Stomatologija, Baltic Dental and Maxillofacial Journal, 10:76-80, 2008

Caries experience in relation to oral hygiene, salivary cariogenic microflora, buffer capacity and secretion rate in 6-year olds and 12 year olds in Riga

Jekaterina Gudkina, Anda Brinkmane

SUMMARY

The objective. The aim was to assess possible relationship between oral hygiene, salivary cariogenic microflora, buffer capacity, secretion rate and caries experience in 6 year olds and 12 year olds in Riga, and to evaluate these variables in relation to caries risk.

Materials and methods. 50 children aged 6 and 71 children aged 12 were examined clinically and by bitewing X-ray for caries diagnosis. Green-Vermillion oral hygiene index, stimulated salivary flow rate and buffer capacity were estimated (CRT-buffer; Ivoclar, Vivadent, Liechtenstein). Salivary mutans streptococci (MS) and lactobacilli (LB) (CRT-bacteria; Vivadent) were determined only for children with dmft/DMFT>4: 60% at age of 6, 54,9% at age of 12. All data were statistically analyzed using frequency tables, Pearson χ^2 test and ANOVA analysis.

Results. Mean DMFT was 0.12 in 6 year olds, and 4.6 in 12 year olds. Mean Green-Vermillion index was 0.75 in 6 year olds and 0.99 in 12 year olds. Caries experience and Green-Vermillion index were associated only in 6 year olds (p=0.024). Salivary MS was associated with Green-Vermillion index only in 12 year olds (p=0.086). Salivary MS and caries experience were associated only in 12 year olds (p=0.010). Salivary LB was associated with stimulated saliva's secretion rate only in 12 year olds (p=0.027). Salivary cariogenic microflora level and buffer capacity were associated in 6 year olds (p for MS=0.010; p for LB=0.052). Same association was observed only between salivary MS and buffer capacity in 12 year olds (p=0.081). Stimulated saliva's secretion rate and buffer capacity were associated only in 12 year olds (p=0.004).

Conclusions. Information of caries risk factors should be used to work effectively on caries reduction in 6 year olds and 12 year olds in Riga.

Key words: caries experience, salivary cariogenic microflora, caries risk assessment.

INTRODUCTION

Dental caries is the main oral health problem in industrialized countries, and it affects 60-90% of school aged children and adults [1,2]. Dental caries experience among 12 year olds is still rather high: in Americas DMFT=3,0; in Europe DMFT=2,6. [1]. Notwithstanding the decline in caries development over the last century in the world, this disease is still affecting children's population, and can be only supervised to a definite level, but not eradicated [1]. In developing countries, dental caries experience among 12 year olds was rather low, for example in African countries DMFT was 1,7 [1]. Presently it starts to increase due to the frequent usage of sugars and inadequate exposure to fluorides [1,3]. Lithuania also should little tendency towards a decline in the prevalence of dental caries [4]. The recent epidemiological research in Riga has shown the decline in caries in 53% (DMFT=0,6) in 6-7 year olds and in 28% (DMFT=3,9) in 12 year olds due to the introduction of some containing general recommendations, caries preventive programs [5]. Despite the progress in reduction of caries development in 6-7 year old and 12

*Conservative Dentistry Department, Institute of Stomatology, Riga Stradins University, Riga, Latvia

Jekaterina Gudkina – D.D.S., assist. prof.*
Anda Brinkmane – D.D.S., MD., PhD, prof.*

Address correspondence to Jekaterina Gudkina, Dzirciema str 20, Institute of Stomatology, Riga Stradins University, Riga, Latvia
E-mail: e.strosmane@latnet.lv

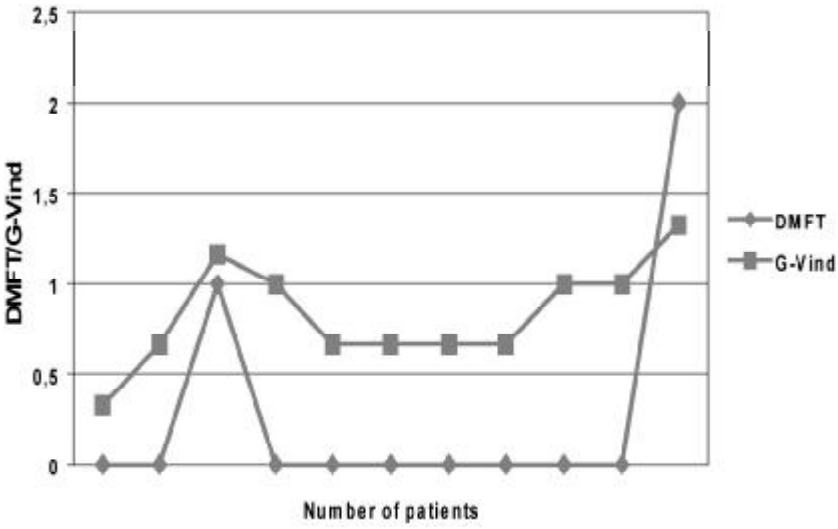

Fig. 1. Caries experience and Green-Vermillion index in 6 y. o.

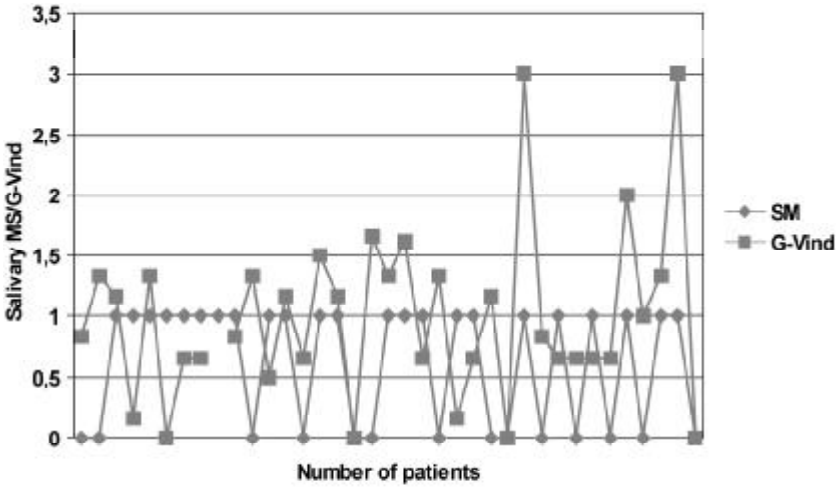

Fig. 2. Salivary MS level and Green-Vermillion index in 12 y. o.

year old children in Riga, the aims proclaimed by the WHO for 2000 year as 55% in 5-6 year olds should be caries-free and DMFT ≤3 in 12 year olds [6] have not been achieved in Riga.

The aim of this study was to assess possible relationship between oral hygiene, salivary cariogenic microflora, buffer capacity, secretion rate and caries experience among 6-year old and 12 year old children in Riga, and to evaluate these variables in relation to caries risk.

MATERIALS AND METHODS

Study population comprised of 50 children in the age group of 6 year old and 71 child in the age group of 12 year old, examined in Riga, in the Institute of Stomatology. All patients were volunteers, with permission to take part in this study from their parents. All children were inhabitants of Riga. Caries was detected clinically and using Bitewing X-rays. Green-Vermillion oral hygiene index was used to determine the oral hygiene level in both age groups. Stimulated salivary secretion rate and buffer capacity (CRT-buffer, Ivoclar, Vivadent, Lichtenstein) also were measured for each child. Salivary cariogenic microflora (CRT-bacteria, Ivoclar, Vivadent, Lichtenstein) was assessed only for children with caries experience higher than moderate level (dmft/DMFT>4): 60% at the age of 6, and 54,9% at the age of 12.

All data were collected during 2006-2007 years and then statistically analyzed using frequency tables, difference in proportions was tested using Pearson χ^2 test, and also analysis of variance (ANOVA) was used to evaluate how different variables, i.e. salivary buffer capacity, affect caries in the particular age group. Level of statistical significance was assumed at $p<0,01$.

This study was performed under the permission of Riga Stradins University ethical committee.

RESULTS

Mean DMFT of examined children was 0.12 in 6 year olds, and 4.6 in 12 year olds. Mean Green-Vermillion oral hygiene index was 0.75 in 6 year olds and 0.99 in 12 year olds meaning rather good level of oral hygiene in both age groups. The statistically significant relationship was observed between caries experience and Green-Vermillion index only in 6 year olds (p=0.024) (Fig. 1). Salivary mutans streptococci (MS) level also was strongly associated with Green – Vermillion index but only in 12 year olds (p=0.086) (Fig. 2). The statistically significant association has been found between salivary MS level and caries experience, but only in 12 year olds (p=0.010) (Fig. 3). Salivary lactobacilli (LB) level was associated with stimulated saliva's secretion rate also only in 12 year olds (p=0.027) (Fig. 4). Statistically significant relationship was found between salivary cariogenic microflora level and buffer capacity in 6 year olds (p value for MS=0.010; p value for LB=0.052) (Fig. 5). Same association was observed only between salivary MS level and buffer capacity in 12 year olds (p=0.081) (Fig. 6). Significant association was found between stimulated saliva's secre-

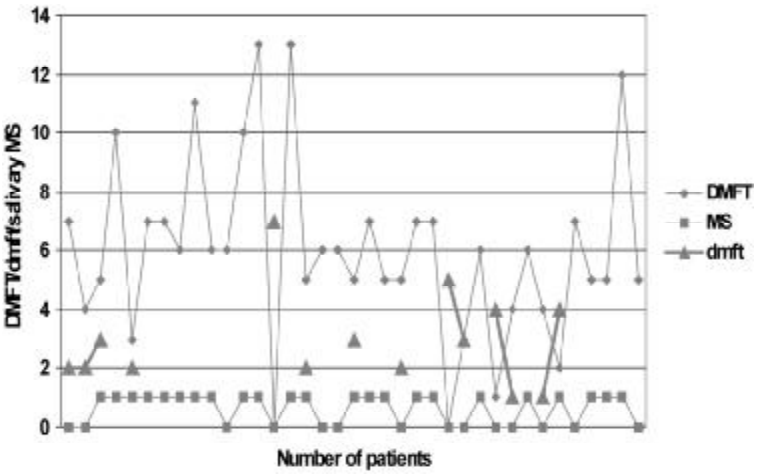

Fig. 3. Caries experience and salivary MS level in 12 y.o.

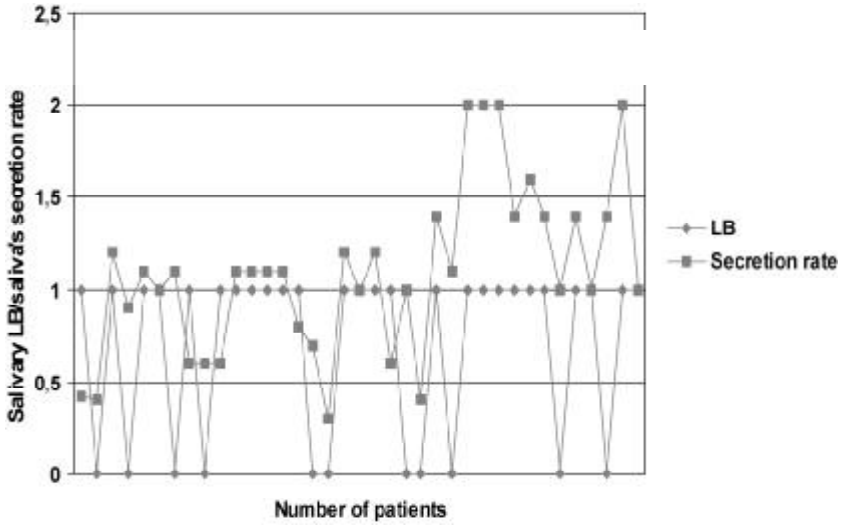

Fig. 4. Salivary LB level and saliva's secretion rate in 12 y.o.

tion rate and buffer capacity only in 12 year olds (p=0.004) (Fig. 7).

DISCUSSION

It is known that oral hygiene plays one of the main roles in caries development [6]. Our study also showed direct influence of oral hygiene on caries experience but only in 6 year olds in Riga (Fig. 1). In our research oral hygiene status tried to be compared in both age groups in Riga, using the same oral hygiene index in each age group. The index of our choice was Green Vermillion index. Most probably this index could broadly reflect the level of oral hygiene in 6 year olds in Riga, but it couldn't completely describe oral hygiene level in children mostly with permanent dentition. However, our results are not diminish the important role of oral hygiene in caries development in 12 year olds in Riga. Probably another oral hygiene index could be used in order to achieve complete picture of oral hygiene status in 12 year olds in Riga.

The study performed in 1996 by Beighton D., et al., showed the positive correlation between oral hygiene level and salivary MS level in 12 year olds [7]. Same positive relationship was observed in the other study by Zoitopoulos L., et al., but only in younger age group [8]. Also our study showed positive influence of oral hygiene on salivary MS level, but only in 12 year olds in Riga (Fig. 2). This fact allows to suggest indirect influence of oral hygiene on caries experience through salivary MS level in 12 year olds in Riga (Fig. 3). The absence of association between oral hygiene level and salivary MS level could be explained by the small sample of children at the age of 6 in Riga with all first permanent molars and all central incisors completely erupted and salivary cariogenic microflora determined for one and the same child.

A lot of research have been done to find out and prove the influence of salivary MS on caries experience in children population [9-18]. Our results also showed that caries experience directly relates to salivary MS level, but only in 12 year olds in Riga (Fig. 3). Despite previous research our study did not find significant association between caries experience and salivary MS level in 6 year olds in Riga. Further research probably will clarify possible existence of this association in children at the age of 6 in Riga. However, the study in 2002 by Dasanayake AP., et al, using "Dentocult MS" set, found no positive correlation between caries and salivary MS level in children of 2-17 year olds [19]. Notwithstanding the positive correlation between salivary LB level and caries experience in children population [15, 20-23], the study performed in 2001 by Tarzen et al., showed that salivary MS plays the main role in caries onset, and the role of salivary LB in caries development needs further research [24].

As it known, saliva's pH has no influence on caries experience in different age groups [25, 26]. But low salivary buffer capacity influences on the growth of salivary cariogenic microflora. [6]. Similar results were obtained by our study in both age groups in Riga (Fig. 5, 6), except the relationship between

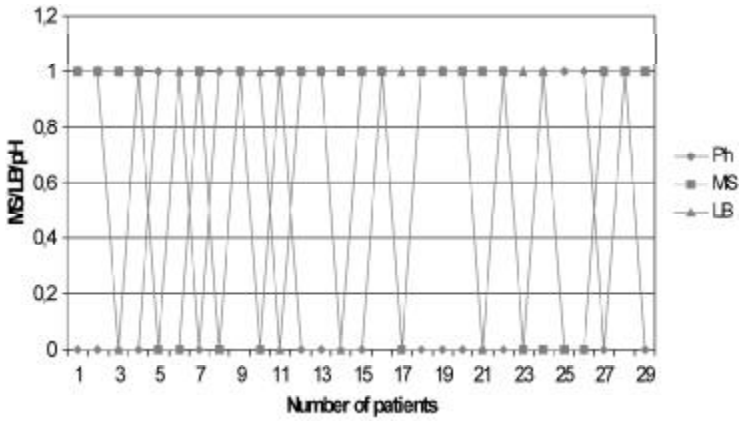

Fig. 5. Cariogenic bacteria level and salivary pH in 6.y.o.

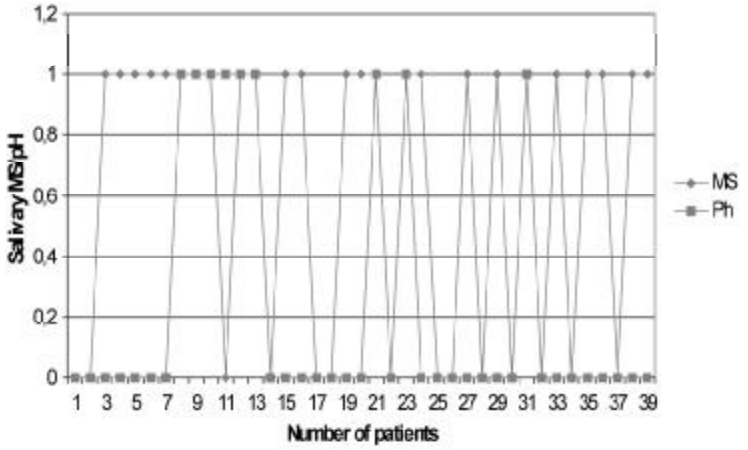

Fig. 6. Salivary MS level and salivary Ph in 12 y.o.

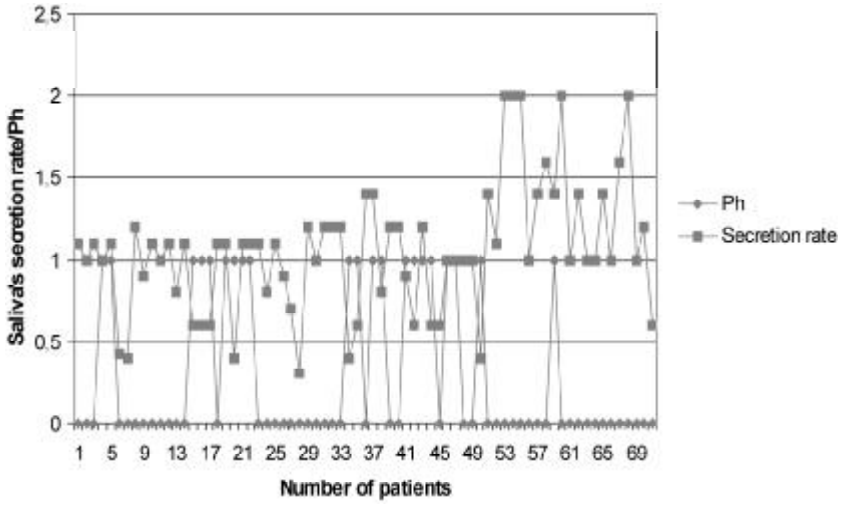

Fig. 7. Saliva's secretion rate and buffer capacity in 12 y.o.

salivary pH and salivary LB level in 12 year olds. Based on our results, low salivary pH rises up the level of salivary MS (Fig. 6), and due to the association between salivary MS level and caries experience (Fig. 3), the indirect influence of saliva's pH on caries development could be suggested in 12 year olds in Riga. But it is difficult to predict the appearance of same linkage in 6 year olds in Riga. Salivary buffer capacity was strongly associated with stimulated saliva's secretion rate [27, 28] and depends on age [28]. Our study also found direct connection between salivary buffer capacity and simulated saliva's secretion rate, but only in 12 years olds in Riga (Fig. 7).

The study in 1999 by Almstahl A., et al., stated connection between stimulated saliva's secretion rate and salivary LB level in grown ups [29]. Our study gainsed similar results only in 12 year olds in Riga (Fig. 4.). The absence of this kind of relationship in younger age group could be explained by the small quantity of 6 year olds, participating in our study. But it is necessary to mention the lack of information about the influence of salivary pH, salivary secretion rates and bacterial level in detection of caries risk in children [2]. In the end, it is important to emphasize, that our research is an ongoing project, and results, gained by this study, could be overlooked with the enlargement of samples in both age groups in Riga.

CONCLUSION

- Based on gained results, the oral hygiene seems to be one of the main factors influencing on caries development in 6 year olds, but salivary MS level – in 12 year olds. However, the role of salivary MS level and oral hygiene couldn't be denied in 6 year olds and 12 year olds in Riga accordingly.
- The role of salivary buffer capacity and stimulated saliva's secretion rate in caries development needs to be studied further in both age groups in Riga. Also the influence of salivary LB as a caries risk factor should be studied further in both age groups in Riga
- The influence of factors and their importance differs within both age groups in Riga.
- To work effectively on caries reduction, it is necessary to determine caries risk factors in order to use this information in identifying at-risk children, apply targeted measures to reduce caries development in 6 year olds and 12 year olds children in Riga.

REFERENCES

1. Petersen PE, Bougreois D, Ogawa H, Estupian-Day S, Ndiaye Ch. The global burden of oral diseases and risks to oral health. *Bull World Health Organ* 2005; 83:661-9.
2. Berg JH. Early dental caries detection as a part of oral Health maintenance in young children. *Compendium* 2005;26(suppl 1):24-9.
3. Edelstein BL. Pediatric caries worldwide: Implications for oral health hygiene products. *Compendium* 2005;26(suppl 1):4-9.
4. Brukiene V, Aleksejuniene J, Balciuniene I. Dental Treatment Needs in Lithuanian Adolescents. *Stomatologija. Baltic Dent Maxillofac J* 2005;7:11-5.
5. Senakola E, Brinkmane A. Dentistry in Latvia – developments since 1995. *FDI World* 2000;4:21-3
6. Axelsson P. An introduction to risk prediction and preventive dentistry. Quintessence Publ Co; 1999. p. 24-7.
7. Beighton D, Adamson A, Rugg-Gunn A. Associations between dietary intake, dental caries experience and salivary bacterial levels in 12-year-old English schoolchildren. *Arch Oral Biol* 1996;41:271-80.
8. Zoitopoulos L, Brailsford SR, Gelbier S, Ludford RW, Marchant SH, Beighton D. Dental caries and caries-associated micro-organisms in the saliva and plaque of 3- and 4-years old Afro-Caribbean and Caucasian children in south London. *Arch Oral Biol.* 1996;41:1011-8.
9. Chia JS, Teng LJ, Wong MY, Hsieh CC. Association between dental caries prevalence and Streptococcus mutans among 13-year-old children. *Taiwan Yi Xue Hui Za Zhi* 1989;88:589-94.
10. del Rio Gomez I. Dental caries and mutans streptococci in selected groups of urban and native Indian Schoolchildren in Mexico. *Community Dent Oral Epidemiol* 1991;19:98-100.
11. van Houte J. Microbiological predictors of caries risk. *Adv Dent Res* 1993;7:87-96.
12. Twetman S, Syahl B, Nederfors T. Use of the strip mutans tests in the assessment of caries risk in a group of preschool children. *Int J Paediatr Dent* 1994;4:245-50.
13. Richardson L, McKibbins SM, Seibert W, Tyus J. Salivary count of Streptococcus mutans in elementary school children. *NDA J* 1995;46:8-11.
14. Ratio M, Pienihakkinen K, Scheinin A. Assessment of single risk indicators in relation to caries increment in adolescents. *Acta Odontal Scand* 1996;54:113-7.
15. Campus G, Lumbau A, Bachisio SL. Caries experience and streptococci and lactobacilli salivary levels in 6-8-year-old Sardinians. *Int J Paediatr Dent* 2000;10:306-12.
16. Seibert W, Farmer-Dixon C, Bolden T, Stewrt JH. Streptococcus mutans levels and caries prevalence in low-income schoolchildren. *J Tenn Dent Assoc* 2002;82:19-22.
17. Scheutz F, Frydenberg M, Matee MI, Poulsen S. The effect of choosing different units of analysis when estimating risk of presence of dental caries in the primary dentition. *Community Dent Health* 2003;20:27-33.
18. Koll-Klais P, Mandar R, Leibur E, Kjaeldgaard M. High levels of salivary lactobacilli in Estonian schoolchildren. *Eur J Paediatr Dent* 2004;5:107-9.
19. Dasanayake AP, Caufield PW. Prevalence of dental caries in Sri Lankan aboriginal Veddha children. *Int Dent J* 2002;52:438-44.
20. Alaluusua S. Salivary counts of mutans streptococci and lactobacilli and past caries experience in caries prediction. *Caries Res* 1993;27(Suppl 1):68-71.
21. Shi S, Zhao Y, Hayashi Y, Yakushiji M, Machida Y. A study of the relationship between caries activity and the status of dental caries: application of the Dentocult LB method. *Chin J Dent Res* 1999;2:34-7.
22. Vehkalahti M, Nikula-Sarakorpi E, Paunio I. Evaluation of salivary tests and dental status in the prediction of caries increment in caries-susceptible teenagers. *Caries Res* 1996;301:22-8.
23. Brambilla E, Twetman S, Felloni A, Cagetti MG, Canegallo L, Garcia-Godoy F, et al. Salivary mutans streptococci and lactobacilli in 9-and 13-year-old Italian schoolchildren and the relation to oral health. *Clin Oral Investing* 1999;3:7-10.
24. Tanzer JM, Livingston J, Thompson AM. The microbiology of primary dental caries in humans. *J Dent Educ* 2001;65:1028-37.
25. Sullivan A. Correlation between caries incidence and secretion rate/buffer capacity of stimulated whole saliva in 5-7-year-old children matched for lactobacillus count and gingival state. *Swed Dent J* 1990;14:131-5.
26. Russell JI, MacFarlane TW, Aitchison TC, Stephen KW, Burchell CK. Caries prevalence and microbiological and salivary caries activity tests in Scottish adolescents. *Community Dent Oral Epidemiol* 1990;18:120-5.
27. Holbrook WP. Dental caries and cariogenic factors in preschool urban Icelandic children. *Caries Res* 1993;27:431-7.
28. Fenoll-Palomares C, Munoz Montagud JV, Sanchiz V, Herreros B, Hernandez V, Minguez M, et al. Unstimulated salivary flow rate, pH and buffer capacity of saliva in healthy volunteers. *Rev Esp Enferm Dig* 2004;96:773-83.
29. Almstahl A, Wikstrom M. Oral microflora in subjects with reduced salivary secretion. *J Dent Res* 1999;78:1410-6.

Received: 28 11 2007
Accepted for publishing: 26 06 2008