Oral Health Status of Children Aged 6–12 Years From the Danube Delta Biosphere Reserve

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Abstract

Aim: The aim of this study was to investigate the oral health status of children aged 6–12 years old living in the Danube Delta Biosphere Reserve.

Methods: The entire population of 6–12-year-olds living in the Reserve was targeted. A cross-sectional study consisting of dental examinations based on World Health Organization (WHO) 1997 criteria was performed in 2011. Dental caries, periodontal (gingival) health, oral hygiene, orthodontic status, and dental fluorosis were assessed at the children's schools by one examiner.

Results: A total of 595 children were examined. The overall mean DMFT was 2.01 (range 0–13) and 32.9% of children had caries-free permanent teeth. The mean DMFT for 12-year-olds was 2.46. Gingival bleeding was found in 32.8% of the children and oral hygiene worsened with age. Only 8% of 12-year-olds were free of dental plaque. There was a low need for orthodontic treatment (89% of children were Index of Orthodontic Treatment Need grade 1 or 2) and only 2% had any noticeable fluorosis.

Conclusions: The oral health status of children living in the Danube Delta Biosphere Reserve can be classified as quite poor, especially due to the low number of caries-free children and the high prevalence of children with gingival bleeding and poor or fair oral hygiene. Malocclusion and fluorosis do not appear to be public health problems for this population. Considering the poor economic development of the region, with bad access to dental services, special health education programmes are necessary in order to reach the WHO oral health goals for 2020.

Key Words: Oral Health, Epidemiology, 6–12-Year-Olds, Danube Delta, Romania

Introduction

Almost a decade has passed since the World Health Organization (WHO) published a report aimed at the continuous improvement of oral health in the twenty-first century [1]. The document stressed that oral health is integral to general health and that it is essential for general wellbeing. Despite numerous efforts, the improvement of oral health still remains a challenge in both developed and developing countries [1]. Oral health in children and adolescents was recognised as a priority action area and countries were encouraged to develop preventive approaches through health education in schools, through partnerships between families, schools, oral health professionals and communities, and by improving access to preventive and curative oral health services.

During last two decades in Romania, the transition to a free economy and reform of the health system has focused on decentralisation. This has made it difficult to adopt a national approach to improving the oral health status in Romanian children and young people. Even though access to basic oral health services is legally covered by the social health insurance system, in reality—because reliable data are rarely collected at a population level—it is difficult to assess the oral health of the population. Additionally, there are some remote areas where access to dental care is very poor due to the absence of facilities and staff. One of these regions is the Danube Delta Biosphere Reserve. This is a natural paradise formed by the waters of the river Danube, which passes through ten countries and four capitals and finally flows into the

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Black Sea via the delta. This area of floating reed islands, forests and sand dunes covers almost 3000 square miles and is home to a fascinating mix of cultures and people as well as a vast array of wildlife. It is, perhaps, the least-inhabited region in temperate Europe, with a density of approximately two inhabitants per square kilometre [2]. The population of the Danube Delta is scattered in 24 settlements that are divided into seven communes. The largest village in each commune serves as a centre for social services. The population of approximately 15,000 inhabitants is composed mainly of people of Romanian origin; the remainder is a mixture of Russians, Lipovans, and Ukrainians living in isolation, often without the comforts of modern life. Their only occupations are the traditional ones of fishing, sheep- and cattle-breeding. No one has previously investigated their oral health status.

Aim

The aim of this study was to investigate the oral health status of children aged 6–12 years old living in the Danube Delta Biosphere Reserve.

Methods

A cross-sectional study was conducted in the Danube Delta Biosphere Reserve, targeting all children between 6 and 12 years of age. This age group was chosen because of the age of enrolment in primary schools in Romania and the WHO recommendation [3]. The children were examined in their schools, during their regular classes, in their classrooms. The oral examination of the children was undertaken by one investigator between February 2011 and October 2011. Because the area is composed of small isolated villages and children do not always attend school, two visits took place to every school.

All the children aged between 6 and 12 years who were at school on the examination days were examined. Every child was examined once. A self-administrated questionnaire was used for demographic data collection (age, gender, school). Oral health was assessed using the WHO (1997) criteria and procedures [3]. Data were collected on:

- Dental caries (decayed, missing, or filled teeth index, DMFT or dmft).
- Periodontal status, which was assessed by the use of the Oral Hygiene Index–Simplified (OHI–S) [4] and the Plaque Index (Silness & Löe, 1964) [5] for oral hygiene and plaque, and WHO (1997) recommendations [3] for gingival health.
- Orthodontic status (Angle's classification of occlusion and orthodontic treatment need; dental health component of the Index of Orthodontic Treatment Need [IOTN] [6]).
- Dental fluorosis (Dean Index, 1942) [7].

Periodontal status was assessed by probing the central upper index and the molar respectively, to detect the bleeding response. The codes recommended by WHO (1997) [3] were used. Oral hygiene was classified as good, fair, or poor, according to the OHI–S score (<1, 1-2, and 3-6, respectively). In addition, the Silness & Löe (1964) Plaque Index was used. Occlusion was assessed according to Angle's classification (molar Classes I, II, and III). Orthodontic treatment needs were classified according to the dental health component of the IOTN and were interpreted as: no need for treatment (grades 1, 2), borderline need (grade 3) and normative need (grades 4 or 5) [6]. Dental fluorosis was assessed according to WHO 1997 recommendations and classified as normal, questionable, very mild, mild, moderate, or severe [3].

Oral health-related quality of life was also assessed using Oral Impact of Daily Performance (OIDP) questionnaire and Michigan Oral Health-Related Quality of Life Scale—child and parent versions [8-10]. The resulting data for oral health-related quality of life will be presented elsewhere.

Ethical considerations

The research protocol was approved by the Ethical Committee of the Medical College of Tulcea, Romania, by the District the Public Health Department, by the County Board of Education, and by individual school authorities. A letter was sent to each parent explaining the aim and the significance of the study and asking for their child's participation in the study. Informed consent was given by the parents for every child included in the study.

Statistical analysis

Variables were assessed for normality using the Kolmogorov-Smirnov test. The non-symmetric scale variables were reported as medians (range). Mann-Whitney *U*-test was used for comparison. A *P*-value <0.05 was considered for statistical significance (two-tailed test). Categorical data were presented as percentages with one decimal.

Table 1. *Distribution by age group and gender in study population compared to overall population of 6-12-year-olds in the Danube Delta Reserve*

Age group	Overall population				Study population			
	Boys		Girls		Boys		Girls	
	(no)	(%)	(no)	(%)	(no)	(%)	(no)	(%)
6 years	58	13.8%	64	15.4%	7	2.3%	7	2.4%
7 years	48	11.4%	63	15.1%	39	12.9%	49	16.7%
8 years	63	15.0%	66	15.9%	49	16.2%	54	18.4%
9 years	65	15.4%	64	15.4%	52	17.2%	51	17.4%
10 years	63	15.0%	56	13.5%	52	17.2%	46	15.7%
11 years	57	13.5%	51	12.3%	47	15.6%	43	14.7%
12 years	67	15.9%	52	12.5%	56	18.5%	43	14.7%
Total	**421**	**100.0%**	**416**	**100.0%**	**302**	**100.0%**	**293**	**100.0%**

Percentages were compared by using the chi-square test ($P<0.05$). Statistical software was used for data entry (Microsoft Office Excel 2007 for Windows, Microsoft Corporation, Redmond, WA, USA) and analysis (Statistical Package for Social Sciences version 17.0, SPSS Inc, Chicago, USA, and Open Epi; www.openepi.com)

Results

In the study, 595 children (302 boys and 293 girls) were examined, forming 71.1% of the 837 6–12-year-olds living in the Danube Delta Biosphere. A total of 242 were not examined, 108 of whom were 6-year-olds (*Table 1*). This was because although children can enrol in schools starting at an age of 6 years, many families prefer them to start at 7 years of age. So, many 6-year-olds were not enrolled at school. For a variety of reasons, the other 134 missing children cases were not present at schools on either of the two days when oral examinations were performed.

The median age was 10 years for boys and 9 years for girls. The gender structure and age group distribution were similar to the total population of 6–12-year-olds in the Danube Delta Reserve ($P=0.86$), except for the 6-year-olds, who, as mentioned previously, were under represented in the study group (*Table 1*). Caution is therefore needed in interpreting data related to the 6-year-olds.

Dental caries

Both original and logarithmic values of DMFT were not normally distributed ($P<0.05$, test Kolmogorov-Smirnov). The overall mean DMFT for all children of all ages was 2.01 (1.85 for boys and 2.17 for girls). For 12-year-olds, the mean DMFT was 2.46 (*Table 2*).

Overall, 32.9% of the children had caries-free permanent teeth with no significant difference by gender. This percentage decreased by age group,

Table 2. *DMFT in the study population (overall, by gender, by age group)*

DMFT	Median	Range	Coefficient of quartile deviation	Mean	SD	% of caries free	*P**
Total	**2**	**0-13**	**1**	**2.01**	**2.076**	**32.9%**	-
Boys	2	0-13	1	1.85	2.089	35.8%	0.13
Girls	2	0-10	1	2.17	2.054	30.0%	
Age group							
6 years	**0**	**0 - 2**	**1**	**0.29**	**0.611**	**78.6%**	**0.19**
7 years	0	0 - 10	1	1.15	2.115	60.2%	0.00
8 years	2	0 - 11	1	1.99	1.978	33.3%	0.31
9 years	2	0 - 10	1	1.94	2.127	39.8%	0.07
10 years	2	0- 13	1	2.58	2.636	27.6%	0.31
11 years	2	0 - 7	0.5	2.08	1.671	21.1%	0.06
12 years	**3**	**0 - 7**	**0.5**	**2.46**	**1.507**	**11.1%**	**-**

*Chi-square test, between genders and between adjacent age groups.

from 78.6% in 6-year-olds to 11.1% in 12-year-olds. A significant difference was seen between 6- and 7-year-old children.

Of the 12-year-olds, 17.2% had a DMFT higher than 3 and 72.7% had a DMFT higher than 1.5.

Gingival status

Of the children examined, 32.8% had a bleeding response when their gingivae were probed, with a significantly higher proportion of boys bleeding than girls (37.4% and 28.0% respectively, *P*=0.01). There were variations by year of age in the percentage of with bleeding gums, with the highest percentage (52.4%) in the 9-year-olds and the lowest in (20.00%) in 11-year-olds (*Table 3*).

Table 3. *Gingival status*

Age	Gingival status		
	Normal (%)	**Bleeding gums (%)**	***P****
6 years	71.4%	28.6%	NA
7 years	67.1%	32.9%	0.18
8* years	75.7%	24.3%	0.00
9 years	47.6%	52.4%	0.05
10*years	61.2%	38.8%	0.00
11 years	80.00%	20.00%	0.24
12 years	72.7%	27.3%	-
TOTAL	**67.2%**	**32.8%**	**-**

* Chi-square test, comparison among adjacent age groups.

Oral hygiene status

Overall, 27.1%, 57.6%, and 15.3% of the children had a good, fair and poor oral hygiene respectively (*Figure 1*). No differences were seen between boys and girls. The oral hygiene status seemed to worsen by age, except for the 6-year-olds, very few of whom were examined (*Figure 2*).

Overall, the Silness & Löe (1964) Plaque Index indicated that 26.4% of the children had no plaque (a score of 0), 58.8% had plaque visible when a probe was rubbed on the tooth surface (a score of 1) and 14.5% had visible or abundant plaque (a score of 2 or 3). The percentage of children without plaque decreased as the children grew older (*Figure 3*).

Angle's class of occlusion

Of the children examined, 64.0%, 29.9% and 6.1% had Angle's class I, II and III occlusion, respectively, with no difference among genders and adjacent age groups, except between the 7- and 8-year-olds (*Table 3*).

Orthodontic treatment need

Overall, 92.1% of the children had no need for orthodontic treatment and 7.6% had a borderline need, without difference by gender or age group (*Table 5*). A normative need for treatment was found very rarely (only in two girls).

Fluorosis

Of the children who were examined, 19.5% seemed to have fluorosis, the majority in questionable form. Very mild and mild cases were found rarely

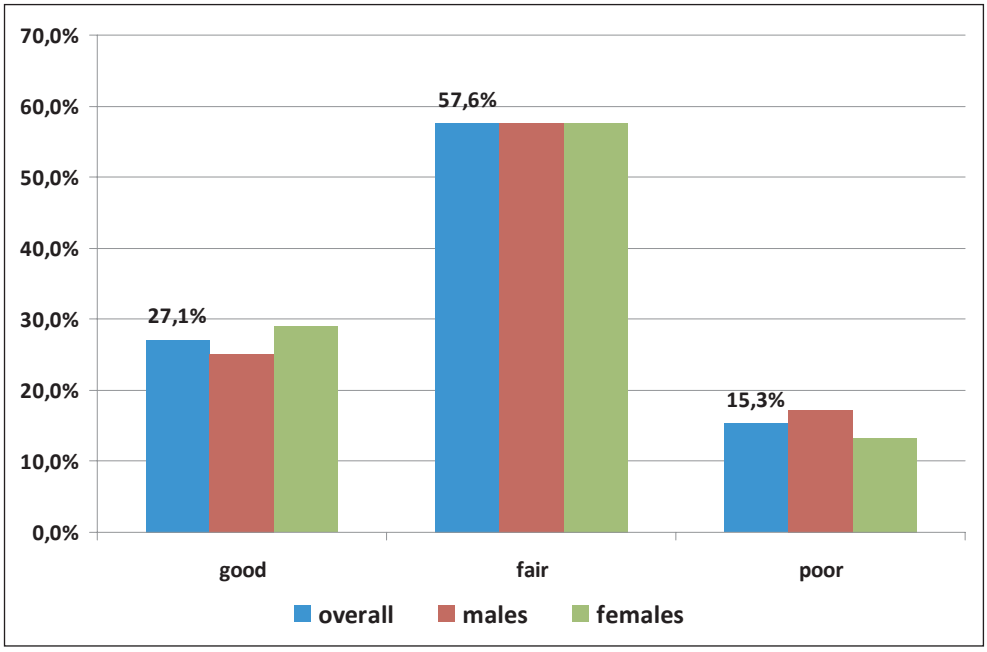

Figure 1. *Oral hygiene status by gender.*

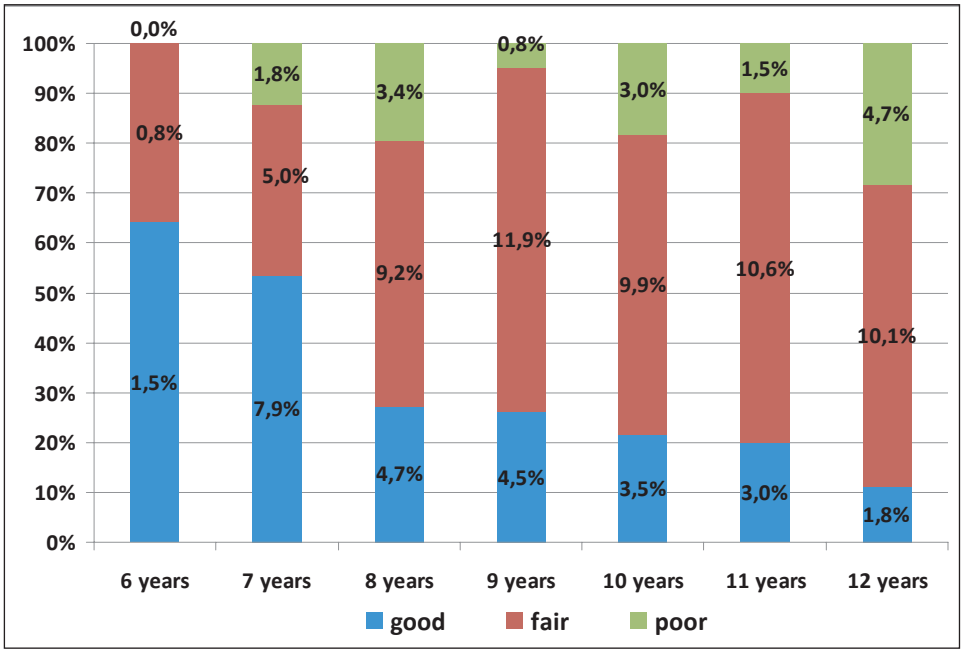

Figure 2. *Oral hygiene status by age group.*

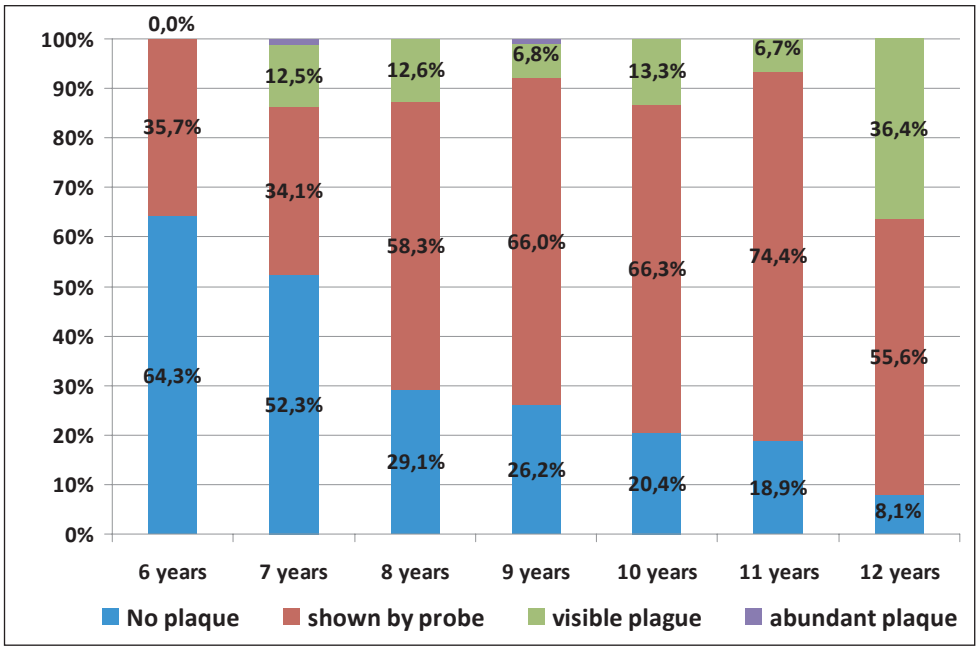

Figure 3. *Bacterial plaque by age group.*

Table 4. *Angle's class of occlusion.*

Age	Angle's class			
	I (%)	II (%)	III (%)	*P**
6 years	100.0%	0.0%	0.0%	NA
7 years	79.5%	19.3%	1.1%	0.00
8* years	51.5%	46.6%	1.9%	0.12
9 years	62.1%	35.9%	1.9%	0.99
10*years	62.2%	25.5%	12.2%	0.99
11 years	62.2%	26.7%	11.1%	0.84
12 years	63.6%	27.3%	9.1%	-
TOTAL	**64.0%**	**29.9%**	**6.1%**	**-**

* Chi-square test, comparison among adjacent age groups.

(*Table 6*). No differences were seen by gender or by age group, except for age groups 7 to 8 years (increasing) and 10 to 11 years (decreasing)

Discussion

This study is the first to examine the oral health status of children living in the rural areas from the Danube Delta Biosphere Reserve. In spite of the fact that it is a remote area, with very poor access to medical and dental services, especially for prevention, if mean DMFT is considered, the oral health of the children seemed rather good compared to that in many new European Union (EU) member states, non-EU East European countries, and to other Romanian studies. For 12-year-olds

Table 5. *Orthodontic treatment need*

Variable	Orthodontic treatment need (IOTN)			
	No need	Borderline need	Normative need	*P**
Overall	92.1%	7.6%	0.3%	NA
Boys	90.4%	0.7%	0.0%	0.12
Girls	93.9%	5.5%	0.7%	-
Age groups				
6 years	100.0%	0.0%	0.0%	-
7 years	97.7%	2.3%	0.0%	0.06
8 years	89.3%	8.7%	1.9%	0.77
9 years	92.2%	7.8%	0.0%	0.42
10 years	88.8%	11.2%	0.0%	0.09
11 years	95.6%	4.4%	0.0%	0.10
12 years	88.9%	11.1%	0.0%	-

* Chi-square test, comparison among adjacent age groups.

Table 6. *Fluorosis*

Variable	Dean's Fluorosis Index				
	Normal	Questionable	Very mild	Mild	*P**
Overall	80.5%	17.3%	1.8%	0.3%	NA
Boys	81.1%	15.9%	2.3%	0.7%	0.28
Girls	79.9%	18.8%	1.4%	0.0%	-
Age groups					
6 years	64.3%	35.7%	0.0%	0.0%	0.20
7 years	80.7%	19.3%	0.0%	0.0%	0.03
8 years	67.0%	30.1%	2.9%	0.0%	0.17
9 years	75.7%	22.3%	0.0%	1.9%	0.41
10 years	80.6%	13.3%	6.1%	0.0%	0.00
11 years	94.4%	3.3%	2.2%	0.0%	0.18
12 years	88.9%	11.1%	0.0%	0.0%	-

* Chi-square test, comparison among genders or adjacent age groups.

living in the Danube Delta Biosphere, the mean DMFT was 2.46, which is lower than has been reported in the new EU member states except for Cyprus, Malta and Slovenia [11]. It is also lower than the mean the DMFT for Romania, reported to the WHO some 11 years ago in 2000 [11]. The result is consistent with other studies in 12-year-old Romanian children in the country's two largest cities, which found mean DMFTs of 2.59 in Constanta [12] and 2.01 in Bucharest [13]. Higher values for mean DMFT have been found in recent studies in neighbouring countries such as 3.1 Bulgaria [11], 3.8 Albania [14] and 4.8 Croatia [15]. However, the mean DMFT reported in the current study is higher than those reported in all of the old EU member states [11]. Unfortunately, it is higher than the target mean DMFT for 12-year-olds of 1.5 by the year 2020, set for Europe in the WHO Health21 policy [16].

The prevalence of children with caries-free permanent teeth was 32.9% (overall), 78.6% (6-year-olds), and 11.6% (12-year-olds) For the 12-year-olds, it was much lower than had been found in the Constanta (22.2%) [12] and the Bucharest (44.7%) studies [13]. The apparent prevalence for the 6-year-olds did not meet the WHO European Goal for Oral Health target of at least 80% of 6-year-olds to be caries free. However, as only 11.4% of Danube Delta Reserve 6-year-olds took part in this study, this result should be viewed with caution.

The prevalence of gingival bleeding was of 27.3% in 12-year-old children, almost double that found in school children of same age from Bucharest [13].

Oral hygiene was identified as a problem: only 27.1% of the children of all ages had good oral hygiene and only 26.4% were found to be free of bacterial plaque. Furthermore, oral hygiene deteriorated as the children grew older. This result calls for immediate oral health education programmes for children.

The orthodontic treatment need was low compared to that found in children from Bucharest [13] and a small percentage of children suffered from fluorosis (1.8% very mild and 0.3% mild).

Conclusion

The oral health status of children living in the Danube Delta Biosphere Reserve can be classified as quite poor, especially due to the low number of caries-free children and the high prevalence of children with gingival bleeding and poor or fair oral hygiene. Malocclusion and fluorosis do not appear to be public health problems for this population. Considering the poor economic development of the region, with bad access to dental services, special health education programmes are necessary in order to reach the WHO oral health goals for 2020.

Contributions of each author

- ITJ commissioned the work and checked the drafts.
- AIC gave advice and checked drafts.

Statement of conflict of interest

As far as the authors are aware, there is no conflict of interests.

References

1. Petersen PE. The World Oral Health Report, 2003: continuous improvement of oral health in the 21st century—the approach of the WHO Global Oral Health Programme. *Community Dentistry and Oral Epidemiology.* 2003; **32 Suppl 1**: 3-24.

2. Eurostat. *Statistical Yearbook of Romania*. Luxemburg: European Commission; 2012.

3. World Health Organization (WHO). *Oral Health Surveys. Basic Methods*. 4th ed. Geneva: WHO; 1997.

4. Greene JC, Vermillion JK. The simplified oral hygiene index. *Journal of the American Dental Association*. 1964; **68**: 7-13.

5. Silness , Löe H. Periodontal disease in pregnancy. II Correlation between oral hygiene and periodontal condition. *Acta Odontologica Scandinavia.* 1964; **24**: 747-759.

6. Brook PH, Shaw WC. The development of an orthodontic priority index. *European Journal of Orthodontics.* 1989; **11**: 309-320.

7. Dean HT. The investigation of physiological effects by the epidemiological method. In: Moulton FR, editor. *Fluorine and Dental Health*. Publication no 19. Washington, DC: Association for the Advancement of Science; 1942. p. 23-31.

8. de Oliveira CM, Sheiham A. Orthodontic treatment and its impact on oral health-related quality of life in Brazilian adolescents. *Journal of Orthodontics.* 2004; **31**: 20-27.

9. Gherunpong S, Tsakos G, Sheiham A. A sociodental approach to assessing dental needs of children: concept and models. *International Journal of Paediatric Dentistry*. 2006; **16**: 81-88.

10. Hassan A, Amin ES. Association of orthodontic treatment needs and oral health-related quality of life in young adults. *American Journal of Orthodontics and Dentofacial Orthopedics*. 2010; **137**: 42-47.

11. Country Area Profile Project. Country Oral Health Profiles. Oral Health Database: Dental Caries for 12 Year Olds. Accessed (2012 Feb 4) at:

12. Nuca C, Amariei C, Martoncsak E, Tomi DD. Study regarding the correlation between the Child-OIDP index and the dental status in 12-year-old children from Harsova, Constanta county. *Oral Health and Dental Management in the Black Sea Countries*. 2005; **4**(4): 4-13.

13. Dumitrache MA, Comes C, Teodorescu E, Dumitraºcu L, Cuculescu M, Ionescu E. Life quality related to oral health of school children from Bucharest. *Revista Romana de Bioetica*. 2009; **7**: 169-178.

14. Hysi D, Droboniku E, Toti C, Xhemnica L, Petrela E. Dental caries experience and oral health behaviour among 12-year-olds in the city of Tirana, Albania. *Journal of Oral Health and Dental Management.* 2010; **9**: 229-234.

15. Dukiæ W, Delija B. Caries prevalence among schoolchildren in Zagreb, Croatia**.** *Croatian Medical Journal.* 2011; **52**: 665-671.

16. World Health Organization (WHO). *Health21: Health for All in the 21st Century.* Copenhagen: WHO Regional Office for Europe; 1999.