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Inadequacy of self-Implemented preventive measures to control caries increment due to poor dietary habits in 6 and 12 years old children in Riga, Latvia

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SUMMARY

Aim. This study investigated whether the self-implemented preventive measures practiced among the 6 and 12 years olds in Riga, Latvia can control the caries increment due to poor dietary habits among this age groups.

Material and methods. Caries examination was performed on Thirty-eight 6 and thirty-nine 12 years olds by visual and bitewing radiographic examination at baseline and after 3 years. All participants and/or their parents completed dietary habits questionnaires. The data was analyzed using t-test, chi-square test, ANOVA and frequency tables, Wilcoxon and Fisher's tests (α=0.05).

Results. The mean (SD) values of caries experience at baseline/3-year period in 6- vs.12-year olds were as follows. DMFS: 0.72 (1.02)/3.13 (3.13) (p=0.0000) vs. 6.79 (5.14)/14.79 (9.86) (p=0.0000); dmfs: 11.26(8.71)/7.74 (4.86) (p=0.078) vs. 3.57 (2.03)/1.5 (0.71) (p=0.317). The statistical significance was reported only for the consumption of soft drinks (p=0.032) and sugared tea (p=0.018) for the 6 years olds, and for sugared tea (p=0.017) and number of teaspoons of sugar added to tea (p=0.0095) for the 12-years olds. There was positive caries increment in all the 6 and 12 years olds that reported significant increase in consumption of soft drinks and sugared tea, and increase daily number of teaspoons of sugar used in tea.

Conclusions. The present study demonstrated high cariogenic diet among the children in Riga, which is associated with increased caries experience that the currently practiced self-implemented oral hygiene measures was not capable of controlling.

Keywords: caries experience, caries increment, dietary habits, soft drinks.

INTRODUCTION

Dental caries is the most prevalent noncommunicable diseases (NCDs) worldwide (1). Despite the great improvements in prevention and treatment of dental caries in the past decades, the problems still persist, causing pain, anxiety, functional limitation (including poor school attendance and academic performance in children) and social handicap through tooth loss (1). The treatment of dental caries is expensive, consuming 5-10% of health-care budgets in industrialized countries, and would exceed the entire financial resources available for the health care of children in most lower income countries (1).

The American Dietetic Association (ADA) notes that nutrition is an integral component of oral health, and different components of the diet are related to same (2, 3). The contribution of cariogenic foods, such as sugary drinks, to the prevalence of dental caries has long been established in dentistry (2, 3). The knowledge and the identification of the benefits of anticariogenicic/cariostatic foods would help to develop more appropriate interventions to modify poor dietary habits (2, 3). It is essential, according ADA, to differentiate anticariogenic, cariogenic and cariostatic foods (2). The anticariogenic/cariostatic foods are foods that can raise the pH of the saliva to an alkaline level, to promote enamel remineralization and protect tooth against demineralization, such foods as, dairy products, particularly cheese (2).

The popularity of tea drinking, usually with sugar, in Latvia is considered historical and cultural, and also related to the cold climate both in summer and winter. Also just as soft drinks are commonly and increasingly consumed in many countries (3), so is the situation in Latvia. Our previous study has demonstrated that this dietary habit increases the caries experience among the children of Riga, Latvia (4). A follow-up study also demonstrated a decreased level of oral hygiene among these children (5). However, at the moment, there is no

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caries preventive program for children in Riga, Latvia. Therefore, the present study investigated whether the self-implemented preventive measures currently practiced among the 6 and 12 years olds in Riga, Latvia can control the caries increment due to poor dietary habits among this age group for a period of 3 years.

MATERIALS AND METHODS

Sample Size

The study was performed at the Institute of Stomatology, in Riga. The study population comprised of thirty-eight 6 year old and thirty-nine 12 year old children, inhabitants of Riga, who visited the Institute of Stomatology for dental treatment. Subjects were recruited by poster advertisement at the Institute of Stomatology. All subjects and their parents volunteered to participate, thus the sample size was limited by the number of patients at the chosen age that visited the Institute of Stomatology at the period of enrollment. Written informed consents were obtained from all subjects following clear explanation of the study protocol. Approval was obtained from the Ethical Committee of the Riga Stradins University (Approval No. 834 and No. 967). The study enrollment and baseline examination took place over a two year period from 2006 to 2008, and the three years evaluation took place from 2009-2011.

Oral Examination procedure

The children were examined sitting in a dental chair. A visual-tactile examination of all teeth was conducted using the dental operatory light and without prior drying. The examination environment, the procedure and the sequence employed during routine dental check-up were maintained throughout the study.

Caries diagnostic and scoring criteria

Only one dentist-examiner (JG) examined all the patients. The examiner recorded only the caries status of each subject at baseline and at 3-year examination time point. The examiner was calibrated for visual examination by a caries detection expert using the first 15 patients recruited, who were not included in the study. Agreement to the set standard was quantified by Kappa analysis (6). The Kappa (6) scores for intra-examiner agreement was 0.81. Any score greater 0.70 was considered to be acceptable as adequate agreement, since this was the standard set prior to calibration. Caries was detected by visual examination and bitewing radiography. A tooth was deemed to be fully erupted when part of it was visible on the occlusal plane without the need for gingival displacement. Caries was diagnosed at the level of dentin using the WHO methodology and assessment criteria (Radke criteria) (7). Assessment was based on a hierarchical principle that assigned each tooth (and surface) to one of six mutually exclusive categories – sound, decayed, restored, missing due to caries, missing due to other reasons or absent (unerupted). The rule of thumb was to record a tooth as sound when there was any doubt whether caries was present, and decay was the overriding diagnosis when present with any other lesion on a tooth or surface. Initial caries lesions (white spot lesions) were included in this study. Radiograph was used to diagnose caries on proximal surfaces, and caries was defined when there was radiolucency in the dentin or broken enamel dentin junction (DEJ), but without obvious spread into dentin. Radiolucency only in the enamel (not reaching the DEJ) was not recorded as caries. Caries experience was evaluated using dmft/DMFT and dmfs/DMFS in both age groups.

When there is caries affected teeth that needs treatment, it was recommended to the patient to seek dental care. The recommended caries preventive advice, including the appropriate oral hygiene and dietary advice, was provided to every patient and/or their parents. A particular advice emphasized upon was reduction of sugar consumption with tea drinking. It is pertinent to mention that for all the participating children, it was not their first time of visiting the dentist, so the child may have had some information about teeth healthy diet, oral hygiene measures (Fluoride toothpaste, brushing skills and frequency), and the importance of regular visit to the dentist and the hygienist.

Questionnaire on dietary habits

A standardized questionnaire (Figure 1) was used to obtain information on oral hygiene and dietary habits at baseline and at 3-year examinations. Depending on age, children and/or their parents were questioned about snacking habits (cookies, candies, chocolates, ice cream, chips), fresh fruits consumption and carbonated soft drinks during the day, number of teaspoons of sugar (TS) used per cup of tea, and the number of cups of tea consumed daily (i.e. daily number of teaspoons of sugar (DN). Also frequencies of soft drinks consumptions were calculated. Questionnaires were administered while the children, accompanied by their parents, were waiting to have a radiographic examination. Parents provided all responses for the 6-year olds. The 12 year old children completed their own dietary questionnaire but we found that the parents were involved in completing the form.

Statistical analysis

Data were analysed using SPSS software package with $p<0.05$ chosen as level of statistical significance. The data was analyzed using t-test, chi-square test, Wilcoxon and Fisher's tests ($p=0.05$). The relationship between the

Questionnaire

1.How many mealtime you/your child have/has daily?
- 2 times
- 3 times
- More than 3 times

2.Are/is you/your child snacking between mealtimes?
- Yes
- No

3. What snacks you/your child are/is consuming?
- Sweets (candies, chocolates, ice cream)
- Coockies
- Chips
- Fresh friuts
- Not snacking

4. Are/is you/your child consuming soft carbonated drinks?
- Yes
- No

5. How many times you/your child are/is consuming soft carbonated drinks?
- Mealtimes ____ times
- In between mealtimes ____ times
- Not consuming

6. Are/is you/your child consuming a tea?
- Yes
- No

7. How many times you/your child are /is consuming tea?
- Mealtimes ____ times
- In between mealtimes ____ times
- Not consuming

8. Are/is you/your child drinking tea with?
- Sugar ____ teaspoons per cup
- Sugar substitutes ____ drops/pills per cup
- Without sugar
- Not drinking

Fig. 1. Questionnaire used to record dietary habits in 6 and 12 year olds

sugar consumption parameter (daily number of teaspoons of sugar) and caries experience (dmfs/DMFS) was calculated by ANOVA analysis and frequency tables. Level of statistical significance was assumed at $p<0.05$.

RESULTS

Caries experience

All recruited subjects completed the study. Figure 2 showed the caries experience in both age groups. The mean (SD) values of caries experience at baseline/3-year period in 6-year vs.12-year olds were as follows. DMFT in 6 and 12 year old children at baseline/3-year period were 0.67 (1.04) / 2.13 (1.69) (p=0.0000) and 4.38 (2.99) / 8.28 (4.60) (p=0.0000) respectively, while dmft were 6.21 (3.37) / 3.9 (2.24) (p=0.0012) and 2.14 (1.03) / 1.0 (0) respectively. DMFS in 6 and 12 year old children at baseline/3-year period were 0.72 (1.02) / 3.13 (3.13) (p=0.0000) and 6.79 (5.14) / 14.79 (9.86) (p=0.0000) respectively, while dmfs were 11.26 (8.71) / 7.74 (4.86) (p=0.0780) and 3.57 (2.03) / 1.5 (0.71) (p=0.3173) respectively (Figure 2, 3).

Dietary habits

The Table1 presents the data on snacking habits (cariogenic snacks - cookies, candies chocolates, ice cream, chips, fresh fruits), consumptions of soft drinks as well as drinking tea at baseline and at 3 year period in both age groups. The daily number of teaspoons of sugar have almost doubled within 3 year period in 12 year olds as shown in Table 1, which also presented the mean values of the daily amount of sugar in terms of the number of teaspoons of sugar (TS) at baseline and at 3-year period in 6- and 12-year olds. The data on the daily frequency of dietary habits is presented in the Table 2. However, when the dietary habits were categorized into, snacking, consumption of soft drinks and tea drinking, the sample size became too small in both age groups for observation of statistically significant difference between the baseline and the 3-year data.

Among the 6 year olds in a 3 year period, there was no statistically significant relationship observed between the dmfs/DMFS and daily number of teaspoons of sugar both at baseline (p=0.42) and at 3 year period (p=0.61). In 12 year olds, within 3 year period, both at baseline (p=0.091) and at 3 year period (p=0.42), there was no statistically significant relationship observed between caries experience and daily number of teaspoons of sugar.

Further data examination showed positive caries increment in all the 6 and 12 years old children that reported significant increase in consumption of soft drinks and sugared tea, and increase in daily number of teaspoons of sugar used per cup of tea. Although statistical significance was not observed between daily number of teaspoons of sugar (as the only parameter possible to be analyzed) and dmfs/DMFS, the findings concerning the increase of caries increment and statistically significant changes in dietary habits (Table1) were calculated. All examined children were categorized as follows:

In 6 year olds (n=38):

- 55.30% (n=21) had no changes in soft drink and sugary tea consumption;
- 44.70% (n=17) with changes (increase/decrease) in consumption of soft drink and

sugary tea.

In 12 year olds (n=37):

- 30.80% (n=12) had no changes in daily amount on teaspoon containing sugar (TS) and sugary tea (ST) consumption;
- 69.20% (n=27) had changes (increase/decrease) in the daily amount of sugary teaspoons (TS) and consumption of sugary tea (ST).

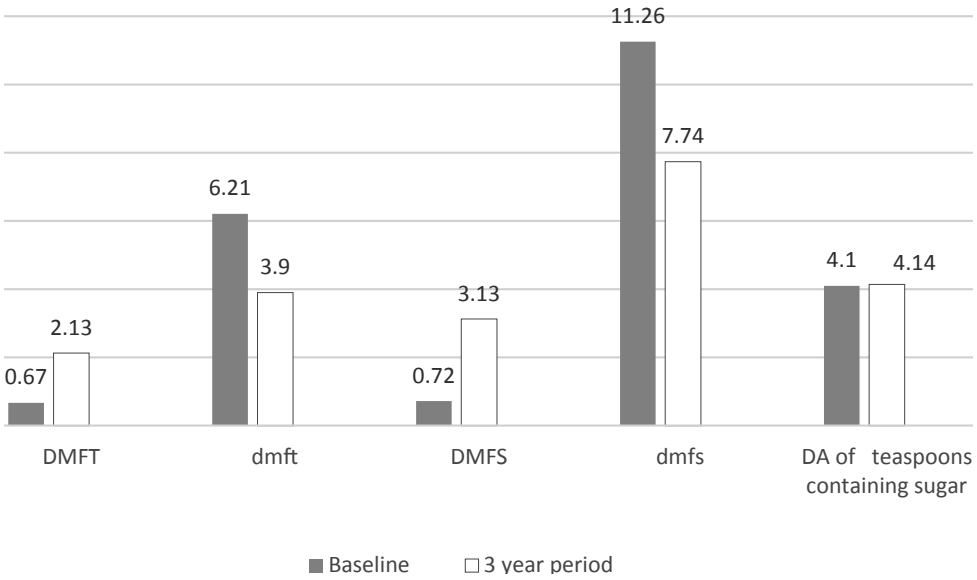

Fig. 2. Mean values of dmft/DMFT, dmfs/DMFS and a daily amount (DA) of teaspoons containing sugar in 6 year olds in a 3 year period

Then the percentage of children with changes in parameters with statistical significance (Table 1) was calculated:

In 6 year olds (n=17) (consumption of soft drinks (p=0.032) and tea containing sugar (p=0.018)):

- 47.10% (n=8) had changes only in consumption of soft drinks (SD);
- 35.30% (n=6) had changes in the consumption of tea with sugar (ST);
- 17.60% (n=3) had changes in both parameters.

In 12 year olds (n=27) (daily amount of sugar containing teaspoons(p=0.0095) and consumption of tea with sugar (p=0.017)):

- 66.70% (n=18) had changes only in the daily amount of sugary tea spoons (DA),
- 33.30% (n=9) had changes in both parameters: daily amount of teaspoons containing sugar ad consumption of tea with sugar.

Then the increase in number of cariously affected surfaces (Radike criteria) in each group were calculated. The findings were as follows (Figure 4):

In 6 year olds:

- 81% (n=17) (Group 1) had increased or unchanged consumption of sugared tea (ST) with increased or decreased consumption of soft drinks showed an increase of DMFS on 44 surfaces;
- 19% (n=4) (Group2) with decreased ST but with increased or decreased soft drinks had an increase of DMFS on 5 surfaces only.

In 12 year olds:

- 70.40% (n=19) (Group 3) with increased or unchanged consumption of ST but with increased or decreased DA of teaspoons containing sugar showed the increase DMFS on 217 surfaces;

Table 1. Dietary habits among the 6 – and 12-year old children at baseline and at 3 years

	6 Year Olds	**(n=38)**	**12 year Olds**	**(n=39)**
	At a baseline(%)	**At a 36 months(%)**	**At a baseline(%)**	**At a 36 months(%)**
Snacking (p-value)	92.11 (n=35) – cariogenic snacks; 5.26 (n=2) – fresh fruits only; 2.63 (n=1) – not snacking.	78.95 (n=30) cariogenic snacks; 7.89 (n=3) fresh fruits only; 13.16 (n=5) – not snacking (p=0.24).	87.18 (n=34) – cariogenic snacks; 10.26 (n=4) – fresh fruits only; 2.56 (n=1) – not snacking.	81.58 (n=32) – cariogenic snacks; 10.53 (n=4) – fresh fruits only; 7.89 (n=3) – not snacking (p=0.31).
Consumption of soft drinks (p-value)	60.53 (n=23) – consuming; 36.84 (n=14) – not consuming; 2.63 (n=1) – not indicated.	65.79 (n=25) – consuming; 34.21 (n=13) – not consuming; 0 – not indicated (p=0.032).	84.62 (n=33) – consuming 15.38 (n=6) – not consuming	74.54(n=29)- consuming 25.64(n=10)- not consuming (p=0.4)
Tea drinking (p-value)	73.68 (n=28) – with sugar; 13.16 (n=5) – without sugar; 13.16 (n=5) – not drinking.	81.58 (n=31) – with sugar; 7.89 (n=3) – without sugar; 10.53 (n=4) – not drinking (p=0.018).	73.68 (n=28) – with sugar 21.05 (n=8) – without sugar 5.26 (n=2) – not drinking	53.84(n=23)- with sugar 30.77(n=12)- without sugar 12.82(n=5)- not drinking (p=0.017)
Mean values (SD) of daily number of teaspoons of sugar (p-value)	4.10 (0.5)	4.0 (2.7) (p=0.945)	3.57 (2.48)	7.82(6.98) (p=0.0095)

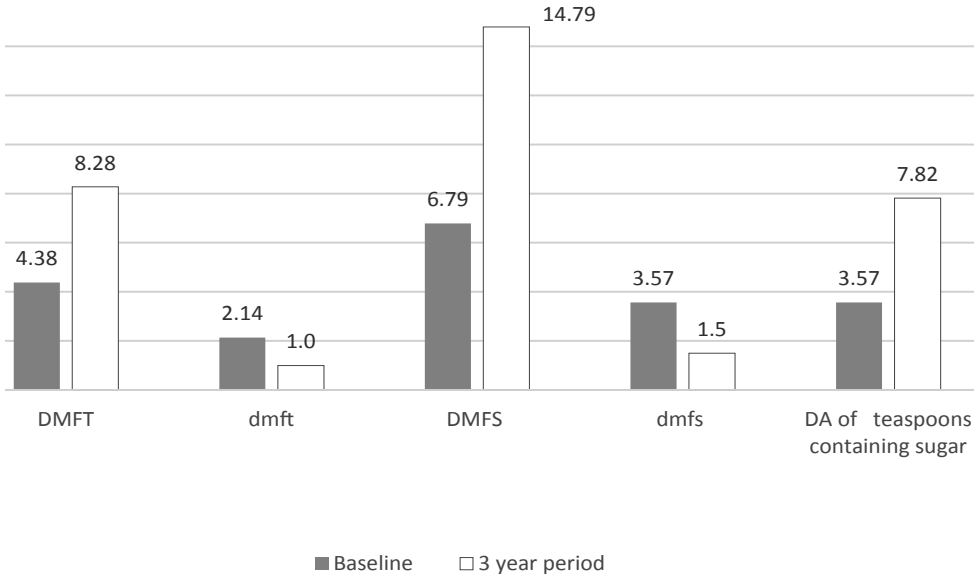

Fig. 3. Mean values of dmft/DMFT, dmfs/DMFS and a daily amount (DA) of teaspoons containing sugar in 12 year olds in a 3 year period

- 29.60% (n=8) (Group 4) with decreased consumption of ST and DA of teaspoons containing sugar showed the increase of DMFS on 41 surfaces only.

Decreased consumption of soft drinks was recorded when the subject reported drinking at baseline examination but not drinking at the 3 year examination. Similarly consumption of sugared tea is considered decreased when subject reported drinking at baseline but either stop drinking tea or started drinking tea without sugar. On the otherhand, increased consumption of soft drinks was reported when not drinking at baseline but reported to have started drinking at the 3 years examination. Intake of sugared tea was considered increased when subject is not drinking or drinking tea without sugar at the baseline, but started to drink following the baseline examination.

DISCUSSION

Dental caries is one of the most common chronic and multifactorial diseases affecting the human population (8). The appearance of a caries lesion is determined by the coexistence of three main factors: acidogenic and acidophilic microorganisms, carbohydrates derived from the diet, and host factors (8). Since diet cariogenicity is associated with frequency of exposure (9), consumption patterns are important (9). Furthermore, the increasing rise in dental caries experience due to sugar-sweetened

Table 2. Daily frequency of snacking, consumption of soft drinks and tea drinking with sugar among the 6 – and 12-year old children at the baseline and at the 36 months

	6 Year Olds	(n=38)	12 year Olds	(n=39)
	At a baseline(%)	At a 36 months(%)	At a baseline(%)	At a 36 months(%)
Snacking	10.52 (n=4) – once daily; 36.84 (n=14) – twice daily; 15.78 (n=6) – 3 times daily; 2.63 (n=1) – more than 3 times daily; 2.63 (n=1) – not snack at all; 31.57 (n=12) – not indicated.	7.89 (n=3) – once daily; 28.94 (n=11) – twice daily; 26.31 (n=10) – 3 times daily; 13.16 (n=5) – more than 3 times daily; 13.16 (n=5) – not snack at all; 10.52 (n=4) – not indicated.	30.77 (n=12) – once daily; 30.77 (n=12) – twice daily; 7.69 (n=3) – 3 times daily; 10.26 (n=4) – more than 3 times daily; 2.56 (n=1) – not snack at all; 17.95 (n=7) – not indicated.	10.26 (n=4) – once daily; 20.51 (n=8) – twice daily; 33.33 (n=13) – 3 times daily; 17.95 (n=7) – more than 3 times daily; 7.89 (n=3) – not snack at all; 10.26 (n=4) – not indicated.
Soft drink consumption	15.79 (n=6) – once daily; 21.05 (n=8) – twice daily; 5.27 (n=2) – 3 times daily; 2.63 (n=1) – more than 3 times daily; 13.16 (n=5) – not indicated; 36.84 (n=14) – not consuming.	5.26 (n=2) – once daily; 26.31 (n=10) – twice daily; 10.52 (n=4) – 3 times daily; 13.16 (n=5) – more than 3 times daily; 2.63 (n=1) – not indicated; 34.21 (n=13) – not consuming.	23.07 (n=9) – once daily; 33.33 (n=13) – twice daily; 10.27 (n=4) – 3 times daily; 17.95 (n=7) – more than 3 times daily; 15.38 (n=6) – not consuming.	20.51 (n=8) – once daily; 23.07 (n=9) – twice daily; 25.64 (n=10) – 3 times daily; 5.13 (n=2) – more than 3 times daily; 25.64 (n=10) – not consuming.
Tea drinking with sugar	15.79 (n=6) – once daily; 34.58(n=13) – twice daily; 18.42 (n=7) – 3 times daily; 0 (n=0) – more than 3 times; 26.31 (n=10) – not drinking.	21.68 (n=8) – once daily; 34.58 (n=13) – twice daily; 7.89 (n=3) – 3 times daily; 18.42 (n=7) – more than 3 times; 18.42 (n=7) – not drinking.	33.33 (n=13) – once daily; 17.95 (n=7) – twice daily; 15.38 (n=6) – 3 times daily; 5.13(n=2) – more than 3 times; 25.64 (n=10) – not drinking.	5.13 (n=2) – once daily; 20.51 (n=9) – twice daily; 17.95 (n=7) – 3 times daily; 12.82 (n=5) – more than 3 times; 43.59 (n=17) – not drinking.
Frequency of snacking, consumption of soft drinks and tea drinking with sugar	31.58 (n=24) – 1-5 times daily; 28.95 (n=11) – 6-10 times daily; 0 (n=0) – more than 10 times daily; 7.89 (n=3) – not consuming.	31.58 (n=12) – 1-5 times daily; 52.63 (n=20) – 6-10 times daily; 10.52 (n=4) – more than 10 times daily; 5.27 (n=2) – not consuming.	61.53 (n=24) – 1-5 times daily; 35.91 (n=14) – 6-10 times daily; 2.56 (n=1) – more than 10 times daily; 0 (n=0) – not consuming.	43.60 (n=17) – 1-5 times daily; 41.03 (n=16) – 6-10 times daily; 12.82 (n=5) – more than 10 times daily; 2.56 (n=1) – not consuming.

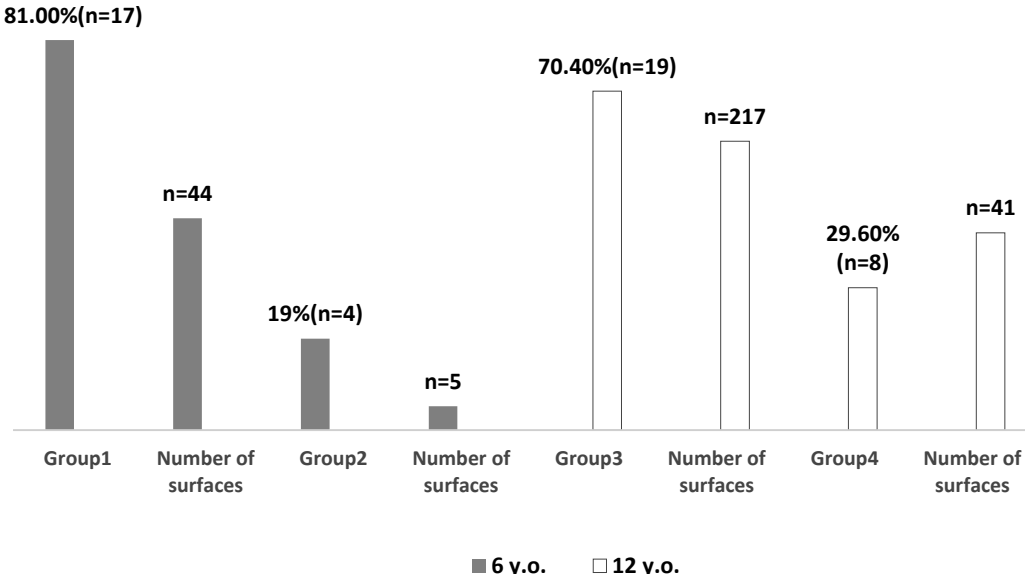

Fig. 4. Changes in statistically significant dietary habits and the increase of the number of surfaces in 6- and 12- year olds in 3 year period

beverages (SSBs) has become a global public health problem that has attracted the attention of clinicians, scientists, and policy makers (10). It is widely accepted that dental caries is a multifactorial disease; however, the effects of added sugars as one of the major culprits contributing to disease initiation and progression cannot be ruled out (10). With the advent of chemotherapeutic interventions that are widely available, such as fluorides and antimicrobial treatments, one wonders why the rate of disease has not decreased but actually increased (10). There is a marked variation in the caries occurence in the World. (11) The highest levels of caries in 12 year olds is seen in Latin American countries and in the European region, while the lowest levels are reported for the African countries (11). The relatively high overall caries levels among European 12 year olds are due to high caries levels in the eastern European countries (11).

Soft drink consumption has increased dramatically in the United States over the last two decades (12). This increase in the consumption of soft drinks has led to a decrease in dairy consumption among children and adolescents, and has increased the risk for dental caries (12). In the USA, carbonated soft drinks and milk are the two most popular non-alcoholic beverages, accounting for 39.1% of total beverage consumption (13). Soft drink consumption has exploded over the past three decades) demonstrating a per capita availability increase from 22 gallons to 52 gallons (13). Sixty years ago, Americans drank four times more milk than soft drinks, but 2 1/3 times more soft drinks were consumed than milk by 1998 (13).

There is a strong correlation between increased caries experience of teenagers and high levels of consumption of sugary drinks (14). The frequent consumption of sugary beverages and medications, and failure to regularly use fluoride rinses were positively correlated to an increased number of early caries lesions (ECLs) in patients with a high prevalence of caries (15). Also, high soft drink consumption was related to poorer oral health and a poor dietary habits lifestyle (16). It was concluded that prolonged exposure to soft drinks could lead to significant enamel loss (16). Regular soft drink possesses a greater acid challenge potential on enamel than diet and high energy soft drinks (17). It was suggested that high consumption of carbonated soft drinks by young children is a risk indicator for dental caries in the primary dentition and should be discouraged (18).

In the present study the majority of children in both age groups were consuming soft drinks, but statistically significant changes in the intake of soft drinks within 3 year period were obtained only in 6 year olds (Table1). It is impossible to expect children to stop eating sweets completely, but it is worth reducing the total amount of sugar consumed and restricting sugar intake mainly to meal times (19). Sugary foods and drinks between meals are very harmful for oral health (19). In the United States, for example, soft drink consumption increased by approximately 500% between 1947 and 1999 (3). Increases in consumption occurred for both children and adults (3). In the 25-year period between 1977 and 2002, consumption of soft drinks as a percentage of total beverage intake by children aged 6 to 11 years increased from 15% to 33% (3). In Australia, consumption of carbonated beverages increased by 240% between 1969 and 1999 (3).

Both frequency and amount of sugar are associated with dental caries (20). At the level of the individual patient, it is more practical to advise limiting frequency of intake (20). Since frequency and amount of sugar consumed are closely associated, efforts to reduce the frequency are also likely to reduce the quantity consumed (20). Sugary foods or drinks between meals are particularly harmful and should be avoided (20). Children should be encouraged to eat healthy, balanced meals before any sweets are given (20). If sweet are eaten, they will do least damage as a part of a main meal (20). The bed time snacks or drinks are particularly dangerous for dental health and they should be avoided (20). Our study found that changes in snacking habits were not significant in the number of patient in both age groups

in 3 year period (Table1). The majority of children were snacking during the daytime in both age groups. With regards to the frequency of snacking habit in our study changes in these parameters were insignificant relative to the small number of examined children in both age groups during the period of 3 years. Our results showed that the number of snacks and sugared drinks consumed during each day was rather high. Only 3 children at a baseline and 2 children in 3 year period in 6 years olds and 1 child in 3 year period in 12 years olds were not exposing their teeth to sugared snacks and drinks.

Children and/or their parents were not able to provide us with information on the type and amount of snack foods, chocolates and carbonated soft or sport drinks used during the day. This made it difficult to calculate the total dietary intake of sugar but we found that the main source of sugar intake was with tea. Unfortunately there is no published statistical report on the consumption of tea with or without milk, sweetened or not. Based on our previous studies, it remains a very popular habit for children in Latvia, especially when it is sweetened (4,5). One drawback in the present study was the fact that the type and the components of the tea taken were not examined, considering the impact of the fluoride content in the tea to dental caries. Tea contains polyphenols, (which are antibacterial), fluoride and flavanoids (20). Animal studies have shownd that infusions of black tea reduce dental caries, but the sugar used was not examined (20).

The present study showed that majority of children in 6 year olds and reduced number of children (n=5) in 12 year olds were consuming sugary tea during the day time at baseline and at 3 year period. Also, the study measured sugar intake by counting the number of teaspoons of sugar per cup, and frequency of cups used daily in both age groups. By measuring the sugar intake in teaspoons per cup of tea and cups of tea consumed daily, we were able to help the patients reduce either the intake or frequency of tea consumption as a means of improving their oral health. But from the view point of demineralization, reduction in the number of teaspoons of sugar per cup of tea would not reduce the frequency of pH drop during the demineralization process (19). In the present study it was obvious that the increase in DMFT/DMFS in permanent dentition has increased equally with the mean value of the daily amount of sugary tea spoons in 12 years olds (Figure 3) in a period of 3 years. But the mean value of daily amount of sugary teaspoons remained the same in 3 year period, mostly due to parental involvement in 6 year olds (Figure 2).

Based on the findings in the present study, it could be suggested that the habit of drinking tea with sugar plays more important role in the increase in caries experience in both age groups in a period of 3 years than the consumption of soft carbonated drinks (Figure 4). Dental caries process is dynamic and fluid by nature. Featherstone (2004) describes it as a balance between pathological factors that lead to demineralization and protective factors that lead to remineralization (21). It is obvious that in our study the balance of pathological and protective factors tilted towards pathological. There is a need for the adequate prevention using fluorides and other agents as one of the protective factors.

Unfortunately, Latvia with its capital Riga has low content of fluoride in natural water (4,5). Only several western regions of country have acceptable concentration of fluoride in natural water, but not in the drinking water or water used in food preparation. There is no water fluoridation, neither natural nor community in the whole of Latvia, making the F-containing toothpaste and chewable F-containing tablets the only sources of fluoride (4,5). Although we know that in some western countries, despite the widespread use of home and professional fluorides and community water fluoridation, dental caries continues to be a problem (22-24).

In our study caries experience (DMFT/DMFS) in permanent teeth has increased in both age groups within 3 year period (Figure 1) showing statistical significance.

Radke's criteria were used for caries detection. Radke's (7) caries assessment criteria is the most commonly used method for the detection of caries in oral health surveys and clinical practice (24). However, this method of caries assessment considers only cavitated lesions, and as such it is no longer sufficient to demonstrate the real incidence of disease because of the exclusion of non-cavitated lesions and consequent underestimation of caries experience in populations (25). It is pertinent to mention that we have used dmft/dmfs parameters in both age groups at baseline and at 3 year period, and the reduction in dmft/dmfs within 3 year period can be attributed to the exfoliation of primary teeth only. On the other hand, these parameters could not be excluded from the statistical analysis from older age group.

ICDAS II caries assessment criteria includes non-cavitated caries lesions, and was devised based on the principle that the visual examination should be carried out on clean, plaque-free teeth, with careful drying of the lesion/ surface to identify early lesions (25). According to this system, the replacement of the traditional explorers and sharp probes with a ball-ended periodontal probe would avoid traumatic and iatrogenic defects on incipient lesions (25). However, we use the WHO caries criteria, as opposed to the more recent International Caries Detection and Assessment System (ICDAS-II), in order to enable comparison of our results with studies previously carried out in Latvia.

Oral hygiene is one of the most important factors influencing caries development. Caries process is based

on the metabolic activity of the plaque and tooth completely without plaque will not decay (26). However, the systemic review proposed a more balanced view by concluding that there is no unequivocal evidence that good oral cleanliness reduces caries experience, nor is sufficient evidence to condemn the value of good oral cleanliness as a caries preventive measure (26). In the present study, we were only observing the status of oral hygiene in a period of 3 years, giving only general oral hygiene instruction, but not individually motivating the subjects as recommended by The International Caries Classification and Management System (ICCMS™) (27) The ICCMS™ is a comprehensive set of clinical protocols that address all diagnostic, preventive and restorative decisions necessary to preserve tooth structure and restore only when indicated (27).

CONCLUSIONS

The present study demonstrated high cariogenic diet among the children in Riga, which is associated with increased caries experience that the currently practiced self-implemented oral hygiene measures was not capable of controlling. Thus the study highlighted the need for an additional caries preventive measures or program for these children.

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