

Prevalence and Severity of Dental Caries in school students aged 6 - 11 years in Tafelah Governorate –South Jordan: Results of National Woman’s Health Care Center Survey

Leena Smadi¹, Reem Azab², Rania Rodan³, Feryal Khlaifat⁴, Asma Abdalmohdi⁵

¹Associate professor / Department of conservative dentistry/ University of Jordan, Jordan. ²Senior Specialist in Pediatric dentistry/ Ministry of Health, Jordan Ministry of Health, Jordan. ³Senior specialist in periodontology/ Royal Medical Services, King Hussein Medical Centre, Jordan. ⁴Specialist in periodontology/ Ministry of Health, Jordan Ministry of Health, Jordan. ⁵RN/ Head of planning, research and information department, National Woman’s Health Care Center, Jordan.

Abstract

Aims: To determine the prevalence, and severity of dental caries in school children of Tafelah Governorate –South of Jordan aged 6-11 years and to evaluate the oral hygiene habits among them as a part of National Woman’s Health Care Center Survey.

Methods: A cross-sectional census was conducted on 999 public school students aged 6-11 years (mixed dentition stage) living in 3 different parts of Tafelah Governorate. All students were examined for Decay-Extracted–Fillings for deciduous teeth (deft) Decay-Missing–Fillings (DMFT) for permanent teeth, information about oral hygiene habits was recorded.

Results: Caries prevalence was 70.6% and 28% for deciduous and permanent teeth respectively with a mean deft and DMFT 3.2 and 0.2. 34.3% of the examined students never brushed their teeth.

Conclusions: The results indicated that more than 50% of examined students in this age group have caries in their teeth with deft, DMFT 3.2 and 0.2 respectively. It is important for those school children to be closely assessed in order to provide dental care, enhance dental awareness and to allow different preventive measures to be implemented.

Key Words: Dental caries, Prevalence, Mixed dentition, Oral hygiene, Caries index

Introduction

The development of cavities in the teeth of children represents a significant burden in both human and financial terms. The oral pain and infection associated with dental caries can result in lost sleep, poor growth, behavioral problems and poor learning [1,2]. Dental problems may also undermine a child’s self-esteem and interfere with communication and socialization [3,4].

Dental caries is a preventable infectious disease and is the most common chronic disease of childhood [1]. Minimizing the risk of dental caries among children can be accomplished in large part by maintaining good oral health starting at an early age (such as brushing teeth and having healthy dietary habits), using proven preventive techniques (such as topical fluoride treatments) and ensuring access to fluoridated water [5,6].

According to the World Health Organization (WHO), oral health is integral to general health and essential for well-being [4]. Surveillance of oral health on community level thus has to be done at regular intervals.

One of the tasks of the Jordanian National Woman’s Health Care Center is to assess the health status and needs of the underprivileged communities throughout Jordan by collection and interpretation of reliable health information.

Tafelah is one of these communities (*Figure 1*), it is a governorate in south of Jordan with a population estimated by the Department of Statistics of Jordan at the end of year 2012 to be 89400, which account for 1.4% of Jordan Population (of them 45500 males and 43900 females). Tafelah is divided into three districts: Tafelah District (62.3% of population), Bsaira District (25.7%) and Hasa District (12%).



Figure 1. Tafelah Province.

The number of schools in Tafelah is 48, 41 of them are for boys and rest are for girls accommodate 26548 student (13085 girl and 13463 boy). The population of Tafelah is served by 16 dental clinic distributed throughout the govern rate [7]. The Oral Health Survey (OHS) 2014 for students aged 6-11 years of age (mixed dentition stage) was conducted at Tafelah Governorate schools (south of Jordan) to obtain relevant information on both the oral health condition of the students in this underprivileged area of Jordan and to assess the oral health related behaviors of the students in this area. The survey focuses on two most common but preventable oral diseases, tooth decay (dental caries) and gum disease (periodontal disease), which affect many students; in this article we will review the results of dental caries part of the survey.

Corresponding author: Leena Smadi, Associate Professor, Department of Conservative dentistry, Faculty of Dentistry, Jordan University, Consultant Endodontist, Jordan University Hospital, P.O Box 2708, Amman, 11953 Jordan; Tel: 66900 777411271; e-mail: alsomadi@yahoo.com

Methods

The survey methodology comprised of a series of fieldwork surveys which were conducted from October 2013 through March 2014. The survey includes students aged 6-11 years of age in six public schools within the governorate (distributed between all districts). The schools selection was based on the two largest schools per district, these schools include classes with mixed gender (grade 1- grade 4) after which mixed classes are not allowed and male students have to move to a boys only schools, all students examined after grade 4 were girls (age group 10-11).

Tooth decay was defined as the occurrence of cavity extended into dentine. This is in accordance with the recommendation of the WHO in defining tooth decay as 'cavities with a softened dentine floor'. The number of teeth with untreated decay (cavity) is referred to as DT/dt (decayed teeth). The number of teeth with decay in the past but already been repaired by restorative procedures is referred to as FT/ft (filled teeth). The number of teeth that were removed (extracted) due to decay is referred to as MT/et (missing teeth/ extracted teeth). The sum of DT/dt, MT/et and FT/ft is referred to as the DMFT/deft value, which reflects the total number of teeth that has been affected by tooth decay in the past and at present. The convention is to use DMFT for decay experience of permanent teeth, and deft for decay experience in primary teeth [8].

The study protocol was approved by the ethical committee at Ministry Of Health. The oral health status was assessed by clinical examination according to the method and criteria recommended by the World Health Organization edition 4 [9]. The clinical examination was carried out by three dentists (examiners) all through the survey. The clinical judgment differences were minimized through pre- survey training for all examiners to homogenize and standardize the examination. Information on the behavior of students was collected using a questionnaire which was completed by the students themselves with the assistance of specially trained dental nurse. Before the survey, the draft questionnaire was pre-evaluated by dentists and dental care nurses working for the School Dental Care Service of the Ministry of Health. Several revisions were made on the questionnaire before it was finalized. Students were examined in a mobile dental clinic which is fully equipped with all the necessary examination instruments, cross infection control methods (Figure 2).

Results

Demographic data

The sample population were 999 students, 60% of them were



Figure 2. Mobile dental clinic used during the survey examination.

females distributed almost equally over the three districts, (Table 1) the students were examined in the 6 schools of the three districts, the contribution of all schools were almost similar ranging between 13.5 and 20.6%. Most of these students were in the (6-8years age) group (66.5%) and the rest are in the (9-11 years age) group, the distribution of students per age was as follows: (24.2% age 6, 21.0 % age 7, 21.3% age 8, 12.6% age 9, 11.7% age 10 and 9.3% age 11).

Caries Prevalence

Among the students examined 70.6% had caries in their deciduous teeth and 28% had caries in the permanent teeth, prevalence of caries in female students were more than in male students for both deciduous teeth and permanent teeth (41.5% and 19.5% respectively compared to 29.0% and 8.5% respectively in male students) (Table 2).

The Decay-Extracted –Fillings index (deft) for deciduous teeth was 3.2 for the whole sample, it was higher in male students in three geographical districts of Tafelah province. The deft in Tafelah district and Bsera district was 4.4 and 4.5 respectively compared to Hasa district which scored lower index of 1.2 this trend was seen both in males and females students (Table 3).

The Decay-Missing–Fillings index (DMFT) for permanent teeth was 0.2 for the whole sample, it was higher in female students in two geographical districts of Tafelah province where Tafelah district and Bsera district students' records index of 0.1 and 0.2 respectively compared to Hasa district which scored higher index of 0.5. This trend was seen both in males and females students (Table 4).

Table 1. Students per District and Gender.

District	Gender		Total
	M	F	
Tafelah	132	196	328
Hasa	150	226	376
Bsera	115	180	295
Total	397	602	999

Table 2. Caries prevalence for both deciduous and permanent teeth according to Gender.

Gender	Deciduous teeth (no/%)		Permanent teeth (no/%)	
Males	290	29.0	85	8.5
Females	415	41.5	195	19.5
Total	705	70.6	280	28.0

Table 3. Decay- Extracted –Fillings index (deft) according to district and gender.

District	Gender		Total
	M	F	
Tafelah	5.4	3.8	4.4
Hasa	1.3	1.2	1.2
Bsera	5.2	4.1	4.5
Total	3.8	2.9	3.2

Table 4. Decay-Missing –Fillings index (DMFT) according to district and gender.

District	Gender		Total
	M	F	
Tafelah	0	0.1	0.1
Hasa	0.5	0.5	0.5
Bsera	0.1	0.3	0.2
Total	0.1	0.2	0.2

When comparing the Decay-Extracted-Fillings index (deft) for deciduous teeth according to age groups, the highest index was reported in the age group (6-7years) followed by (8-9 years) and the least index was in the (10-11 years age), this trend was seen in all geographical districts (Table 5).

Table 6 shows the Decay-Missing-Fillings index (DMFT) for permanent teeth according to age groups and districts. As predicted the highest index was reported in the age group (10-11years) followed by (8-9 years) and the least index was in the (6-7 years age), this trend was seen in all geographical districts.

Tables 7 and 8 showed that untreated decay (d, D) comprised the major component of dmft and DMFT with percentage of 82.2 and 84.8 respectively and less than 10% of filled teeth.

Oral Health behavior

Table 9 shows that 34.3% of the interviewed students never brushed their teeth, 16.9% brush their teeth once per day, 29.4% twice daily, 17.5% three times a day, and only 1.8% four time and more per day.

Table 9 shows significant difference in the oral health behavior between districts, where Hasa district shows the

least frequency of brushing teeth per day, followed by Tafelah district with the best practice was noticed in Bsera district.

When comparing the oral health practice according to age group, Table 10 shows that the care of teeth represented by number of teeth brushing per day deteriorate with increasing age where the best practice was seen in (6-7 years) followed by (8-9 years) and the least brushing per day was in the (10-11 years age). This trend was seen in all districts.

Discussion

Several published studies have examined dental caries among school children [10,11]. In Jordan very few studies looked at oral health among school children, all of them neither examined oral health at neither south of Jordan nor studied specifically dental caries in mixed dentition stage [12-15]. The mixed dentition is the first stage to study an association of the number of caries lesions between the primary and permanent teeth. Several studies have shown very clear correlations in caries experience between the primary and permanent teeth [16,17].

The present study is among the foremost efforts to

Table 5. Decay-Extracted -Fillings index (deft) according to district and Age.

District	Age (years)						Total
	6	7	8	9	10	11	
Tafeleh	5.4	5.8	4.7	4.1	2.7	1.2	4.4
Hasa	1.5	1.1	1.4	1.4	0.8	0.7	1.2
Bsera	5.2	5.2	4.5	5.1	2	2.1	4.5
Total	3.9	4.2	3.5	3.2	1.7	1.1	3.2

Table 6. Decay-Missing -Fillings index (DMFT) according to district and Age.

District	Age (years)						Total
	6	7	8	9	10	11	
Tafeleh	0	0	0.1	0.1	0.1	0.7	0.1
Hasa	0	0.6	0.7	0.6	0.9	1.7	0.5
Bsera	0	0.1	0.2	0.4	0.9	0.6	0.2
Total	0	0.1	0.2	0.3	0.6	0.9	0.2

Table 7. Percentage of d, e, f out of d+e+f.

District	Tafela			Hasa			Bsera			Total			
	% out of d+e+f	d	m	f	d	m	f	d	m	f	d	m	f
Gender	Male	76.6	8.9	14.5	78.9	20.5	0.5	90.2	4.7	5.2	82.3	8.7	9.0
	Female	75.1	18.6	6.4	91.9	3.7	4.4	85.5	8.0	6.5	82.1	11.8	6.1
Total		75.8	13.8	10.4	86.6	10.6	2.8	87.6	6.5	5.9	82.2	10.4	7.5

Table 8. Percentage of D, M, F out of D+M+F.

District	Tafela			Hasa			Bsera			Total			
	% out of D+M+F	D	M	F	D	M	F	D	M	F	D	M	F
Gender	Male	94.7	0.0	10.5	96.7	3.3	0.0	100.0	0.0	0.0	97.4	1.9	1.3
	Female	89.3	1.3	9.3	97.3	2.0	0.7	62.4	33.3	4.3	80.0	16.1	4.3
Total		90.4	0.0	9.6	97.1	2.5	0.4	69.8	26.7	3.4	84.8	12.0	3.2

Table 9. Distribution according to No. of Teeth Brushing /day & to district.

Number of brushing teeth per day	District							
	Tafeleh		Hasa		Bsera		Total	
	Count	Percent	Count	Percent	Count	Percent	Count	Percent
Zero	42	14.2	252	67.6	0.0	0.0	294	34.3
Once	58	19.7	37	9.9	50	26.6	145	16.9
2 times	128	43.4	74	19.8	50	26.6	252	29.4
3 times	56	19.0	10	2.7	84	44.7	150	17.5
4 times or more	11	3.7	0.0	0.0	4	2.1	15	1.8
Total	295	100.0	373	100.0	188	100.0	856	100.0

Table 10. Distribution according to No. of Teeth Brushing /day & age.

Number of brushing teeth per day	Age (years)					
	6	7	8	9	10	11
zero	34.6	24.4	30.0	40.2	43.6	41.6
Once	20.5	19.0	19.4	11.1	10.9	15.7
2 times	30.2	25.0	31.8	29.1	27.7	34.8
3 times	12.2	28.0	17.6	18.8	17.8	6.7
4 times or more	2.4	3.6	1.2	0.9	0.0	1.1
Total	100.0	100.0	100.0	100.0	100.0	100.0

determine the caries pattern in school children in one of the most unprivileged areas of Jordan. The health burden associated with dental caries for children and their mothers and the considerable financial costs to the families in already underprivileged area like Tafelah was one of the main reasons why National Woman's Health Care Center was interested in this survey.

This survey was conducted to assess the need to start a local campaign to raise the public awareness for oral hygiene and the need to modify policies for early access to preventive dental services among school children. The level of tooth decay experience in a population can be represented by the mean values of DT/dt, MT/et, FT/ft and DMFT/deft, as well as by the proportion of population affected by each type of decay experience.

The DMFT/deft value indicates the total number of teeth affected in the past and at present which reflects a cohort more indicative of oral health status compared to the DT/dt value which reflects only the number of teeth with untreated decay at present that needs attention, hence the DMFT/dmft have been chosen to be evaluated in this study. DMFT/deft index has been criticized for not counting enamel caries, caries activity, teeth or surfaces at special risk, as well as the difficulties in confirming the reason of extraction for decay at the point of examination especially for deciduous teeth. However it can still give important descriptive information for monitoring the trends and for giving dental health a visibility for policy makers.

The results of this study showed that approximately two third (70.6%) of the examined students have dental caries in their deciduous teeth and one third of them (28.0%) have dental caries in their erupted permanent teeth. The dental caries prevalence among 6-11 year-old school children is above the recommended target of WHO and Federation of Dentistry International of having less than 50% caries free children by 2000 [18]. Our results are similar to reports from countries which have similar socioeconomic and cultural environments such as Philippines, Korea, Kuwait, Ajman, Estonia, Iran, Brazil, and India where more than 70% of their schoolchildren are affected by tooth decay [19-25]. On the other hand countries such as United Kingdom, Portugal, Northern Ireland, Poland, Greece, and Italy reported 50% caries free schoolchildren [26-31].

In surveys conducted in Europe between 1991 and 1995, the mean dmft in primary dentition in children aged 5-7 years ranged between 0.9 and 8.5 [10]. It was lowest in Spain (1.0 dmft) and Denmark (1.3 dmft). National mean dmft values below 2.0 were also reported in Finland, the Netherlands, and Norway [10]. Ireland had the lowest mean dmft value of

0.9 [10]. All of the mentioned countries had a lower mean dmft than this study, which was 4.2 (1.1-5.8) for 7-year-old children.

The mean DMFT in the majority of countries was below 3.0, and in the countries of North-Western Europe and the USA it was below 2.0 [11]. However, other European populations, particularly those living in the Mediterranean area, had different results. Twelve-year-old Sicilian schoolchildren had the mean DMFT of 2.88 and their Sardinian peers of 2.4 [32,33]. Twelve-year-old Greek children had a DMFT from 2.77 to 6.74, and parental education status, reason for visiting a dentist, and oral hygiene were strong determinants for caries experience [34]. Spain had the mean DMFT in 12-year-old children of 1.33, with a goal to reduce it to below 1.0 by 2015 [35,36]. The mean DMFT in German 8-9 year-olds was 0.7 and in Hungary it was 0.4 [37].

The DMFT (0.2) of the examined students was low when compared to other surveys in developed and developing countries. This can be attributed to several factors including the methodology where dentine caries was diagnosed at cavitations level, the age of the selected sample (> 60% were under the age of 8) where only few permanent teeth have recently been erupted, and to some extent to the difference in traditional diets and socio-economic status between urban and rural areas [32-34]. On the other hand, the deft of the same age group was high >3.0 indicating that those students need dental treatment and they are at high risk of developing dental caries in their erupting permanent teeth [16,17].

The results of this study showed that the untreated decay (d) comprised the major component of the dmft score in the current sample approaching approximately 90 % with very low filled component (less than 10%) indicating that the majority of the examined students in this age group (6-11) (mixed dentition stage) didn't seek any dental treatment and emphasizing the need to raise dental awareness among those students and their parents. The same applies to the D component of the DMFT score in the same age group.

Consequently, it is of utmost importance in this age group (mixed dentition stage) for those school children to be closely assessed in order to provide dental care, enhance dental awareness and to allow different preventive measures to be implemented.

A considerable amount of children in the studied population had never been to a dentist nor had access to preventive hygiene practices. 34.3% of the examined students never brushed their teeth, the majority of those (67.6%) were in Hasa, 14.2% were in Tafelah and 0.0% were in Bsera, whereas 63.1% of the examined students in Tafelah reported brushing their teeth one to two times daily compared to 53.2%

in Bsera and only 29.7% in Hasa.

This is against the WHO recommendation for public health efforts to make fluoridated toothpaste affordable in developing countries, [5] and the American Academy of Pediatric Dentistry (AAPD) guidelines which recommended brushing teeth twice a day [38]. Surprisingly enough, Hasa showed the worst teeth brushing frequency and the lowest deft score 1.2 compared to 4.4, 4.5 in Tafelah and Bsera respectively. This difference might be related to the difference in the age of the selected sample (less deciduous teeth in Hasa students), the difference in dietary habits and the source of drinking water where fluoride may be present naturally in Hasa district. Intersectoral coordination with education, government sectors and development of public health policy has profound effect in improving the health of the community people [6]. Schools provide an ideal setting for providing oral health education at

early stage. However education itself is not enough to bring tangible changes in behavior change. Another opportunity to utilize the school setting would be to ensure lifelong skills such as school based tooth brushing and hand washing.

Conclusions

1. 70.6% of the examined students had caries in their deciduous teeth and 28% had caries in their permanent teeth with deft, DMFT scores 3.2, 0.2 respectively.
2. 34.3% of the examined students never brushed their teeth; the majority of those (67.6%) were in Hasa district.
3. Oral hygiene should be enhanced through school based education and school based tooth brushing.
4. Early preventive measures should be made more accessible.

References

1. Rowan-Legg A. Oral health care for children - a call for action. *Pediatric Child Health*. 2011; **18**: 37-43.
2. Schroth RJ, Harrison RL, Moffatt ME. Oral health of indigenous children and the influence of early childhood caries on childhood health and well-being. *Pediatric Clinics of North America*. 2009; **56**: 1481-1499.
3. Filstrup SL, Briskie D, da Fonseca M, Lawrence L, Wandera A, Inglehart MR. Early childhood caries and quality of life: Child and parent perspectives. *Pediatric Dentistry*. 2003; **25**: 431-440.
4. Sheiham A. Oral health, general health and quality of life. *Bull World Health Organ*. 2005; **83**: 644.
5. Petersen PE, Lennon MA: Effective use of fluorides for the prevention of dental caries in the 21st century: the WHO approach. *Community Dentistry and Oral Epidemiology*. 2004; **32**: 319-321.
6. Sheiham A (Editor). Oral health policy and prevention. In *The prevention of Oral Disease* (3rd edn.). Edited by Ed Murray JJ. New York: Oxford University Press; 1996: 234-249.
7. Department of Statistics, Jordan Statistical Yearbook. 2012.
8. Larmas M. Has dental caries prevalence some connection with caries index values in adults? *Caries Research*. 2010; **44**: 81-84.
9. World Health Organization. Oral Health Surveys, basic methods (4th edn.). Geneva (Switzerland): World Health Organization; 1997.
10. Marthaler TM, O'Mullane DM, Vrbic V. The prevalence of dental caries in Europe 1990-1995. ORCA Saturday afternoon symposium 1995. *Caries Research*. 1996; **30**: 237-255.
11. Marthaler TM. Changes in dental caries 1953-2003. *Caries Research*. 2004; **38**: 173-181.
12. Rajab LD, Hamdan MA. Early childhood caries and risk factors in Jordan. *Community Dental Health*. 2002; **19**: 224-229.
13. Rajab LD, Petersen PE, Baqain Z, Bakaeen G. Oral Health Status Among 6- and 12-year-old Jordanian Schoolchildren. *Oral Health & Preventive Dentistry*. 2014; **12**: 99-107.
14. Al-Omiri MK, Al-Wahadni AM, Saeed KN. Oral health attitudes, knowledge, and behavior among school children in North Jordan. *Journal of Dental Education*. 2006; **70**: 179-187.
15. Sayegh A, Dini EL, Holt RD, Bedi R. Caries prevalence and patterns and their relationship to social class, infant feeding and oral hygiene in 4-5-year-old children in Amman, Jordan. *Community Dental Health*. 2002; **19**: 144-151.
16. J. M. Broadbent, W. M. Thomson, and S. M. Williams, "Does caries in primary teeth predict enamel defects in permanent teeth? A longitudinal study," *Journal of Dental Research*. 2005; **84**: 260-264.
17. M. S. Skeie, M. Raadal, G. V. Strand, and I. Espelid, "The relationship between caries in the primary dentition at 5 years of age and permanent dentition at 10 years of age—a longitudinal study," *International Journal of Paediatric Dentistry*. 2006; **16**: 152-160.
18. World Health Organization: Oral health global indicators for 2000. Geneva: World Health Organization; 1988.
19. Cariño KM, Shinada K, Kawaguchi Y. Early childhood caries in northern Philippines. *Community Dental and Oral Epidemiology*. 2003; **31**: 81-89.
20. Rosenblatt A, Zarzar P. The prevalence of early childhood caries in 12- to 36-month-old children in Recife, Brazil. *ASDC Journal of Dentistry for Children*. 2002; **69**: 319-324.
21. Hashim R, Thomson WM, Ayers KM, Lewsey JD, Awad M. Dental caries experience and use of dental services among preschool children in Ajman, UAE. *International Journal of Paediatric Dentistry*. 2006; **16**: 257-262.
22. Olak J, Mändar R, Karjalainen S, Söderling E, Saag M. Dental health and oral mutans streptococci in 2-4-year-old Estonian children. *International Journal of Paediatric Dentistry*. 2007; **17**: 92-97.
23. Jin BH, Ma DS, Moon HS, Paik DI, Hahn SH, Horowitz AM. Early childhood caries: prevalence and risk factors in Seoul, Korea. *Journal of Public Health and Dentistry*. 2003; **63**: 183-188. *Journal of Indian Society of Pedodontics and Preventive Dentistry*. 2006; **24**: 177-181.
24. Mohebbi SZ1, Virtanen JI, Vahid-Golpayegani M, Vehkalahti MM. Early childhood caries and dental plaque among 1-3-year-olds in Tehran, Iran. *Journal of Indian Society of Pedodontics and Preventive Dentistry*. 2006; **24**: 177-181.
25. Goyal A, Gauba K, Chawla HS, Kaur M, Kapur A. Epidemiology of dental caries in Chandigarh school children and trends over the last 25 years. *Journal of Indian Society of Pedodontics and Preventive Dentistry*. 2007; **25**: 115-118.
26. McCabe M, Kinirons MJ. Dental caries and dental registration status in nursery school children in Newry, Northern Ireland. *Community Dentistry and Oral Epidemiology*. 1995; **23**: 69-71.
27. De Almeida CM, Petersen PE, André SJ, Toscano A. Changing oral health status of 6- and 12-year-old schoolchildren in Portugal. *Community Dental Health*. 2003; **20**: 211-216.
28. McCabe M, Kinirons MJ. Dental caries and dental registration status in nursery school children in Newry, Northern Ireland. *Community Dental and Oral Epidemiology*. 1995; **23**: 69-71.
29. Szatko F, Wierzbicka M, Dybizbanska E, Struzyccka I, Iwanicka-Frankowska E. Oral health of Polish three-year-olds and

mothers' oral health-related knowledge. *Community Dental Health*. 2004; **21**: 175-180.

30. Kalyvas DI, Taylor CM, Michas V, Lygidakis NA. Dental health of 5-year-old children and parents' perceptions for oral health in the prefectures of Athens and Piraeus in the Attica County of Greece. *International Journal of Paediatric Dentistry*. 2006; **16**: 352-357.

31. Campus G, Lumbau A, Sanna AM, Solinas G, Lugliè P, Castiglia P. Oral health condition in an Italian preschool population. *European Journal of Paediatric Dentistry*. 2004; **5**: 86-91.

32. Pizzo G, Piscopo MR, Matranga D, Luparello M, Pizzo I, Giuliana G. Prevalence and socio-behavioral determinants of dental caries in Sicilian schoolchildren. *Medical Science Monitor*. 2010; **16**: 83-89.

33. Campus G, Lumbau A, Lai S, Solinas G, Castiglia P. Socio-economic and behavioural factors related to caries in twelve-year-old Sardinian children. *Caries Research*. 2001; **35**: 427-434.

34. Vadiakas G, Oulis CJ, Tsinidou K, Mamai-Homata E, Polychronopoulou A. Socio-behavioural factors influencing oral health of 12 and 15 year old Greek adolescents. A national pathfinder survey. *European Archives of Paediatric Dentistry*. 2011; **12**: 139-145.

35. Bravo Perez M, Casals Peidro E, Cortes Martincorena FJ. Oral health survey of Spain 2005 [in Spanish]. RCOE. 2006; **11**: 409-456.

36. Bravo M, Cortes J, Casals E, Llena C, Almerich-Silla JM, Cuenca E. Basic oral health goals for Spain 2015/2020. *International Dental Journal*. 2009; **59**: 78- 82.

37. Borutta A, Brauner K, Hufnagl S, Marton S, Mavrodisz K, Tarjan I. Oral health in 8-9 year-old children in Saxony-Anhalt (Germany) and in two Hungarian cities (Budapest and Debrecen). *Community Dental Health*. 2006; **23**: 26-30.

38. American Academy of Pediatric Dentistry. Council on clinical Affairs, Committee on the Adolescent. Guidelines on adolescent oral health care. *American Academy of Pediatric dentistry*. 2010; **16**: 146-153.