ORIGINAL ARTICLE

RELATIONSHIP BETWEEN DIET AND DENTAL HEALTH IN SCHOOL GOING CHILDREN OF MIXED DENTITION PERIOD

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ABSTRACT

Background: Diet and nutrition are significant influencers of oral health, and can affect the development and progression of oral diseases such as caries, periodontal disease, erosion, and others. Sucrose is the most common dietary sugar and is considered the most cariogenic carbohydrate. Frequent consumption of carbohydrates in the form of simple sugars increases the risk of dental caries. The aim of this study was to determine the relationship between diet and dental caries.

Methods: The present cross-sectional study was conducted at selected school located in Janakpur sub- metropolitan city over a period of two and half months from 27th February to 10th May, 2024. A total of 400 school going students aged between 6 to below 12 years were included in the study. Semi-structured questionnaire, dental check-up and 24-hour diet recall sheets were used to capture detailed information about all foods consumed by the participants in the past 24 hours, Descriptive analysis and Chi-square tests were presented by using IBM SPSS version 20.0.

Results: The mean age of the total population was 9.34±1.47 years. Among 400 participants, 53.5% were male and 46.5% were female. Significant differences in oral hygiene status were found between male and female ($p < 0.009$). Two hundred forty-five (61.25%) of total students eat 4-5 servings starchy cereals and 81.25% of them reported of eating 1-2 servings of refined carbohydrate products. Dental caries was found in 52.35% in underweight participants and 38.89% in participants with normal BMI. Overall prevalence of dental caries was found to be 50.8% for both permanent and primary tooth.

Conclusions: School children of mixed dentition period have higher prevalence of dental caries. Our study revealed that school children of underweight group are more prone to develop dental caries and are associated with low caloric and cariogenic diet. Implementation of proper oral hygiene practice, parental guidance, good food habits and carioprotective diet is recommended to improve dental health in school children.

Keywords: ***Dental caries, Diet, Mixed dentition period, School going children***

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INTRODUCTION

Over recent decades, globalization and urbanization have led to a nutritional transition in low and middle-income countries from traditional, agricultural-based diets to ultra-processed and high-sugar diets, particularly for children.[1] Nepal has had a gradual shift in diet for the past forty years, but recent decades have seen an accelerated increase in sugar and fat consumption.[2] Drivers of the dietary changes include child-targeted marketing of processed sweet and savory snack foods and sugar-sweetened beverages (SSBs), sold in and around schools, at very low prices.[3] Children of mixed dentition period[4] are vulnerable to marketing strategies and can develop serious diet-related health conditions including severe dental caries (tooth decay), malnutrition, and obesity, which can have adverse short-term and long-term consequences.[5]

Oral health is a part of a person's health and general wellbeing and is considered very important for a good and consistent quality of life. The teeth are one of the most important parts of the oral cavity.[6] Dental caries, the most prevalent chronic disease of childhood, is driven by exposure to dietary sugars. Metabolized within the dental biofilm, these sugars create a state of imbalance where net demineralization enamel and dentin of the tooth structure occurs. That process, when left unchecked, will lead to cavitation and then chronic infection of the pulp space and surrounding tissue.[7-9]

Malnutrition (overweight and underweight) have significant relationship with dental health. Children with low body mass index (BMI) results in increased dental caries because of hypoplasia, hyposalivation, altered composition of saliva and depression of protective constituents of teeth.[10] Although, dental caries is more prevalent in school children, there was very few documented data available for Janakpur sub-metropolitan city. Therefore, the present study aims to determine the relationship between diet and nutrition and dental caries among school-going children of mixed dentition period.

MATERIALS AND METHODS

The present cross-sectional study was conducted at selected schools located in Janakpur sub- metropolitan city, which is located in Dhanusha district of Madhesh Province, Nepal over a period of two and half months from 27th February to 10th May, 2024. A total of 400 students included in this research were children of age group ranges from 6 years to below 12

years from 10 different schools. Ethical approval was taken from the research committee of College of Applied Food and Dairy Technology (CAFODAT), PU, Nepal.

Sample size evaluated for each school was obtained by systematic random sampling method for data collection from the children of mixed dentition period who can serve as primary source of data due to nature of research design, aims and objectives, study place and study population. Participants of mixed dentition period who gave verbal consent in the presence of legally authorized representative (LAR) and physically present at the time of interview/study were included. Questionnaire was prepared in both English and Nepali language. Twenty-four-hour diet recall sheet was used to capture detailed information about all foods consumed by the participants in the past 24 hours, most commonly, from midnight to midnight the previous day. Examiners needed for dental check-up were trained and body mass index (BMI) was recorded. After completeness of each questionnaire, height and weight measurement and dental check-up, all collected data were exported to IBM SPSS version 20.0 for further analysis. Quantitative variables were presented as means and standard deviations and qualitative variables as frequencies and percentages. Differences between groups were analyzed according to Chi-square tests (qualitative variables). P value < 0.05 was considered to declare a result as statistically significant.

RESULTS

Our present study included 400 participants aged between 6 to below 12 years. The mean age of the total population was 9.34±1.47. Among 400 participants, 53.5% were male and 46.5% were female with the mean age of 9.42±1.44 and 9.25±1.5 respectively (Table 1).

Table 1: Gender analysis of study population with mean and std. deviation

Gender	Frequency	Percent	Mean age	Std. Deviation
Male	214	53.5	9.42	1.444
Female	186	46.5	9.25	1.491
Total	400	100.0	9.34	1.466

Higher percentage of female scored Good (19.8%) and Fair (53.22%) compared to males, 13.08% and 46.26% respectively. Significant differences in oral hygiene status were found between male and female (p < 0.009) as shown in table 2.

Table 2: Result of oral hygiene status of school children

OHI-S Status	Male (n=214)	Female (n=186)	Total (n=400)	Chi square value	P value
Good	28(13.08%)	37(19.89%)	65 (16.2%)		
Fair	99(46.26%)	99(53.22%)	198 (49.5%)	9.32	0.009*
Poor	87(40.65%)	50(26.88%)	137 (34.25%)		

As shown in Table 3, majority of study participants takes 4-5 meals per day. With regard to the food classification, 61.25% of the total students eat 4-5 servings of starchy cereals, followed by 90% of them eating less than the 4 servings of starchy vegetables. Female students tend to eat starchy cereals 68.27% and starchy vegetables 90.86% compared to males. Refined carbohydrate products was consumed by majority of students (81.25%).

Table 3: Result of food habit of school children

Food Habits (Revealed from 24-hour diet recall)	Male (n=214)	Female (n=186)	Total (N=400)
Frequency of meal			
<4 meals	6(2.8%)	8 (4.30%)	14 (3.5%)
4 to 5 meals	102(47.66%)	92(49.46%)	194(48.5%)
>5 meals	106(49.53%)	86(46.23%)	192(48%)\
Refined carbohydrate products consumption			
1 to 2 servings	172 (80.37%)	153 (82.25%)	325(81.25%)
>2 servings	42 (19.62%)	33(17.74%)	75(18.75%)
Starchy cereals consumption			
<4 servings	11 (5.14%)	25 (13.44%)	36 (9%)
4 to 6 servings	118 (55.14%)	127 (68.27%)	245 (61.25%)
Starchy vegetables consumption			
>6 servings	85 (39.71%)	34(18.27%)	119 (29.75%)
<4 servings	119(55.60%)	169(90.86%)	360 (90%)
4 to 5 servings	23 (10.74%)	16 (8.60%)	39 (9.75%)
>5 servings	0 (0%)	1 (0.53%)	1 (0.25%)

Majority (90.3%) of study participants were found to be underweight, out of which dental caries was found in 189 (52.35%). Male (52.38%) were more prone to dental caries as compared to female (47.62%). Less than 1% of the total population was overweight and 14 (38.89%) out of 36 participants with normal BMI have dental caries female dominancy (57.14%) as shown in Table 4.

Table 4: BMI of school children with dental caries status stratified with gender

Nutritional Status (BMI)	Total (n=400) Frequency/ Percentage	Male with dental caries	Female with dental caries	Total dental caries status
Underweight	361 (90.3%)	99 (52.38%)	47.62 (47.62)	189 (52.35%)
Normal	36 (9.0%)	6 (42.85%)	8 (57.14%)	14 (38.88%)
Overweight	3 (0.8%)	0	0	0 (0%)

Overall dental caries found in study population was 50.8%. For permanent tooth, female had higher prevalence than male with score 57.57% and 42.42% respectively. For primary tooth, prevalence was almost same for both genders (Table 5).

Table 5: Study population with dental caries status-stratified by gender

Population with dental caries	Male Frequency/ percentage	Female Frequency/ percentage	Total Frequency/ percentage
Study population	102 (47.66%)	101 (54.30%)	203 (50.8%)
Permanent tooth	14 (42.42%)	19 (57.5%)	33 (8.3%)
Primary tooth	93 (50.27%)	92 (49.72%)	185 (46.3%)

DISCUSSION

Dental caries is a concerning issue because it is common among children and negatively impacts a child's quality of life. Caries is a global public health challenge and is continuously studied and documented in various countries.[11]

In the present study, the percentage of children with good oral hygiene was very low (16.2%) and percentage with fairly poor hygiene was 34.25% which is similar to the study done by Anupriya and her team in Himachal Pradesh, India where they had reported good oral hygiene (9.4% and 7.3% in 5-8 and 9-12 years age group, respectively) and percentage with fairly poor hygiene was 26.8% and 41.1% in 5-8 and 9-12 years of age group, respectively.[12] Another study on oral health condition was also done among 5-6 years and 12-13 year's children in Nawalparasi district, Nepal in which the oral health of the children was poor, chiefly dental carries remained widespread.[13] This was believed to be a result of newly erupted teeth and because most of the teeth lie in the anterior segment of the arches where the teeth could be cleaned as the child bites on a cloth and other objects and not necessarily as a direct maintenance of the child's oral hygiene.[12]

Data from the study done in rural and urban areas of Nepal provides evidence that families in urban and rural Nepal are experiencing a nutrition transition in which junk food has become a daily staple of young children's diet, contributing to high rates of early childhood caries (ECC), mouth pain, and malnutrition.[14] In our study, 61.25% of the total students eat 4-5 servings starchy cereals and 81.25% of them reported of eating 1-2 servings of refined carbohydrate products. The present study is similar to the study done in India by Athavale and co-investigators in which she had reported that the majority of children consumed cariogenic items daily-sweets, candy or chocolate (52%), chips and biscuits (58%), and tea with sugar (51%) and Neha Zahid in Nepal where 60% of children consumed sweet snacks, and 65% consumed processed savory snacks daily.[15,16] Dental caries is caused by dental plaque deposits on the tooth surface. Frequency and timing of fermentable carbohydrates intake, which will be metabolized by a certain bacterium, such as Streptococcus mutans, lead to fermentation and therefore produce copious amount of acid and lower the local pH to a level where the minerals of enamel and dentine dissolve.[17]

Report from our study revealed that there was high prevalence (52.35%) of dental caries among school children with low BMI (underweight) among which male (52.38%) were more prone to dental caries as compared to female (47.62%). Similar study done by Madhusudhan and Khargekar considered the same parameters and conducted a study in Chitwan, Nepal, among children aged 6, 10, and 12 years and concluded that children with lower BMI scores tended to have more caries-affected teeth.[18] Sadeghi and Alizadeh conducted studies in Isfahan, Iran, among children aged 6–11 years, assessed height, and weight parameters considered for BMI and dental caries, and found similar results.[19] Other study done among school-age children in Shenzhen, China reported that students in the lower BMI categories had higher risk of experiencing caries in both girls and boys. Similar results have been reported based on data from large surveys in Guangzhou and the United States and Riyadh, Saudi Arab.[10,20,21] It is possible that students with malnutrition were more likely to have severe caries compared with their peers. As a consequence of malnutrition, enamel hypoplasia, salivary glandular hypofunction, and saliva compositional changes might be potential sequelae linked to malnutrition and caries.[22] In return, severe dental caries might result in a reduced food intake and thereby malnutrition, as mentioned above.[23]

The overall prevalence of dental caries found in the present study was 50.8%. The caries prevalence was higher than studies carried out in Gunung Anyar Surabaya in 2014 (30.8%) and the study conducted in Tanzania in 2012 (17.6%). However, the caries prevalence was equal to the results of a study conducted in other parts of Nepal (52%) and in primary school of Indonesia by Bramantoro and team in 2019 (53%).[17,24-26] In reference to prevalence of dental caries across different types of dentition, highest overall prevalence was noted in the mixed dentition (58%) category, followed by the primary (54%) type. This points towards the slow increment in prevalence of caries in the transitory period between primary and mixed dentition, as dental caries takes time to manifest as clinically detectable lesions and impact of changing dietary patterns.[27]

CONCLUSION

In conclusion, school children of mixed dentition period have higher prevalence of dental caries. Female had higher prevalence of dental caries in permanent tooth than male. Our study revealed that school children of underweight group (low BMI) are more prone to develop dental caries and are associated with low caloric and cariogenic diet. Good oral hygiene was very low in all participants. Implementation of proper oral hygiene practice, parental guidance, good food habits and carioprotective diet is recommended to improve dental health in school children.

CONFLICT OF INTEREST

We declare no conflict of interest.

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