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Oral Health Status and Effectiveness of Caries Prevention Programme in Kindergartens in Kaunas City (Lithuania)

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Purpose: To describe oral health status and to evaluate the effectiveness of a caries prevention programme in preschool children.

Materials and Methods: A sample of 1656 3- to 7-year-old children were examined in kindergartens in 2002, and 411 3-year-old children were then selected to participate in the prevention programme. The test group A (n = 156), group B (n = 118), and the control group (n = 137) were defined for the study. For test group A, supervised toothbrushing was prescribed and for test group B, fluoride gel applications were used. For the control group, children did not undergo any of the aforementioned procedures. Dental caries was assessed according to the World Health Organization (WHO) criteria, and oral hygiene according to the Greene–Vermillion simplified oral hygiene index. Preventive programmes were based on oral hygiene instructions, supervised daily toothbrushing, and fluoride gel applications. The relationship between oral hygiene and severity of dental caries was determined by using Fisher's test.

Results: The prevalence of dental caries varied between 39.7% and 90.8%, and the decayed, missing, and filled teeth (dmf-t) varied between 1.3 ± 0.16 and 5.0 ± 0.24. Oral hygiene was satisfactory in 43.2% of children. During the 3 years of the programme, a significant difference was found between the test and the control groups. The reduction in test group A was 45.4% and in test group B was 60.1%.

Conclusions: The prevalence and severity of dental caries among the examined children increased with age, and was lower in both the test groups compared with the control group. The professional fluoride applications and proper oral hygiene showed the most effective results in caries prevention.

Key words: dental caries, kindergarten, oral hygiene, preschool children, preventive programme

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Previous studies have shown a rather high prevalence of dental caries among both preschool and school children in Lithuania (Slabšinskienė and Milciuviene, 2002; Aleksiejūnienė et al, 2004), although studies in other countries such as Denmark, Finland, Italy, Norway and Ireland showed opposite results (Marthaler and O'Mullane, 1996). Different studies in countries with low caries experience demonstrate that a decrease in caries prevalence has been achieved by conducting oral health prevention programmes (Creedon and O'Mullane, 2001; Holland et al, 2001).

At present, the finances devoted to the prevention of dental caries in preschool children in Lithuania are insufficient. This might explain why so many children had untreated teeth. Early extractions of primary teeth may predispose the development of

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orthodontic anomalies, masticatory dysfunctions, and aesthetic defects (Šidlauskas and Vasiliauskas, 1999).

Most preschool children in Lithuania attend kindergartens, where they spend the day learning as well as developing skills in oral health. The success of the preventive programmes is determined by the knowledge of the staff in the kindergartens concerning the risk factors of dental caries and their understanding of the importance of caries prevention. Each clinician engaged in the prevention programme required the support of the kindergarten staff, as well as parents that were willing for their children to participate (Petersen, 1992).

Raitio et al (2001) and Seppä (2001) analysed the strategy, efficacy, and cost-effectiveness of the implemented prevention programmes, and indicated that the preparation of the project encountered certain difficulties, such as lack of finances, unwillingness of the parents and kindergarten staff to co-operate, and, sometimes, disapproval of the state institutions. Similar problems were also common in Lithuania; there is insufficient attention to the prevention and treatment of the primary teeth as well as insufficient education of parents and children concerning proper oral hygiene habits. In addition, clinicians do not always pay enough attention or devote enough time to such issues.

The objective of this study was to describe oral health status and to evaluate the effectiveness of a caries prevention programme among 3- to 7-year-old children in kindergartens in Kaunas (Lithuania).

MATERIALS AND METHODS

In 2002, 1656 children (878 boys and 778 girls) aged from 3 to 7 years who were attending 16 kindergartens in Kaunas city were examined. A group of 411 3-year-old children were selected as participants in the prevention programme that began in 2003. Test group A (n = 156), test group B (n = 118), and the control group (n = 137) were defined for the study. These groups were homogeneous with respect to oral health status (non-parametric chi-square test [$P > 0.72$]).

Oral health status was evaluated according to the World Health Organization (WHO) criteria (1997). The severity of dental caries was determined by decayed, missing, and filled teeth (dmf-t) and decayed, missing, and filled surface (dmf-s) indices. The increment in the severity of dental caries was evaluated by determining the difference between the values of the dmf-t over a 3-year period. The reduction in the severity of dental caries was evaluated by determining the decrease in the severity of dental caries in the test groups, compared with that of the controls. The value was expressed as a percentage.

Oral hygiene status was evaluated by the simplified oral hygiene index (OHI-S) according to the Greene–Vermillion OHI-S (1964). Ethical approval for the study was obtained from Kaunas University of Medicine.

Dental caries prevention methods used in the programme

For test group A, supervised toothbrushing was applied twice a day with dentifrice containing 500 ppm fluoride. In the morning this was supervised at the kindergarten and in the evening at home.

Test group B used fluoride gel applications (Thixo gel™, Henry Schein, Port Washington, 1.23% Acidulated Phosphate Fluoride [APF]) that were performed every 4 months. Toothbrushing twice a day with dentifrice containing 500 ppm fluoride was carried out; in the morning this was supervised at the kindergarten and in the evening at home.

In the control group, children did not undergo any of the aforementioned procedures.

Kindergarten personnel and the children's parents underwent theoretical instruction and visual material demonstration about the importance of oral hygiene and fluoride.

After 3 years, 397 participants were re-examined. There was a drop-out of 14 participants (4 in test group A, 6 in test group B, and 4 in the control group) owing to the children leaving the kindergarten. The increase or decrease in the prevalence and severity of dental caries in the test groups was evaluated, and compared with the control group.

The analysed characteristics of the studied groups were described using the general statistical position, distribution, and symmetry definitions. Hypotheses about the relationships between the qualitative variables were verified by using the chi-square (χ^2) criterion. The comparison of quantitative data was performed by using student's *t* test or Fisher's *F* criteria. For the validation of hypotheses about the mean values of two or more groups, the mean and the standard error of the sample of the descriptive statistics were calculated. Using the logistic regression technique, the characteristics of having the greatest value for the development of dental caries were determined. A stepwise selection was applied in the model. Statistical significance was assumed when $P < 0.05$.

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Table 1 The prevalence of dental caries in an age-matched Kaunas city kindergarten population

Gender	Age									
	3 years		4 years		5 years		6 years		7 years	
	n	%	n	%	n	%	n	%	n	%
Boys	112	33.9	190	57.4	221	76.0	277	86.6	78	88.5
Girls	84	45.5	187	64.2	213	75.6	220	84.5	74	93.2
Total	196	39.7	377	60.8	434	75.8	497	85.5	152	90.8

$\chi^2 = 72.3$; df = 4; $P < 0.001$, comparing age groups.

Table 2 The dmf-t in the studied preschool children

Gender	Age											
	3 years		4 years		5 years		6 years		7 years		Total	
	n	$\bar{X} \pm SE$	n	$\bar{X} \pm SE$	n	$\bar{X} \pm SE$	n	$\bar{X} \pm SE$	n	$\bar{X} \pm SE$	n	$\bar{X} \pm SE$
Boys	112	1.23 ± 0.22	190	2.33 ± 0.21	221	4.02 ± 1.08	277	5.10 ± 1.10	78	5.16 ± 0.35	878	3.50 ± 0.11
Girls	84	1.54 ± 0.26	187	2.75 ± 0.22	213	3.72 ± 0.25	220	4.55 ± 0.23	74	4.66 ± 0.33	778	3.70 ± 0.12
Total	196	1.30 ± 0.16	377	2.50 ± 1.40	434	3.80 ± 1.40	497	4.80 ± 0.16	152	5.00 ± 0.24	1,656	3.60 ± 0.09

$F = 54.8$; df = 4; $P < 0.001$, comparing age groups.

The inter-examiner agreement of dmf-t scores was measured by applying the kappa index. A kappa value of 0.8 for the inter-examiner agreement was considered satisfactory. The study was performed on an agreement with the Health and Education Committees of Kaunas City municipality and the managers of the kindergartens. Parents' permission for the examination of children was obtained prior to the procedures. Approval from the Ethics Committee of Kaunas University of Medicine was obtained prior to starting the study.

RESULTS

Caries prevalence was different in different age groups, varied from 39.7% among 3-year-olds to 90.8% among 7-year-olds, and increased with age (Table 1). The mean dmf-t in the examined children was 3.6 ± 0.09, varied within age groups, and increased with age (Table 2). No significant gender difference was found and 74.6% of 3-year-olds

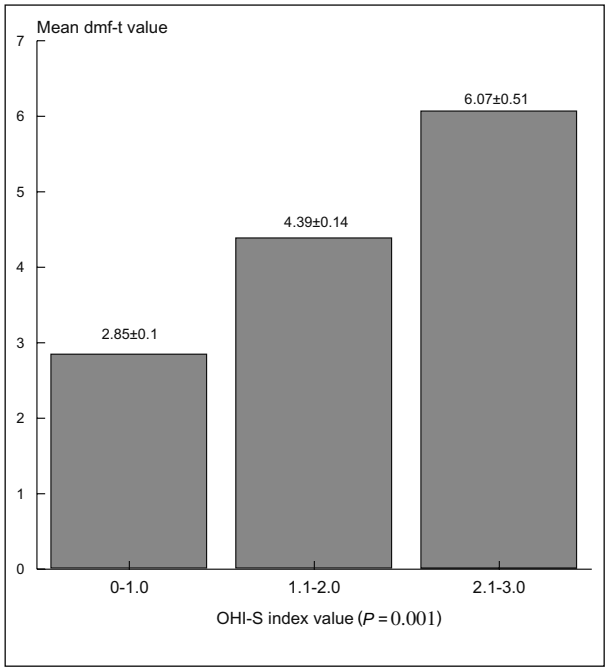

Fig 1 The relationship between the mean dmf-t value and simplified oral hygiene index.

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Table 3 The changes in the dmf-t and dmf-s indices after completion of the dental caries prevention programme

Group	2003			2005				
	n	dmf-t $\bar{X} \pm SE$	dmf-s $\bar{X} \pm SE$	n	dmf-t $\bar{X} \pm SE$	dmf-s $\bar{X} \pm SE$	dmf-t increment after 2 years $\bar{X} \pm SE$	dmf-s increment after 2 years $\bar{X} \pm SE$
	3-year-old children			*5-year-old children*				
Test group A	156	1.33 ± 0.17	1.42 ± 0.15	152	2.10 ± 0.22	2.3 ± 0.25	0.77 ± 0.05	0.88 ± 0.09
Test group B	118	1.50 ± 0.18	1.85 ± 0.25	112	2.05 ± 0.19	2.53 ± 0.30	0.55 ± 0.04	0.68 ± 0.06
Control group	137	1.59 ± 0.19	1.86 ± 0.24	133	3.0 ± 0.23	3.78 ± 0.29	1.41 ± 0.08	1.92 ± 0.08

$P < 0.003$, comparing the effect group A and the control group.
$P < 0.001$, comparing the effect group B and the control group.

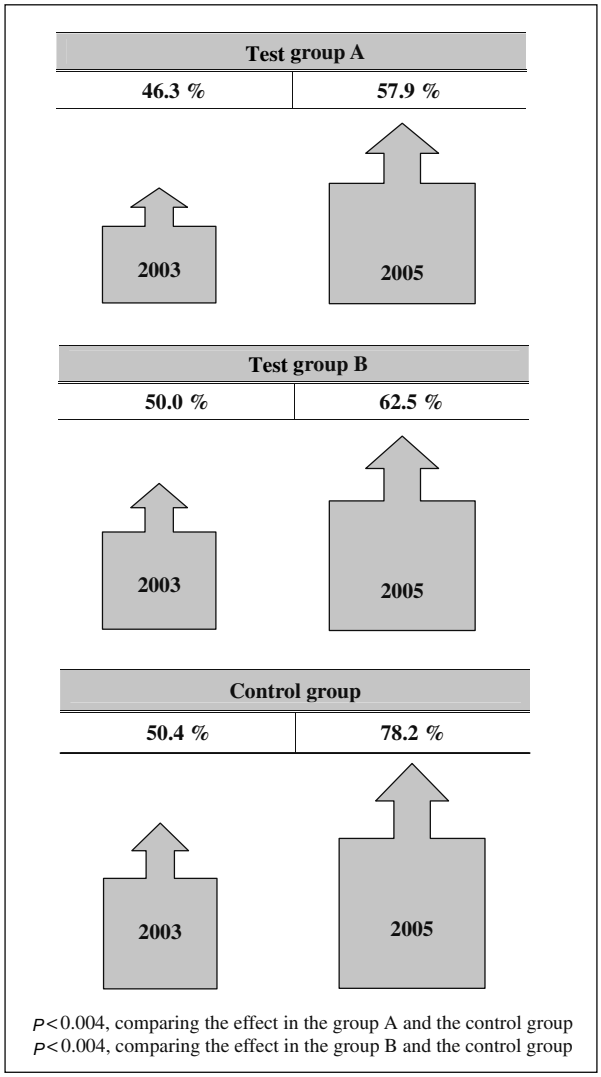

Fig 2 The changes in the prevalence of dental caries after completion of the dental caries prevention programme.

showed untreated lesions. The teeth most affected were the primary molars.

OHI-S among 40.8% of the examined children varied between 1.1 and 2.0.

Figure 1 illustrates the relationship between the quality of oral hygiene and dmf-t.

There was no significant difference in dmf-t and dmf-s between the test and the control groups at the baseline of the programme (Table 3). Figure 2 and Table 3 illustrate changes in caries experience during the 3-year period of the programme. The prevalence of dental caries and the means of the dmf-t and dmf-s increased despite the applied preventive measures, but, nevertheless, there was a significant difference between the test groups and the control group ($P < 0.004$). The highest reduction of the increment of dental caries was in test group B, compared with the control group.

The reduction in groups A and B was 45.4% and 60.1% respectively. The prevalence of dental caries in the test groups A and B was lower than that in the control group (group A 15% and group B 20% [$P < 0.05$]).

The OHI-S scores varied between 0.1 and 0.7 among child participants of the programme in comparison with their counterparts in the control group (1.27).

The analysis of the dynamics in caries experience at the beginning and during the programme in all groups increased with age. However, there was a significant difference between test groups and the control group.

Multiple logistic analysis showed that if the children regularly brushed their teeth twice a day, the OHI-S scores ranged between 0 and 1.0, and if

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Table 4 Results of the prognostication of the risk of dental caries among the studied children		
Independent variables	**B (*P*)**	**OR (95%CI)**
Frequency of toothbrushing	−1.217 (0.013)	0.296 (0.113–0.776)
The OHI-S index value	−2.683 (0.001)	0.680 (0.031–0.153)
The studied effect group	−0.456 (0.019)	0.634 (0.432–0.929)

B: logistic regression coefficients; *P*: value of significance; OR: odds ratio; CI: confidence interval.

additional fluoride gel applications were performed, there was a low caries risk (Table 4).

DISCUSSION

The results of the authors' study showed that the mean dmf-t among the examined children was 3.6. It differed from the findings of the previous studies in Denmark, Finland, Italy and Norway, where the mean dmf-t was found to be 1.4. In Ireland the mean dmf-t was 0.9 (Marthaler and O'Mullane, 1996; Bolin et al, 1997; Poulsen, 2002).

However, those studies where caries experience among preschool children increased with age are in line with the present findings (Carvalho et al, 1998; Seppä and Kärkkäinen Hausen, 2000). If dental caries affects children at a very early age and then tends to increase as the child gets older, prevention should be started at the earliest age possible.

Prevalence of dental caries in the present study was found to be 12% higher compared with developed countries and 70% lower compared with developing countries (Milnes, 1996). In his study about the prevalence of caries in 20 countries. Renson (1986) found that during the past 20 years in the developed countries (Australia, Denmark, Finland, Netherlands, New Zealand, Norway, Sweden, UK and USA) dental caries has decreased from 50% to 30%. The most probable reasons for this decrease were considered to be associated with the widespread exposure to fluoridated water and fluoride supplements, especially the regular use of fluoridated dentifrice.

The results of the present study showed that oral hygiene was unsatisfactory among the examined preschool children. Similar results were also found in a study carried out by Tai et al (2001).

It has been found that unsatisfactory oral hygiene resulted in higher severity of dental caries (Fig 1). A similar result was observed by Beal et al (1979), Bellini et al (1981), and Nyvad and Fejerskov (1997) when they looked at the relationship between dental plaque accumulation and dental caries presence.

In test group A, the oral hygiene improved from OHI-S 1.37 ± 0.2 at the beginning of the programme to 0.1 ± 0.02 at the end. In test group A, children underwent controlled toothbrushing and significantly differed from the control group (where OHI-S was 1.26 ± 0.1 at the beginning and 1.27 ± 0.18 at the end of the programme [$P < 0.05$]). Similar results to those seen in the dynamics of the OHI between the test and the control groups during the 3-year prevention programme were also found by Zenovsky and Ushnitsky (1998).

The multiple logistic regression analysis showed that the greatest effect was in the group where controlled toothbrushing was combined with professional fluoride application, where the reduction was 45.4%. Olivier et al (1992) reported a 34.3% reduction in the group with biannual APF gel applications. In the present study, fluoride gel applications were applied four times a year and this might offer a possible explanation for the better results in comparison with the previous studies. Supervised toothbrushing (twice daily) with fluoride dentifrice also showed good results. Similar results were reported by Pine et al (2000), where the controlled toothbrushing was applied for 2 years. In the control group, children had 64% more caries than in the test group. Using analogous techniques, after 2 years of the application of the prevention programme, Rong et al (2003) achieved a reduction of 30.6%.

Prevalence of caries in the primary dentition in Lithuania is high. Therefore, it is very important to find the most effective prevention measures that can be readily implemented to change this situation. The professional fluoride applications and proper oral hygiene were the most effective measures in dental caries prevention. Implementation of a similar programme in all kindergartens of the city was a main recommendation to the Health and Education Committee of Kaunas Municipality to improve children's oral health. Lithuania is a country

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with an unbalanced oral health care system for children where two-thirds of preschool children have untreated lesions. Therefore, better organised prevention is necessary.

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