J Dent Child* 2003; 70:235-242.
12. Paul TR. Dental health status and caries pattern of preschool children in Al-Kharj, Saudi Arabia. *Saudi Med J* 2003; 24:1347-1351.
13. Wyne A, Darwish S, Adenubi J, Battata S, Khan N. Caries prevalence and pattern in Saudi preschoolers. *J Dent Res J* 1996; 75:360. Abstract 2739.
14. AlDosari AM, Akpata ES, Khan N, Wyne AH. Fluoride levels in drinking water in the central province of Saudi Arabia. *Ann Saudi Med* 2003; 23:37-40.
15. Center for Information and Computer. Directorate General for Training and Education, Riyadh Region. Ministry of Training and Education. Personal Communication. January 2007.
16. Weiss NA, Hasset MJ. *Introductory Statistics*. 2nd ed. Reading Massachusetts: Addison-Wesley, 1986:321.
17. World Health Organization. *Oral Health Surveys: Basic Methods*. 3rd ed. Geneva: WHO; 1997.
18. Saravanan S, Madivanan I, Subashini B, Felix JW. Prevalence pattern of dental caries in the primary dentition among school children. *Indian J Dent Res* 2005; 16:140-146.
19. Segovia-Villanueva A, Estrella-Rodriguez R, Medina-Solis CE, Maupome G. Dental caries experience and factors among preschoolers in southeastern Mexico: a brief communication. *J Public Health Dent* 2006; 66:88-91.
20. Wanjau J, du Plessis JB. Prevalence of early childhood caries in 3- to 5-year-old children in Philadelphia district, Mpumalanga Province. *SADJ* 2006; 61:390-392.
21. Du M, Luo Y, Zeng X, Alkhatib N, Bedi R. Caries in preschool children and its risk factors in 2 provinces in China. *Quintessence Int* 2007; 38:143-151.
22. Alder P, Alder-Hradecky C. Caries prevalence and caries susceptibility of individual deciduous teeth. *Adv Fluorine Res* 1966; 107-112.
23. Hennon DK, Stookey GK, Muhler JC. Prevalence and distribution of caries in pre-school children. *J Am Dent Assoc* 1969; 79:1405-1414.
24. Kerusuo H, Honkala E. Caries experience in the primary dentition of Tanzanian and Finnish 3-7 year old children. *Community Dent Oral Epidemiol* 1991; 19:272-276.
25. Mayanagi H, Saito T, Kamiyama K. Cross-sectional comparisons of caries time trends in nursery school children in Sendai, Japan. *Community Dent Oral Epidemiol* 1995; 23:344-349.

26. Elfrink ME, Veerkamp JS, Kalsbeek H. Caries pattern in primary molars in Dutch 5-year-old children. *Eur Arch Paediatr Dent* 2006; 7:236-240.
27. Mosha HJ, Robison VA. Caries experience of the primary dentition among groups of Tanzanian urban pre-school children. *Community Dent Oral Epidemiol* 1989; 17:34-37.
28. Wyne AH. Early childhood caries: a review. *Indian J Dent Res* 1996; 7:7-15.
29. Nainar SMH, Wyne AH. Caries pattern of high caries preschool children attending a dental clinic in Riyadh, Saudi Arabia. *Saudi Dent J* 1998; 10:80-85.
30. Skeie MS, Raadal M, Strand GV, Espelid I. The relationship between caries in the primary dentition at 5 years of age and permanent dentition at 10 years of age – a longitudinal study. *Int J Paediatr Dent* 2006; 16:152-160.
31. Vanderas AP, Gizani S, Papagiannoulis L. Progression of proximal caries in children with different caries indices: a 4-year radiographic study. *Eur Arch Paediatr Dent* 2006; 7:148-152.
32. Wyne AH. Early childhood caries: a challenge to health care professionals. *Emirates Med J* 1997; 15:5-11.
33. Acs G, Lodolini G, Kaminsky S, Cisneros GJ. Effect of nursing caries on body weight in a body weight in a pediatric population. *Ped Dent* 1992; 14:302-305.

About the Author

Amjad H. Wyne, BDS, BSc, MDS, FASDC, FADII



Dr. Wyne is an Associate Professor and Consultant in Pediatric Dentistry at King Saud University College of Dentistry in Riyadh, Kingdom of Saudi Arabia. He is also Associate Editor of the *Pakistan Oral & Dental Journal*. Dr. Wyne graduated from deMontmorency College of Dentistry/University of Punjab, Lahore, Pakistan in 1981. He later completed his Masters degree in Pediatric Dentistry at the University of Adelaide, Australia in 1990. He was awarded Fellowships in the American Society of Dentistry for Children and the International Academy of Dentistry in 1997. In addition to the national dental organizations Dr. Wyne is a member of the International Association for Dental Research, the International Association of Paediatric Dentistry, the American Academy of Pediatric Dentistry, and the Australasian Academy of Paediatric Dentistry. Dr. Wyne is also a member of the Global Child Dental Health Task Force.

e-mail: ahwyne@gmail.com

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