
ORIGINAL PAPER

AWARENESS OF THE ROLE OF NUTRITION - AN IMPORTANT FACTOR FOR DENTAL CARIES PREVENTION

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SUMMARY

Background: The composition and frequency of dietary intake are of great importance for the appearance and development of dental caries. Nutrition could be a preventive and a risk factor as well. It depends to a great extent on the individual's awareness and cultural competence. The aim of this survey is to investigate the relationship between patient's awareness, his/her dental status and risk for caries development.

Methods: This survey implemented the questionnaire method. It involved 52 patients aged 17 - 60 years. Groups with high degree of awareness (A+) and with low degree of awareness (A-) were formed depending on the answers. Besides the patients' answers to the questions, their dental status, reported after an examination by a dentist is also written on the questionnaire sheet.

Results: The number of affected teeth (DMFT) in the group of patients with better knowledge (A+) was as a mean with 0.63 smaller and the number of active caries lesions (AT) in the same group was with 0.37 smaller vs. the (A-) group. They also consumed as a mean 0.71 times daily more yellow and white cheese (FCC).

Conclusions: 1. Statistically significant relationship was observed between the patients' awareness level and their dietary habits. The greater awareness leads to elevated frequency of dietary habits reducing the risk for DCC development. 2. Statistically significant relationship was established between patients' awareness level and the real oral status. Patients with higher awareness level presented a smaller number of DCC teeth (DMFT).

Abbreviations: DCC – dental caries and its complications, DMFT – Decayed, Missing, Filled Teeth - index showing the number of teeth with caries, obturation or missing due to of caries and its complications, AT – index showing the number of teeth with at least one active lesion, FCC – Daily rate of yellow and white cheese consumption

Key words: Caries, Information, Prevention, Habits, Nutrition, Bulgaria, Tooth Decay, Cheese, Dentistry

RÉSUMÉ

La conscience du rôle de la nutrition - un facteur important pour la prévention des caries dentaires

Contexte: La composition et la fréquence de la prise alimentaire sont d'une importance primordiale pour l'émergence et l'évolution de la carie dentaire. L'alimentation peut être tant un facteur préventif qu'un facteur de risque. Cela dépend en grande partie de la sensibilisation et de la compétence culturelle du patient. La présente recherche a pour objectif d'étudier la relation entre la sensibilisation du patient, son statut dentaire et le risque de développement d'une carie dentaire.

Méthodes: La méthode d'enquête utilisée dans la présente recherche a été le sondage. Le sondage a couvert 52 patients dans la tranche d'âge de 17 à 60 ans. En fonction de leurs réponses, un groupe présentant un niveau élevé de sensibilisation (S+) et un groupe présentant un niveau bas de sensibilisation (S-) ont été formés. Outre les réponses aux questions, les personnes interrogées renseignent également dans le formulaire le statut dentaire établi lors de l'examen par un praticien de l'art dentaire.

Résultats: Le groupe de patients justifiant de bonnes connaissances (S+) ont en moyenne 0,63 moins de dents cariées, absentes ou obturées (DCAO) et 0,37 de lésions de caries à évolution active (AT) par rapport au groupe (S-). Ils consomment également en moyenne 0,71 fois par jour plus souvent de kashkavals et de fromages blancs (fréquence de consommation de kashkavals et de fromages blancs).

Conclusions: 1. On observe une relation statistiquement significative entre le niveau de sensibilisation des patients et leurs habitudes alimentaires. Plus la sensibilisation augmente, plus la fréquence des habitudes alimentaires réduisant le risque de développement de la carie dentaire et de ses complications (CDC) diminue. 2. On relève une relation statistiquement significative entre le niveau de sensibilisation des patients et le statut oral réel. On observe moins de dents concernées par la CDC chez les patients présentant un degré élevé de sensibilisation.

Mots clefs: Caries, information, prévention, habitudes, nutrition, Bulgarie, carie dentaire, fromage, art dentaire

BACKGROUND

The environmental risk factors for caries development have been studied for decades. They include dietary habits, bacterial flora, bacterial exchange between hosts, oral hygiene, saliva composition and amount, location and morphological particularities of the teeth, fluoride intake, socioeconomic status and access to dental care (1). There is an association between the socioeconomic factors, such as health knowledge and caries prevalence rate in adults (2). Their education level has a substantial effect on their children's behavior and dental knowledge (3,4). The low level of knowledge in children is associated with dental caries, disuse of fluoride tooth paste and fear of visit to dentists (5). The provision of information by the dentist on the effect of nutrition on caries prevention to his/her patients is of great importance (6).

The present survey aimed to study the role of awareness as a preventive factor for dental caries development.

The knowledge on the effect of saccharose-containing foods on the reduction of plaque pH and development of dental caries as well as caries-protective properties of certain other foods is important at the individual's establishing his/her dietary habits (7). The current high prevalence rate of dental caries is due to the more frequent consumption of plant foods rich in fermentable carbohydrates (8). In human population level a significant correlation is revealed between the amount of sugars consumed daily and the DMFT index (9). Experimentally, caries lesions can appear quickly in individuals often consuming saccharose-containing foods (10). It is known that the prevalence rate of caries is small if the food contains small amounts of fermentable carbohydrates. Rats fed with cariogenic foods only two or three times daily develop few to zero cavities (11). The number of *S. mutans*, that are a factor at caries development in the plaque and saliva can be reduced when the diet contains low amounts of carbohydrates (12). As the cariogenicity of a dietary regime is associated with the exposure rate (13) the dietary habits are of great importance (14).

The food itself can have caries-preventive effect too. The intake of yogurt and fresh milk can reduce the caries prevalence rate on some dental surfaces (15). The sequence of foods consumption affects their cariogenicity. Cheeses have shown such effects even when they have been consumed right before saccharose intake (16). The food structure, its ability to adhere to various dental surfaces, as well as the duration of chewing, necessary to swallow the food affect substantially its cariogenic potential. The necessary chewing intensity determines the oral cleaning, duration of acid attack and reduce of pH (17). That is the beneficial effect of foods like yellow and white cheese on saliva pH (18). The nutritional characteristics, such as taste, acid content, texture and nutrient content are important variables at inducing an oral biological response (19). All cheese types are strong stimulators of saliva flow rate. Cheese and its ingredients lead to incorporation of high calcium and phosphates levels in the human dental plaque and reduce experimentally the caries prevalence rate due to saccharose(20). The use of non-

cariogenic foods, such as peanuts, cheese or sugar-free chewing gum (21), soon after consumption of sugar-containing foods drastically accelerates the removal of sugars from the mouth and reduces the amount of demineralizing acids produced in the plaque. Some researchers have established that the glycemic index is directly associated with plaque acidity. The higher values of the glycemic index lead to a greater pH reduction (22).

The present survey discusses also the effect of patients' awareness on their dietary habits, through which it possibly affects their dental status. The consumption of yellow and white cheeses is outlined as a positive caries-preventing habit.

METHODS

The present survey implemented a questionnaire research method. It covered 52 patients aged 17 – 60 years. The questionnaire, containing 23 questions was specially designed for this survey. The patients were classified in two groups: Group giving correct answers, respectively showing higher awareness level (A+) (n = 15) and a group of patients with lower awareness level (A-) (n = 37). The questionnaire sheet, besides the answers of the interviewed patients, contained also the particular patient's dental status, examined and reported by a dental medicine doctor. The index DFMT showing the number of teeth with caries, obturation or missing was used for recording the number of affected teeth. Together with that the number of teeth with at least one active caries lesion was recorded. Those values are listed in this paper as AT index. The daily rate of cheese consumption was entered as value of the FCC index. Further, the data were processed statistically aiming to detect significant relationships between awareness level and respective indexes. Fisher's test was used to compare the dispersion level in the two samples ((A+) and (A-)), Two-tailed Student's-test was implemented for calculation of the p-value and confirmation of the zero hypothesis, and Hedges Effect Size produced the absolute values of the differences between the groups.

RESULTS

Table 1 presents the individual values of the questionnaire study. The statistically processed data are listed in table 2. The corresponding values of each index for the particular group – group with higher awareness level (A+) and group with lower awareness level (A-) - as well as the difference between the groups are entered.

The (A+) group revealed lower mean values of DFMT index (mean 7 ± 3.58569) versus the group (A-) - DFMT Mean 10.34 ± 5.87469 . The index DFMT shows the current status (it incorporates the AT index) and the presence of caries in the past that cannot be observed currently because of obturation or extraction of the tooth.

The difference between the (A+) and (A-) groups concerning DFMT is statistically significant: (p < .05). The p-value is 0.04535, calculated by the Two-tailed T-test.

The absolute value itself is equal to Effect Size Hedges'

Table 1 - Questionnaire results

No	Inf	FCC	DMFT	AT
1	-	1,5	9	1
2	-	1,5	10	1
3	-	1	12	4
4	-	2,5	23	2
5	-	0,5	7	0
6	-	2,5	16	3
7	+	0,4	13	1
8	-	2	20	4
9	-	2	14	6
10	-	0,5	11	2
11	-	2	9	8
12	-	0	12	1
13	-	1	9	2
14	-	1	7	2
15	-	0,1	9	2
16	+	2	4	1
17	+	1	6	0
18	+	2	10	0
19	-	1	7	0
20	-	1	2	0
21	-	1,5	18	8
22	-	3	1	0
23	-	0,1	5	1
24	-	0,1	7	1
25	-	0,3	7	2
26	-	0,3	4	3
27	-	1	8	2
28	-	0	4	1
29	-	2	7	2
30	-	0,5	9	4
31	-	1	0	0
32	+	0,3	5	0
33	-	0,4	9	2
34	+	2	7	5
35	-	0,5	3	3
36	+	1	3	2
37	+	2	12	4
38	-	1	20	0
39	+	2,5	11	3
40	-	2	20	0
41	-	1	20	2
42	-	2,5	16	3
43	-	0,7	5	0
44	+	1	10	1
45	-	0,4	18	10
46	+	2	5	1
47	-	2	10	4
48	+	2	6	2
49	+	2	7	3
50	-	0,5	13	7
51	+	2	0	0
52	+	3	6	2

Inf - awareness group, FCC – frequency rate of average daily consumption of yellow and white cheese, DMFT – Extracted, obturated or cariotic teeth, AT – current active lesions.

$$g = (10.34 - 7) / 5.333726 = 0.626204.$$

The AT index shows the current status of the dentition. The recording of active caries was not affected by the missing (already extracted) teeth or obturated teeth. For this indicator (A+) group showed lower value of AT/Mean 1.67 ± 1.54303 , vs. the (A-) group respectively AT (Mean 2.51 ± 2.50135). Though statistically insignificant ($p > 0.05$), the absolute difference can be calculated as Effect Size

Table 2 - Values of the indexes by groups

Index	Group (A+)	Group (A-)	Difference
DMFT	7 ± 3.58569	10.34 ± 5.87469	0.62620
AT	1.67 ± 1.54303	2.51 ± 2.50135	0.36862
FCC	1.68 ± 0.76364	1.11 ± 0.82375	0.70571

FCC – frequency rate of average daily consumption of yellow and white cheese, DMFT – Extracted, obturated or cariotic teeth, AT – current active lesions.

$$\text{Hedges' } g = (2.51 - 1.67) / 2.278772 = 0.36862.$$

Significantly better oral status was recorded in the (A+) group and the difference between them and (A-) patients was as a mean 0.63 teeth that had currently DCC or have had DCC in the past.

Referring to currently active caries, the difference between the two groups was smaller (0.37 active lesions), still in favor of the (A+) group.

Referring to the FCC index, the (A+) group reported higher values (mean 1.68 ± 0.76364) vs. (A-) - FCC (mean 1.11 ± 0.82375). The high consumption of cheeses was accepted as a positive factor at caries risk modulation. The difference referring to this indicator was statistically significant too: ($p < .05$). The p-value was 0.00188 (Two-tailed T-test). As an absolute value it equaled Effect Size Hedges' $g = (1.11 - 1.68) / 0.807695 = 0.705712$

The group (A+) showed higher results for this indicator too. The patients belonging to this group consumed significantly more frequently yellow and white cheese. Graphically this finding is presented in fig. 2. The respondents of group (A+) showed better oral status (DMFT) as seen on fig. 1.

General results: The number of affected teeth (DFMT) in the group of patients with better knowledge(A+) was as a mean with 0.63 smaller and the number of active caries lesions (AT) in the same group was with 0.37 smaller vs. the (A-) group. They also consumed as a mean 0.71 times daily more yellow and white cheese (FCC). The role of awareness level was statistically significant for the value of DFMT and for the frequency rate of consumption of carioprotective yellow and white cheese.

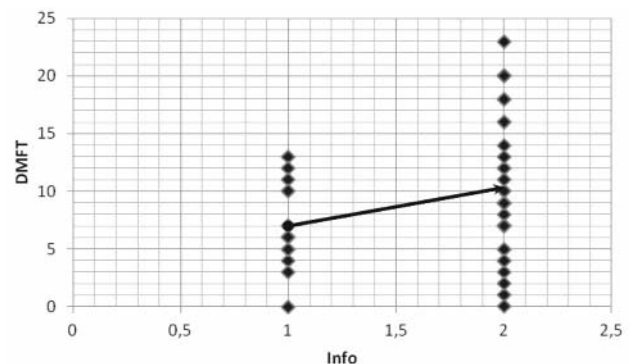


Figure 1 - Relationship between the awareness level and the DMFT index

Where Info1 is the (A+) awareness group and Info2 is the awareness (A-) group. The graph shows the trend to increased number of DCC teeth when the awareness level is decreased (from group (A+) to (A-)).

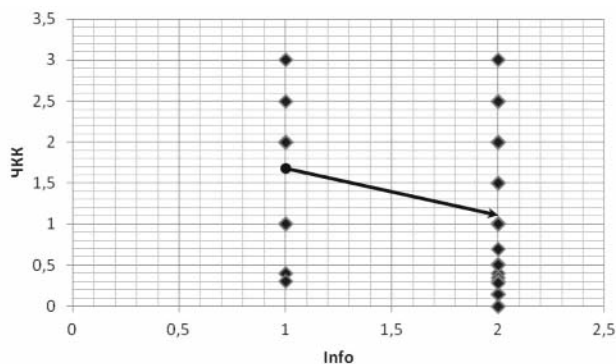


Figure 2 - Relationship between awareness level and FCC Where 1 is the Group (A+), and 2 is the Group (A-). The graph shows the trend to decreased level of carioprotective foods consumption when the awareness level is decreased (from group (A+) to (A-)).

CONCLUSIONS

1. Statistically significant relationship was observed between the patients' awareness level and their dietary habits. The greater awareness leads to elevated frequency of dietary habits reducing the risk for DCC development.

2. Statistically significant relationship was established between patients' awareness level and the real oral status. Patients with higher awareness level presented a smaller number of DCC teeth (DMFT).

Conflict of interests

The author declares that there is no conflict of interest.

REFERENCES

- Hunter PB. Risk factors in dental caries. *Int Dent J*. 1988; 38:211-217
- Simone M. Costa,1 Carolina C. Martins,1 Maria de Lourdes C. Bonfim,1 Livia G. Zina,2 Saul M. Paiva,1 Isabela A. Pordeus,1 and Mauro H. N. G. Abreu1 ;A Systematic Review of Socioeconomic Indicators and Dental Caries in Adults; *Int J Environ Res Public Health*. 2012 Oct; 9(10): 3540-3574
- Masahiro Heima, Wonik Lee, Peter Milgrom, and Suchitra Nelson; Caregiver's education level and child's dental caries in African Americans: A path analytic study; *Caries Res*. 2015; 49(2): 177-183.
- Morenike O Folayan, Kikelomo A Kolawole, Titus Oyedele and all; Association between knowledge of caries preventive practices, preventive oral health habits of parents and children and caries experience in children resident in sub-urban Nigeria; *BMC Oral Health*. 2014; 14: 156.
- Baranya Shrikrishna Suprabha,1,* Arathi Rao,1 Ramya Shenoy,2 and Sanskriti Khanal1; Utility of knowledge, attitude, and practice survey, and prevalence of dental caries

- among 11- to 13-year-old children in an urban community in India; *Glob Health Action*. 2013; 6: 10.3402/gha.v6i0.20750.
- Liliya Doichinova, Peter Bakardjiev and Milena Peneva.; Assessment of food habits in children aged 6-12 years and the risk of caries *Biotechnol Biotechnol Equip*. 2015 Jan 2; 29(1): 200-204
- Touger-Decker R, van Loveren C. ;Sugars and dental caries. ;*Am J Clin Nutr*. 2003;78(4):881S-92S
- Earliest evidence for caries and exploitation of starchy plant foods in Pleistocene hunter-gatherers from Morocco; Louise T. Humphrey, Isabelle De Groote, [...], and Abdeljalil Bouzouggar; *Proc Natl Acad Sci U S A*. Jan 21, 2014; 111(3): 954-959. ;Published online Jan 6, 2014
- Sreebny LM.; Sugar availability, sugar consumption and dental caries.; *Comm Dent Oral Epidemiol* 1982;10:1-7
- Von der Fehr FR, Loe H, Theilade E.; Experimental caries in man.; *Caries Res* 1970;4:131-48
- Bowen WH, Amsbaugh SM, Monell Torrens E, et al.; Method to assess the cariogenic potential of foods.; *J Am Dent Assoc* 1980;100:677-81
- Taubman MA, Smith DJ.; Mutans streptococcal enzyme-based vaccine for dental infection.; In: Kohler H, LoVerde PT, Ward CW, (eds); *Vaccines: new concepts and developments*. Proceedings of the Tenth International Convocation on Immunology, Buffalo, NY: Longmans Group, 1987
- Bowen WH. ; Role of sugar and other sweeteners in dental caries.; In: Stegnik LD, Filger U, eds.; *Aspartame: Physiology and Biochemistry*; New York: Dekker, 1984:263-72
- Krasse B. (2001). The Vipeholm Dental Caries Study: recollections and reflections 50 years later. *J Dent Res* 80:1785-1788
- Maryam Ghasempour,1 Ramazam Rajabnia,2 Manouchehr Ashrafpour,3 Atiyyeh Ehsani,1 Ali Akbar Moghadamnia,4 Samane Gharekhani,1 Elaheh Ferdosi Shahandashati,2 and Meghdad Bagheri ; Effect of milk and yogurt on streptococcus sobrinus counts and caries score in rats ; *Dent Res J (Isfahan)*. 2015 Nov-Dec; 12(6): 569-573.
- Jensen ME, Harlander SK, Schachtele CF, et al.; Evaluation of the acidogenic and antacid properties of cheeses by; Telemetric recording of plaque pH.; In: Hefferen JJ, Ayer WA, Koehler HM, et al., eds.; *Foods, nutrition and dental health IV*; Chicago: American Dental Association 1984:3147
- Lingstrom P, Birkhed D, Granfeldt Y, Bjorck I. pH measurements of human dental plaque after consumption of starchy foods using the microtouch and the sampling method. *Caries Res*. 1993;27(5):394-401.
- Tabassum Tayab, Kavitha Rai, Vasantha Kumari, and Eapen Thomas; Effect of Chewing Paneer and Cheese on Salivary Acidogenicity: A Comparative Study; *Int J Clin Pediatr Dent*. 2012 Jan-Apr; 5(1): 20-24.
- Signoretto C, Bianchi F, Burlacchini G, Sivieri F, Spratt D, Canepari P. Drinking habits are associated with changes in the dental plaque microbial community. *J Clin Microbiol*. 2010;48(2):347-56
- Kohler B, Bratthall D.; Intrafamilial levels of Streptococcus mutans and some aspects of; Bacterial transmission. *Scand J Dent Res* 1978;86:35-42
- Kohler B, Bratthall D, Krasse B.; Preventive measures in mothers influence the establishment of the Bacterium Streptococcus mutans in their infants.; *Arch Oral Biol* 1983;28:225-31
- Jenkins DJ, Wolever TM, Jenkins AL. Starchy foods and glycemic index. *Diabetes care*. 2011;11(2):149-59