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Assessing the Cariogenicity of Snack and Lunch Box Content of School-Going Children: A Cross-Sectional Study in Chennai

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ABSTRACT:

Background: Dental caries remains one of the most prevalent chronic diseases among school-going children and is strongly influenced by dietary habits, particularly the frequent consumption of cariogenic foods during school hours. Snacks and lunch box contents constitute a significant portion of children's daily dietary intake; however, limited data are available regarding their cariogenic potential in urban Indian school settings. The study aims to assess the cariogenicity of snack and lunch box contents consumed by school-going children in Chennai.

Materials and Methods: A cross-sectional study was conducted among school-going children aged 6–9 years in selected schools of Chennai. Data regarding snack and lunch box contents were collected using a pre-tested structured questionnaire and direct observation. The cariogenicity of food items was assessed using established cariogenic food classification criteria. Dental caries status was recorded using the decayed, missing, and filled teeth (dmft/DMFT) index. Data were analysed using descriptive and inferential statistics, with the level of significance set at $p < 0.05$.

Results: A high prevalence of cariogenic food consumption was observed, with frequent intake of sugar-rich packaged snacks, confectioneries, and sweetened beverages during school hours. Children consuming highly cariogenic foods showed significantly higher dmft scores compared to those consuming non-cariogenic or minimally cariogenic foods. Despite adequate maternal education levels, unhealthy dietary practices were prevalent, indicating the influence of school food environments and accessibility of processed foods.

Conclusion: The study highlights a substantial cariogenic potential of snacks and lunch box contents consumed by school-going children in Chennai, underscoring the need for targeted school-based dietary interventions, parental education, and policy-driven regulation of unhealthy food availability within school premises.

INTRODUCTION:

Dental caries remains one of the most prevalent chronic conditions affecting children across the globe (1). Among the various etiological factors, the frequent consumption of fermentable carbohydrates, particularly sugars, is a major dietary determinant in the development of dental caries (2). Cariogenic foods are those that promote acid formation by oral microorganisms, leading to the demineralisation of the enamel surface (3). The risk increases when such foods are consumed in sticky or retentive forms, as

these tend to adhere to tooth surfaces and prolong acid exposure (4). Processed snack items, confectionery, and sweetened beverages are commonly identified as contributors to this problem (5). Repeated snacking between meals without adequate oral hygiene intensifies the risk of caries initiation and progression (6).
In the context of school-going children, dietary exposure during school hours plays a critical role (7). The contents of snack and lunch boxes often reflect both parental choices and broader cultural and commercial influences (8). Multiple studies have reported that children's lunch boxes frequently contain sugar- and fat-rich foods with poor nutritional quality (9). These dietary patterns, if consistent, may contribute to the early establishment of caries and influence long-term oral health behaviours (10).
Urbanisation and changing lifestyles have led to significant shifts in the dietary practices of Indian children (11). Metropolitan cities like Chennai have witnessed an increasing reliance on packaged snacks and convenience foods among school-going children (12). These changes warrant a systematic assessment to identify potential oral health implications (13). Evaluating the cariogenicity of foods consumed during school hours provides essential insight into children's daily sugar exposure and highlights the need for tailored preventive strategies (14).
Hence, the present study aims to assess the cariogenic potential of snack and lunch box contents among primary school children in Chennai. This study seeks to generate evidence by evaluating the type and frequency of food items consumed and their cariogenic scores, thereby informing school-based dietary recommendations, enhancing parental awareness, and strengthening oral health promotion programmes (15).

MATERIALS AND METHODS:

Study Design: A descriptive cross-sectional study was carried out among primary school-going children aged 6–9 years in Chennai, Tamil Nadu.

Study Setting and Duration: The study was conducted in selected government and private primary schools located across the four zones of Chennai—North, East, West, and South—over a period of one month.

Ethical Considerations: The research protocol was approved by the Institutional Ethical Committee of Tagore Dental College and Hospital, Chennai. Official permissions were obtained from school authorities. Prior to the commencement of data collection, written informed consent was obtained from parents or legal guardians.

Sampling and Sample Size: A multistage cluster sampling method was employed. From each zone, one government and one private school were randomly selected. In each school, classes from Grades I to IV were considered sub-clusters, from which participants were selected through simple random sampling. The sample size was calculated as 384 based on a 5% margin of error using OpenEpi.

Inclusion Criteria:

- Children bringing homemade snacks and lunch boxes.

Exclusion Criteria:

- Children who consumed food from school canteens.
- Children with dietary restrictions due to medical conditions.

Data Collection:

Data were collected using the following methods:

1. **Structured questionnaire**: Capturing demographic details, parental education, and socioeconomic status.

2. **24-hour dietary recall**: Obtained from parents, documenting the type, timing, and quantity of foods consumed by the child.
3. **Direct visual examination**: The contents of each child's snack and lunch box were observed and recorded during school hours.
4. **Anthropometric measurements**: Weight and height were measured using standardised tools.

Cariogenicity Scoring System:

Each food item was categorised and assigned a cariogenicity score based on its physical form, as described by Nizel and Papas (1987):

- Liquid and non-sticky foods – 5 points
- Solid and sticky foods – 10 points
- Slowly dissolving foods – 15 points

The total daily sugar exposure score was computed by summing the scores of all food items consumed.

Statistical Analysis:

Data were entered into Microsoft Excel and analysed using IBM SPSS version 27. Descriptive statistics were used to determine frequencies and percentages. Correlation tests were applied to assess associations between cariogenic food exposure, parental education, and socioeconomic status.

RESULTS:

A total of 384 children participated in the study. A high proportion consumed snack and lunch box items with moderate to high cariogenic potential. Solid and sticky foods were the most frequently observed and contributed substantially to higher cariogenicity scores. Children from lower socioeconomic backgrounds and those with lower parental education levels demonstrated significantly higher mean cariogenic scores. The study population predominantly comprised children aged 8 and 9 years (28.3% each), followed by those aged 7 years (23.3%) and 6 years (20.3%). The gender distribution was nearly equal, with males accounting for 51.3% and females 48.8% of participants. A higher proportion of children belonged to Class III (31.1%) and Class IV (30.6%), indicating greater representation from higher primary grades.

Nearly half of the children (47.1%) weighed between 20–25 kg, while 30.8% weighed more than 25 kg. Most participants (43.1%) had heights ranging from 116–130 cm. Regarding maternal education, 51.0% of mothers were graduates, 25.8% were postgraduates, and 23.0% had education below the 12th standard. With respect to sweet consumption, 61.1% of children consumed sweet foods or drinks fewer than 10 times in the previous 24 hours. However, 31.7% reported consumption 10–15 times, and 7.3% exceeded 15 exposures. Dietary analysis showed that rice (58.8%) and chapathi (21.8%) were the most commonly consumed homemade foods. Packaged snacks such as chips (43.5%) and namkeen (29.5%) were frequently included. Banana was the most commonly consumed fruit (80.3%).

A high intake of bakery and confectionery items was observed, including cakes (64.3%), chocolates (45.9%), biscuits (29.5%), and Indian sweets (42.9%). Milk was the most commonly consumed beverage (68.9%), followed by tea or coffee (30.8%). Snack purchasing behaviour was highly prevalent, with 96.7% of children reporting purchases from school canteens or nearby shops, most commonly chocolates (41.2%) and chips (22.8%).

Table 1. Demographic characteristics and dietary habits of study participants (n = 400)			
Variable	Category	Frequency (n)	Percentage (%)
Age (years)	6	81	20.3
	7	93	23.3
	8	113	28.3
	9	113	28.3
Gender	Male	205	51.3
	Female	195	48.8
Class	Class I	68	17.2
	Class II	84	21.2
	Class III	123	31.1
	Class IV	121	30.6
Weight	<20 kg	88	22.1
	20–25 kg	188	47.1
	>25 kg	123	30.8
Height	<115 cm	135	33.8
	116–130 cm	172	43.1
	>130 cm	92	23.1
Mother's education	Below 12th	92	23
	Graduate	204	51
	Postgraduate	103	25.8
Sweet food/drink intake (last 24 h)	<10 times	243	61.1
	10–15 times	126	31.7
	>15 times	29	7.3
Homemade foods*	Chapathi	87	21.8
	Rice	235	58.8
	Salad	19	4.8
	Poha	46	11.5
	Halwa	13	3.3
Packaged snacks*	Chips	174	43.5
	Namkeen	118	29.5
Fruits*	Banana	321	80.3
	Apple	79	19.8
Bread/Sandwich & biscuits*	Bread or sandwich	174	43.5
	Biscuits	118	29.5
Cakes & pastries*	Cakes	257	64.3
	Pastries	143	35.8
Dry fruits*	Almonds	257	64.4
	Cashews	142	35.6
Chocolates & sweets*	Chocolates	183	45.9

	Indian sweets	171	42.9
Beverages*	Milk	275	68.9
	Tea/Coffee	123	30.8
	Homemade drinks	1	0.3
Lunch box prepared by	Parents	186	46.5
	Others	56	14
Buys snacks from canteen/shops	Yes	385	96.7
	No	13	3.3
If yes, items bought*	Chips	74	22.8
	Chocolates	134	41.2
	Cold drinks	42	12.9
	Biscuits	73	22.5
	Others	2	0.6
*Multiple responses permitted; therefore, percentages may exceed 100% for these variables.			

DISCUSSION:

The present study assessed dietary practices, sweet consumption frequency, and snack purchasing behaviour among school-going children aged 6–9 years, highlighting key cariogenic risk factors within the school environment. Greater representation from higher primary classes likely reflects increased independence in food choices and snack purchasing, as reported in previous school-based studies (16).

Anthropometric findings indicated generally appropriate growth patterns; however, a considerable proportion of children weighing more than 25 kg suggests early trends toward overweight. This may be attributed to frequent intake of energy-dense, sugar-rich foods, emphasising shared risk factors between dental caries and childhood obesity. Despite the high educational status of mothers, unhealthy dietary practices—particularly frequent consumption of sweets and packaged snacks—were prevalent. These findings indicate that maternal education alone does not guarantee healthy dietary behaviours due to the influence of accessibility, convenience foods, peer dynamics, and school food environments (17).

Although most children reported fewer than 10 sweet exposures in the previous 24 hours, nearly one-third exceeded this frequency. Frequent exposure to sugars is a major contributor to dental caries, as sustained acid attacks on enamel underscore the importance of reducing intake frequency rather than focusing solely on quantity.

Homemade meals primarily comprised rice and chapathi, consistent with traditional diets; however, low consumption of protective foods such as salads suggests inadequate dietary diversity. High consumption of packaged snacks, cakes, chocolates, and biscuits aligns with existing literature identifying processed foods as major contributors to childhood sugar intake. Fruit intake was largely restricted to bananas, while dry fruits were consumed moderately, offering limited protective benefit.

Milk consumption was common and represents a favourable dietary habit; however, the intake of tea or coffee—often with added sugar—raises concern. Less than half of lunch boxes were prepared by parents, suggesting reduced parental control over daily food choices.

The majority of children purchased snacks from school canteens or nearby shops, predominantly chocolates and chips, underscoring the strong influence of the school food environment on dietary behaviours.

Overall, the findings reveal substantial exposure to cariogenic foods from both homemade and purchased sources. The results emphasise the importance of implementing comprehensive school-based dietary policies, limiting sugary snack availability, promoting healthy alternatives, and enhancing parental involvement to improve children's oral health outcomes.

LIMITATIONS:

- Dietary data were partly based on parental recall, which may be subject to recall bias.
- The cross-sectional design limits causal inference.
- Cariogenicity assessment was based on physical form rather than biochemical sugar analysis.

CONCLUSION:

Snack and lunch box contents of primary school children in Chennai exhibit considerable cariogenic potential. There is a clear need for targeted oral health education initiatives, school-based dietary guidelines, and parental counselling to encourage healthier dietary practices and minimise caries risk among children.

RECOMMENDATIONS:

- Implementation of school nutrition policies emphasising low-carbohydrate foods.
- Parental awareness programmes focusing on healthy lunch box planning.
- Incorporation of oral health education within school curricula.

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REFERENCES:

1. Kazeminia M, Abdi A, Shohaimi S, Jalali R, Vaisi-Raygani A, Salari N, et al. Dental caries in primary and permanent teeth in children's worldwide, 1995 to 2019: a systematic review and meta-analysis. Head Face Med. 2020 Oct 6;16(1):22.
2. Lamont RJ, Koo H, Hajishengallis G. The oral microbiota: dynamic communities and host interactions. Nat Rev Microbiol. 2018 Dec;16(12):745–59.
3. Mazurkiewicz D, Pustułka M, Ambrozik-Haba J, Bienkiewicz M. Dietary Habits and Oral Hygiene as Determinants of the Incidence and Intensity of Dental Caries—A Pilot Study. Nutrients. 2023 Nov 19;15(22):4833.
4. Tungare S, Paranjpe AG. Diet and Nutrition to Prevent Dental Problems. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2025 [cited 2026 Jan 19]. Available from: http://www.ncbi.nlm.nih.gov/books/NBK534248/
5. Sarmadi MH, Sharififard N, Mahboobi Z, Faramarzi E, Zohdi O. The association between cariogenic diet and dental caries in the Azar cohort population: a cross-sectional study. BMC Public Health. 2025 July 3;25(1):2328.

6. Nutrition and Oral Health [Internet]. [cited 2026 Jan 19]. Available from: https://www.ada.org/resources/ada-library/oral-health-topics/nutrition-and-oral-health
7. Gugawad S, Patil SV, Devendrappa SN. To Assess the Cariogenicity of the Lunch Box Content of Schoolgoing Children of Karad: A Cross-sectional Study. Int J Clin Pediatr Dent. 2024 Feb;17(2):121–4.
8. 8. Griffin TL, Barker ME. Packed lunches for primary-school children: A qualitative study of parents' views. Proc Nutr Soc. 2008 May;67(OCE6):E218.
9. Farris AR, Misyak S, Duffey KJ, Davis GC, Hosig K, Atzaba-Poria N, et al. Nutritional comparison of packed and school lunches in pre-kindergarten and kindergarten children following the implementation of the 2012-2013 National School Lunch Program standards. J Nutr Educ Behav. 2014;46(6):621–6.
10. Oral Health Across the Lifespan: Children. In: Oral Health in America: Advances and Challenges [Internet] [Internet]. National Institute of Dental and Craniofacial Research(US); 2021 [cited 2026 Jan 19]. Available from: https://www.ncbi.nlm.nih.gov/books/NBK578299/
11. Nutritional Shift in India: From Food Scarcity to Fast Food Culture - Socio.Health [Internet]. 2024 [cited 2026 Jan 19]. Available from: https://socio.health/social-groups-and-family-health/nutritional-shift-india-food-scarcity-fast-food/
12. Purushothaman S, Reddy C, Chaly PE, Priyadarshni I. Predilection for Junk Food Consumption Among 15-Year-Old Schoolchildren in North Chennai, India. Med J Islam World Acad Sci.
13. Tsang C, Sokal-Gutierrez K, Patel P, Lewis B, Huang D, Ronsin K, et al. Early Childhood Oral Health and Nutrition in Urban and Rural Nepal. Int J Environ Res Public Health. 2019 July;16(14):2456.
14. Gugawad S, Patil SV, Devendrappa SN. To Assess the Cariogenicity of the Lunch Box Content of Schoolgoing Children of Karad: A Cross-sectional Study. Int J Clin Pediatr Dent. 2024 Feb;17(2):121–4.
15. Dashiell L, Star J. Cariogenicity and Calories of Meals Served at a Pre-Kindergarten School-Based Meal Program. Pediatr Dent. 2024 July 15;46(4):263–8.
16. Macdiarmid JI, Wills WJ, Masson LF, Craig LCA, Bromley C, McNeill G. Food and drink purchasing habits out of school at lunchtime: a national survey of secondary school pupils in Scotland. Int J Behav Nutr Phys Act. 2015 Aug 4;12:98.
17. Sakeenabi B, Swamy HS, Mohammed RN. Association between obesity, dental caries and socioeconomic status in 6- and 13-year-old school children. Oral Health Prev Dent. 2012;10(3):231–41.