

# Survey of dental caries prevalence, dietary and oral hygiene habits among urban and rural 5 and 12-years old children in The Gambia

*Silvio Kosovic, Angelica Nilsson-Andersson*

Department of Paediatric Dentistry, School of Dentistry,  
Karolinska Institutet, Box 4064,  
S-141 04 Huddinge, Sweden

## **Abstract**

The aim of this survey was to assess the dental caries status, dietary and oral hygiene habits among urban and rural 5 and 12-years old children in The Gambia, for the purpose of establishing the dental treatment need. One hundred nine 5-years old (45 boys, 64 girls) and 172 12-years old (87 boys, 85 girls) schoolchildren were examined according to the criteria set by the WHO. Interviews were conducted using a fixed questionnaire to determine the dietary and oral hygiene habits of the children. Eighty-eight and 73% of the examined 5 respectively 12-years old children exhibited clinically diagnosed caries. Furthermore, girls tend to be more caries free than boys. A tendency of more girls than boys being caries free is suggested in the results. At an average, dmft among the 5-years old was 4.25, and the highest dmft (5.87) was observed among urban children with low socio-economic standards while significantly lower dmft (2.97) was found in the children living in the rural area ( $p < 0.001$ ). DMFT for the 12-years old was at an average 2.27. The highest DMFT (2.84) in this age group was found among the rural children and significantly differ ( $p < 0.05$ ) from the urban children with high socio-economic standards (DMFT = 1.69). Treatment need (dt/dmft) for 5-years old was very high, 86% were untreated. Corresponding value for the 12-years old was 70%. Oral hygiene habits such as frequency of tooth brushing were more established in the 12-years old than in the 5-years old, while consumption of sweets/candy and soft drinks was more frequent in the 5-years old. The study shows that 5 and 12-years old children in The Gambia exhibited high caries prevalence and treatment need. Therefore, great need for dental treatment and preventive measures are advocated.

## **Introduction**

The Republic of The Gambia a small country situated in Western Africa bordering the Atlantic Ocean and Senegal. It's population of 1.501.050 (1) is characterised by a growing young population, 44.9% are 0-14 years. The inhabitants are divided into five major ethnic groups Mandinka, Fula, Wolof, Jola, and Serahuli of whom 90% are Muslims, 9% are Christian and 1% have indigenous beliefs.

In 2001 the GDP per capita was 1214 international dollars of which 6.4% was calculated as health expenditure (2). The life expectancy at birth is 58.9 years for females respectively 55.4 years for males (2).

Compared to other African countries, The Gambia has been spared from a high prevalence of HIV and AIDS. The prevalence of HIV and AIDS is estimated to be 1.6 % (Botswana 38.8%) in the adult population (3). Malaria and tuberculosis are other infectious diseases with potentially deadly outcomes. General health resources consists of mainly 55 medical physicians, while the oral health personal is composed of 6 dentists (2 of these are oral surgeons), 1 dental therapist, 25 chair side nurses, 1 dental hygienist and 4 lab technicians (4). Approximately half are state employed (5). Recent data concerning oral health in The Gambia is rare. Earlier reports have

suggested that the prevalence of caries amongst 12-years old children was 1.6 (DMFT)1989 (6) which was low compared to available data from industrial countries at that time. Oral health in most of the third world countries including The Gambia has deteriorated since then mainly due to urbanisation that has lead to a change in food culture, with a tendency to abandon traditional food habits for the more popular high sucrose containing western foods and beverages. A recent survey of the caries situation in The Gambia indicates a deterioration of the oral health status among children 12-years of age. According to this study among children 12-years of age DMFT had increased from 1.6 in 1989 to 2.3 in 1995 (7). Due to these findings and lack of data concerning dmft in the primary dentition this study was undertaken. The objective of this study was to determine the prevalence of caries and survey the dietary and oral hygiene habits as well as knowledge of oral health amongst 5 and 12-years old children from urban and rural areas in The Gambia.

### **Material and methods**

#### **Subjects**

Five and 12-years old children from urban and rural areas of The Gambia were randomly selected and examined. The primary division of subjects was made according to the recommendations that WHO has stated in their *Fourth edition of the "Oral Health Surveys - Basic methods"*, Geneva 1997 (8). Further the subjects where divided up based on their socio-economic belonging which resulted in high and low socio-economic categories in the urban area and one low socio-economic category in the rural area.

**Table 1.** Demographic data of the children examined.

Area/socio-economic status	Age	Location	School	Number
Urban/high	5	Serrekunda	St. Joseph Ex-pupils School	25
		Bakau	Marina International School	13
	12	Serrekunda	Ndow´s Comprehensive School	41
		Bakau	Marina International School	22
Urban/low	5	Serrekunda	Malnut Kindergarten	24
		Bakau	The Swallow Nursery School	13
	12	Serrekunda	Barothe Annex Lower Basic School	49
Rural/low	5	Kubuneh	Kubuneh Arabic School	7
		Mandinari	Jones Nursery School	23
	12	Kubuneh	Kubuneh Arabic School	11
		Makumbaya	Makumbaya Lower Basic School	44

The urban 5-years old and 12-years old children were selected from four respectively three different city schools and nursery schools with different socio-economic status from two cities situated on the north western bank of The Gambia. The 5-years old children from the rural area were selected from two schools in the villages of Kubuneh and Mandinari. These children are sent



## Interview

After the intra oral examination, the children were interviewed concerning their dietary and oral health habits as well as their knowledge of oral health by a teacher or an employee of the non governmental organisation *Youth Action For Food, Self-sufficiency and Education* (Y.A.F.F.S.E.) who interpreted the questions from a fixed questionnaire in English into the local spoken language. All examined subjects answered the questionnaire. When the answers were evaluated a discrepancy in questions number 2 and 3 was noted in 50 subjects answers presumably due to misinterpretation. The subjects were, therefore, re-asked the same questions afterwards.

<b>Dietary habits</b>	<b>Oral hygiene habits</b>
1. How many times do you eat per day? <input type="radio"/> 2-4 <input type="radio"/> 4-6 <input type="radio"/> >6	4. Do you rinse your mouth with water after meals? <input type="radio"/> No <input type="radio"/> Sometimes <input type="radio"/> Always
2. How often do you eat sweets/candy? <input type="radio"/> never/once in a while <input type="radio"/> 1 time/week <input type="radio"/> 2 times/week <input type="radio"/> 3-5 times/week <input type="radio"/> Every day <input type="radio"/> Several times/day	5. How often do you brush your teeth? <input type="radio"/> Never/once in a while <input type="radio"/> 1 time/week <input type="radio"/> 1 time/day <input type="radio"/> 2 times/day <input type="radio"/> More than 2 times/day
3. How often do you drink soft drinks? <input type="radio"/> never/once in a while <input type="radio"/> 1 time/week <input type="radio"/> 2 times/week <input type="radio"/> 3-5 times/week <input type="radio"/> Every day <input type="radio"/> Several times/day	6. What type of toothbrush do you use? <input type="radio"/> None <input type="radio"/> Imported type <input type="radio"/> Chewing stick
<b>Knowledge of oral health</b>	
Level of knowledge	
7. What causes cavities? What should you do to protect yourself from caries? <input type="radio"/> Low <input type="radio"/> Some <input type="radio"/> Good - knowledge of bacterial infection, association to sugar consumption and that tooth brushing reduce bacterial load.	

**Figure 2.** Fixed questionnaire.

## Statistical methods

The collected dental data was statistically analysed using the One-way Anova test. The Chi-square test was used for analyses of data consisting of frequencies in discrete categories. Differences were considered significant at  $p < 0.05$ .

## Results

### Dental caries

Eighty-eight and 73 percent of the examined 5 respectively 12-years old children exhibited clinically diagnosed caries. The mean dmft, DMFT, percent caries free individuals and treatment need of the children examined are presented in Table 2 and 3.

**Table 2.** Caries prevalence and % caries free 5-years old children in urban and rural areas of The Gambia.

	Urban		Rural	Total (n=109)
	High (n=38)	Low (n=36)	Low (n=35)	
Sex (number male/female)	15/23	19/17	11/24	45/64
dmft, mean ( $\pm$ S.D.)	3.97 (3.33)	5.78 (3.58)	2.97 (2.87)	4.25 (3.45)
% caries free	13	3	26	14
dt/dmft	93	94	100	95

DMFT= decayed, missing, filled teeth

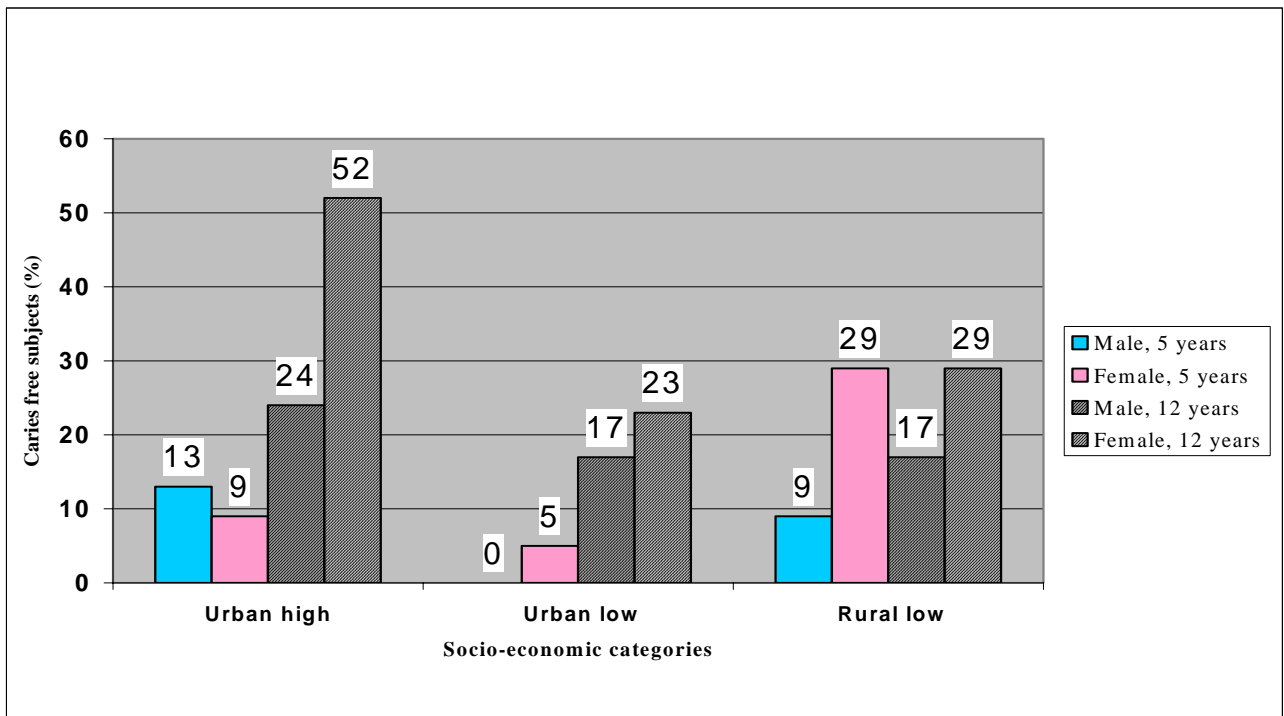
The prevalence of caries (dmft) among the 5-years old urban and rural children was 4.25. The mean dmft values differed significantly between the three groups, thus urban children with high socio-economic status, urban children with low socio-economic status and rural children with low socio-economic status ( $p < 0.01$ ). The 5-years old children living in the urban area with low socio-economic status exhibited the highest dmft (5.78), this level was significantly higher ( $p < 0.05$ ) compared to the children with high socio-economic status living in the same area (3.97). The lowest dmft (2.97) was recorded among the children living in the rural area and differed significantly from the urban children with low socio-economic status ( $p < 0.001$ ). Children living in the rural area exhibited the highest treatment need of 100%.

**Table 3.** Caries prevalence and % caries free 12 years old children in urban and rural areas of the Gambia.

	Urban		Rural	Total (n=172)
	High (n=65)	Low (n=50)	Low (n=57)	
Sex (number male/female)	34/31	24/26	29/28	87/85
dmft, mean ( $\pm$ S.D.)	1.69 (1,91)	2.38 (2,18)	2.84 (2.68)	2.27 (2.31)
% caries free	37	28	23	30
dt/dmft	64	87	93	83

DMFT= decayed, missing, filled teeth

More caries free children (30%) were found among the 12-years old when compared to the 5-years olds (14%). The prevalence of caries (DMFT) among the 12-years old urban and rural children was in general 2.27. The mean DMFT values differed significantly between the three groups, thus urban children with high socio-economic status, urban children with low socio-economic status and rural children with low socio-economic status ( $p < 0.05$ ). The prevalence of caries (DMFT=2.84) among the children in the rural area was significantly higher ( $p < 0.05$ ) when compared to the urban children high socio-economic status (DMFT=1.69) but was similar to the urban children with low socio-economic status. Children living in the rural area exhibited the highest treatment need of 93% while the urban children with high socio-economic status had only a 64% treatment need.



**Figure 3.** Distribution in % of caries free male and female 5 and 12-years old children in urban and rural areas in The Gambia

A pattern of more females than boys being caries free is seen (Fig.3) in 5 and 12-years old male and female subjects among urban high, urban low and rural low socio-economic groups. All socio-economic groups show the same pattern except 5-years old children in the urban high socio-economic group. Which showed a greater number of males being caries free. At an average in the group of 5-years old boys 3% were caries free compared to 12% of the girls. Corresponding values for 12-years old boys and girls are 38% respectively 47%. Saravanan S. et al., 2003 (9) also observed that more females than males among examined school children in India were caries free.

### **Dietary habits**

All examined subjects were interviewed using a fixed multiple choice questionnaire that included questions – *How often do you eat sweets/candy?* and – *How often do you drink soft drinks?* The findings are presented in table 4.

**Table 4.** Intake of refined carbohydrates in % among 5 and 12-years old children in urban and rural areas of The Gambia.

Type of sucrose intake	Consumption	Urban				Rural	
		High SE-status		Low SE-status		Low SE-status	
		5y	12y	5y	12y	5y	12y
Sweets and candy	Low	13	9	5	25	0	31
	Moderate	33	51	19	40	50	43
	High	54	40	76	35	50	26
Soft drinks	Low	0	5	6	25	0	41
	Moderate	16	49	6	40	62	46
	High	84	46	88	35	38	13

Low consumption= never or once in a while

Moderate consumption= 1 time/week + 2 times/week

High consumption= 3-5 times/week + every day + several times/day

SE-status= socio-economic status

The highest intake for both sweets/candy and soft drinks was observed in the 5-years old living in the urban area under low socio-economic standards. Generally most of the 5-years old are in the high consumption group while the 12-years old answer that they have a more moderate to low consumption. Thus, the intake of high sucrose containing food and beverages is higher in the in the 5-years old compared to the 12-years old. The statistical significance for intake of sweets and candy was  $p < 0.05$  for both 5 and 12-years old. Corresponding significance for soft drinks is  $p < 0.001$ .

#### Oral hygiene habits

To asses the oral hygiene habits question number 5, – *How often do you brush your teeth?* was asked. In the results from those interviews the urban living children in both age categories exhibited a higher brushing frequency.

**Table 5.** Tooth brushing frequency in % among 5 and 12-years old children in urban and rural areas of The Gambia.

Frequency	Urban				Rural	
	High SE-status		Low SE-status		Low SE-status	
	5y	12y	5y	12y	5y	12y
Low	5	1	6	6	41	33
Moderate	44	24	70	52	6	30
High	51	75	24	42	53	37

Low frequency= never or once in a while + 1 time/week

Moderate frequency= 1 time/day

High frequency= 2 times/day + more than 2 times/day

SE-status= socio-economic status

More then 50% of the 5 and 12-years old urban children with high socio-economic status brush their teeth 2 times a day or more. Urban and rural children 5 and 12-years old living under low socio-economic conditions brush their teeth less frequently then the urban high, only in the rural

5-years old more than 50% brushed their teeth 2 times a day or more. Within the age groups of 5 and 12-years statistical significance for tooth brushing was  $p < 0.001$ .

In all categories a higher teeth cleaning frequency is seen in the older subject group, 12-years old children, compared to the younger 5-years old. A higher frequency of children did not clean or rarely clean their teeth in the rural communities when compared to the urban.

The children were asked in question number 6 to answer – “*What kind of toothbrush do you use?*” in the questionnaire. The results showed a difference between the communities where they live in. Fifty percent of the children from the rural areas aged 5-years used chewing stick while the remaining used nothing at all. Among the 12-years old rural living children, 72% used chewing sticks and 28% used imported toothbrushes. All children aged 5-years in the urban area reported that they use imported toothbrushes. The same results were shown in the higher socio-economic category among the 12-years old while 62% of the subjects in the poor urban category used chewing sticks. There was a significant difference ( $p < 0.001$ ) in the 5-years old as well as in the 12-years old.

## **Discussion**

An oral health survey was conducted according to the WHO recommendations to assess the oral health status, treatment needs, dietary and oral hygiene habits among children aged

5 and 12-years in three different socio-economic categories in rural and urban areas of The Gambia. The findings showed that 88% respectively 73% of the 5 and 12-years old children examined exhibited dental caries.

The prevalence of caries (dmft/DMFT) among the 5 and the 12-years old children was estimated to be 4.25 and 2.27 respectively in the present study. Similar results have previously been reported for the 12-years old (7). The results in the present study should, however, be interpreted with caution, since the method used (8) did not include radiographic examination. Thus, higher dmft/DMFT values are likely since approximal dental caries was only registered when manifested clinically. Furthermore, the examiners might also have affected the results due to variation in clinical registration skills as two of the participating examiners were last year dental students. Variation in sunlight might also have affected the conditions to perform an adequate examination. Nevertheless, with the basic and easy to follow recommendations from the WHO (8) we believe reliable and reproducible results were achieved and therefore should be possible to compare to other studies made in Africa.

Earlier studies of 12-years old children in other developing countries have reported that there is a tendency of school girls being more caries free than school boys (9). In the present study we found that 3% of the 5-years old boys were caries free compared to 12% girls. Corresponding values for 12-years old boys and girls are 38% respectively 47%. The reason why girls have less caries than boys is hard to conclude from this study. Notably, we have a slight over representation of girls in our material and this might have influenced the outcome.

Previous reports concerning caries prevalence in different socio-economic categories in Africa have indicated that dental caries increase with urbanisation and higher socio-economic standards (10, 11). In agreement with these findings, we here report that the children living in the urban area had the highest dmft (3.97 and 5.78) compared to the children living in the rural area (2.97). The reason to this difference might be related to the difference in the pattern of the children's diet. In the present study, approximately 80% of the 5-years old children living in the urban area consumed sweets/candy and soft drinks more than 3-5 times a week indicating higher refined sugar consumption than the children living in the rural area (45%). This might be related to the fact that these children live in an area where the availability of high sucrose containing snacks and beverages is higher, hence, more often consumed. Earlier studies have shown that availability of sugar reflects on the dmft (12). It should be noted that there are many factors that affect the



prevalence of caries among these children as lack of dental professionals, poor oral hygiene in addition to higher carbohydrate intake.

The dental hygiene aids in The Gambia consist of imported toothbrushes and chewing sticks. The technical use of these was not investigated nor the use of any fluoride containing toothpaste. Why perhaps a wrong conclusion might be drawn concerning dental hygiene aids inefficiency to prevent caries prevalence in the age group of 5-years old.

Interestingly and contrary to what has been previously reported in studies from Africa (10, 11) the prevalence of caries in the present study was found to be lower (DMFT=1.69) among the 12-years old children with high socio-economic status compared to the children with low socio-economic status living in urban (2.38) and rural (2.84) areas. Similar tendencies, that socio-economically high status children have less caries, have been indicated in other studies (13, 14). It is difficult to give any conclusive explanation for this discrepancy based on this study. One possible factor that could explain the lower DMFT seen among the 12-years old children with high socio-economic status might be the oral hygiene habits of these children. The 12-years old children with high socio-economic status were most frequent users of toothbrushes, 99 % brushed their teeth once or more every day. This observation suggests better awareness about oral health among the 12-years old children with high socio-economic status than the other children. Notably, the children with high socio-economic status had also received more frequent dental treatments than their counter parts and might have received education and preventive treatment in the existing dental institutions that may have increased their knowledge on oral health. Unfortunately, we were not able to determine the knowledge and attitude of the children in the present study, because neither the translator nor the subject understood the question fully. Further investigation concerning the knowledge and attitude on oral health of these children is needed.

In the present study, 95% of the 5-years old children and 84% of the 12-years old were in need of dental care. Indicating a very low access to oral health institutions. As expected, there was hardly any fillings among the children and when treatment was present extraction seemed to be the first choice. This is probably due to the fact that the dentist/patient ratio is low that makes extractions the treatment of choice. Understandably, priority is given to manage the many life threatening diseases and socio-economic problems than oral health in this developing country. Traditionally, most diseases in the oral cavity including dental caries has in the medical and dental professions been considered as isolated local pathologies and therefore received a low priority for treatment especially in developing countries. New research data, however, suggests that local oral pathologies as severe dental caries results in parameters of systemic inflammatory response (15) as well as weight loss and pain with catch up growth when dental rehabilitation is accomplished (16). Therefore, the alarming situation of high caries prevalence in The Gambia needs a serious consideration and more dentists even if we have reported a 16% decrease in dental caries treatment need among 12-years old children since the previous report by Adegbembo et al. 2000 (7).

To tackle the problem of dental caries among children in The Gambia preventive care in form of self performed oral hygiene and dental treatment by professional personal as well as information to children about etiology and preventive measures in school must be initiated as soon as possible. Education of nursery school personal should be emphasised as habits good or bad are founded at an early age. To achieve maximum effect of the oral hygiene information in school, parents must be included. Results presented in an earlier published study by Okullo et al. (17) in agreement with our recommendations of early implementation.

## **Conclusion**

This study of dental health among pre-school and school children in The Gambia shows that only 14% of the 5-years old are caries free and 30% of the 12-years old. Caries prevalence in The Gambia is high with a mean dmft of 4.25 in the 5-years old and 2.27 in the 12-years old. Peak

value of 5.87 in the examined 5-years old children is seen in the urban socio-economically low standard category, corresponding peak value among the 12-years old is found in the rural socio-economically low category (2.84). Therefore, measures that promote preventive and curative dentistry are needed and advocated.

### **Acknowledgements**

The authors wish to thank Dr Jette Lehrman Madsen and Dr Biniyam Wondimu for excellent guidance and untiring help and encouragement throughout the study. Dr Pamela Esangbedo, FDSRCS, FWACS, Chief Medical Director of the Royal Victoria Teaching Hospital for granting permission to conduct this research project in The Gambia. Y.A.F.F.S.E for their help and support with transportation, guidance and translation. All the teachers and schoolchildren for their participation who made this study possible. Gillette Group Sverige AB, Oral B, and Colgate-Palmolive AB for sponsoring with products, that was handed out to the examined children. Karolinska Institutet for financial support.

### **References**

1. Central Intelligence Agency. The World Factbook 2003.
2. World Health Organization. The World Health Report 2003 - Shaping the Future.
3. UNAIDS. Gambia. Epidemiological fact sheets on HIV/AIDS and sexually transmitted infections 2002.
4. World Health Organization. Oral Health Country/Area Profile Programme. The Gambia Medical and Dental Association, 2000
5. World Health Organization. Estimates of Health Personnel, 1998.
6. Woodward M, Walker A.R. Sugar consumption and dental caries: evidence from 90 countries. *Br Dent J.* 1994 Apr 23;176(8):297-302
7. Adegbembo A.O, Adeyinka A, George M.O, Aihveba N, Danfillo I.S, Thorpe S.J, Enwonwu C.O. National pathfinder survey of dental caries prevalence and treatment needs in The Gambia. *SADJ.* 2000 Feb;55(2):77-81
8. World Health Organization. Oral Health Surveys. Basic methods. Fourth Edition. Geneva 1997.
9. Saravanan S, Anuradha K.P, Bhaskar D.J. Prevalence of dental caries and treatment needs among school going children of Pondicherry, India. *J Indian Soc Pedod Prev Dent.* 2003 Mar;21(1):1-12.
10. Enwonwu C. Review of oral disease in Africa and the influence of socio-economic factors. *Int Dent J.* 1981 Mar;31(1):29-38
11. MacGregor A.B. Diet and dental disease in Ghana. *Ann R Coll Surg Engl.* 1964 Mar;34:179-85

12. Jamel H, Plasschaert A, Sheiham A. Dental caries experience and availability of sugar in Iraqi children. *Int Dent J*. 2004 Feb;54(1):21-5.
13. du Plessis J.B. The effect of socio-economic status on dental caries experience in 6, 12 and 15 year-old school children in Port Elizabeth and Despatch. *J Dent Assoc S Afr*. 1997 Jul;52(7):483-6.
14. Rajab L.D, Hamdan M.A. Early childhood caries and risk factors in Jordan. *Community Dent Health*. 2002 Dec;19(4):224-9.
15. de Soet J.J, Schriks M.C, Kratz E, Poland D.C, van Dijk W, van Amerongen W.E. Dental caries related to plasma IgG and alpha1-acid glycoprotein. *Caries Res* 2003 Mar-Apr;37(2):79-84.
16. Acs G, Shulman R, Wai M, Chussid S. The effect of dental rehabilitation on the body weight of children with early childhood caries. *Pediatr Dent*. 1999 Mar-Apr;21(2):109-13.
17. Okullo I, Astrom A.N, Haugejorden O, Rwenyonvi C.M. Variation in caries experience and sugar intake among secondary school students in urban and rural Uganda. *Acta Odontol Scand*. 2003 Aug;61(4):197-202.

