



ORIGINAL RESEARCH PAPER

Dental Science

"RELATIONSHIP BETWEEN DENTAL CARIES, DIET, & BMI IN SCHOOL CHILDREN WITH MID-DAY MEALS & LUNCH BOXES IN BADGAON TEHSIL, UDAIPUR"

KEY WORDS: Diet , Dental caries, Lunch box, BMI, Mid day meal

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ABSTRACT

Background : Dental caries is a common yet preventable condition among school-aged children. Frequent intake of fermentable carbohydrates & sugar-sweetened beverages increases caries risk & contributes to weight gain & higher BMI. This study will help to explore the information regarding cariogenic food consumption patterns of school children & their association with dental caries & BMI. **Aim :** The aim of this study was to evaluate and compare the relationship between dental caries, food intake, and body mass index in school-age children having mid- day meal and lunch box food. **Methodology/Study Design :** A cross sectional descriptive study involving 154 children aged 6-9 years from private & government schools. Clinical assessment of caries status was done using DMFT index. BMI was evaluated and 24-hour diet chart was taken.. Lunch boxes were inspected during lunch breaks. The data obtained be analysed using SPSS version 21 software. **Results :** Majority of the students were girls(55.8%) and boys (44.4%) from class I- IV & their weights varied from 10.8 kg to 43.7 kg, with a mean weight of 20.76 kg .It was observed that the most frequently consumed food in the lunch box was chapati and vegetables (45%) followed by poha (28%) and biscuits (22%). On the other hand mid day meal consisted chapati and dal . The sweet score(9.80) and dmft(2.33) values of lunch box having children are high comparing it with mid day meal. BMI values of both group significantly varies. **Conclusion:** The type of diet has significant impact on children's sweet consumption score & also influence BMI. Lunch box contents were found to be more cariogenic but has better nutritional value as compared to mid day meal.

INTRODUCTION:

Dental caries is a common chronic dental infection in children.¹ It is the most ubiquitous disease that can cause enormous pain & discomfort to the children. In other terms , dental caries can be looked at , as destruction or the dissolution of the calcified tissues of the tooth.²

According to the American Dietetic Association, "nutrition is an integral component of oral health."³ In other words, we can say that dental caries is a diet-related disease as it has an indirect effect on the integrity of the teeth, pH, & quantity of the saliva. Among the dietary components, sucrose is the most cariogenic as compared to other sugars & is considered the "arch criminal" for the formation of dental caries⁴. Present study concluded that the consumption of sucrose i.e sugar containing foods can be a determining factor for the initiation of dental caries.

While developed countries have seen a decline in caries prevalence, it remains a significant public health issue in developing countries. The World Health Organization (WHO) reports that 60–90% of school-age children globally suffer from dental caries.

In parallel, childhood obesity has increased due to dietary, lifestyle changes & is associated with future health risks, including chronic diseases. Some studies suggest a link between dental caries & obesity. BMI is commonly used to assess obesity, although body fat ratio, derived from methods like bioelectric impedance analysis (BIA), offers a more specific assessment..^{5,6,7,8}

However, the relationship between nutritional status, BMI, and dental caries remains inconclusive. A systematic review of studies from 2004–2011 found that about half showed no association between BMI & caries, one-third found a positive association, and the rest showed an inverse relationship¹⁰. The present study determines relationship between BMI , dental caries and diet .

The Mid-Day-Meal-Scheme (MDMS) is implemented in
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Rajasthan under the administrative control of the School Education Department, Government of Rajasthan (GoR). It is a school meal programme in India designed to improve the nutritional status of school-age children nationwide. Launched in 1995, this scheme provides free lunches on working days for children in every primary & upper primary class in government, government-aided, and local body schools.¹⁰

To the best of our knowledge, not many studies were conducted to explore the relationship between cariogenic/ high carbohydrate content , dental caries &, the present study was conducted to identify the main foods & beverages consumed in both goverement & private schools and also to explore the information regarding cariogenic food consumption patterns and association with BMI.

MATERIALS AND METHODS:

The study included 154 children with age group 6-9 years (from 1st standard to 4th), studying in 3 different private & government schools in Thoor and Madar regions. A total of 160 questionnaires were distributed to the children. Necessary permission was also obtained from the respective school authorities.

Inclusion Criteria

- Healthy and normal children, aged 6 to 9 years from 1st to 4th classes
- Children bringing home made lunch and having mid day meal

Exclusion Criteria

- Medically compromised children
- Difficulty in opening mouth or any other health issues.

Assessment Of Children's Dental Health

Oral health practices, including the frequency of tooth brushing & dental visits, were assessed using a structured questionnaire. Clinical examinations were performed by a single calibrated dentist using a mouth mirror & explorer.

Dental caries in primary & permanent teeth were recorded using the dmft and DMFT indices, respectively, in accordance with WHO guidelines.

Assessment Of Food Consumption

Students were randomly selected for the study, and their food contents were evaluated. Questionnaires were distributed to their mothers, who were instructed to complete, sign, and return them the following day. Additionally, each child's lunch box was inspected during the lunch break to directly observe the type of food brought from home.

The Questionnaire Consisted Of 3 Parts- 24 Hr Dietary Recall

- **Part 1:** Included general sociodemographic data (age, sex, gender, and mother's name, occupation , educational status).
- **Part 2:** Detailed information regarding dietary intake of the child (breakfast , lunch , dinner, snacks , amount of sugar added,frequency)
- **Part 3:**Oral hygiene practices of children

Measurements

Body height and weight was measured with inch tape and digital weighing machine. BMI classification in children was done according to WHO (2007) reference values.

Statistical Analysis:

Data was analysed by SPSS (21.0 version).Shapiro Wilk test was used to check which all variables were following normal distribution. Differential statistics were performed using the parametric test. For intergroup comparison - Independent data, Independent t test was used. Level of statistical significance was set at p-value less than 0.05 (*).

RESULTS

The study involved children aged 6 to 9 years, with an average age of 7.53 years and a standard deviation of 1.095, indicating a relatively narrow age range among the participants.Weight varied considerably, ranging from 10.8 kg to 43.7 kg, with a mean weight of 20.76 kg and a standard deviation of 7.4869, reflecting significant diversity in body weight. Height measurements also showed variability, ranging from 76 cm to 162 cm, with a mean height of 123.66 cm and a standard deviation of 16.095, indicating differences in growth patterns among the children.

For BMI, children who brought lunch box had a significantly higher mean BMI of 15.37 (SD = 4.69135) compared to those who participated in the Mid Day Meal program. The difference in BMI between the two groups is statistically significant, with a p-value of 0.001, indicating that the type of diet is likely to influence the children's BMI.

However, when examining dental caries, as measured by the dmft score, there is no significant difference between the two dietary groups. The mean dmft score for children in the lunch box group was 2.33 (SD = 2.324), while for those in the Mid Day Meal group, it was 2.12 (SD = 1.843). (Graph 1)The p-value of 0.543 suggests that diet does not significantly impact the occurrence of dental caries among the children in this study.(Table 1)

Table 1 : Association of diet , BMI , Dental caries and sweet score

	DIET	N	Mean	Std. Deviation	Std. Error Mean	P VALUE
BMI	Lunch box	79	15.3666	4.69135	.52782	0.001*
	MID DAY MEAL	74	11.9584	3.57023	.41503	
Dmft	Lunch box	79	2.33	2.324	.262	0.543

	MID DAY MEAL	74	2.12	1.843	.214	
Sweet score	Lunch box	79	9.80	8.015	.902	0.001*
	MID DAY MEAL	74	8.65	7.733	.899	

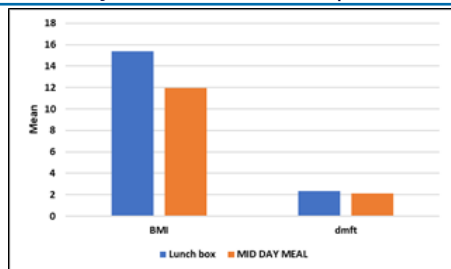
The mean sweet score for children who brought a lunch box was 9.80 (SD = 8.015), while the mean sweet score for those who participated in the Mid Day Meal program was slightly lower at 8.65 (SD = 7.733). The standard error of the mean is similar for both groups, being 0.902 for the Lunch box group and 0.899 for the Mid Day Meal group. The p-value of 0.001 indicates that the difference in sweet scores between the two groups is statistically significant, suggesting that the type of diet have a significant impact on the children's sweet consumption habits.

Table 2: Correlation Of Dmft Scores With Parent Filling The Form, Occupation, And Education

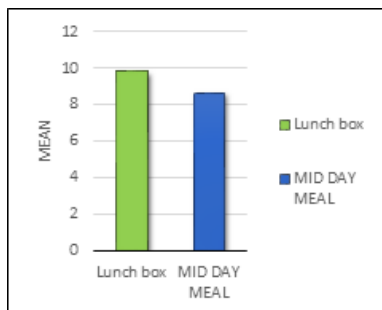
		Mean dmft	N (Number of subjects)	Standard Deviation
dmft by Parent Filling the Form	A (Mother)	2.18	129	2.158
	B (Father)	2.67	21	1.880
	C (Others)	2.00	3	1.732
dmft by Education	A (Not Educated)	0.00	2	0.000
	B (Middle School)	1.93	41	1.967
	C (High School Diploma)	2.01	68	1.832
	D (Bachelor's Degree)	2.74	38	2.165
	E (Higher Education)	5.25	4	4.272
dmft by Occupation	A (Housewife)	1.78	106	1.942
	B (Clerk)	2.67	6	1.751
	C (Worker)	3.52	21	1.721
	D (Businessman)	3.00	11	1.897
	G (Others)	3.22	9	3.383

Table 3 : Categorisation of food in lunch box

. No.	Categories	Food items	Frequency (%)
1	Homemade foods	Chapati/paratha and vegetables	69 (45%)
		Rice	26 (17%)
		Salad	21 (14%)
		Poha/upma	43 (28%)
		Halwa	15 (10%)
		Other items	5 (3%)
2	Packaged snacks	Chips and namkeen	6 (4%)
3	Fruits	Fruits	26 (17%)
4	Bread and biscuits	Bread/sandwich	21 (14%)
		Biscuit	34 (22%)
5	Cakes and pastries	Cakes and pastries	2 (1%)
6	Dry fruits	Dry fruits	5 (3%)
7	Chocolates and sweets	Chocolates	–
		Sweets	14 (9%)
8	Beverages	Milk	–
		Tea/coffee	–
		Cold drinks	9 (6%)
		Homemade drinks	2 (1%)



Graph 1 : Association of diet with BMI and Dental caries



Graph 2: Association of sweet score with diet

DISCUSSION

Many factors influence caries development, including the presence of cariogenic bacteria, innate susceptibility of tooth surfaces, frequency of eating, fermentable carbohydrate source, oral hygiene practices, fluoride availability, salivary flow and composition, salivary gland hypofunction, socioeconomic status and parenting practices¹². The present study endeavours to elaborate the relationship between diet, severity of caries and BMI in school going children.

Early adoption of healthy habits during childhood is crucial for establishing a lifelong foundation of well-being. Schools, where children spend an average of six hours daily and up to 15 years of their formative lives, offer an ideal environment to promote these practices. With their unique ability to influence both the food environment and nutritional education, schools play a vital role in shaping children's long-term health behaviours.

A study conducted by Manish Jain et al.¹³ investigated the effect of cariogenic food exposure on the prevalence of dental caries among fee-paying and non-fee-paying school children. He found that children from fee-paying schools, who often belong to higher socioeconomic classes, exhibited a higher prevalence of dental caries due to increased consumption of sugary foods and bakery items. This finding is consistent with the results of the current study.

In the present study, foods consumed largely during lunch time by the students in school setting were chapatti, vegetables, poha, rice and snacks including sweets and biscuits. However drinks such as coffee/tea, milk was the least common, cold beverages consumption was bit higher. This was in contrast with the study conducted by Bamba S et al¹⁹ who noticed that the key contents in lunch box was chapatti, vegetables, bread and snacks. But cold beverages consumption was the least common. This disparity in the pattern of food consumption could be due to the different dietary habits among different regions.

Sweet consumption (sweet score) in lunch box contents is more than that of food provided in mid day meal programme in the current study. Although the dmft scores of both groups were significant suggesting that caries incidence is higher in lunch box group.

Bamba S et al¹⁸ also noticed that children who were more

exposed to sugar showed a higher incidence of caries, which was in accordance with the studies by Gangwar SK et al¹⁴ in rural area of Lucknow (1990), Rahmatulla and Guile in Tamil Nadu (1990). However, this is in contrast with the other studies conducted by Chawla et al in Lucknow (1979) and Sarvanan et al in Pondicherry (2003).^{14,15,16,17}

The study by Özel Ç, (2024)¹¹ on relationship between dental caries, dietary intake and body composition in school-age children, concluded that dental caries has been associated with both food consumption and body composition in a sample of Turkish school-age children, which was in accordance with the current study stating that BMI and dental caries are related but this was contradictory to the study by Santhosh Kumar¹⁹, who concluded that there was no association between BMI and dental caries, also dental caries prevalence and experience did not differ significantly between the categories of BMI. Though results are conclusive studies are still going on.

Socioeconomic factors also play a significant role in dental caries development. Shyam R (2019)¹⁸ concluded that children from higher socioeconomic backgrounds had a higher incidence of dental caries, a finding consistent with the current study.

Additionally, Gugawad S (2024)³ emphasized that food consumed at school is often brought from home and tends to be less cariogenic. He recommended that parents replace energy-dense snacks with healthier alternatives like fruits, though this differs from the current study, which found that lunch box contents were more cariogenic than mid-day meals.

A diet rich in fruits and vegetables is essential for overall health, increased longevity, and the prevention of chronic conditions such as cardiovascular disease, stroke, hypertension, diabetes, obesity, and certain cancers. In contrast, lunch boxes high in carbohydrates and processed foods are not only associated with dental caries but also contribute to childhood obesity and related health issues. These unhealthy dietary habits pose significant short- and long-term health risks. According to the International Obesity Task Force (IOTF), nearly 10% of school-aged children worldwide are overweight or obese.

Although the incidence of dental caries is lower in mid-day meal components, their overall nutritional value remains limited. To address this, school curricula should incorporate comprehensive topics on nutrition and its impact on oral health.

To enhance the effectiveness of the Mid-Day Meal Scheme, more nutritious food options should be incorporated to meet the growing dietary needs of children. While the current meals help reduce the risk of dental caries, they often lack adequate nutritional diversity. Therefore, the Ministry of Health, in collaboration with the Ministry of Education, should take proactive steps to revise and enrich the mid-day meal menu. This initiative would not only support better oral health but also contribute to the overall growth and development of school-aged children.

Limitation:

The findings of this study cannot be generalised to the whole population in the area as a because the sample was recruited from first to fourth -grade children of selected schools only. However, our subjects were representative of school-going children typically of rural/semi-urban children across the Badgaon tehsil. Furthermore, nutritional status and dental caries experience are multifactorial, and their relationship is likely to be weakened by confounding variables, notably fluoride usage, which was not assessed in this study.

CONCLUSION

- Type of diet have a significant impact on the children's

sweet consumption habits.

- Type of diet is likely to influence the children's BMI.
- Children having mid day meal have less sweet score compared to that of lunch box and hence less prone to caries
- Mean value of BMI is higher in children having lunch box along with mean sweet score and dmft indicating that BMI and dental caries are related .
- The nutritional status of mid day meal programme less than that of lunch box contents
- Higher the socioeconomic status higher the incidence of caries

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