

Cross-Sectional Study to Evaluate The Influence Of Nutritional Behavior On The Dental Health Of Romanian Teenagers

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Summary. Nutritional behavior is one of the current concerns regarding the primary prevention of carious lesions. Material and method: Cross-sectional study was performed for 150 subjects aged between 12-18 years randomly selected. The assessment of knowledge and attitudes about influence of nutritional behavior on the dental health was carried out by the method of the questionnaire for: general data, frequency of snacks, consumption of carbonated drinks with sugar and without sugar, consumption of sugar, sweeteners, sweets, fruits, dairy products, chewing gum. Also, dates about subjective symptoms regarding the appearance of gingival bleeding and the presence of pain in the form of dental sensitivity, were recorded. The dates were collected online and then entered an IBM SPSS statistic26. The Chi-Square Test was applied taking into account the Pearson Chi-square and the level of significance was $\alpha=0.05$. Results and Discussion: The comparison of the results regarding the consumption of carbonated drinks with sugar showed differences for class level, gingival bleeding and for dairy products $p\leq 0.05$ and increase the number of subjects with toothache in relation to frequency of meals $r = .51$. The frequency of fruit consumption is not different at the level of studies and is not closely correlated with the presence of gingival bleeding, the presence of pain or the consumption of dairy products. Only 26% (39) do not consume chewing gum and of those who consume only 22.7% (34) consume sugar-free chewing gum, and 12% (18) chewing gum with fluoride. Conclusion: Nutritional behavior is an important factor on which dental health depends.

Key words: diet, sugars, sweeteners, hydrocarbons

Introduction

Food hygiene is one of the current concerns regarding the primary prevention of carious lesions. The World Health Organization ranks food hygiene in second place. Food hygiene is important both in terms of pre-resorbing and post-resorbing effect

manifested by the content in nutritional principles. Vitale et al (1) emphasize the role of the dietary factor in maintaining general health. Numerous studies also debate this issue, nutrition being a highly contested factor today (2, 3).

Various studies show that the diversity of nutritional principles is closely correlated with the

formation and maintenance of health in general and especially locally in the oral cavity, these aspects being influenced since the stages of body formation (1-4).

The World Health Organization focuses on educating the population about food hygiene, and there are currently numerous studies that address various aspects of dietary involvement in the initiation, formation and development of carious lesions.

The intake of acidogenic foods is considered a favorable factor in the appearance of carious lesions. The ingestion of these foods will favor the appearance of favorable conditions for the demineralization of the teeth. This is influenced by the frequency of ingestion and the amount consumed. Certain bacteria present in the oral cavity such as streptococcus mutans and lactobacillus promote the fermentation of these foods. By fermentation, acids are produced that will favor the demineralization of dental structures. Thus, the recommendations in this regard are to reduce the amount of hydrocarbon consumption and the frequency of consumption.

According to the World Health Organization, carious lesions are a major health problem, as they affect 60-90% of school-age children.

The following hypotheses were formulated in the conception and development of the clinical study: The null hypothesis was that carbonated beverages, sweets and dairy consumption do not influence the occurrence of gingival bleeding and toothache. The test hypothesis was that carbonated drinks, sweets and dairy consumption influence the occurrence of gingival bleeding and tooth pain, which translates into statistically significant differences obtained from analyzing the answers obtained by applying the questionnaire method. Thus, the purpose of this study was to analyze dietary risk factors for the appearance of carious lesions and their correlation with gingival bleeding and the appearance of dental pain in adolescents.

Materials and Methods

Participants

The study group consisted of a number of 150 subjects aged between 12 and 18 years. Subjects were

randomly selected. The study was conducted between October and January 2020. The subjects were selected from two counties in Romania, Iasi and Botosani, respectively. The inclusion criteria aimed at belonging to the form of education and the consent of the subjects to participate in this study. Cross-sectional, questionnaire-based study was applied.

The survey

The assessment of the level of knowledge and attitudes was performed by the method of the questionnaire, applying a number of 25 questions that aimed at: general data on age, study class, frequency of snacks, consumption of carbonated beverages and cola, pepsi with sugar = cps; cola, pepsi without sugar = cp; energy drinks = ed; carbonated juices with sugar = cjs; carbonated juices without sugar = cj; consumption of sugar, sweeteners and sweets sweets = s; link disease-sweets = link d-s; link disease-hygiene = link d-h; frequency of meals = f.m. ; adding sugar = a.s.; use sweeteners = u.s. caramels = car; jellies = jel; gummy candies = gc; jam / jam = j / j; chocolate = cho; fruit consumption figs = f; lemon = l; oranges = o; berries = br; banana = ba; apples / pears = a; almonds / pistachios = p; consumption of dairy products = dp as well as consumption of chewing gum. The following consumption variants were questioned: 0 = does not consume; 3w = 3 times a week; 5w = 5 times a week; d = daily / day. It was also recorded by subjective symptoms the appearance of gingival bleeding B = bleeding, and the presence of pain in the form of dental sensitivity P = pain;

Statistical analysis

The data was collected online and then entered into an IBM SPSS statistics 26 for Windows database. Descriptive and analytical analysis tests were applied using the Chi-Square Test.

In order to establish the correlation between two binary categorical variables, we verified the existence of the links by creating the association table (contingency). To determine the association we took into account the values: Pearson Chi-square, Likelihood Ratio and Fisher's Exact Test. We used several variants

of the Chi square test, in order to favor the elimination of possible errors due to the determined low frequencies. To determine the strength and direction of linear relationships between pairs of the analyzed data, we calculated Pearson's correlation coefficient (r) and the associated probability. The level of significance $\alpha = 0.05$ was used to check the hypothesis.

Results

The analysis of the obtained data showed an average age of the subjects of 16.14 years (± 1.25). The distribution was equal for the two counties. The origin of the subjects was 90.7% from the urban area, 44.67% for Iași, 44% for Botoșani and 9.3% for the rural area 5.33% for Iasi and 4% for Botoșani. The analysis of the answers to the questions targeted respondents from classes VI-XII, respectively, 0.7% class VI, 0.7% class VII, 6% class VIII, 21.3% class IX -a, 29.3% class to Xa, 27.3% class to XI-a, 14.7% class to XII-a. The presence of gingival bleeding was noticed in only 27.3% (41) of the subjects, compared to the presence

of toothache 56.7%. The pains were of low intensity, of a few seconds in a percentage of 50.7% (76) and of high intensity at 6% (9) of the studied group.

Analysis of responses on carbonated beverage consumption

Regarding the consumption of cps, 42.7% do not consume, 36.7% consume a maximum of 3 times a week, 14.7% consume a maximum of 5 times a week and 6% every day. (Fig.1) Comparison results in terms of cps consumption showed statistically significant differences for class level $\chi^2 = 39.58$, $df = 18$ with $p \leq 0.05$ establishing a link $r = -, 13$ and for gingival bleeding $\chi^2 = 7.54$, $df = 3$ with $p \leq 0.05$ establishing a connection $r = -, 18$. (Tab.1)

Regarding the consumption of cp, it is not preferred by 59.3% of the subjects, it is achieved a maximum of 3 times a week by 29.3%, a maximum of 5 times a week by 8% and 3.3 times a day. % (Fig.1). The results are statistically significant depending on the study class $\chi^2 = 38.8$ $df = 18$ with $p \leq 0.05$, $r = -, 05$ and in function by dairy products $\chi^2 = 9.69$ $df = 9$ with $p \leq 0.05$, $r = -, 07$ (Tab.1).

PERCENTAGE OF CONSUMPTION OF COLA, PEPSI AND ENERGY DRINKS IN RELATION WITH GINGIVAL BLEEDING AND DENTAL PAIN

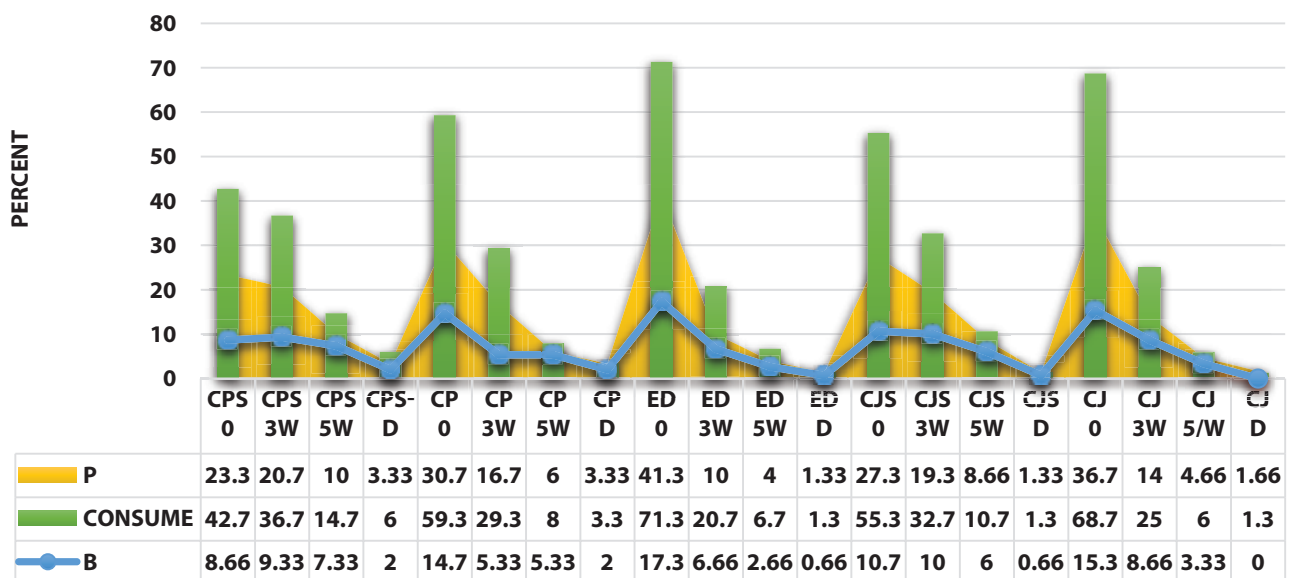


Figure 1. Percentage of consumption of cola, pepsi and energy drinks in relation with gingival bleeding and dental pain

PERCENTAGE OF CONSUMPTION OF SWEETS IN RELATION WITH GINGIVAL BLEEDING AND DENTAL PAIN

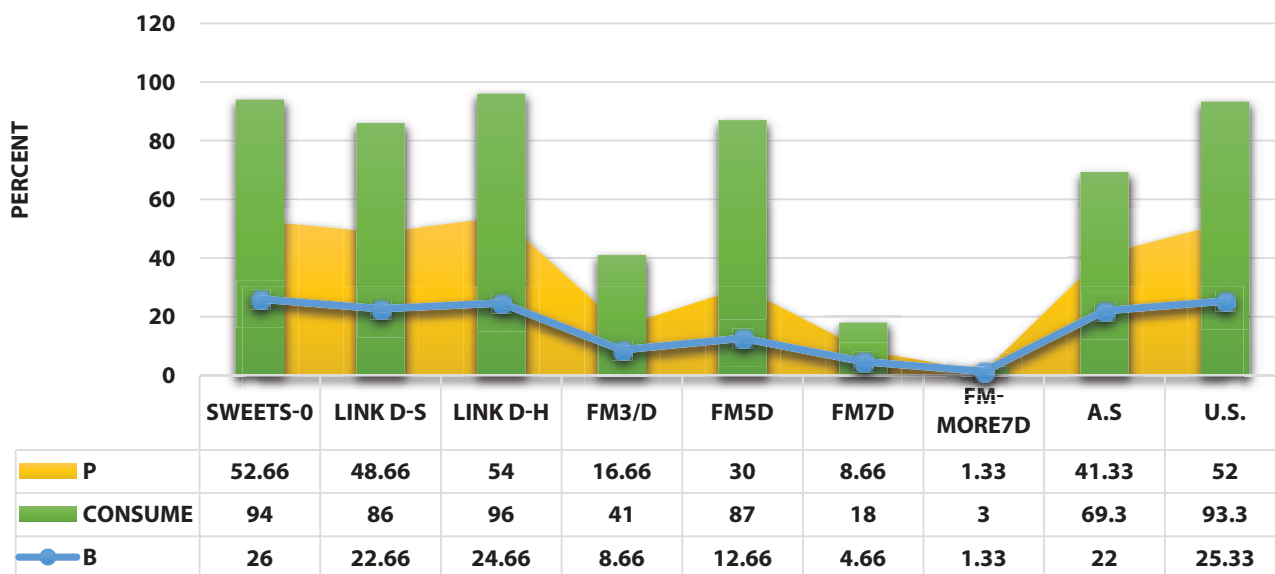


Figure 2. Percentage of consumption of sweets in general, the link between disease and oral hygiene and the consumption of sweets in relation with gingival bleeding respectively dental pain

CJS consumption is achieved by only 1.3% every day, and 55.3% do not consume (Fig.1). Among those who consume there are statistically significant differences depending on the study class $\chi^2 = 100.7$ $df = 18$ with $p \leq 0.05$, $r = -.014$, and with gingival bleeding $\chi^2 = 10.23$ $df = 3$ with $p \leq 0.05$, $r = -.23$ (Tab. 1).

Regarding the consumption of CJ drinks, also only 1.3% consume every day, and 68.7% do not consume (Fig.1) the differences being statistically significant for gingival bleeding $\chi^2 = 7.06$ $df = 3$ with $p \leq 0.05$, $r = -.20$ (Tab. 1).

ED consumption is achieved by only 1.3% every day, and 71% do not consume (Fig.1). Among those who consume there are statistically significant differences depending on the consumption of dairy products $\chi^2 = 38.73$ $df = 9$ with $p \leq 0.05$ $r = -.07$ (Tab. 1).

Analysis of the answers regarding the consumption of sweets

Although the link between the consumption of sweets and the presence of dental diseases is known by most subjects 86%, the consumption of sweets is high,

94% of subjects preferring their consumption 94%, and 87% achieve this consumption about 5 times a day. (Fig. 2). The correlation of the consumption of sweets with the presence of gingival bleeding and pain, as well as with the level of studies and the consumption of dairy products is not statistically significant. Instead, there is an increase in gingival bleeding in those who add sugar to the diet $r = .15$, and an increase in the number of subjects with dental pain compared to the frequency of meals $r = .51$ (Tab.1).

Analysis of responses on fruit consumption

Fruits are rarely consumed daily, with approximately 2% figs, 8% lemons, 4% oranges, 5.3% berries and 61% figs, lemons 52%, oranges 41%, berries 48%, bananas 12%, apples and pears 8% (Fig.4). The frequency of consumption of various fruits is not different at the level of studies and is not closely correlated with the presence of gingival bleeding, the presence of pain or the consumption of dairy products. (Tab.1). Moreover, the consumption of bananas has nothing to do with the presence of dental pain and a reduced

Table 1. Establishing correlations between the frequency of consumption for carbonated drinks, sweets, fruits, dairy products and chewing gum

	Class			Gingival Bleeding			Dental pain			Dairy products		
	χ^2	r	p	χ^2	r	p	χ^2	r	p	χ^2	r	p
What is the frequency of consumption for carbonated beverages?												
Cola, Pepsi with sugar	39,58 ^a (18)	-,13	,00*	7,54 ^a (3)	-,18	,03 ^{c*}	2,49 ^a (6)	,05	,50 ^c	9,69 ^a (9)	,07	,37
Cola, Pepsi without sugar	39,8(18)	-,05	,00*	14,19 ^a (3)	-,12	,16 ^c	8,611 ^a (6)	,07	,40 ^c	21,53 ^a (9)	-,04	,01*
Carbonated juices with sugar	100,7 ^a (18)	-,14	,00*	10,23 ^a (3)	-,23	,01 ^{c*}	8,06 ^a (6)	,15	,07 ^c	7,85 ^a (9)	-,02	,54
Carbonated juices	15 ^a (18)	-,15	,66	7,06 ^a (3)	-,20	,01 ^{c*}	10,5 ^a (6)	,12	,13 ^c	6,23 ^a (9)	-,13	,71
Energy drinks	19,48 ^a (18)	-,06	,36	2,20 ^a (3)	-,11	,20 ^c	9,08 ^a (6)	-,01	,88 ^c	38,73 ^a (9)	-,07	,00
Do you use?												
Sweets	17,43 ^a (6)	,01	,93	,13 ^a (1)	,03	,73 ^c	4,49 ^a (2)	,11	,18 ^c	,37 ^a (3)	,029	,73 ^c
Link disease-sweets	7,249 ^a (6)	-,08	,34 ^c	,44 ^a (1)	-,05	,51 ^c	,08 ^a (2)	-,01	,95 ^c	1,17 ^a (3)	,02	,78 ^c
Link disease-hygiene	29,79 ^a (6)	-,06	,47	4,87 ^a (1)	-,18	,03 ^{c*}	1,33 ^a (2)	,07	,39 ^c	12,91 ^a (3)	,00	,98
Frequency meals	18,04 ^a (6)	,022	,79	3,96 ^a (3)	-,05	,59 ^c	7,62 ^a (6)	,05	,51 ^c	16,43 ^a (3)	-,03	,68
Added sugar	10,33 ^a (6)	,09	,11	3,3 ^a (1)	,15	,07 ^c	2,41 ^a (2)	-,12	,15 ^c	,80 ^a (3)	,00	,84
Sweeteners	1,39 ^a (6)	,03	,76	,04 ^a (1)	-,02	,85 ^c	3,94 ^a (2)	,12	,13 ^c	,56 ^a (3)	-,02	,77
How many times a week do you eat?												
Caramels	10,06 ^a (18)	-,09	,93	4,46 ^a (3)	-,15	,08 ^c	4,25 ^a (6)	,12	,15 ^c	7,75 ^a (9)	-,03	,55
Jellies	10,21 ^a (18)	-,12	,92	5,6 ^a (3)	-,15	,07 ^c	5,56 ^a (6)	,09	,27 ^c	9,52 ^a (9)	-,11	,39
Jam /jam	24,65 ^a (18)	-,25	,13	3,97 ^a (3)	-,15	,06 ^c	2,84 ^a (6)	,03	,75 ^c	8,88 ^a (9)	-,09	,44
Chocolate	9,66 ^a (18)	,11	,94	8,91 ^a (3)	-,06	,47 ^c	7,6 ^a (6)	,04	,67 ^c	5,38 ^a (9)	,10	,80
Gummy candies	12,41 ^a (18)	-,08	,82	2,27 ^a (3)	-,09	,26 ^c	2,36 ^a (6)	,06	,43 ^c	30,81 ^a (9)	-,02	,00
What is the frequency of consumption of fruits?												
Dates, figs	14,71 ^a (18)	-,13	,68	2,15 ^a (3)	-,11	,18 ^c	9,23 ^a (6)	-,05	,54 ^c	2,59 ^a (9)	-,08	,34 ^c
Lemon/limes	23,74 ^a (18)	-,11	,20 ^c	1,09 ^a (3)	,07	,42 ^c	3,48 ^a (6)	-,06	,46 ^c	9,17 ^a (9)	,02	,82 ^c
Oranges	47,95 ^a (18)	-,11	,20 ^c	5,52 ^a (3)	,07	,40 ^c	9,13 ^a (6)	,02	,83 ^c	13,78 ^a (9)	-,05	,58 ^c
Berries	18,86 ^a (18)	-,18	,02 ^c	1,23 ^a (3)	-,03	,72 ^c	10,4 ^a (3)	,16	,05 ^{c*}	11,27 ^a (9)	-,10	,23 ^c
Banana	25,16 ^a (18)	-,05	,56 ^c	4,10 ^a (3)	-,05	,53 ^c	4,20 ^a (6)	,00	,96 ^c	22,97 ^a (9)	,21	,01 ^{c*}
Apple	12,13 ^a (18)	-,03	,68 ^c	1,88 ^a (3)	,07	,39 ^c	2,04 ^a (6)	,02	,81 ^c	12,49 ^a (9)	,033	,69 ^c
Peanuts	13,21 ^a (18)	-,09	,30 ^c	1,31 ^a (3)	-,03	,73 ^c	2,02 ^a (6)	,01	,92 ^c	13,66 ^a (9)	,11	,20 ^c
What is the frequency of consumption of dairy products and chewing gum?												
Dairy products	13,66 ^a (18)	,11	,20 ^c	2,37 ^a (3)	,04	,66 ^c	3,02 ^a (6)	-,01	,95 ^c	-	-	-
Cheewing gum	11,50 ^a (18)	0,2	,82 ^c	1,08 ^a (3)	,05	,51 ^c	5,18 ^a (6)	,15	,07 ^c	7,02 ^a (9)	,08	,32 ^c

^a0 cells (0,0%) have expected count less than 5. The minimum expected count is 10,50, c. Based on normal approximation. χ^2 = Chi-Square; Pearson R=r, p=interval of confidence, p \leq 0,05.

PERCENTAGE OF CONSUMPTION OF CANDIES, JAM, CHOCOLATE IN RELATION WITH GINGIVAL BLEEDING AND DENTAL PAIN

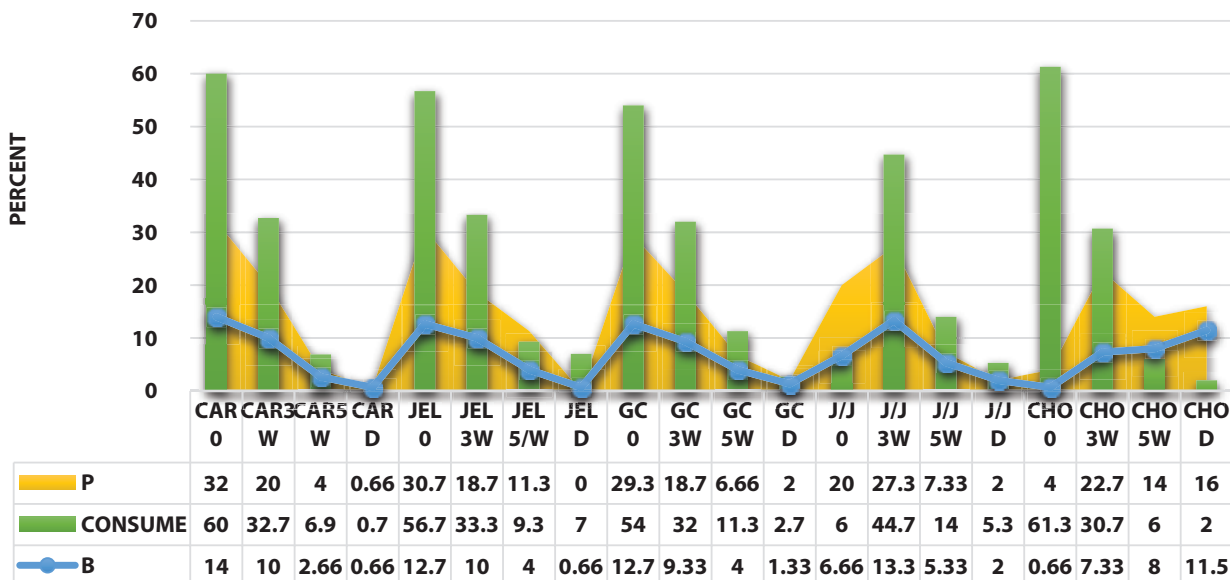


Figure 3. Percentage of consumption of candies, jam and chocolate in relation with gingival bleeding and dental pain

PERCENTAGE OF CONSUMPTION OF FRUITS IN RELATION WITH GINGIVAL BLEEDING AND DENTAL PAIN

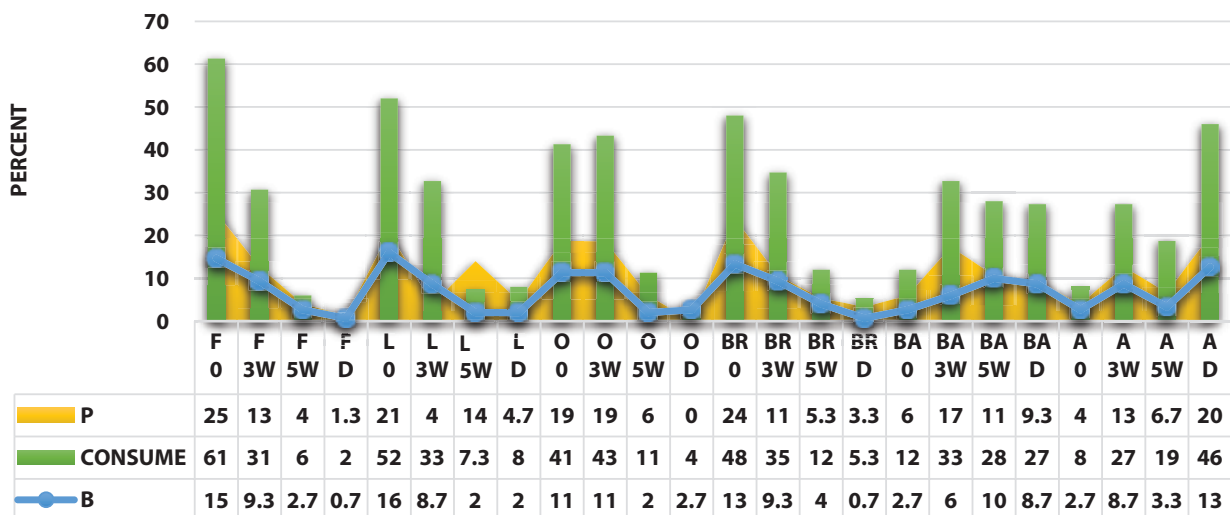


Figure 4. Percentage of consumption of fruits in relation with gingival bleeding and dental pain.

correlation with gingival bleeding. This aspect can also be explained by their low consistency.

Dairy products are consumed daily by 61.3% (92) of the subjects, 16.7% (25) maximum 3 times /

week, 20.7% (31) maximum 5 times a week (Fig. 5) and the one of nuts and pistachios of 19.3% of the subjects the results not being statistically significant (Tab.1)

PERCENTAGE OF CONSUMPTION OF ALMONDS/PISTACHIOS AND DAIRY PRODUCTS IN RELATION WITH GINGIVAL BLEEDING AND DENTAL PAIN

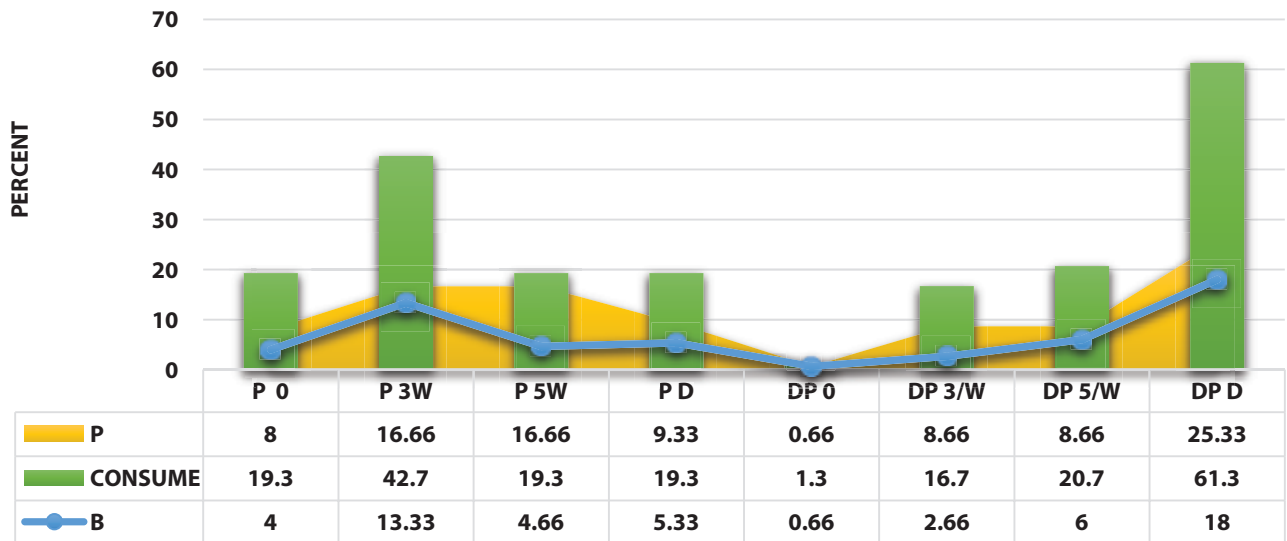


Figure 5. Percentage of consumption of almonds/pistachios and dairy products in relation with gingival bleeding and dental pain

Only 26% (39) do not consume chewing gum and of those who consume 39.3% (59) consume chewing gum with sugar, 22.7% (34) consume sugar-free chewing gum, and 12% (18) chewing gum with fluoride. There are differences between the two backgrounds of the subjects in terms of gum consumption in favor of those in Iasi, but they are not statistically significant (Tab.1)

Discussion

A favorable factor in the etiopathogenesis of dental diseases is represented by the consumption of acidic drinks with or without sugar, an aspect involved especially in the slow demineralization of hard dental structures and the appearance of cervical erosions. In addition to the consumption of acidic beverages, especially important are the frequency of consumption,

Consumption of acidic drinks before going to bed has a harmful effect on dental health, by maintaining an acidic pH, and during sleep salivary flow is lower to 0.05 ml / min.

Through carbon dioxide and other acids contained (citric acid, phosphoric acid) Coca-Cola has

an extremely low pH, around 2 -3. In addition, the demineralization of young teeth is initiated at a critical pH of 5-5.5 and of teeth with exposed root at a pH of 6-6.5. Remineralization is also inhibited by the presence of citric acid that retains calcium ions from saliva. At the same time, the decrease of the pH after the consumption of Coca-Cola at very critical levels cannot be increased until neutralization by the intervention of salivary buffer systems. Thus the pH of the oral cavity is maintained at a very low level, favorable to the demineralization of hard dental structures. Toothbrushing, immediately after ingesting carbonated beverages, especially coca-cola is contraindicated, because in this way the organic matrix that would be the support for a possible remineralization is destroyed. In this context, there is a percentage of 2.67% of subjects who stated that they perform tooth brushing immediately after consuming acidic beverages. Products such as caramels, jellies, jams are not recommended to be consumed due to the harmfulness given by the increased stagnation time in the oral cavity, adhesiveness, reduced self-cleaning, reduced salivary secretion, thus increasing the acid potential of sugar.

In a recent report, the World Health Organization (WHO) changed the recommendation on free

sugar consumption from 10% (WHO, 2003) to 5% of daily energy intake to reduce obesity, type 2 diabetes and the occurrence of carious lesions (5,6). The diet also influences the composition of the bacterial plaque by ensuring the nutrient content necessary for the development of bacteria (7). Products containing stevia, sucralose and saccharin have antibacterial properties through their mechanism of action with interference on bacterial metabolism. Stevia is a plant rich in vitamins (B, C and K), mineral salts (potassium, phosphorus, manganese, calcium, iron, zinc). The high acid content of many fruits and fruit juices can cause the enamel to demineralize over time. Some fruits, although rich in vitamins, have a low acid potential well below the critical salivary pH value. Among these acidic fruits are: lemons (pH: 2.00 - 2.80), oranges (pH: 3.69 - 4.34), berries (pH: (2.30 - 2.52)). Also the high glycemic index of some fruits can explain certain situations. Thus the most consumed fruits are bananas 27% and apples with pears 46% in this way being able to explain the oro-dental diseases manifested by the presence of gingival bleeding and pain. In addition bananas have a high content of carbohydrates (22.84 g carbohydrates / 100g) with a high GI (glycemic index), respectively IG: 55 and apples IG: 39; pears IG: 38. Unfortunately, berries with a low GI (Blueberries - IG: 25; Currants - IG: 25; Blackberries - IG: 25; Raspberries - IG: 25;) are not consumed by 48% of subjects. Only 1.3% do not consume dairy products, which is beneficial in terms of regulating the pH of the oral cavity and bringing factors that can protect against tooth decay. Dairy foods have many mechanisms to combat the damage to dental structures. Thus, they exert a cario-preventive role through the calcium and phosphate content, through the casein content, through the protein components having at the same time an antibacterial effect through the casein phosphopeptides complexes. Dairy products also shorten the clearance of sugar in the oral cavity, promote buffer capacity and reduce the number of pathogenic microorganisms in the oral cavity (8). The addition of mineral components such as fluor, calcium, phosphate reduces the cariogenic and erosive potential of food. These minerals can be found in chewing gum. CPP-ACP (phosphopeptide casein, amorphous calcium phosphate) media provide a similar effect. Given the students' schedule and the fact that they do not have access to toothbrushing during study

hours, the use of chewing gum may partially replace brushing. Moreover, used after meals helps to increase salivary flow. This contributes to the self-cleaning effect and removes food debris that can cause tooth decay or bad breath. Analyzing the results of this study, we can say that, although we observed a tendency of subjects in schools in Iasi to consume a slightly larger amount of cariogenic foods, they compensate by the higher intake of caries-prophylactic foods and by acquiring a sano-genic behavior represented either by the intake of a fruit after a snack, or the use of chewing gum with fluoride and they take it to a greater extent than the subjects from Botoșani. The way of eating is one of the most important factors for oral health, being in close correlation with the appearance of carious lesions (9). Also, the oro-dental health condition is the expression of the general health condition, interrelating and contributing directly to its achievement. These issues have been addressed in specialized studies. These showed a strong positive correlation between the lifestyle reflected by movement and a correct diet and the physical condition of each Savu et al 2019 and Gheorghiu et al 2019 presenting in their studies these aspects (10,11).

And the results of other studies have concluded that studies have concluded that diet is a decisive factor in maintaining optimal health (12,13). The hours spent at school can affect the diet through an unbalanced and irregular diet, the appearance of unhealthy eating habits, as well as the imbalance of meal schedule due to the loss of lunch sometimes. Thus, it was found an increased consumption of sweets and fast food products, but also the preference for sugary juices, to the detriment of those without sugar. Daily consumption of dairy products by a large number of subjects is beneficial. The diversity of daily foods is very important due to the fact that the excess of one type of food can cause nutrition problems, therefore the general and oro-dental health can be affected, including the quantity and quality of saliva (14). Reducing the buffer capacity of saliva by depleting the components due to repeated acid attacks in the oral cavity helps maintain an acidic pH for a longer time. Most of the subjects evaluated manage to balance their daily menu in terms of food diversity. Thus, in agreement with other studies, we can state that motivational school policies to reduce sugary food consumption may be required (15).

Conclusion

Within the limits of this study we can say that food hygiene is an important factor on which oro-dental health depends. The eating behaviors were similar for the subjects from the two localities, which may indicate that the access to information and the establishment of certain attitudes is similar. Subjects have a diet rich in sugary foods. Foods and juices sweetened with artificial sweeteners are not in the subjects' preferences.

Limitations: Larger samples in each class for establishing correlations would have been necessary.

Conflict of interest: The authors declare that they have no competing interests.

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