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THE RELATIONSHIP BETWEEN DIET AND DMFT / DMFT INDEXES IN 2-12 YEARS OLD CHILDREN REFERRED TO DENTAL CLINICS IN AHVAZ IN 2015

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Abstract

Objective: To examine the relationship between diet and DMFT / dmft indexes among 2-12 years old children referred to dental clinics in Ahvaz in 2015.

Methods: This was a cross sectional study conducted on 259 children (131 girls-128 boys) who were selected randomly among the 2-12 aged children (mean age 6.59 years old) referred to 3 private and one state dental clinic in Ahvaz, Iran. To investigate the variables, a questionnaire was prepared and mothers and children were asked to enter dietary information of child in a day of a week. After completing the questionnaire, all of the children were examined by a dentist to investigate and record DMFT/dmft.

Results: Based on the Spearman analysis there was significant but reverse relationship between the level of DMFT with that of dmft ($P= -0.004$) and the time frequency of consuming dairy ($P= -0.022$). Also, there was a direct and significant relationship between the level of DMFT and time frequency of consuming foods containing sugar ($P= -0.046$) and sweet drinks ($P= 0.04$).

There was a significant but reverse relationship between the level of dmft with level of DMFT ($P= -0.004$) and the time frequency of consuming dairy ($P= -0.043$) and protein foods ($P= -0.007$). There was a direct and significant relationship between the level of dmft and using food containing sugar ($P= 0.049$), sweet drinks ($P= 0.046$) and other foods like different kinds of non- sweet junkies (chips) ($P= 0.01$). There was not a significant relationship between DMFT and dmft and the amount of water consuming, the fast foods in restaurants, tea and different kinds of cereals. Analysis of demographic information was shown that there was a positive and significant relationship between the level of DMFT and age ($P= 0.00$) while there was a negative and significant relationship between the level of dmft and age ($P= -0.00$)

Conclusion: The changes in diet specially increasing the frequency of consuming food and beverages containing sugar and snacks and junkies can increase dental caries. By using dairy and protein food, the dental caries will decrease by recognizing the cariogenic foods and limiting the frequency of daily consumption of food, we can control the caries formation and take effective step toward improving the oral health.

Keywords: 24 hour diet, Dental caries, DMFT/dmft.

Introduction

Preventing from dental caries in children and adolescents had positive benefits on both primary and permanent systems. Better recognition of the mechanism of caries initiation and succeeding in prevention from caries are essential (1). Dental caries is an infectious and epidemic disease and various factors had an effect on its initiation and expansion. It is determined that the disease requires the host (teeth in the mouth), food culture medium and Uric acid bacteria (2). Salivary (is considered as host), food and bacteria form the dental plaque (biofilm) which adheres to the surface of teeth. Over time, the substrate (background material) acts as the food of bacteria (3).

The bacteria in dental plaque break down monosaccharides and disaccharides (such as Glucose, Fructose, Sucrose) in Glycolytic path to provide their required energy and the acid is produces as a byproduct of this reaction. Following this path, dental plaque PH decreases which causes demineralization of the teeth structure. The speed of demineralization depends on the reduction rate of PH and duration of which PH rate is lower than the critical limit (4). The critical PH for decalcification of enamel equals to or lower than 5.2-5.5 (5).

Factors such as substrate for bacterial metabolism, low percentage of cariogenic bacteria in dental plaque, increasing the salivary flowing, buffering capacity of salivary, high percentage of non-organic ions in salivary, and quick cleaning of food from mouth lead to reducing the production of acid or quick reduction of plaque acidity. The key role of nutrition on dental caries is undeniable. The human, animal and lab researches showed that using the carbohydrates frequently and in a long term is the main reason of tooth caries in the mouth (4). In various epidemiological studies, it is shown that using sugars (especially Sucrose) is the biggest nutritional factor related to the caries. In a well know study by Hopwood house in Australia in 1947-52, children resident in this center have received controlled and sugar free diet. The reported outbreak of caries in these children (the average tooth caries-88%) was lower than that in children in other schools (the average tooth caries-8.6%) (6).

The study done by Vipeholm approves the great effect of sugars on caries. 633 mental patients hospitalized in this hospital have received diet with excessive consumption of sugar. The frequency of sugar consumption, the time of its

consumption and the duration in which the sugar remains in the mouth and the caries rate in patients were investigated. The sugar added to the food leads to increasing the caries the rate of caries in cases which the sugar was consumed between the meals (7). Among the sugars, sucrose is the most cariogenic type and its reason is the production of glucan (a water-insoluble polysaccharide) as well as the production of acid during metabolism. Glucan acts as an extracellular glue and causes streptococci adheres tightly to the teeth (8). The fresh fruits contain different types of sugar and can cause caries. Juices and the fruit flavored beverages is potentially cariogenic due to containing high amount of sugar (9). The most common food used among preschool children is milk and the food containing milk. Lactose in milk is not fermented as much as other sugars. The lower rate of caries forming in milk might be due to phosphor proteins in milk which prevents from enamel dissolution (10).

In animal and human studies, it is shown that the starchy foods such as rice, potatoes, pasta and bread are lowly cariogenic. Although the starch used after being grinded and cooked can cause caries forming, its cariogenic rate is lower than that of sucrose. Long- term remaining of starchy foods in the mouth and its hydrolysis by salivary result in producing metabolized monosaccharaides and disaccharides by bacteria (5).

Foods like fats causes PH increase. Fats and proteins should be consumed before using desserts. By increasing urea and subsequently increasing PH, proteins buffer the acids. The fats and proteins should be consumed before eating desserts. By increasing urea and subsequently increasing PH, protein causes acids to be buffered. Fat, protein, phosphate (in protein-rich foods such as egg, poultry and fish, cereals and dairy) and fluoride (in water, soil, tea and sea foods) has cario-static feature (11, 12).

In a study by Marshall, children who drink less amount of mother milk at their 2-3 years old suffer from more tooth caries. Lack of consumption of non-dairy foods and highly consumption of foods containing vitamin C was not so related to caries (13).

In a study, a clear relationship between the newly formed caries and drinking soft drinks or sweet snacks at 9 -month age was seen (14). Therefore, this study aims to investigate the diet and its relationship with DMFT and dmft among children aged 2-12 years old in Ahvaz.

Materials and Methods

This was a cross sectional study conducted on 259 children (131 gilrs-128 boys) who were selected randomly among the 2-12 years old children (mean age 6.59 years old) referred to 3 private and one state dental clinic in Ahvaz. A clinic was selected randomly from each region divided by municipal. Sampling method was cluster sampling. In

order to minimize the effect of social and economic variables, an equal number of samples were selected from each urban area and clinic. The samples in both groups aged 2-6 years old (102 subjects -39.4%) and aged 6.5-12 years old (157 subjects -60.6 %) were divided.

In order to investigate the variables, a questionnaire was prepared. The first part included demographic information and the second part included nutritional data. The demographic information included the mothers' age and their education level and children's age. On order to collect nutritional data, a standard 24-hour diet questionnaire by WHO was used (11).

The reliability and validity of the questionnaire were assessed before the study (Cronbach's alpha= 89%). Mothers and children were asked to enter diet of child in a day, for example Friday or another holiday, to the questionnaire.

After completing the questionnaire, all of the children were examined by a dentist in order to investigate and record DMFT/dmft. The examination was done on the dental unit and by means of mirror and explorer probe. The examination was initially done visually and then the questionable area of caries was measures by explorer probe. DMFT/dmft indexes were recorded for all the samples. Demographic and nutritional information and also the DMFT/dmft indexes were inserted in SPSS 21. The correlation tests like Pearson and Spearman tests were used for relationships between the quantitative variables and chi square for relationships between the qualitative variables. Also T test and ANOVA were used. In cases with interfering agent, the analysis of covariance was used. In this study, $P < 0.05$ was considered as significant.

Results

Table 1 shows the frequency distribution of boys and girls at the age groups of 2-6 and 6.5-12 years old. Totally, 259 children (2-12 years old) participated in this study. The samples were classified in both age groups of 2-6 (102 children) and 6.5-12(157 children) years old. There were 121 girls and 128 boys, totally. In group 2-6 years old, there were 49 girls and 53 boys and in group 6.5-12 years old, there were 82 girls and 75 boys.

Table 2 shows the percentage of frequency of DMFT and dmft in both mentioned groups. The recorded data in Table 3 were ordered based on the standard dietary questionnaire by WHO and the percentage of frequency of using each food (the frequency in a day, once in a day, three to five times in a week and less than three times in a week) in terms of gender.

Table 4 shows the Correlation between DMFT/dmft and various foods according to Spearman, s analysis.

Based on the Spearman analysis (for relating the quantitative variables), there was significant but reverse relationship between the level of DMFT with that of dmft ($P = -0.004$) and the time frequency of consuming dairy ($P = -0.022$). Also, there was a direct and significant relationship between the level of DMFT and time frequency of consuming foods containing sugar ($P = -0.046$) and sweet drinks ($P = 0.04$).

There was a significant but reverse relationship between the level of dmft with level of DMFT ($P = -0.004$) and the time frequency of consuming dairy ($P = -0.043$) and protein foods such as types of chickens, fish and poultry ($P = -0.007$). There was a direct and significant relationship between the level of dmft and using food containing sugar ($P = 0.049$), sweet drinks ($P = 0.046$) and other foods like different kinds of non- sweet junkies (chips) ($P = 0.01$).

There was not a significant relationship between DMFT and dmft and the amount of water consuming, the fast foods in restaurants, tea and different kinds of cereals. In an investigation of DMFT and dmft with demographic information, it was shown that there was a positive and significant relationship between the level of DMFT and age ($P = 0.00$) while there was a negative and significant relationship between the level of dmft and age ($P = -0.00$).

Also, a significant relationship between DMFT and dmft regarding gender (boy or girl), age and educational level ($P = -0.00$) was not observed. Due to the fact that the majority of mothers were housewives (less than 10 % of mother had jobs) the variable of mothers' job were not accounted for.

Discussion

For a long time, diet was considered as one of the most important factors which effects on the process of caries formation. Different kinds of foods and the time frequency of consuming foods during a day are highly significant in appearing dental caries. A 24-hour diet for children can suggest the general eating habits of a baby. By studying and investigating the eating habits in different geographical regions, we can provide some scientific and practical approaches properly in order to slow down the increasing process of tooth decay and subsequently reducing the treatment costs. The present study investigates the nutritional habits and eating patterns and the effects of these habits on the number of primary and permanent teeth in 259 children between 2-12 years old in Ahvaz.

As it is shown in Table 1, totally 259 children (2-12 years old) participated in this study. The samples were classified in both groups of 2-6 years old (102) and 6.5-12 years old (157). There were 121 girls and 128 boys. In group of 2-6 years old, there were 49 girls and 53 boys and in group of 6.5-12 years old, there were 82 girls and 75 boys.

In Table 2, the frequency percentage of dmft and DMFT in different age and gender groups and in primary and permanent teeth has been shown separately.

Table 3, investigates the frequency percentage of frequency of consuming different foods and nutritional data separately in terms of gender.

Table 4 showed the relationship between every kind of food with DMFT and dmft indexes.

In the present study, as is shown in table 4, a reverse and significant relationship between DMFT and the frequency of consuming dairy was observed ($p = -0.022$). Accordingly, the level of DMFT will decrease by increasing the frequency of consuming dairy. Similar results in a study by Moynihan (14) were observed. Milk and other dairy prevent from caries formation due to containing calcium and phosphor and casein by stimulating remineralization and buffering the acids and also restricting the remineralization. Also a similar relationship was not observed regarding the level of dmft ($P = -0.043$). In a study by Marshall (13) high frequency of consuming milk and dairy is directly related to the lower level of tooth caries.

According to the results from this study (Table 4), there was a direct and significant relationship between the frequency of consuming different kinds of sugar and sweet foods and also DMFT ($P = 0.046$) and dmft ($P = 0.049$) was reported and the level of DMFT and dmft will increase by increasing the frequency of consuming foods containing sugar. The similar results of the studies by Scardina (15), Krasse (16) and Harriss (17) studies also approves the strong and significant relationship between consuming different kinds of sugars and caries formation in both primary and mixed teeth. Also, the number of frequency of different kinds of sweet beverages (such as artificial juices, syrup made of powders, sweetened juice, soft drinks) has a direct and significant relationship with decayed permanent teeth, filled teeth and lost teeth (DMFT) ($P = 0.04$). In addition, similar relationship was observed in primary teeth ($P = 0.046$) which supports the findings of previous studies including Marshall (13), Krasse (16) and Harriss (17) studies.

It is shown that Glucose transferase in *Streptococcus mutans* from Sucrose but not from Fructose or Glucose is used for producing extracellular glucan as a required element for adhering the bacteria forming plaque, of course these results had not been approved by epidemiologic studies (18). In this study, the effect of different kinds of sugar on caries formation has not been investigated and further studies are required in order to determine the effects of different kinds of sugar on caries formation.

The results from this study (Table 4) does not show any significant relationship between the level of DMFT and dmft in age groups and the frequency of consuming fruits and vegetables and the amount of vitamin C received. These results support the findings of Kleemola (19) and Moynihan (20). Several studies have shown that the fruits contain

fructose which cause them to be acidogenic and this issue can lead to falling the PH of plaque (of course the level of acidogenicity of fructose is lower than that of sucrose) (21, 22). The level of acid produces after consuming fruits depends on its structure and the sugar in it (23). All of different studies only show acidogenicity feature but not cariogenicity feature of fruits.

Besides, Table 4 shows that the frequency of consuming different kinds of foods such as non-sweet junkies is directly and significantly related to the caries formation in primary teeth ($P= 0.01$) and also the level of caries will increase by increasing the frequency of consuming different kinds of snacks an non sweet junkies (such as chips). The similar result was reported in a study of O.Chankanka (1). But this relationship was not significant in permanent teeth ($P= 0.864$) which was expected regarding the age range of children present in this study (2-12 yrs) and the time duration of remaining the permanent teeth in their mouth (the max length of time for permanent molar teeth and central incisors). As seen in table 2, the max number recorded for DMFT is 6. We expect that the permanent teeth system in 12 years old children be completed (3). However, as we know, the age of children does not have high correlation coefficient with tooth age (3) and it is highly likely that in a 12-year old child, all of the permanent teeth not be grown or a short period of time be passed after growing some teeth.

According to derived results from this study, there is a reverse and significant relationship between the frequency of consuming protein foods like chicken, meat and fish ($P= -0.007$) and caries in primary teeth (dmft) ($P= -0.007$) but was not significant regarding permanent teeth (DMFT) ($P= 0.595$). The results of this study about the primary and permanent teeth were different from that of Sonarkar (24). It seems that its reason is the low frequency of consuming different kinds of protein foods throughout a week in all of the samples in this study. According to table 3, only 28.2 % of girls and 29.7 % of boys from total 259 children used protein foods once a day and just a few children that is 15.3 % girls and 9.4 % boys used them frequently in a day. According to the results from the systematic investigation in studies of Sonakar (24), in the cases of severe shortage of protein food following salivary reduction and decreasing the level of IgA, antibacterial activity of salivary decreases and caries formation increases but there was not a relationship between consuming the protein foods and decreasing caries formation.

As seen in Table 4, there was not a significant relationship between the frequency of consuming different kinds of cereal and the level of DMFT ($P= 0.253$) and dmft ($P= 0.331$). According to the results of the study by Tinannof, the cereals contain starch and starch is generally considered as carbohydrates with low cariogenicity, so the foods like rice, potato, bread and pasta is lowly cariogenic. Anyway, if the starchy foods are grinded and cooked and consumed

frequently, they can cause caries. Of course this cariogenicity feature is lower than that of sucrose (4). Besides, if the starchy foods remain on the surface of tooth for a long time, they can be hydrolyzed by means of amylase and break into monosaccharide and Disaccharide and then be metabolized by bacteria (5). The requisite in caries formation is the time of remaining food in mouth and also the frequency of consuming foods. In the present study, as seen in table 3, regarding the frequency of consuming starchy foods in a day in both genders (girls 46.6% and boys 41.6%), the significant relationship between consuming cereals and caries is not observed. There may be a justification that according to the studies by Neumann (25) and Scardina (15), consuming foods with natural tissues can decrease the caries due to increasing chewing activity. As in this study, cereals were not investigated separately and are just considered as a general group, we can justify the lack of significance of the relationship between the caries and cereals consumption.

As shown in table 3, only a few children (13% girls and 6.3% boys) present in this study used tea frequently in a day. Based on the results of different studies such as Scardina (15) and Moynihan (14), the black tea extracts lead to increasing fluoride in plaque and decreasing the cariogenicity features in foods containing sugar. Because of low frequency of consuming tea among the present children in this study, the significant relationship between DMFT ($P=0.525$) and tea consumption was not observed (Table 4) and also the relationship between dmft and tea consumption was not significant ($P=0.175$).

Furthermore, as it is expected, consuming fast foods and prepared foods in restaurant with high amount of sugar, cause caries formation more than ever but due to the low frequency of consuming these foods, there was not any significant relationship between DMFT ($P=0.28$) and dmft ($P=0.534$) in this study.

The significant and direct relationship between the level of DMFT and age of children is observed. This relationship is significant in primary teeth, too but it has a reverse relationship with the level of dmft ($P=0.000$) so that DMFT level will increase by increasing age but dmft level will decrease. We can justify this issue by the effect of increasing age on primary tooth system and losing these teeth in mixed dentition period. Also, with regarding the fact that the age of samples was 2-12 years old, the time duration of remaining the permanent teeth was short and this issue justifies the direct and significant relationship between DMFT and age.

We must acknowledge that there were a lot of limitations and problems in doing this study. The nutritional data of child was collected just in a day but the caries formed in a long term period and this recorded food pattern might not be permanent and it is related to a specific period in which the questionnaire was completed. On the other hand,

nutritional data for each child was completed by the child and the parents and they can not necessarily show the real food consumption by the child.

The dental examination was done visually and the examination by explorer probe and touching was done for approving the results. Radiography examinations for children were not performed. So, the dental caries between the teeth might be remained undiagnosed.

Conclusion

The results of this study suggest that the changes in diet specially increasing the frequency of consuming food and beverages containing sugar and snacks and junkies can increase dental caries. By using diary and protein food, the dental caries will decrease.

By recognizing the cariogenic foods and limiting the frequency of daily consumption of food, we can control the caries formation and take effective step toward improving the oral health.

Table 1. Distribution of frequency in terms of age and gender.

Age \ Gender	Gender		
	Boy	Girl	Total
1-6	53	49	102
6.5-12	75	82	157
total	128	131	259

Table 2. Frequency percentage of DMFT and dmft in terms of age and gender.

		DMFT														dmft													
		0	1	2	3	4	5	6	0	1	2	3	4	5	6	7	8	9	0	1	1	1	1	1	1	1	18	19	20
G i r l	1.6 y	91.8	4.1	2	0	2	0	0	2	0	6.1	4.1	12.2	4.1	8.2	8.2	22.4	8.2	8.2	4.1	0	0	4.1	0	4.1	0	0	0	4.1
	6.5 - 12 y	42.7	8.5	14.6	2.4	26.8	3.7	1.2	4.9	0	7.3	6.1	11.1	13.4	12.2	6.1	30.5	2.4	3.7	2.4	0	0	0	0	0	0	0	0	0
B o y	1- 6 y	98.1	1.9	0	0	0	0	1.9	0	0	5.7	13.2	7.5	11.3	3.8	28.3	5.7	3.8	5.7	1.9	0	0	1.9	1.9	1.9	0	0	0	
	6.5 - 12 y	53.3	8.7	14.7	2.7	20	1.3	5.4	5.4	6.8	5.4	13.5	4.1	16.2	10.8	17.6	4.1	2.7	1.4	1.4	0	0	0	1.4	0	0	0	1.4	

Table 3. The frequency of consuming different kinds of foods in terms of gender.

Food type	gender/ frequency of usage percent of various foods							
	Less than 3 times in a week		3-5 times in a week		One a day		Frequency in a day	
	Girl	Boy	Girl	Boy	Girl	Boy	Girl	boy
Poultry	13.7	24.2	42.7	36.7	28.2	29.7	15.3	9.4
Fruit	7.6	9.4	25.2	21.9	22.9	28.1	44.3	40.6
Vegetable	29	33.6	35.1	28.1	23.7	23.4	12.2	14.8
Vit A	21.4	22.7	35.1	35.9	24.4	29.7	19.1	11.7
Vit C	22.1	22.7	35.9	43	29	25.8	13	8.6
Diary	8.4	11.7	29.8	26.6	26.7	30.5	35.1	31.3
Cereal	5.3	9.4	24.4	21.9	23.7	27.3	46.6	41.4
Fat	39.7	46.9	25.2	25	26	21.9	9.2	6.3
Dessert	32.8	34.4	30.5	28.1	26	19.5	10.7	18
Sugar	31.3	30.5	32.8	35.2	22.9	21.9	13	12.5
Tea	56.5	64.1	13	13.3	16.4	17.6	13	6.3
Sweet beverage	61.8	58.6	20.6	18.8	13	14.8	4.6	7.8
Water	3.1	0.8	3.1	5.5	1.5	1.6	92.4	92.2
Restaurant food	90.1	89.1	4.6	3.1	3.8	7	1.5	8
Snacks	57.3	65.6	20.6	13.3	13.7	11.7	8.4	9.4
Non-sweet snack	79.4	85.2	9.2	7.8	6.1	2.3	5.3	4.7

Table 4. Correlation between DMFT/dmft and various foods according to Spearman' s analysis.

Caries Index		Food type	Meat	Fruit	Vegetable	Vit A	Vit C	Diary	Grains	Fat	Dessert	Sugar	Tea	Sweet beverage	Restaurant food	Water	Snacks	Non-sweet snack
		Meat	Fruit	Vegetable	Vit A	Vit C	Diary	Grains	Fat	Dessert	Sugar	Tea	Sweet beverage	Restaurant food	Water	Snacks	Non-sweet snack	
DMFT	Correlation coefficient	0/033	-0/014	-0/085	-0/100	-0/107	-0/142*	-0/071	-0/042	0/110	0/124*	0/040	0/128*	0/067	-0/050	0/06	0/011	
	sig (2-tailed)	0/595	0/095	0/171	0/110	0/086	0/022	0/253	0/505	0/076	0/046	0/526	0/040	0/281	0/427	0/340	0/864	
dmft	Correlation coefficient	-** 0/168	0/003	-0/109	-0/103	-0/121	-0/126*	-0/061	-0/024	0/046	0/123*	0/085	0/124*	-0/039	-0/038	-0/001	0/151*	
	sig (2-tailed)	0/007	0/967	0/081	0/097	0/053	0/043	0/331	0/699	0/460	0/048	0/175	0/046	0/534	0/542	0/992	0/015	

**Correlation is significant at the 0.01 level (2-tailed)

* Correlation is significant at the 0.05 level (2-tailed)

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