



Evaluation of The Relationship between Children's Eating Behavior and Early Childhood Caries in Children Aged 3 to 6 Years

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Abstract

Background: Eating behavior in childhood was implicated in developing the dental caries. Thus, this study aimed to investigate the effect of problematic eating behavior and its association to early childhood caries (ECC) among 3-6 years-old children.

Material and methods: This study was performed on 52 children with ECC (case group) and 53 children without ECC (control group). Clinical examination of children was performed to determine the caries indices. Subsequently, the parents of children in both groups were requested to complete the Children's Eating Behavior Questionnaire (CEBQ). The statistical analysis was performed with SPSS 24. P-values less than 0.05 were considered statistically significant.

Results: The mean age of subjects in this study was 4.82 ± 1.05 years. The results showed that the food responsiveness, enjoyment of food, emotional overeating, satiety responsiveness, slowness in eating, emotional undereating, and food fussiness were not significantly different between two groups with ECC and without ECC. Furthermore, based on the results, the desire for sugary drinks in two groups was significantly different ($P=0.002$) as the tendency for sugary drinks was higher in ECC group. There was a significant relationship between the dmft ($r=0.33$, $p<0.001$) and dmfs ($r=0.35$, $p<0.001$) indices and the desire for sugary drinks.

Conclusion: The present study showed that the desire for a drink could be implicated in the development of early childhood caries.

Keywords: Dental caries; Eating behavior; Child; Diet

Introduction

Early childhood caries (ECC) is clinically defined as the presence of one or more decayed teeth (lesions without cavities or with cavities), missing teeth (due to caries), or filled surfaces in each deciduous tooth in the children aged below 6 years [1]. Caries is an infectious disease caused by oral acidophilic bacteria feeding on fermentable sugars, e.g. *Streptococcus mutans* [2]. About 60-90% of school-age children worldwide experience caries, with Asian, Latin, and American countries showing higher rates [3]. In this respect, it is essential to improve oral components of general health by gaining knowledge on the role of diet, eating behaviors, and

environmental and demographic factors associated with increased caries rates in children [4]. Eating problems are common concerns in childhood. These problems were reported in 25% of children [5]. Eating behavior in children can vary in a range of eating with cravings, unusual eating, overeating, the avoidance of food (negative behavior during eating), and slow and boring eating [6]. It was evidenced that eating behavior abnormalities developing in childhood can also provide the conditions for eating behaviors in adulthood [5].

Several psychological measurement tools, including Child Eating Behavior Questionnaire (CEBQ), Dutch Eating Behavior Questionnaire (DEBQ), Children Eating Behavior Inventory, and the BATman (Bob and Tom Eating Assessment Method), were developed to assess eating in children [7-10]. CEBQ has generally been considered one of the most comprehensive tools for assessing children's eating behavior [11]. Based on our studies, few studies have examined the relationship between eating behavior and tooth caries in children. Hence, the present study was conducted to evaluate eating behavior and its relationship with dental caries in children.

Materials and methods

This case-control study was conducted on 52 children with ECC (case group) and 54 children without ECC (control group). The age range of children was from 3 to 6 years. The children were included in the study based on the inclusion, non-inclusion, and exclusion criteria using convenience sampling. The samples were selected by referring to kindergartens in Rasht after obtaining permission from their parents or guardian.

Inclusion criteria:

1. Parents' consent to participate in the study
2. Child willingness and cooperation
3. Being aged between 3 and 6 years

Non-inclusion criteria:

1. Lack of underlying diseases
2. History of allergies
3. Long-term take of any drug

Exclusion criteria:

1. Lack of cooperation of the child at any time of the study
2. Parents' reluctance at any time of study
3. Patients' parents not fully responding to the questionnaire questions

Study groups:

Children were divided into the following two groups based on the presence of caries:

Group one: Children without ECC

Group two: Children with ECC

A pediatric dentist performed the clinical examination of children

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Received: June 08, 2020 Accepted: June 24, 2021 Published: July 14, 2021

to diagnose caries. The examination was performed by disposable mirror and flashlight, and sterile dental gas to separate food debris in the kindergarten. The dmfs and dmft indices were measured for each child. The Food Behavioral Abnormality Questionnaire was completed by the parents or guardians of child. The questionnaire was given to children in kindergarten to take home and ask their parents to complete it. At the beginning of questionnaire, demographic information, including age and gender, was asked. The questionnaire also asked about the frequency of toothbrushing during the day. Then, parents were asked to rate the intensity of their child's behavior on a 5-point Likert scale from never to always for each item. A score of 0 to 4 was given for each item Table 1.

Statistical analysis

The descriptive statistical methods such as frequency, percentage, mean, and standard deviation were used to describe the obtained data. To investigate the presuppositions of parametric tests, the normality of the studied groups was examined using Kolmogorov Smirnov test, and the homogeneity of variances was examined using Levene's test. To investigate the relationship and compare the

groups, if the hypotheses were confirmed, an independent t-test and Pearson correlation test were used for the analysis of quantitative data; otherwise, Mann-Whitney test and Spearman correlation test were used. In the case of qualitative variables, if the hypotheses are confirmed, chi-square test was used; otherwise, Fisher's exact test was employed. These calculations were performed in SPSS.v.24 software with statistical significance set at $p < 0.05$.

Results

The mean age of subjects in the study was 4.82 ± 1.05 years, and no significant difference was found between two groups due to mean age ($P=0.184$). Based on the obtained results, 60 people were female (56.6%), and the rest were male. No significant difference was found between two groups regarding gender distribution ($P=0.073$). According to the results, 64 people (60.4%) brushed once a day, 29 people (27.4%) brushed less than once a day, 12 people (11.3%) twice a day, and 1 person (0.9%) more than three times a day. Results revealed that the mean tendency to use sugary drinks in the two groups was significantly different ($P=0.002$), and it was higher in the ECC group Table 2.

Table 1: Child Eating Behavior Questionnaire (CEBQ).

	Never	Rarely	Some -times	Often	Always	
My child loves food						EF
My child eats more when worried						EOE
My child has a big appetite						SR
My child finishes his/her meal quickly						SE
My child is interested in food						EF
My child is always asking for a sugary drink						DD
My child refuses new foods at first						FF
My child eats slowly						SE
My child eats less when angry						EUE
My child enjoys tasting new foods						FF
My child eats less when s/he is tired						EUE
My child is always asking for food						FR
My child eats more when annoyed						EOE
If allowed to, my child would eat too much						FR
My child eats more when anxious						EOE
My child enjoys a wide variety of foods						FF
My child leaves food on his/her plate at the end of a meal						SR
My child takes more than 30 minutes to finish a meal						SE
Given the choice, my child would eat most of the time						FR
My child looks forward to mealtimes						EF
My child gets full before his/her meal is finished						SR
My child enjoys eating						EF
My child eats more when she is happy						EUE
My child is difficult to please with meals						FF
My child eats less when upset						EUE
My child gets full up easily						SR
My child eats more when s/he has nothing else to do						EOE
Even if my child is full up s/he finds room to eat his/her favourite food						FR
If given the chance, my child would drink sugary drinks continuously throughout the day						DD
My child cannot eat a meal if s/he has had a snack just before						SR
If given the chance, my child would always be having drink sugary drinks						DD
My child is interested in tasting food s/he hasn't tasted before						FF
My child decides that s/he doesn't like a food, even without tasting it						FF
If given the chance, my child would always have food in his/her mouth						FR
My child eats more and more slowly during the course of a meal						SE

Abbreviations: EF- Enjoyment of Food, EOE- Emotional overeating, SR- Satiety Responsiveness, SE- Slowness in Eating, DD- Desire to Sugary Drink, FF- Food Fussiness, FR- Food Responsiveness

Table 2: Comparison of Child Eating Behavior among Two Groups.

CEBQ SCORES	Group 1	Group 2	a	p-value
Food Responsiveness	12.50±3.42	12.92±3.45	-0.63	0.529
Emotional Overeating	8.87±3.56	9.34±4.34	-0.61	0.540
Enjoyment of Food	13.00±3.71	13.75±3.34	-1.09	0.278
Desire to Sugary drinks	7.00±3.31	8.92±3.02	-3.10	0.002
Satiety Responsiveness	15.37±3.11	15.44±3.05	-0.12	0.905
Slowness in Eating	11.90±2.82	11.94±2.91	-0.06	0.950
Emotional under eating	13.46±2.94	12.71±3.17	1.26	0.209
Food Fussiness	17.38±1.76	17.57±2.09	-0.50	0.618

a. Independent Samples Test

Table 3: Relationship between the dmft^a Index and Child Eating Behaviour.

	Food Responsiveness	Enjoyment of Food	Emotional Overeating	Desire to Sugary drinks	Satiety Responsiveness	Slowness in Eating	Food Fussiness	Emotional under eating
dmft	R=0.17 P=0.070	R=0.18 P=0.063	R=0.06 P=0.497	R=0.33 P<0.001	R=-0.09 P=0.343	R=-0.09 P=0.345	R=0.08 P=0.410	R=-0.11 P=0.254

a. Spearman correlation

Table 4: Relationship between the dmfsa index and child eating behaviour.

	Food Responsiveness	Enjoyment of Food	Emotional Overeating	Desire to Sugary drinks	Satiety Responsiveness	Slowness in Eating	Food Fussiness	Emotional under eating
dmfs	R=0.15 P=0.121	R=0.15 P=0.114	R=0.05 P=0.545	R=0.35 P<0.001	R=-0.03 P=0.573	R=-0.03 P=0.703	R=0.08 P=0.386	R=-0.09 P=0.332

a. Spearman correlation

Based on the results, a statistically significant relationship was found only between dmft index and tendency to use sugary drinks ($r=0.33, p<0.001$), so that by increasing tendency to use sugary drinks, the dmft level also increases Table 3.

Based on the obtained results, there was only a significant relationship between dmfs index and tendency to use sugary drinks ($r=0.35, p<0.001$) such that by an increase in the tendency to use these drinks, the dmfs level increases as well Table 4.

Discussion

The present study was conducted to investigate the relationship between children eating behavior and early dental caries in the children aged 3 to 6 years. First, based on the results, the mean food responsiveness in two groups was not different significantly. Response to food reflects various aspects of excessive responses to external stimuli of food. It means that the child immediately insists on eating when seeing or smelling it. The results showed no relationship among these responses to external food stimuli and the incidence of dental caries. In line with the results of present study, [12] studying a group of children aged 3-5 years, observed no statistically significant relationship between food responsiveness and early dental caries [12]. Thus, [13] investigated the relationship between children eating behaviors and the prevalence of ECC in a case-control study. They revealed no significant relationship between food response and early dental caries [13]. Inconsistent with the present study results, Anandakrishna et al. (2014) showed a significant relationship between food response and early dental caries. According to their results, increasing the time during with food remains oral cavity, the rate of early dental caries increases as well. The difference among the results of mentioned study and those of the present study can be attributed to differences in sample size as well as demographic differences and differences in the type of food consumed by children.

The results revealed that the mean level of food enjoyment in the

two groups was not significantly different. Food enjoyment, like the response to food, reflects various aspects of excessive responses to the external food stimuli. The present study showed no relationship between these responses to external food stimuli and the incidence of dental caries. Consistent to the results of our study, Anandakrishna et al. (2014) showed that there is no significant relationship between food enjoyment and early dental caries [11]. Inconsistent with the results of our study, Nembhwani et al. (2019) showed that the level of food enjoyment was significantly associated with early dental caries in the group of children aged 3-5 years [12]. Elsewhere, Nembhwani et al. (2020) reported a significant relationship between food enjoyment and early dental caries [13]. This difference might be due to differences in sample size and demographic characteristics of the subjects. Moreover, the enjoyment of foods with different cariogenic properties among different cultures can be another reason for these differences.

Results revealed that the mean rate of emotional overeating in two groups was not significantly different. In line with the results of present study, Anandakrishna et al. (2014) reported a lack of any significant relationship between emotional overeating and early dental caries [11]. Later, Nembhwani et al. (2019), studying a group of children aged 3-5 years, showed no statistically significant relationship between response to food and early dental caries [12]. Emotional overeating indicates an increase in eating in response to a negative range of emotions such as anger, loneliness, or anxiety. These scales are characterized by both a decrease and an increase in response to a range of negative emotions such as anger and anxiety. However, the results of our study revealed that these emotions did not affect the incidence of early dental caries. In contrast to the results of our study, Nembhwani et al. (2020) showed that there is no significant relationship between emotional overeating and early dental caries [13].

According to the results, the mean rate of satiety responsiveness in

two groups was not significantly different. Satiety responses indicate the child's ability to reduce food intake after a meal to regulate his or her consumed energy. Based on the results of our study, this ability of a child was not associated with to incidence of early dental caries. A study conducted in India reported a lack of any significant relationship between satiety responses and early dental caries [13]. The results of this study are in line with those of the present study. In contrast to the results of the present study, Anandakrishna et al. (2014) showed that there is a significant relationship between satiety responses and early tooth decay so that with increasing time during which food remains in the oral cavity, the rate of early tooth decay also increases (11). Moreover, Nembhwani et al. (2019), studying a group of children aged 6-8 years and a group of children aged 3-5 years, reported a significant relationship between satiety responses and early dental caries [12]. The mentioned study results are in line with those of the present study, given the age range of children in our study. A high score on slow eating means a decrease in response rate due to the lack of enjoyment and interest in food. Based on the results, the mean rate of slowness in eating did not differ significantly between two groups. In line with the results of our study, Nembhwani et al. (2019 and 2020), studying a group of children aged 3-5 years, observed no significant relationship between slow eating and early dental caries [12,13]. One of the subjects that attracted researchers' attention is the relationship between obesity and dental caries in children. Moreover, the relationship between obesity and slow eating in children has been investigated. For example, a study conducted in 2011 in Chile showed a statistically significant relationship between slow eating and obesity in children aged 6 to 12 years [14]. Another study conducted in Chile in 2009 reported a significant relationship between slow eating and obesity in children aged 9 to 12 [15]. Since a significant relationship was observed between obesity and early dental caries in various studies [16-18], it was expected that the prevalence of early dental caries in children is associated with slow eating; however, no such relationship was found. The age difference among the children studied in different studies can explain this difference. Thus, one of the limitations of the present study is the lack of calculation of children's BMI, measuring which might have shown a better relationship between slow eating and early dental decay.

Making excuses about food is often described as a rejection of familiar foods as well as new foods, leading to a reduced variety of foods consumed. This type of eating is characterized by a lack of interest in food and slow eating. This study showed that the mean of making excuses about food in the two groups did not differ significantly. In line with the results of present study, Anandakrishna and Nembhwani et al. (2014) showed the lack of any significant relationship between making excuses about food and early dental caries [11]. In contrast to the results of the present study, Nembhwani et al. (2019, 2020), studying a group of children aged 3-5 years, revealed a significant relationship between food response and early dental caries [12,13]. This difference may be due to differences in sample size as well as demographic differences in the subjects. Results revealed that the mean scale of emotional undereating in the two groups was not significantly different. In line with the results of our study, Anandakrishna et al. and Nembhwani revealed no significant relationship between emotional undereating and early dental caries [11,12].

This study showed that the tendency to sugary drinks was higher in the ECC group. Moreover, it was found that dmft and dmfs increase with an increasing tendency to use sugary drinks. Nembhwani et al. (2019, 2020) found that the tendency for sugary drinks is associated

to ECC. In another similar study, Anandakrishna et al. (2014) showed a significant relationship between the tendency for sugary drinks and early dental decay [11]. Hence, the results of present study are in line with those of most previous studies that reported a negative effect of sugary drinks on the teeth [19-24]. Previous studies have also shown that the relationship between the tendency for sweets and dental caries remains sometimes hidden due to a high level of interest in sweets [25,26]. Interest in sweets can be genetically or environmentally transmitted, and this interest may affect the rate of sucrose consumed. Hence, it was shown that the time order of consuming sweets in a meal can affect the acidogenicity of microbial plaque. Moreover, as mentioned, an interest in a sweet taste, like other senses of taste, is dynamic and changeable [27,28]. If mothers feed their children sugary foods intermittently in the early years of life, their child will become more interested in eating very sweet foods. Therefore, an interest in sweets increases with the increased use of sugary drinks and sweet foods. Their high availability for people in this area and people's high interest in sweets can justify the common interest of mothers and children in this taste [25]. The pattern of sucrose consumption and adhesion of sugary foods play a major role in dental caries. As mentioned in previous articles, a person's taste may be affected by the time of using sweets compared to main meals. Therefore, a person may use sucrose more frequently despite his or her lack of interest in sweets, while another person might have a high strong interest in sweets but show a different consumption pattern [29].

Also, the issue of oral health should not be ignored because caries can be controlled by observing proper oral health after consuming each sweet meal [26,28]. Studies conducted in Iran show the lack of attention to the importance of protecting deciduous teeth in Iran. This result can be attributed to the oral health behaviors of children and mothers [30-32]. Parents play a key role in the children's oral health. This effect can be explained in several ways. During the early stages of socialization in the family, children learn self-care behaviors, including oral health. As a result, parents' behaviors can be influenced by providing behavioral patterns. Since children do not have the necessary cognitive and motor skills to brush their teeth, parents are recommended to take care of this task until their children are at the age of 6 [33]. Results of a study conducted in Hamedan (Iran) showed that parents take care of their children by brushing their teeth in only 51% of cases. Out of 168 children who brushed their teeth, 28% did it alone [34].

This study's results estimated the level of parents' involvement lower than that of the study conducted by Mohebbi [35], as well as the results reported in developed countries [38-36]. It seems that parents do not pay much attention to brushing by children as a skill as much as other skills such as eating and dressing. The emphasis of health care providers on the necessity of parental support to help children learn how to brush properly can improve parental performance in this regard. Brushing twice a day is a part of self-care oral health recommendations. In a study conducted in Hamedan, only 26% of studied children brushed at least once a day [34]. This rate was reported higher in developed countries [31,32]. Results revealed that most of the studied children brushed once a day, and the rest brushed less than once, twice, and more than three times a day. Therefore, most children brush less than the ideal rate (twice a day). Hence, it increases the rate of caries after consuming sugary drinks. The status of paying attention to deciduous teeth care in children under 2 years old is even more undesirable. In this regard, several studies have shown that the number of *Streptococcus mutans* in the mother

mouth, as well as active caries in the mother teeth, is a strong risk factor for early dental decay in children [39].

Bacteria can be transmitted from mother to child through the shared use of a spoon, the mother's tasting of food to test the food taste and temperature of food, and then placing it into the mouth of a child or when kissing him/her. The results of a study conducted in Iran showed that almost 90% of children who visited the dentist for the first time were over 3 years old [40]. However, the results of a study showed that more than 60% of the studied children did not visit a dentist at all [34]. Visiting the dentist provides an opportunity to provide the necessary training such as brushing skills training for parents and children and eating recommendations in addition to the possibility of periodic fluids and early and timely treatment of dental problems. However, in addition to encouraging parents to visit dentists timely and regularly, preparedness and the ability of service providers to provide the necessary recommendations and related skills is essential to achieve the goal in this regard. In addition to the mentioned factors, we can refer to the effect of parents' beliefs, especially mothers, on their ability to perform oral care for their children, and various studies have emphasized this effect. The present study results can help dentists, and health care professionals provide new eating recommendations to prevent early dental caries in children. Also, given the effect of psychological problems on some eating habits and the consequent increase in early dental caries, treatment of psychological problems in children with a high prevalence of early dental caries is recommended.

Conclusion

This study's results show that the tendency to sugary drinks in children with ECC is significantly higher than that of healthy children in terms of ECC. It can be concluded that an increase in the tendency to sugary drinks was associated with the consequent increases in the values of dmft and dmfs indices.

Conflicts of Interest

The authors declare no potential conflicts of interest.

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