

INFLUENCE OF DIET AND LIFESTYLE ON CARIES OCCURRENCE

ВЛИЈАНИЕТО НА НАЧИНОТ НА ИСХРАНА И ЖИВОТНИТЕ НАВИКИ ВРЗ ПОЈАВАТА НА КАРИЕС

Damjanoska N.¹, Georgievska E.^{2,3}, Gjorgievska A.⁴, Georgieva-Janceva M.¹, Bojchinovska S.⁵

¹PHI "Health Center Skopje", Polyclinic "Jane Sandanski" – Skopje, R. N. Macedonia, ²Department of Pediatric and Preventive Dentistry, Faculty of Dental Medicine, University "Ss. Cyril and Methodius" - Skopje, R. N. Macedonia, ³Clinic of Pediatric and Preventive Dentistry, PHO University Dental Clinical Centre "St. Pantelejmon" – Skopje, R. N. Macedonia, ⁴Parliament of the Republic of North Macedonia – Skopje, R. N. Macedonia, ⁵PHI "Health Center Krushevo" – Krushevo, R. N. Macedonia

Abstract

Aim: The aim of this research is to investigate the influence of the diet and lifestyle on the occurrence of caries in children of up to 15 years of age and the possibility of dental status improvement by means of dental education. **Materials and Methods:** During the research, 150 children, divided in three age groups – under 9, 9-13 and over 13 years of age, were interviewed answering a questionnaire of 37 questions. Their dental status was then examined, and the children were given recommendations for further dental treatment, information about proper oral hygiene and the advantages of a healthy diet. After 6 – 8 months, the children underwent a secondary examination, in order to observe the effects of the recommendations and the counseling from the previous period. **Results:** The results show that the initial DMFT index increased with the age group: 2.61 (under 9 years), 5.2 (9-13 years) and 7.38 (over 13 years of age). Increased caries occurrence had been registered in children that consume sugary or carbonated beverages, in children that consume sweets frequently or on a regular basis, that brush their teeth occasionally or in the morning only, and in children who have their teeth examined less than twice a year. After 6-8 months, the results show improved DMFT index in the age groups of under 9 (2.51) and over 13 years (7.25). **Conclusions:** A relationship between certain dietary and lifestyle habits and the occurrence of caries had been observed, as well as the improvement of the dental status due to recommendations and counseling. **Keywords:** caries, diet, oral hygiene, prevention, DMFT, children dentistry.

Апстракт

Цел: Цел на ова истражување е да се испита влијанието на начинот на исхрана и животните навики врз појавата на кариес кај деца до 15 годишна возраст, како и можноста за унапредување на деналниот статус преку едукација. **Материјали и метода:** За време на истражувањето беа анкетирани 150 деца поделени во три возрастни групи – до 9 г., 9-13 г. и над 13 г., кои одговараа на прашалник составен од 37 прашања. Потоа беше извршен стоматолошки преглед и беа дадени препораки за натамошен третман како и предавања за одржување на оралната хигиена и за предностите на здравиот начин на исхрана. После 6 – 8 месеци беше спроведен контролен стоматолошки преглед за да се согледаат ефектите од препораките и советите дадени поретходно.

Резултати: Резултатите покажуваат дека почетниот КЕП индекс се зголемува со возраста на децата и изнесува 2,61 (до 9 г.), 5,2 (9-13 г.) односно 7,38 (над 13 г.). Зголемено присуство на кариес е забележано кај деца кои често конзумираат зашеќерени и газирани пијалаци, кај деца кои често или редовно конзумираат слатки, кај деца кои забите ги мијат повремено или само наутро и кај деца кои имаат редовни стоматолошки прегледи поретко од два пати годишно. После 6-8 месеци, резултатите покажуваат подобрен КЕП индекс во групите до 9 г. (2,51) и над 13 г. (7,25). **Заклучок:** Постои извесна врска помеѓу навиките во исхраната и животните навики и појавата на кариес, како и подобрување на деналниот статус преку едукација и советување.

Клучни зборови: кариес, исхрана, орална хигиена, превенција, КЕП, детска стоматологија.

Introduction

The oral health is part of the overall health status and together they form an unbreakable bond. Caries and parodontopathy are the most common oral health issues in modern humans. Alongside diabetes, heart-related conditions and malignant diseases, they are known as Civilization Illnesses and they share common risk-factors related to diet, sugar intake, lifestyle and unhealthy habits¹. The whole population is affected by caries, starting at infancy, but also at adult age². In the past, the per-

centage of caries-affected population had been far lower than in modern times. The fast lifestyle, accompanied by frequent consumption of fast food, wide-spread intake of soft, sticky and highly processed foods, along with insufficient oral hygiene, contribute to the development of dental caries³. If we account for the genetic pre-disposition and microorganisms as well, it is only a matter of time when the caries will occur.

When the caries really does occur and is not treated, it can lead to serious health problems – from pain and abscesses, to system-wide infections and tooth loss.

Caries causes lower life quality and eating difficulties, and the more advanced it is, the more difficult and painful the treatment will be⁵. Therefore the role of the pedodontist is very important – the preventive check-ups for early diagnosis and treatment, fissure sealants, teeth fluoridation and re-mineralization, education of (especially) young people about maintenance of appropriate oral hygiene and diet – what is considered a healthy food and its influence on the body growth and development. Healthy offspring means healthy future.

Caries is multi-causal infectious disease of the dental tissue, that occurs as an interaction among various local and general, exogenous and endogenous factors over a sufficiently long time period. Main factors playing key-role in the caries process are the host (the tooth), the dental plaque (cariogenic micro-organisms and the oral hygiene), the diet and the temporal factor. Additional factors involved in the process are the saliva, patient age, gender, socio-demographic factors, genetic pre-disposition etc.

The relationship between the oral health and the diet is synergetic. The diet influence can be systematic – endogenous (that acts during all development stages and influences the production of the organic matrix, teeth germs and their mineralization) or local – exogenous, in the post-eruption period. The local influence can be physico-mechanical (firm and abrasive food involves the whole masticatory apparatus and causes increased excretion of alkaline saliva rich in calcium and phosphates, that enables physiologic teeth self-cleaning) or chemical (intake of acidic foods or beverages lowers the pH to critical levels for caries formation and demineralization occurs).

Bacteria thrive in biofilms. A biofilm is a mixed population of various bacteria attached to certain surface. The dental plaque is a classic example of biofilm, enabling its inhabitants easy access to nutrients, cross-feeding (one type of bacteria feeding on another type), waste disposal of bacterial metabolism (bacteria feeding on other bacteria metabolic waste), and creation of favorable pH environment. Of all food types, the most cariogenic are the fermentable carbohydrates, such as sucrose (common sugar), that under the influence of the microflora is fermented to glucose and fructose. *Streptococcus mutans* are the most cariogenic bacteria highly selective of sucrose and able to firmly adhere to the tooth surface even in presence of water-proof glucan. By fermenting various sugars, it produces acids and can metabolize in low pH in the mouth⁷. Glucan is responsible for the creation of the dental plaque and can attract certain bacteria that can interconnect and affix to the teeth. It is water-insoluble and prevents the saliva to neutralize the acidic reaction in the dental plaque. After sugar intake, the acids that are produced penetrate the plaque in several seconds,

and in 1-2 minutes its pH level drops under 5,5 creating favorable conditions for demineralization. After a while, between 20 min. and 2 hours depending on the salivation, pufferization capacity of the saliva, the structure and quantity of plaque in the mouth, the pH level normalizes, calcium and phosphates return to the enamel and re-mineralization occurs. If sugars are pre-dominant in the diet, there won't be a possibility for remineralization, i.e. the demineralization prevails over remineralization manifesting in caries in its earliest stages – macula alba. It is reversible, since only demineralization occurred, without any cavity. If the demineralization frequently surpasses remineralization during longer time periods, a cavity occurs in the enamel, later progressing to the dentin⁴. In young teeth, the dentin is thinner and therefore caries can spread more quickly into the pulp, resulting in pain, abscesses and infections spreading, leading to children developing fear of dental treatments⁵.

Epidemiological data presents caries as a pandemic disease, as an important health issue occurring at early infant age and spreading quickly. More than 40% of 5 years-old children in the developed countries already suffer from caries, and the situation in the developing countries is even worse. It has negative consequences on the overall health, having in mind that is connected to lung, cardiac and arthritic inflammations⁸.

Conservative dental treatments are expensive. According to the World Health Organization (WHO) assessments, in most of the developed countries they account for 5-10% of the overall public health expenses and take the fourth place in the expense ranking. The developing countries in general can afford only a very small share of their public expenditure for oral health needs, since the major part of it is spent on emergency treatments and pain relief³.

The condition and the appearance of teeth have a significant influence on the visual image of a person, and therefore on the self-confidence, social interactions and everyday life. The teeth also play very important part in speech and vocal communication¹⁴.

Therefore, prevention methods such as regular dental examinations, fissure sealing, and fluoridation, as well as education on appropriate teeth brushing, gum care, maintenance of oral hygiene and healthy diet are key factors in caries prevention.

By implementing good preventive measures, the developed countries in North America and Europe have observed a decline in the prevalence of caries. The preventive measures combined with healthy lifestyle and improved healthcare helped the developed countries to confine dental caries under control. Unfortunately, that is not the case in the developing countries, where dental caries causes economic problems as well^{1,6}.

Aim

The aim of this research is to confirm the influence of the following groups of factors on caries occurrence:

- diet, lifestyle, socio-economic and demographic factors
- children education on appropriate diet, maintenance of oral hygiene and regular dental examinations

In order to accomplish this goal, 150 children in the following three age groups were included:

- children under 9 years of age,
- children aged between 9 and 13 years and
- children over 13 years of age.

The children were interviewed answering a questionnaire of 37 questions about their demographic background, diet and lifestyle. Each child had a detailed examination of the dental status and instructions on recommended dental treatments were given to the parents. Afterwards, the children were given information about the structure of the oral cavity, the number of teeth and their corresponding function, about how to maintain proper oral hygiene and healthy diet. The lectures were accompanied by flyers and adapted to children's age.

After 6-8 months, the children had a secondary dental examination, the new dental status was recorded and recommendations on further treatment was given where necessary.

Material and method

The following materials and methods were used to accomplish the goal of the research:

- Survey questionnaire
- Group or individual lectures adapted to the age of the respondents, containing:
 - introductory information about the oral cavity, the number and function of teeth and the importance of their preservation,
 - guidelines for appropriate maintenance of oral hygiene,
 - information about the importance of regular dental examinations,
 - explanations and recommendations on how to check for dental plaque at home and usage of fluorides
 - information about the importance of an appropriate diet and its influence on the development of teeth and the whole body,
 - explanation about the food pyramid
- reminding flyers (adapted to the respondents age)

The examinations were conducted according the WHO recommendations, noting the DMFT (decayed, missing, and filled teeth) index.

Results

The results of the research are given in the tables and figures are presented below.

Table I: Personal and family data

Personal and family data	Respondents	Percentage
03. Gender		
a) male	86	57.33%
b) female	64	42.67%
05. Age Group		
a) up to 9 years	42	28.00%
b) 9-13 years	92	61.33%
c) over 13 years	16	10.67%
06. Residence		
a) urban	121	80.67%
b) rural	29	19.33%

Personal and family data	Respondents	Percentage
07a. Mother's education		
a) elementary school	11	7.33%
b) secondary school	54	36.00%
c) university	85	56.67%
07b. Father's education		
a) elementary school	14	9.33%
b) secondary school	46	30.67%
c) university	90	60.00%
08a. Mother's employment		
a) employed	109	72.67%
b) unemployed	41	27.33%
08b. Father's employment		
a) employed	138	92.00%
b) unemployed	12	8.00%

Out of total of 150 respondents (Table I), 28% were under 9 years of age, 61% were between 9 and 13, and

11% were older than 13 years. The gender distribution was in favor of males – 57%, while 43% were female.

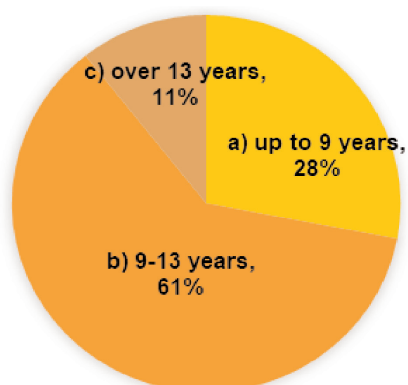


Figure 1: Respondents distribution by age

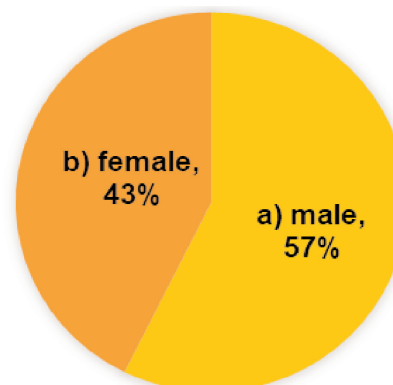


Figure 2: Respondents distribution by gender

Table II: Oral hygiene maintenance

Personal and family data	Respondents	Percentage
09. Teeth brushing frequency		
a) never	7	4.67%
b) occasionally (rarely)	19	12.67%
c) in the mornings only	4	2.67%
d) in the evenings only	54	36.00%
e) in the mornings & in the evenings	65	43.33%
f) after each meal	1	0.67%

Personal and family data	Respondents	Percentage
10. Teeth brushing duration		
a) 1 min.	22	14.67%
b) 2 min.	116	77.33%
c) 3 min.	12	8.00%
11. Toothbrush type		
a) soft	45	30.00%
b) medium	104	69.33%
c) hard	1	0.67%
12. Mouthwash usage		
a) yes	53	35.33%
b) no	97	64.67%
13. Dental floss usage		
a) yes	28	18.67%
b) no	122	81.33%
14. Interdental brush usage		
a) yes	7	4.67%
b) no	143	95.33%
15. Mobile orthodontic appliance usage		
a) yes	33	22.00%
b) no	117	78.00%
16. Fixed orthodontic appliance usage		
a) yes	23	15.33%
b) no	127	84.67%
17. Vitamins/supplements usage		
a) never	49	32.67%
b) occasionally	99	66.00%
c) on a regular basis	2	1.33%
18. Fluorides usage		
a) never	102	68.00%
b) occasionally	44	29.33%
c) on a regular basis	4	2.67%
19. Fluorides used		
a) Tooth Mousse	17	11.33%
b) tabl. NaF	26	17.33%
c) topical fluoridation	5	3.33%
d) not used	102	68.00%

Table III: Caries occurrence vs. tooth brushing frequency

09. Tooth brushing frequency	Cariou teeth	Respondents	Cariou teeth per person
a) never			
A. Before the lecture	40	7	5.71
B. Six months after the lecture	15	7	2.14
b) occasionally (seldom)			
A. Before the lecture	127	19	6.68
B. Six months after the lecture	46	19	2.42
c) in the mornings only			
A. Before the lecture	26	4	6.50
B. Six months after the lecture	4	4	1.00
d) in the evenings only			
A. Before the lecture	225	54	4.17
B. Six months after the lecture	84	54	1.56
e) in the mornings & in the evenings			
A. Before the lecture	246	65	3.78
B. Six months after the lecture	90	65	1.38
f) after each meal			
A. Before the lecture	1	1	1.00
B. Six months after the lecture	1	1	1.00

Table IV: Dentist visits

Dentist visits	Respondents	Percentage
20. Chosen family dentist		
a) yes	150	100.00%
b) no	0	00.00%
21. Distance between residence and family dentist		
a) up to 500m	12	8.00%
b) 500m-1000m	61	40.67%
c) 1km-2km	16	10.67%
d) over 2km	61	40.67%
22. Dentist visits frequency		
a) when an issue arises	59	39.33%
b) semi-annually	63	42.00%
c) annually	25	16.67%
d) bi-annually	3	2.00%

Table V: Caries occurrence vs. tooth brushing frequency

22. Tooth brushing frequency	Carious teeth	Respondents	Carious teeth per person
a) when an issue arises			
A. Before the lecture	332	59	5.63
B. Six months after the lecture	122	59	2.07
b) semi-annually			
A. Before the lecture	158	63	2.51
B. Six months after the lecture	50	63	0.79
c) annually			
A. Before the lecture	156	25	6.24
B. Six months after the lecture	59	25	2.36
d) bi-annually			
A. Before the lecture	19	3	6.33
B. Six months after the lecture	9	3	3.00

Table VI: Dietary habits

Dietary habits	Respondents	Percentage
23. Daily water consumption		
a) 0. 5l (up to 2 glasses)	7	4.67%
b) 1l (3-4 glasses)	38	25.33%
c) 1. 5l (5-6 glasses)	80	53.33%
d) 2l (7-8 glasses)	25	16.67%
24. Beverage consumption frequency		
a) never	0	00.00%
b) occasionally	132	88.00%
c) every day	18	12.00%
25. Consumed bevarage type		
a) natural juice	53	35.33%
b) non-carbonated sugary beverage	30	20.00%
c) soda	67	44.67%
26. Consumed chewing gum type		
a) not used	44	29.33%
b) with sugar	41	27.33%
c) without sugar	65	43.33%

Personal and family data	Respondents	Percentage
27. Number of meals per day		
a) 1-2	0	00.00%
b) 2-3	34	22.67%
c) 3-4	95	63.33%
d) 3 main & 2 snacks	21	14.00%
28. Sweets/cookies/cakes/chocolate consumption frequency		
a) very rarely	1	0.67%
b) rarely	77	51.33%
c) 3-4 times a week	49	32.67%
d) every day	23	15.33%
29. Snacks consumption frequency		
a) very rarely	1	0.67%
b) rarely	66	44.00%
c) 3-4 times a week	64	42.67%
d) every day	19	12.67%
30. Pastry consumption frequency		
a) very rarely	3	2.00%
b) rarely	64	42.67%
c) 3-4 times a week	61	40.67%
d) every day	22	14.67%
31. Sandwiches/pizza consumption frequency		
a) very rarely	7	4.67%
b) rarely	67	44.67%
c) 3-4 times a week	53	35.33%
d) every day	23	15.33%
32. Fresh fruits consumption frequency		
a) very rarely	3	2.00%
b) rarely	45	30.00%
c) 3-4 times a week	80	53.33%
d) every day	22	14.67%
33. Raw vegetables (salads) consumption frequency		
a) very rarely	3	2.00%
b) rarely	43	28.67%
c) 3-4 times a week	84	56.00%
d) every day	20	13.33%
34. Milk and dairy products consumption frequency		
a) very rarely	0	0.00%
b) rarely	37	24.67%
c) 3-4 times a week	80	53.33%
d) every day	33	22.00%

Personal and family data	Respondents	Percentage
35. Cereals consumption frequency		
a) very rarely	1	0.67%
b) rarely	72	48.00%
c) 3-4 times a week	59	39.33%
d) every day	18	12.00%
36. Rice/potatoes/pasta consumption frequency		
a) very rarely	2	1.33%
b) rarely	30	20.00%
c) 3-4 times a week	94	62.67%
d) every day	24	16.00%
37. Weight		
a) underweight	9	6.00%
b) healthy weight	97	64.67%
c) overweight	31	20.67%
d) obese	13	8.67%

Table VII: Caries occurrence vs. beverages consumption frequency and type

24-25. Beverages consumption	Carious teeth	Respondents	Carious teeth per person
a) natural juice			
b) occasionally			
A. Before the lecture	122	51	2.39
B. Six months after the lecture	51	51	1.00
c) every day			
A. Before the lecture	9	2	4.50
B. Six months after the lecture	5	2	2.50
b) non-carbonated sugary beverage			
b) occasionally			
A. Before the lecture	138	23	6.00
B. Six months after the lecture	51	23	2.22
c) every day			
A. Before the lecture	40	7	5.71
B. Six months after the lecture	12	7	1.71
c) soda			
b) occasionally			
A. Before the lecture	310	58	5.34
B. Six months after the lecture	107	58	1.84
c) every day			
A. Before the lecture	46	9	5.11
B. Six months after the lecture	14	9	1.56

Table VIII: Caries occurrence vs. sweets consumption frequency

28. Sweets consumption	Carious teeth	Respondents	Carious teeth per person
a) very rarely			
A. Before the lecture	2	1	2.00
B. Six months after the lecture	1	1	1.00
b) rarely			
A. Before the lecture	226	77	2.94
B. Six months after the lecture	93	77	1.21
c) 3-4 times a week			
A. Before the lecture	275	49	5.61
B. Six months after the lecture	97	49	1.98
d) every day			
A. Before the lecture	162	23	7.04
B. Six months after the lecture	49	23	2.13

The total dmft (primary dentition DMFT) index in the first round of the research was 2.11, and in the second round (6-8 months later) it was 1.79.

The total DMFT index in the first round of the research was 4.72, and in the second round (6-8 months later) it was 4.69.

Table IX: Caries occurrence vs. sweets consumption frequency

Index value	Age group			
Dentition	a) up to 9 years	b) 9-13 years	c) over 13 years	Total
deciduous teeth (dmft)				
A. Before the lecture	2.87	1.43	0.00	2.11
B. Six months after the lecture	2.18	1.09	0.00	1.79
permanent teeth (DMFT)				
A. Before the lecture	2.61	5.20	7.38	4.72
B. Six months after the lecture	2.51	5.22	7.25	4.69

Discussion

The subject of this research are school-aged children. School age is the period when children obtain permanent oral hygiene habits. The mouth reflects our health, and there is no overall health without oral health.

The World Dental Federation (FDI) recommends that teeth be brushed twice a day (9). This research shows that 43.33% of the surveyed brush their teeth both in the morning and in the evening, compared to 12.67% that rarely brush, and 4.67% that don't brush at all (Table II). These results correlate to the dental caries rates in Table

III. The respondents that brush occasionally, or only brush in the morning have the highest number of carious teeth per person on average, 6.68 and 6.5 correspondingly. Those that only brush their teeth in the evening have 4.17, and those that brush both in the morning and in the evening have 3.78 carious teeth per person on average. The second round of examinations shows improvement in all categories, partly attributed to the lectures on proper diet and oral hygiene, but mostly as a result of the suggested treatments, which often resulted in family dentist visits and carious teeth repairs.

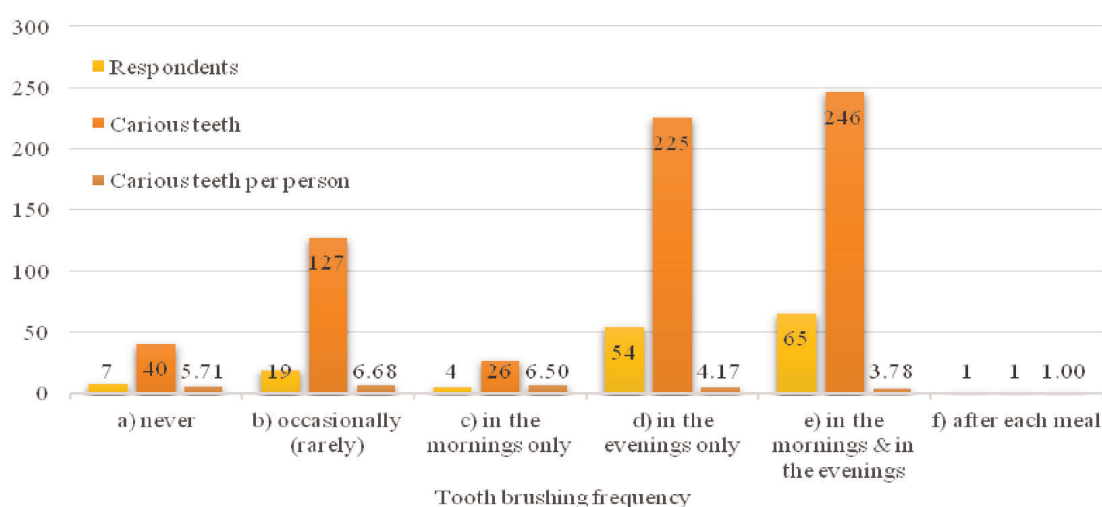


Figure 3: Caries occurrence vs. tooth brushing frequency at the beginning of the research

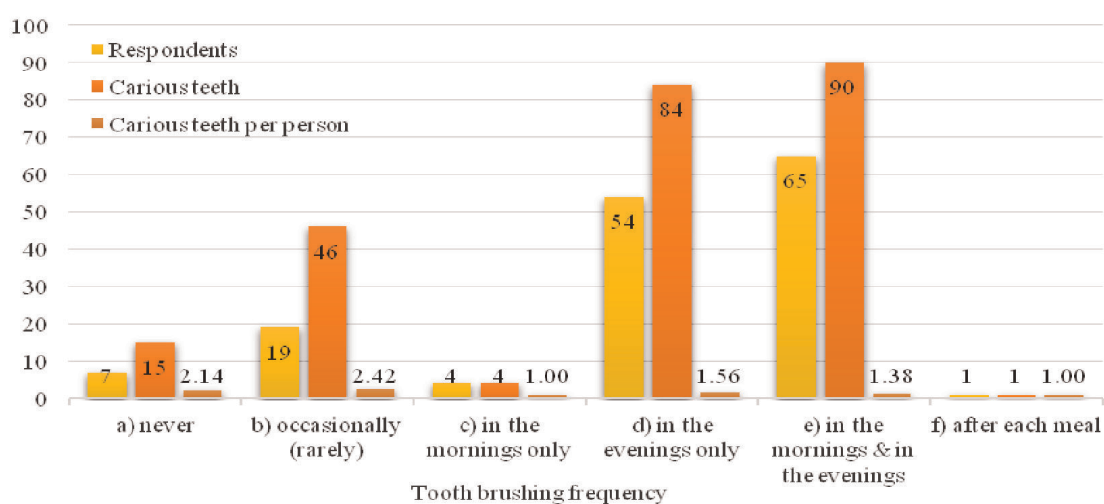


Figure 4: Caries occurrence vs. tooth brushing frequency six months later