



Research Article

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The importance of sugar as predisposing factor for tooth decay

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Abstract

Goal: To indicate the fact that food containing refined sugars impacts dental health depending on the frequency and the time of its consumption and the conduct of oral hygiene. **Materials and methods:** For the accomplishment of our goal, we have polled children from the 2nd grade, from both rural and urban areas, regarding their diet and consumption of foods rich in refined sugars. Then we arranged a systematic checkup of the teeth in which we recorded the condition of the teeth and we have made fissures sealing of all erupted and healthy permanent first molars. Those same respondents had previously received education regarding their diet and the impact refined sugars would have on their oral health. **Results:** In respondents from urban settings we noted: 28.8% consumed foods rich in refined sugars on a daily basis. The systematic checkup showed decent oral hygiene and a high percentage of healthy primary and permanent teeth i.e. 46.8%. The Decayed, Missing or Filled Teeth (DMFT) score valued 0.44. In respondents from rural settings we noted: 75.2% consumed pastries and sweets on a daily basis. The systematic checkup yielded poor oral hygiene and a small number of children with healthy primary and permanent teeth i.e. 9.7%. A high percentage (75.3%) of children had carious primary and permanent teeth, and many of them had unsanitary permanent first molars. The DMFT valued 0.88. **Conclusion:** A diet containing a huge amount of refined sugars negatively impacts the oral health and condition of teeth. However, poor oral hygiene contributes to the high percentage of carious primary and permanent teeth

Keywords: Sugars, Caries, First permanent molar, DMFT index, Education.

INTRODUCTION

Dental health is part of overall health of the body and proper nutrition is one of the factors for the achievement and maintenance of health. All scientific studies suggest that diet is one of the important factors which condition the appearance of teeth cavities. Even in the II century BC Galen noted that tooth decay was caused by improper diet. The primitive lifestyle enabled consuming raw and fresh food. The manner and living conditions changed many centuries ago, and thus began the food processing and thus food became poorer in vitamins and minerals and the need for chewing food decreased ^[1].

Food containing sugar causes tooth decay. But also other physical characteristics of the food, its solubility, stimulating the secretion of saliva, chemical changes in it, size and structure of the particles in it are important about cariogenicity of food. Food rich in carbohydrates that lingers longest around teeth is the most harmful.

The most adequate example of the cariogenicity negative effect of carbohydrates in drinks with sugar is "Baby bottle caries" with children that are fed with bottle (figure 1).

Even in children that are breast-fed mostly in the late hours, circular caries is spotted.



Figure 1: Little child sleeping with bottle after a meal

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The term sugar associates many people with the one we use domestically (sucrose). Under the term sugar all sugar types are included: monosaccharides (glucose, fructose and galactose), disaccharides (sucrose, lactose and maltose) and polysaccharides (starch) [1, 2].

For the occurrence of dental decay the amount of intake of sugars is not the most important factor, but the physical form in which it is fed sucrose, presence of bacteria in dental plaque, frequency and timing of intake (consuming sugar before bed) [4]. Food which highly contains starch without addition of other sugars plays a minor role in the creation of dental caries [5].

It is thought that sucrose facilitates colonization and growth of bacteria in plaque (*Streptococcus mutans*) [4]. This bacterium breaks down sucrose to acids, reduces the permeability of the plaque thus incapacitating saliva to neutralize the acids in the deeper parties of dental plaque and thus begins enamel demineralization. If cariogenic food lasts longer in the mouth the demineralization stops and remineralization will not begin until carbs are not eliminated from the mouth. High frequency of carbohydrate intake during the demineralization increases and the duration of remineralization is reduced thus conditions for occurrence of tooth decay are created [1, 4, 6, 7, 8, 9].



Figure 2: Decay of first permanent molar

Both children and parents should be advised to reduce the amount and frequency of intake of sweetened foods (sweets, juices, different pastries). Especially they should avoid sugary snacks between meals and just before bedtime. Regular, correct and sufficiently long brushing of the teeth, in the morning, before bedtime and after every sugary meal should become a habit [4, 8, 10].

The first permanent molar is a very important tooth according to its location in the oral cavity and the function it performs. It is therefore called the key to the occlusion (figure 2).

The aim of the work is to point out the cariogenic potential of sugar as part of nutrition which, depending on the frequency and time of its consumption, affects dental health.

MATERIAL AND METHODS

The sample for the present cross-sectional study was 183 school children from second grades, attending 3 central and 2 regional schools in the Skopje city and five villages around our main town. For the realization of this study 90 children were included, seven-year-olds of both sexes in a school from urban areas and 93 school children of the same age from rural areas in Skopje region. We decided to take participants of this age because during this period the first permanent teeth eruption (incisors and molars), primary teeth develop cavities and children don't brush their teeth enough.

Based on the information from the Macedonian Institute of Statistics [11] there are 23.266 students attending first grade and 22.035 pupils enrolled in the second grade of primary school. In the school year 2006/2007 there were 1003 primary schools in our country. Today

there are 993 primary schools in the Republic of Macedonia. In the Skopje municipalities 6827 pupils of first grade and 6290 pupils of second grade in regular primary schools are enrolled in school year 2016/2017. In the municipality Saraj, where the involved primary schools from rural area are situated in this investigation, 283 pupils of first grade and 279 pupils of second grade are enrolled.

Permission for the study was obtained from the kindergarten and school authorities, who sought and obtained consent from the parents of the children concerned. Ethical approval was obtained from the Ministry of Health. Children who were from the urban areas were educated about proper nutrition in the period of kindergarten and again in first grade, and children who were from rural areas, the education was carried out only when the children were in first grade due to the fact that these children did not attend kindergarten. Education was to make children understand they should avoid food with sugar (chocolate, foods that are with white flour, various crackers and salty snacks that stick to your teeth and juices containing sugar) and if consumed, they should brush their teeth. Also children that eat at school were advised to eat healthy foods and to avoid meals that are sticky and unhealthy.

We conducted a survey on all these respondents from the 2nd grade to see the frequency of their sugar consumption. We also conducted systematic checkups of the teeth to see the effect of cariogenic food. It was decided to use cluster sampling because it was more economical and achievable within the constraints of resources and finance. Data were collected during three years (from 2014 to 2016). In the course of the first two years, only dental education was conducted, while during the course of 2016, simultaneous education about how to maintain oral health and control examinations of the dental status were conducted. Parents have been interviewed about nutrition of their child during the systematic examinations of children's dental status. Education for oral health was not carried out among the children from in the rural settlements, because there were no kindergartens built yet for the fostering of pre-school children in rural settlements.

We used Klein-Palmer system or Decayed, Missing or Filled Teeth (DMFT). World Health Organization [12] caries diagnostic criteria were followed. The DMFT, Decayed, Missed, or Filled Surfaces for permanent teeth and dmft, decayed, missed, or filled surfaces for primary teeth were used to evaluate children's dental caries experience. Every condition that we found in every child was registered in order to make a comparison between the two groups. Children from the urban areas at the systematic checkup usually arrived with their parents, so the data in the survey on nutrition we received both from the parents and children.

When it comes to the diet, one part of these children receives a snack from the school (the snacks are mostly various pastries). A second part of the children buys snacks from the nearby store (croissants, potato crisps, popcorn snacks, chocolates). The third part of the children carries a snack from home, mostly: fruit, sandwiches made with wholegrain bread, vegetables and yoghurt.

Because the children from rural settings were accompanied by teachers, we could not talk to the parents. We received the data regarding their diet from the teachers. The schools did not offer a meal plan. Most children bought food from the local stores (croissants, cakes, crisps, juice boxes). A small number of children informed us they brought fruit and sandwiches from home. The children carried their snacks with them, so we gained insight right on the spot.

During the systematic checkup we used various materials, some of which are: a mirror, a probe, toothbrushes and toothpastes, flyers and a fuji triage. For the poll we used a questionnaire for every child containing questions regarding the frequency of sugar consumption.

Statistical analysis

Simple descriptive statistical tests were used in the form of percentage and frequency distribution. For statistical analysis of dmft and DMFT scores to assess the oral health among primary school children, the SAS statistical program was used. T-test was used to find the difference in a sugar usage between the children from urban and rural areas. P value ≤ 0.05 was considered statistically significant.

RESULTS

After the education about proper nutrition in both groups we noticed the following: 15.6% of children from urban areas understood well the contents of the education about proper diet and control of sugar intake. Where as, with the children of the rural areas, the situation was totally different. Of these, 75.2% did not bother to mind what they were eating and continued to consume sweets (tables 1 and 2).

Table 1: Participants from urban areas - second-grade pupils from PS Vlado Tasevski according to the questionnaire for proper nutrition

Grade no of children	Rare usage of sugars			Occasional usage			Constant usage		
	m	f	all	m	f	all	m	f	all
m f all									
Ila 14 6 20	1	1	2	7	3	10	5	3	8
Iib 10 9 19	1	0	1	10	4	14	1	3	4
Iic 14 12 26	4	2	6	8	6	14	1	5	6
Iid 12 13 25	3	2	5	6	6	12	3	5	8
All 50 40 90	9	9	14/ 15.6%	31	19	50 / 55.6 %	10	16	26/ 28.8%

Table 1 shows the children from the urban areas, where it can be seen that more than half of them (55.6%) occasionally used sugars in the diet. Where as 15.6 % of children rarely consumed sugar. 28.8% of participants constantly consumed sugars

Respondents from rural areas were children / pupils from second grade

from two schools, of which pupils from three villages were attending PS Naim Frasheri (villages: Bukovik, Arnakija and Chajlane) and in PS Ibe Palikuka the pupils were from the villages Laskarci and Panichari.(Table 2). The name of primary school in the villages Bukovik, Arnakia,Cajlane is Naim Frashiri and name of primary school in the villages Laskarci and Panicari is Ibe Palikuka(table 4).

Table 2: Participants according to the questionnaire for proper nutrition in rural areas

Grade No of children	Rare usage of sugars			Occasional usage			Constant usage		
	m	f	all	m	f	all	m	f	all
m f all									
II-1B. 6 13 19	0	0	0	1	2	3	2	12	14
II-2B.11 6 17	0	0	0	1	0	1	12	6	18
IIAr 8 12 20	1	0	1	1	2	3	6	10	16
IICha 6 5 11	0	0	0	4	3	7	2	2	4
IIla 9 13 22	1	2	3	1	1	2	7	10	17
IIPa 3 1 4	0	1	1	2	0	2	1	0	1
All 43 50 93	2	3	5/ 5.4%	8	8	18/ 19.4%	30	40	70/ 75.2%

Legend: B: -Bukovik, Ar.-Arnakia, Cha-Chajlane, La.-Laskarci, Pa.-Panicari

Table 2 shows the children from rural areas where consuming sugar is present with 75.2% of the children i.e. 70 children consumed food rich in sugar daily. Negligible numbers of children who rarely use sugars in the diet is only 5.4% of the surveyed children.

T-test was performed to see if there are differences between sugar consumption between children from urban and rural areas. The result indicate that there is statistically significant difference ($p < 0.001$).

Table 3: General state of the teeth condition after the examinations in the school Vlado Tasevski

Grade	Ila	Iib	Iic	Iid	all %
examinees	20	19	26	25	90 (100%)
children with healthy teeth (milk and permanent)	9	8	10	15	42 (46.8%)
children with carious teeth (milk and permanent)	11	2	2	9	24 (26.6%)
children with filled teeth (primary and permanent)	0	9	14	1	24 (26.6%)
frst permanent molars (all 360 examined first molars)					
sealed molars	36	65	97	70	268 (74.5%)
filled molars	3	3	5	6	17 (4.7%)
extracted molars	0	2	0	1	3 (0.8%)
impacted molars	34	4	0	14	52 (14.4%)
carious molars	7	2	2	9	20 (5.6%)

At the examinations the children from the urban areas had great oral hygiene. 4.7% of the kids had treated caries on the first permanent molars and the percentage of untreated caries on first molars was 5.6%. The DMFT on permanent teeth is 0.44 (table 3).

A notable fact is that 46.8 % of the pupils from the school Vlado Tasevski had completely healthy teeth: primary and permanent. (table 3).

Table 4: General state of teeth condition after the examinations in the rural areas

Grade	Bukovik	Arnakia	Cajlane	Laskarci	Panicari	all %
examinees	36	20	11	22	4	93 (100%)
children with healthy teeth (primary and permanent)	4	1	0	3	1	9 (9.7%)
children with carious teeth (primary and permanent)	31	14	7	15	3	70 (75.3%)
children with filled teeth (primary and permanent)	1	5	4	4	0	14 (15.0%)
first permanent molars (all 372 examined first molars)						
sealed molars	99	44	26	83	12	264(71.0%)
filled molars	2	4	0	0	0	6(1.6%)
extracted molars	0	1	1	3	2	7(1.9%)
impacted molars	12	4	9	1	0	26(7.0%)
carious molars	31	27	8	1	2	69(18,5%)

With the children from the rural areas we noticed that the percentage of caries in the first molar was 18.5%. These children have small percentage of filled molars 1.6 %. Only 9.7 % of the children had healthy (primary and permanent) teeth. Decayed, Missing or Filled Teeth (DMFT) on permanent teeth is 0.88. The dental status of the first permanent molars among the pupils from rural area are presented in table 4.

DISCUSSION

According to these facts in relation to the results of our survey it is certain that the care for oral health should start from an early age as many other authors consider. Implementation of preventive measures, proper nutrition, control of the intake of sugars, the removal of harmful habits, regular, proper and sufficiently long-time implemented oral hygiene, regular fluoride prophylaxis and regular visits to the pediatric dentist and the family dentist will provide satisfactory results.

The prevalence of caries was globally accepted that was associated with the type of food (sticky and sweet food, chips, cookies, crackers, small chocolate cakes and sweets), the frequency of input of the same and how long the teeth are exposed to the cariogenic food [6, 7, 8, 10, 13].

Also carbohydrates, i.e. sweets should be consumed after the main meal and not before the main meal or during the whole day. All sorts of sugar contribute to the development of caries and it's recommended that they should be replaced with artificial sweeteners, according to Prahlad Gupta [2].

The type of sugar entering is very important, except frequency of input as Burt highlights, and the results are in line with our received results in the incidence of tooth decay [7].

Liquid or mushy food that contain sugar, frequent meals during the day and in the evenings, bad nutrition habits (the child only consumes foods high in sugars), not brushing the teeth in the evening, all of which have a serious impact on the development of caries. According to Burt and associates, this happens especially during the night when less saliva is excreted thus not allowing the oral cavity to clean itself and making it a suitable environment for development of bacteria and development of caries [7].

Children in kindergarten in the urban areas in most cases rarely consumed meals containing sugar. They paid attention to their oral

hygiene whilst children living in rural areas despite the fact they had the possibility to be fed healthier, they consumed food which contains a high amount of sugar few times daily. They did not pay attention to their oral hygiene especially before going to bed. According to our results we can see that the children living in the urban areas have healthy teeth, sealed first molars or 74.5%. The number of filled teeth and teeth decay is not high, the DMFT index on permanent teeth is 0.44. That means that the education gave results.

Nutrition with food containing sugar is a very important factor for the oral health and it coincides with the results given by Doichinova where 100 children were examined and in 54% a bad oral condition was determined due to unhealthy nutrition [6]. Nutrition with food highly rich in sugar is one of the factors causing bad oral health in many countries around the world [10].

Many of the examined children living in rural areas did not quite understand the need for proper nutrition and many of them consumed meals containing sugar so that the oral condition was bad in most of the children. The number of children with milk tooth decay and not filled first permanent molars was high as well as the number of children that had not visited a dentist. Among the children were a few of them that had extracted the first permanent molars. The DMFT index was higher unlike the DMFT index for the children living in urban areas. G.B. Winter concluded that although sugar consumption correlates with dental problems like caries, we stress out that sugar alone is not the isolated cause of these diseases [13].

Even children with a healthy diet may develop circular caries of milk teeth as a result of their bad habits (long-lasting and frequent breast-feeding, breast-feeding longer than a year, the lingering of food in the oral cavity, the frequent consumption of sweets in between meals) [15].

The very important role of the parents in the motivation and education of young children concerning healthy eating habits. Nowadays many parents are informed and aware of the harmful effects of sugar and also believe that poor oral hygiene can cause cavities.

In a survey conducted in England, with the respondents being parents to children aged 5 and 15, the following parameters were recorded: 82% of the parents of 5-year-olds, in comparison to the 73% of the parents of 15-year-olds, thought that a diet containing refined sugars is the main reason of tooth decay. Around 2 thirds of the respondents (from all age groups) believed that bad oral hygiene was the main

reason for the occurrence of caries. There's an increase in the awareness of oral health in parents of children from all age groups, but there are differences in regard to the social stratum^[16].

The education about the importance of regular dental visits can prevent dental diseases in children. Yet the need for health education of parents and children exists because there is a big discrepancy between attitudes of parents, their dental knowledge, their socioeconomic status and dental practice^[6, 9, 13].

Proper nutrition and avoiding foods containing sugar as some of the preventive measures are part of the educational activities included in the preventive measures to preserve oral health as part of The National Strategy for the prevention of oral diseases in children 0-14 years. In R of Macedonia the education of children of five, six and nine years are implemented in all preschool and school facilities^[8, 9, 10, 13, 17].

From our research with children that are from Skopje and in the 7th grade, where the DMFT values 1.71, which is close to European standards, Todorovska G. points out that the childhood is the ideal period in which education about good diet as a part of preventive measures can contribute to excellent results in improving the health of permanent teeth^[17].

Children from urban areas who were strongly influenced by the education and the parents, teachers, and pediatric dentists (pedodontists) mastered the lesson successfully and understood that health comes from proper nutrition.

Children from rural areas even though live in a region with opportunities to feed healthily, fed more with processed foods purchased in shop. In both cases the crucial part was played by the parents^[18, 19].

Providing good education about proper nutrition and control of the food that contains sugar allow us to create a generation that will have a solid oral health. Necessity of the present study arose from our desire to evaluate the outcomes from the implementation of the National Strategy for prevention of oral diseases in children from 0 to 14 years of age which started to be implemented in 2007. In the study conducted by Ambarkova et al in 2013 in the East region among 12 years old children was shown that dental caries experience is high^[20].

Ambarkova in the study conducted in the Vardar region among 15 years old students concluded that prevalence of dental caries among 15-year old children from Veles city was 90.55%^[21]. Besides the improvement of the oral health of the children in our Republic from the beginning of the implementation of the national strategy in the 2007, we should still work hard on its improvement in all age groups of children.

CONCLUSION

Although sugar itself is a factor for dental diseases it must be emphasized that it is not the only factor that leads to tooth decay. Its more frequent consumption accompanied by bad oral health are factors that lead to milk and permanent teeth decay.

Education about proper diet (limiting the consumption of refined sugars), as well as regular and proper oral hygiene, both play a vital role in the prevention of caries in primary and permanent teeth and preserves the oral health in children from the earliest age.

During dental check-up examinations, pediatric dentists should give informative, education so that children can receive proper knowledge about the impact of the oral health on their quality of life and how to maintain good oral health. In that way children can receive knowledge about the importance of the oral health and how to maintain the same

with proper nutrition and regular oral hygiene. Certainly parents should be included.

Our recommendations stemming from this research would be that children need to be feeding healthy, which involves the inclusion of fresh fruits and vegetables in larger quantities, the regular maintenance of oral hygiene and taking sweets just shortly after the main meals.

REFERENCES

1. Rajić Z, Kostić A, Jelinek E. Pediatric and Preventive Dentistry. (Dječja i preventivna stomatologija) Zagreb: Jugoslavenska medicinska naklada, 1985.
2. Gupta P, Gupta N, Pawar AP, Birajdar SS, Natt AS, Singh HP. Role of sugar and sugar substitutes in dental caries: a review. ISRN Dent. 2013; 2013:519421.
3. Todd JE, Dodd T. Children's dental health in the United Kingdom 1983. Social Survey Report SS1189 London: HMSO, 1985.
4. Cvetkovic A, Ivanovic M. The Role of Streptococcus mutans group and salivary immunoglobulins in etiology of early childhood caries Serbian dental journal. 2006; 53(2):113-123.
5. Sheiham A. Dietary effects on dental diseases. Public Health Nutrition. 2001; 4(2B):569-591.
6. Doichinova L, Bakardjiev P, Peneva M. Assessment of food habits in children aged 6-12 years and the risk of caries. Biotechnology & Biotechnological Equipment. 2015; 29(1):200-204.
7. Burt BA, Eklund SA, Morgan KJ, Larkin FE, Guire KE, Brown LO, et al. The effects of sugars intake and frequency of ingestion on dental caries increment in a three-year longitudinal study. J Dent Res. 1988; 67(11):1422-9.
8. Preventing Dental Caries in Children at High Caries. Scottish Intercollegiate Guidelines Network, A National Clinical Guideline, 2000.
9. Carcev M, Milosevski B, Spirovski V, Getova B, Sarakinova O, Pavlevska M, et al. Guidebook for Implementation of the National Strategy for Prevention of Oral Diseases for children of 0-14 year of the Republic of Macedonia. Ministry of Health, Department for Dental Health Care, Skopje, 2010.
10. Moynihan P, Petersen PE. Diet, nutrition and the prevention of dental diseases. Public Health Nutr. 2004; 7(1A):201-26.
11. Primary, Lower Secondary and Upper Secondary Schools at the school year 2016/2017. Statistical Review: Population and Social statistics, Macedonia.
12. Oral Health Surveys. Basic Methods 5-th edition. World Health Organization, Geneva, 2013.
13. Kalsbeek H, Verrips GH. Consumption of sweet snacks and caries experience of primary school children. Caries Res. 1994; 28(6):477-83.
14. Winter GB, Hamilton MC, James PM. Role of the comfortor as an etiological factor in rampant caries of the deciduous dentition. Archives of Disease in Childhood. 1966; 41(216):207-212.
15. Anđelić Z, Petrović V. Karies Ranog Detinjstva, Early childhood caries Student seminar work, Faculty of dentistry, University of Beograd, Dentopedia 1/7 2015.
16. White DA, Chadwick BL, Nuttall NM, Chestnutt IG, Steele JG. Oral health habits amongst children in the United Kingdom in 2003. Br Dent J. 2006; 200(9):487-91.
17. Todorovska G, Simjanovska LJ, Todorovska K, Kokoceva O, Markovska-Arsovska M. Prevention in pediatric dentistry-health and bright smile. Physioacta 2016; 10(1):105-111.
18. Igic M, Apostolovic M, Kostadinovic LJ, Trickovic-Janjic O, Surdilovic D. The importance of health education in the prevention of children oral health. Medicinski pregled 2008; LXI (1-2):65-70, Novi Sad: januar-februar.
19. Mitrovic R, Petrovic V. Stomatoloski rad sa decom I plan terapije, (Dental work with children and therapy plan). Student seminar work, Faculty of dentistry, University of Beograd Dentopedia 1/3 2015.
20. Ambarkova V, Andonovska V. Dental Caries Experience among primary school children in the Eastern Region of the Republic of Macedonia. Oral Health & Dental Management OHDM, 2014; 13(1):514-520.
21. Ambarkova V, Jankulovska M, Arian D, Glavina D, Soleva A. Dental Caries Experience among Secondary School Children in the Vardar Region of the Republic of Macedonia. Oral Health & Dental Management OHDM, 2014; 13(3):805-10.