

Awareness Regarding Effects of Diet on Oral Health among Parents of Children Aged 6 to 15 Years in Bengaluru

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Abstract: ***Background:** Diet plays a key role in oral and dental health. Similarly, oral health affects diet intake. An unhealthy diet has been implicated as risk factors for several chronic diseases that are known to be associated with oral diseases. Consumption of much cariogenic nutrients such as sugar affects both dental and gum health. The awareness of dietary factors that affect the oral health is an essential component in the dental care system. **Aim:** To assess the awareness regarding effects of diet on oral health among parents of children aged 6 to 15 years in Bengaluru city. **Methods:** A cross sectional web based online study was conducted among parents of children aged 6-15 years in Bengaluru city using Google forms through social media networks. A pretested questionnaire was used to collect the required data which included parents socio-demographics and oral health related diet awareness. The questionnaire was validated and pilot tested. A sample of 400 parents using the formula $N = Z^2(1-\alpha) \times PQ / \delta^2$ were included. Statistical Package for Statistical Sciences (SPSS) for Windows Version 22.0 Released 2013. Armonk, NY: IBM Corp, was used to perform statistical analyses. The level of significance (P-value) was set at $P < 0.05$. **Results:** Among the four hundred parents, 133(33.3%) belong to the children age group of 6-9years and 165(41.3%) belong to the children age group of 10-12 years, and 102(25.5%) belong to the children age group of 13-15yrs. When participants' socioeconomic status was considered, it showed that 13(3.3%) of the study samples belong to Lower Class, about 121(30.3%) belong to Upper Lower and 97 (24.3%) study subjects were in the Lower Middle Class. Almost 136(34.0%) of the parents belong to Upper Middle and 33(8.3%) belong to Upper Class. Significant difference in the mean awareness scores was observed between different socioeconomic status at $P < 0.001$. The total mean score of the awareness regarding effects of diet on oral health was 10.62 ± 2.39 . **Conclusion:** The findings of this study showed moderate awareness regarding effects of diet on oral health among parents of children aged 6-15 years in Bengaluru city. Health education on the importance of adequate diet in preventing oral diseases and for maintaining good oral health is recommended.*

Keywords: Diet, Oral health, Awareness, Parents

1. Introduction

Oral health is an essential part in general health. It affects and is affected by nutritional status and overall health status. Moreover, it has an impact on the quality of life and health outcomes of the patient.¹ Poor oral health is associated with many chronic diseases such as diabetes mellitus, cardiovascular diseases, respiratory infections, and gastrointestinal pathologies. Moreover, poor oral health has been associated with low birth weight and preterm delivery.² On the other hand, good nutrition enhances healthy teeth and gum development and reduces the risk of some oral diseases. Both macronutrients and micronutrients have an impact on oral health, teeth development, enamel and dentin synthesis, dental mineralization, and tooth protection.³ Dental caries is a disease that results from microbiome dysbiosis with the involvement of multiple cariogenic species, including mutans streptococci (MS), lactobacilli, *Scardovia wiggisiae*, and several *Actinomyces* species that have the cariogenic traits of acid production and acid tolerance.⁴ The relationship between nutrition and dental caries is a well-defined relationship; the anaerobic metabolism of dietary sugar by certain bacteria in the cavity leads to demineralization of enamel and dentin of the tooth by organic acid metabolites.⁵ Depending on this mechanism, food items are categorized according to their effect on teeth into cariogenic, cariostatic, and anticariogenic food.³ The

carcinogenicity of food depends on bioavailability, digestibility, and texture of the consumed food. Meaning that liquid food is less cariogenic than solid, while chewy food is less cariogenic than sticky ones.⁶ Type of sugar also plays a specific role; that is, lactose has less effect than other sugars; and xylitol (alcohol sugar) reduces the risk of caries through its inhibitory effect on bacterial growth. Consumption of food and drinks that affect the oral cavity acidity (soft drinks, sweetened coffee and tea, candies) leads to teeth demineralization and causes tooth decay.⁷ Previous findings have highlighted the preference of consuming fresh fruits to fruits juices because chewing stimulates more saliva production and promotes washing effect; and fruit juices may have extrinsic sugars and lower pH that contributes to erosive tooth wear. Concerning the meal patterns, it was reported that less frequent meals are recommended over more frequent meals due to their effect on dental caries; similarly, eating dessert after meals is preferred compared to eating them after a period of time.⁸ Nutrition education on oral and dental health plays a vital role in preventing oral diseases and related problems. Hence, it should be included in management plans for any dental or oral problems. It maintains good oral health, enhances treatment outcomes, and prevents further dental problems. Higher nutritional knowledge is associated with better eating behaviors and with better nutritional status.⁹ To the best of the researchers' knowledge, studies conducted to assess oral health nutrition related knowledge among dental patients or any age groups are very sparse.

Volume 15 Issue 3, March 2026

Fully Refereed | Open Access | Double Blind Peer Reviewed Journal

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On the contrary, there are many studies conducted to assess the awareness, practices, and attitudes on oral health in general, without focusing on nutrition related knowledge among secondary school students,^{10,11} primary schools students,¹² housewives and mothers,¹³ and adults.¹⁴ It has found sufficient level of awareness without significant differences between males and females¹⁵ while a study conducted on school teachers in India found that a fair level of oral health awareness was reported. Having searched scientific databases including PubMed, Springer's, Science Direct, and Scopus, it was noticed that literature was lacking studies reporting knowledge or awareness of public or dental patients regarding the nutritional factors that affect oral health. In Palestine, a study to address the relationship between oral health and nutritional knowledge among dental patients was recommended. A study was conducted in India to assess students' knowledge in nutrition and oral health relationship⁸ and has found a low level of dental nutrition knowledge whose significance has differed according to the student's year of study. This study is designed to fill in such a gap by determining the levels of factors of oral health related nutritional knowledge. Nutrition plays a key role in oral and dental health. Similarly, oral health affects nutrition status and diet intake. The awareness of dietary practices that affect the oral health is an essential component in the dental care system. The knowledge of the dietary factors that affect the oral health is a major component in the treatment plan. This study was aimed to determine the level of awareness of diet affecting oral health among parents of children aged 6 to 15yrs in Bengaluru city and also to compare the level of awareness regarding effects of diet on oral health with socioeconomic status of the parents.

2. Methodology

Study Design-The present study was a cross sectional study with the aim to assess the awareness regarding effects of diet on oral health among parents of children aged 6 to 15 years in Bengaluru city. Study subjects were Parents with children 6 -15 years of age and Parents who were able to read English. Parents who were not willing to participate in the study and Parents working as health care professionals excluded from the study. The study was conducted over a period of 3 months from October 2020 to January 2021. Using Google forms, the study was conducted among the parents of children aged 6-15yrs in Bengaluru

Data Collection: Self-developed and validated questionnaire was used by the investigator to obtain Socio-demographic details of the parents which included age, gender, education, occupation and monthly income and Oral health related diet knowledge.

Content Validation of Questionnaire: Content validity was done using C.H Lawshe method of content validation.¹⁶ It assessed whether the information sought / skill / knowledge measured is essential to the performance of the construct. The response of the appropriate option for each item was graded as 'essential', 'useful, but not essential', or 'not useful'. Panel experts (n=6) from the

Department of Public Health Dentistry participated in the content validation. According to minimum acceptable CVR values of 6 panellists, a minimum CVR values of 0.99 was considered to be the cut off value to retain an item in the questionnaire. The formula of content validity ratio is $CVR = (N_e - N/2) / (N/2)$ In which the N_e = Number of panellists indicating "essential" and N = Total number of panellists. Based on the final CVR value, 3 questions related to awareness regarding diet on oral health were modified and included in the final questionnaire. The final questionnaire consisted of 5 items on sociodemographic details of the parents which included age, gender, education, occupation and monthly income. 15 questions on awareness regarding diet on oral health, each question with three options (True, False, I do not know). The questionnaire was modified based on the score of the content validation. The final version of the questionnaire was pilot tested on 10% of the estimates sample size. A pilot study was conducted to determine the feasibility of the study and to get acquainted with the study work. Face and content validity were tested with regard to wording, content, and appropriateness of the questionnaires administered. Modifications required were done, and the difficulties experienced were overcome by redesigning the proforma, which was later used for conducting the study.

Sample Size Estimation- Sample size for the present study was derived in the following manner. $N = \frac{Z(1-\alpha) \cdot P \cdot Q}{\delta^2}$ (For 95% Confidence Interval) $P=0.50$ [Based on the probability, that approximately 50% of the parents in Bengaluru city have adequate awareness regarding diet on oral health] $Q=1-P$, δ (Margin of Error)=0.05 Therefore, $N=384.16$, rounded off to 400 The total sample size $N=400$

Data Collection Method- Using Google forms, the questionnaire was randomly distributed among the parents of children aged 6-15years in Bengaluru city through emails and social networking platforms. Also, requested people to circulate the survey link among their respective family members, friends and colleagues.

Outcome Assessment- A cross-sectional web based online survey was performed to assess the existing level of awareness towards the effects of diet on oral health among parents of children aged 6-15 years and also to compare the level of awareness with socioeconomic status of the parents.

Statistical Methods- Data was collected and tabulated using the Microsoft Excel sheet. The recorded data was subjected to frequency distribution and Chi-square statistical tests using Statistical Package For Social Sciences (SPSS) for Windows version 22.0 released 2013. Kruskal wallis test was used to compare the mean awareness scores regarding effects of diet on oral health among parents based on their socioeconomic status. Mann whitney post hoc test was used for multiple comparison of the mean awareness scores regarding effects of diet on oral health among parents based on their socioeconomic status. The level of significance was set at $P < 0.05$.

3. Results

Results were analyzed in accordance with the aim and objectives of the study.

Table 1: Distribution of age among children of the study participants

Variable	Category	n	%
Age	6-9 yrs.	133	33.3%
	9-12 yrs.	165	41.3%
	12-15 yrs.	102	25.5%

Table 1 reveals Age group of children of the study participants. A total of 400 parents were included in the study. The age range of their children was found to be between 6 to 15 years. Among the four hundred parents, 133(33.3%) belong to the children age group of 6-9years and 165(41.3%) belong to the children age group of 9-12 years, and 102(25.5%) belong to the children age group of 12-15yrs.

Table 2: Distribution of gender among study participants

Variable	Category	n	%
Gender	Males	182	45.5%
	Females	218	54.5%

Table 2 reveals Gender distribution of the study participants. Out of the four hundred study participants, 182(45.5%) were males and 218(54.5%) were females.

Table 3: Distribution of SES status based on Kuppuswamy socioeconomic scale among study participants

Variable	Category	n	%
SES	Lower Class	13	3.3%
	Upper Lower	121	30.3%
	Lower Middle	97	24.3%
	Upper Middle	136	34.0%
	Upper Class	33	8.3%

Table 3 describes distribution of Socioeconomic status based on Kuppuswamy socioeconomic scale among study participants. When participants' socioeconomic status was considered, it showed that 13(3.3%) of the study samples belong to Lower Class, about 121(30.3%) belong to Upper Lower and 97 (24.3%) study subjects were in the Lower Middle Class. Almost 136(34.0%) of the parents belong to Upper Middle and 33(8.3%) belong to Upper Class.

Table 4: Comparison of difference in the distribution of responses to study questionnaire among study participants using Chi Square Goodness of Fit Test

Questions	Responses	n	%	χ^2 Value	P-Value
Food plays an Important role in the oral Health	True	391	97.8%	364.810	<0.001*
	False	0	0.0%		
	I Don't know	9	2.3%		
Sugar is one of the food element that causes tooth decay	True	378	94.5%	673.445	<0.001*
	False	11	2.8%		
	I Don't know	11	2.8%		
Common sources of sugar in the diet are soft drinks, candy, cookies & pastries	True	396	99.0%	384.160	<0.001*
	False	4	1.0%		
	I Don't know	0	0.0%		
Medicine and gummy vitamins can contain sugar	True	270	67.5%	218.765	<0.001*
	False	41	10.3%		
	I Don't know	89	22.3%		
Chewing sugar free gum reduces tooth decay	True	109	27.5%	6.015	0.06
	False	144	36.4%		
	I Don't know	143	36.1%		
Drinking milk and dairy products protect the teeth from tooth decay	True	237	59.3%	121.205	<0.001*
	False	86	21.5%		
	I Don't know	77	19.3%		
Eating sweets with meals is better than eating sweets b/w meals to prevent tooth decay	True	185	46.3%	30.665	<0.001*
	False	101	25.3%		
	I Don't know	114	28.5%		
Healthy snacks like high fibre foods are better than Sugary foods	True	377	94.3%	668.255	<0.001*
	False	7	1.8%		
	I Don't know	16	4.0%		
Foods that are eaten as part of a meal cause less harm to	True	306	76.5%	338.345	<0.001*
	False	33	8.3%		
	I Don't know	61	15.3%		

Table 4: Comparison of difference in the distribution of responses to study questionnaire among study participants using Chi Square Goodness of Fit Test

Questions	Responses	n	%	χ^2 Value	P-Value
Teeth than eating lots of snacks					
Food stuck in the teeth and b/w the teeth are associated with tooth decay and gum disease.	True	371	92.8%	635.645	<0.001*
	False	11	2.8%		
	I Don't know	18	4.5%		
Diet with lack of nutrients like Vit C, A & Folate may cause difficulty for tissues in mouth to resist infection	True	293	73.3%	322.085	<0.001*
	False	5	1.3%		
	I Don't know	102	25.5%		
Sticky sweets increase the probability of tooth decay compared to non-sticky sweets	True	348	87.0%	520.235	<0.001*
	False	15	3.8%		
	I Don't know	37	9.3%		
Eating nuts with tooth decay causing element like sugar protects the teeth from decay	True	93	23.3%	19.385	<0.001*
	False	162	40.5%		
	I Don't know	145	36.3%		
Extrinsic acids found in fruit juices, in drinks, and in vinegar cause corroding of the teeth	True	226	56.5%	180.980	<0.001*
	False	12	3.0%		
	I Don't know	162	40.5%		
Spicy food increases the probability of oral mucosal lesions compared to non-spicy food	True	235	58.8%	159.215	<0.001*
	False	29	7.2%		
	I Don't know	136	34.0%		

* - Statistically Significant

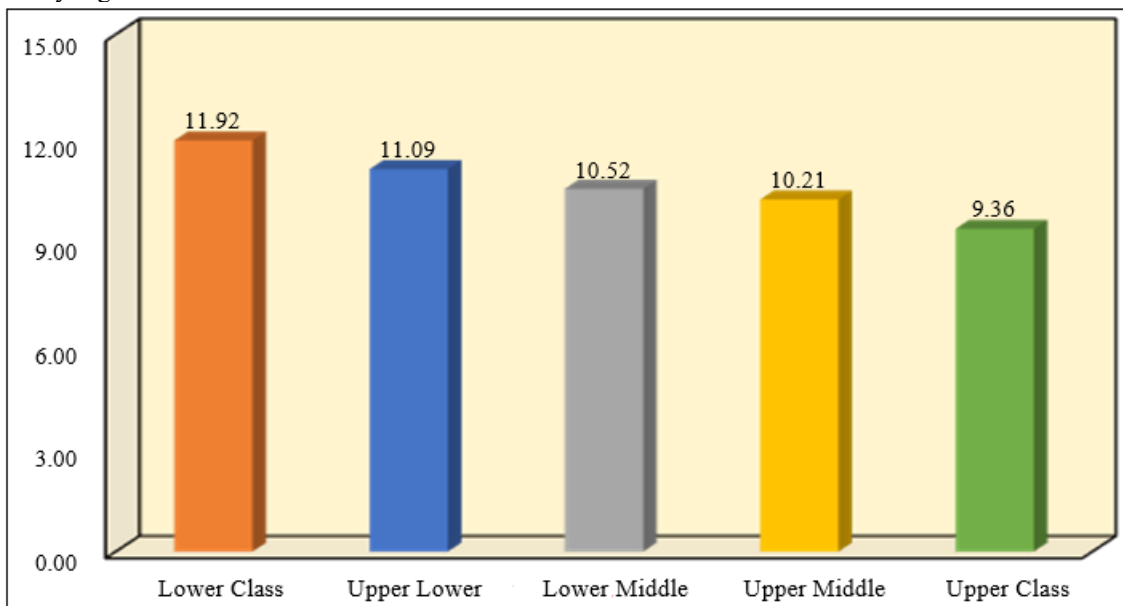


Figure 1: Mean awareness score regarding effects of diet on oral health among parents based on their SES status

Figure 1: Mean awareness score regarding effects of diet on oral health among parents belong to Lower socioeconomic class was 11.92±2.02, among parents belong to Upper Lower class was 11.09±2.84, among parents of Lower Middle class was 10.52±2.58, among parents of Upper Middle class was 10.21±2.10 and among Upper class was 9.36±2.45 which is statistically highly significant with the p value <0.001.

Table 5: Comparison of mean Awareness scores regarding effects of diet on oral health among parents based on their SES status using Kruskal Wallis Test

SES	N	Mean	SD	Min	Max	P-Value
Lower Class	13	11.92	2.02	10	15	<0.001*
Upper Lower	121	11.09	2.84	4	15	
Lower Middle	97	10.52	2.58	4	15	
Upper Middle	136	10.21	2.10	7	15	
Upper Class	33	9.36	2.45	3	12	

* - Statistically Significant

Table 6: Multiple comparison of mean awareness scores regarding effects of diet on oral health among parents using Mann Whitney Post hoc Test

(I) SES	(J) SES	Mean Diff.(I-J)	95% CI for the Diff.		P-Value
			Lower	Upper	
Lower Class	Upper Lower	0.83	-1.16	2.82	0.49
	Lower Middle	1.41	-0.61	3.42	0.08
	Upper Middle	1.71	-0.27	3.69	0.009*
	Upper Class	2.56	0.33	4.79	0.006*
Upper Lower	Lower Middle	0.58	-0.35	1.50	0.04*
	Upper Middle	0.88	0.03	1.73	<0.001*
	Upper Class	1.73	0.39	3.07	0.001*
Lower Middle	Upper Middle	0.30	-0.60	1.21	0.27
	Upper Class	1.15	-0.22	2.53	0.04*
Upper Middle	Lower Middle	-0.30	-1.21	0.60	0.40

* - Statistically Significant

Significant difference in the mean awareness scores was observed between different Socioeconomic status at $P < 0.001$. Multiple comparison revealed Lower class showed significantly higher mean awareness scores as compared to Upper middle and Upper class at $P = 0.009$ and $P = 0.006$ respectively. This was then followed next by Upper lower class showing significantly higher mean awareness score as compared to Lower Middle ($P = 0.04$), Upper middle ($P < 0.001$) and Upper class ($P = 0.001$) and finally lower middle class also showed significantly higher mean awareness score as compared to Upper class at $P = 0.04$.

4. Discussion

This study aimed at assessing the awareness regarding diet on oral health among parents of children aged 6 to 15 years in Bengaluru city. These parents portrayed an average representation of diet awareness on oral health. Overall, the results of the study showed that the study population lacked the essential oral diet knowledge indicated by their average scores on the given questionnaire. Dietary practises, especially the consumption of free sugars are recognised as a common risk factor for the occurrence of non-communicable diseases.¹⁷ The relationship between dietary proteins and dental caries has been suggested and reinforced since the 1950's.¹ The current study is unique because it has assessed knowledge regarding diet on oral health, whereas many other studies have focused on knowledge, attitude, and practices related to oral health in general, mainly hygienic practices.^{10,11,12} Some of the common reasons suggested to affect food choices in different individuals include ignorance, availability, cost and financial resources.¹⁸ Therefore, it is necessary to determine the background characteristics of participants to know the socio-demographic components that effect their dietary pattern in relations to oral health. In this study, the socio-demographic characteristics used include age, gender, educational level, employment status and income. The level of socioeconomic status showed significant difference in the mean score of oral diet knowledge, supported by the significant mean difference among the groups. In the present study, the overall mean score of the study population regarding diet knowledge related to oral health was insufficient. A study conducted by Bapat S et al., among nutrition/ dietetic students of Udaipur city, India portrayed a low dental nutrition knowledge.⁸ A study on surgeon's knowledge about nutritional therapy conducted by Paulo DA, found that 80% of the surgeons showed lack of knowledge and were not confident in providing nutritional therapy.¹⁹ These study findings revealed that lacking knowledge regarding nutrition on oral health is an issue even among health care professionals. By comparing this study findings with other studies focusing on oral health diet awareness, almost similar trends were reported. The participants were unaware of the various aspects of oral diet. For example, A study conducted by Szatco and his colleagues among Polish mothers lacked diet awareness which significantly affected their kids' oral health.²⁰ Another study among Jordanian adults revealed poor level of knowledge related to periodontal diseases and the study recommended more educational programs to improve oral health awareness.²¹ A study conducted by Badrasawi et al.,

among dental patients at dental clinics revealed insufficient nutrition knowledge related to oral health.¹ The frequencies of correct answers were varying among the questionnaire items. General questions reported higher percentages of correct answers compared to oral diet specific items. Questions 1,2,3,8 and 10 asked about the role of food in oral health and role of sugar in dental caries. These items asked about basic general knowledge, which is well known to most of the parents. Similar findings were reported in different studies targeting different populations. Among school teachers in Saudi Arabia, satisfactory level of knowledge was found in general oral health questions.²² Another study showed majority of school children were familiar with the oral health awareness.²³ However, high percentages of participants gave wrong answers to questions 4,9,11,12,14 and 15 asking about effects of dietary factors and oral diseases. Specifically, they were asked about the effect of sugars on dental caries, effect of other types of sweeteners, frequency and the length of exposure between sugar and teeth, eating more frequent meals, and increasing the risk of caries by consuming sticky dessert which stays at the oral cavity for longer time. Such findings were surprisingly reported in Bapat et al., who found lack of knowledge of similar questions among nutritionist and dietetic students.⁸ Questions 5,6,7 and 13 focused on protective dietary factors against dental caries (nutrients that play protective roles against dental caries if consumed with cariogenic food, including dairy products, nuts, and presence of protein or fat with sugars).³ The protective effect of dairy products got 59.3% of correct answers, while the other item, eating nuts with tooth decay causing element like sugar protects the teeth from decay, reported much lower percentages of correct answers ie, 23% which is similar to the study findings conducted by Badrasawi et al.¹ This variation may be due to the recommendations of drinking milk and dairy products for healthy teeth as a calcium source and not due to their awareness of effect of bioactive compounds and types of polypeptides found on milk and dairy products that have the carioprotective effect.²⁴ These results supported the main finding which was the lack in the specific oral health diet information among the study participants.

The present study is limited to one geographical location and the results cannot be generalized throughout the country. Online survey are completed only by persons who are literate and who have access to the internet and by those who are sufficiently biased to be interested in the subject.

Further studies need to be conducted on a large scale with a larger sample size involving many geographical areas. Insufficient knowledge regarding diet on oral health recommend educational programs regarding effects of diet on oral health, should be tailored to address parents of children at various settings so that they may use this information and embark a positive oral health attitude in their children. Also the most appropriate intervention recommended is that of an effective dietary counselling in various settings. Dietary changes will not only improve the oral health (and vice versa), but most importantly improve the general health.

5. Conclusion

The finding of this study showed that the awareness on the effects of diet on oral health was found to be moderate among parents of children aged 5-16 years in Bengaluru city. The participants were unaware of the various aspects of oral diet. On comparing different socioeconomic levels of parents, statistically significant difference in the mean awareness scores was observed between different socioeconomic status. Multiple comparison revealed lower socioeconomic class showed significantly higher mean awareness scores as comparison with other socioeconomic status. Further research is needed utilizing different study designs (follow-up and longitudinal and intervention designs) to determine the effect of poor and good diet practices on oral health in short- and long-term practices. Insufficient knowledge regarding diet on oral health recommend educational programs regarding effects of diet on oral health to enhance diet-related knowledge and diet practices, should be tailored to address parents of children at various settings so that they may use this information and embark a positive oral health attitude in their children. Also the most appropriate intervention recommended is that of an effective dietary counselling in various settings. Further research is needed to determine effective intervention programs that can be implemented. The study suggests including oral health diet consultation regularly and continuously at dental clinics, schools and any other possible places. Nutrition education on the importance of adequate diet for good oral health is required and treatment of oral health problems should also involve registered dietitian nutritionists.¹⁶ Dietary changes will not only improve the oral health but most importantly improve the general health.

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