

# To Assess the Cariogenicity of the Lunch Box Content of Schoolgoing Children of Karad: A Cross-sectional Study

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## ABSTRACT

**Aim:** The present study was conducted to identify the main foods and beverages consumed at primary school and also to explore the information regarding cariogenic food consumption patterns of children in the school.

**Materials and methods:** A cross-sectional descriptive study was conducted among 150 schoolgoing children of age 6–9 years of an English medium school in Karad. Respondents were asked about the type of daily food consumption at breakfast, lunch, and dinner using a 24-hour diet chart, and the lunch box of children was viewed at the time of lunch break to assess for carbohydrate-rich diet.

**Results:** Majority of the students (58.6%) were boys, from class IV (25.4%) and class III (25.4%), and were between 20 and 25 kg (48%) and 116 and 130 cm (42%). It was observed that the most frequently consumed food in the lunch box was chapati/paratha and vegetables (45%) followed by poha/upma (28%) and biscuits (22%). Almost half of the students (46%) were in the category of “watch-out zone,” that is, >15 sugar exposure.

**Conclusion:** Most of the food consumed in school was homemade and was less cariogenic. Beverages were less consumed by the students in the school time.

**Clinical significance:** Since dental caries is a chronic infectious disease affecting more than two-thirds of all children and the incidence of caries is directly related to “form” or “physical consistency” of the sugar-containing foods, the content of lunch box should be considered a priority for health promotion efforts among children.

**Keywords:** Children, Dental caries, Lunch box, Schools.

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## INTRODUCTION

Over two-thirds of children have dental caries, a persistent infectious illness that results in lesions. It is the most ubiquitous disease that can cause enormous pain and discomfort in an individual. In simple terms, dental caries can be looked at as destruction or the dissolution of the calcified tissues of the tooth. The dissolution of the calcified tissues occurs due to the production of acid and this acidic attack of the tooth occurs due to the consumption of cariogenic foods out of the many factors that lead to dental caries, diet is the most important one.

According to the American Dietetic Association, “nutrition is an integral component of oral health.”<sup>1</sup> 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, and quantity of the saliva. Also, frequent consumption of fermentable carbohydrates having low oral clearance rates increases the risk for dental caries. Among the dietary components, sucrose is the most cariogenic as compared to other sugars and is considered the “arch criminal” for the formation of dental caries.<sup>2</sup> A study conducted on preschool children in Sweden found that the children consuming sucrose had a higher increment in dental caries compared to the children consuming invert sugar (a mixture of glucose and fructose).<sup>3</sup> This study proves that the consumption of sucrose can be a determining factor for the initiation of dental caries. Even lactose (milk sugar) was found to be less cariogenic than other sugars in studies conducted on animals.<sup>4</sup> It is well accepted in the previous literature that the incidence of caries is directly related to “form” or “physical consistency” of the sugar-containing foods.

Schools are seen as a recognized setting for altering an individual’s personality since students often spend 6 hours a

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day, or 36 hours a week, there, and early life experiences are when likes and dislikes are most easily formed.<sup>5</sup> It has been found that childhood is the most sensitive period for developing acceptance or negligence to various food groups and also in controlling children’s preferences.<sup>6</sup> An individual’s choice of food intake is influenced by a number of factors, including age, eating habits, sex, nutritional knowledge, personal preferences, general health, and social position.<sup>7</sup> Among these numerous factors deciding the choice of food intake, the most vital one is “individual preferences.”<sup>8</sup> In addition to having a significant influence on students’ eating habits, the school environment can also help lower a number of risk factors linked to dental caries.<sup>9</sup>

To the best of our knowledge, not many studies were conducted to explore the cariogenic/high carbohydrate content of lunch box, the present study was conducted to identify the main foods and

beverages consumed at primary school and also to explore the information regarding cariogenic food consumption patterns of children in the school.

### MATERIALS AND METHODS

A cross-sectional descriptive study was done among schoolgoing children of Karad, Maharashtra to assess the cariogenic effect of the lunch box contents. Data collection was done during the month of November 2018. The study protocol was reviewed by the ethical committee of the Institutional Review Board and was granted ethical clearance. Written permission was taken from the school authorities and also written informed consent was taken from the parents of the school children before the start of the study.

Through simple random sampling technique, a total of 150 school children, aged 6–9 years were selected from class I to class IV. The students who were bringing homemade lunch box were included in the study and the students taking food from the school canteen were excluded.

A questionnaire was distributed to all the school children which contained several questions like the children's age, parental education, and their daily food consumption at breakfast, lunch, and dinner using a 24-hour diet chart. The children were asked to give this questionnaire to their mothers, take their signature after filling it, and return it to us tomorrow. In the 24-hour diet chart, the mothers have to answer the timing of the food consumption, food/drink taken by their children, and its quantity. The proforma for recording the 24-hour diet chart is given in Table 1. Based on their responses, we have grouped the food under three categories—liquid and nonsticky, solid and sticky, and slowly dissolving. The sugar exposure score for liquid and nonsticky group was 5, solid and sticky was 10, and for slowly dissolving, it was 15. Then the total sugar exposure for the whole day was calculated. Also, the lunch box of each child was viewed at the time of lunch break to assess for the carbohydrate-rich foods and beverages. Each and every food and beverage item were categorized into groups to identify the cariogenicity of food. Foods were categorized into various groups—packaged snacks, homemade food, fruits, bread and biscuit, cake and pastries, dry fruits, and chocolates. Beverages were categorized as milk, tea/coffee, and a cold drink. Apart from this, their weight and height were also recorded. Weight was measured to the nearest 0.05 kg using electronic scales and height was measured to the nearest 0.1 cm using a portable stadiometer. Also, the nature of their diet and the food items bought by the student in their lunch box were recorded.

All completed proformas were entered in Microsoft Excel 2013. IBM Statistical Package for the Social Sciences (SPSS) Statistics V22.0 was used for descriptive data analysis; the results were then tabulated for calculation of response percentage.

### RESULTS

A total of 150 school students were included in the final sample and out of them maximum students (58.6%) were boys and were from

class IV (25.4%) and class III (25.4%). The majority of the students were between 20 and 25 kg (48%) and 116 and 130 cm (42%). The mothers of most of the students were graduates (44.6%) (Table 2).

The respondents were also asked about the type of daily food consumption at breakfast, lunch, and dinner using a 24-hour diet chart. The total sugar exposure for the whole day was calculated and grouped under three categories—<5, between 5 and 15, and >15. Almost half of the students (46%) were in the category of “watch-out zone,” that is, >15 sugar exposure (Table 3).

The lunch box was viewed physically to identify the main foods and beverages consumed and it was observed that the most frequently consumed food in the lunch box was chapati/paratha and vegetables (45%) followed by poha/upma (28%) and biscuits (22%). So, it was observed that most of the food consumed in school was homemade, less cariogenic, and beverages were less consumed by the students in the school time (Table 4).

### DISCUSSION

Early initiation of healthy childhood practices has been identified as key strategy for promoting a healthy lifestyle and schools are the perfect example of such settings as on an average a student spends his/her most precious 6 hours per day and 15 years of his/her life in schools. Hence, schools have the potential of influencing the food environment and learning opportunities about nutrition.

Since it is well-established that schools have a potential to modify the behavior of a child and also act as a powerful setting for intervention, our study was conducted with the aim to assess the contents of lunch boxes of 6–9-year-old children attending a school in Karad, Maharashtra. In this study, the level of cariogenicity

**Table 2:** Demographic and anthropometric characteristics of 150 children aged 6–9 years

S. No.	Characteristics	Number of students n (%)
1	Gender	
	Male	88 (58.6%)
	Female	62 (41.4%)
2	Class	
	I	37 (24.6%)
	II	37 (24.6%)
	III	38 (25.4%)
	IV	38 (25.4%)
3	Weight	
	<20 kg	33 (22%)
	20–25 kg	72 (48%)
	25–30 kg	45 (30%)
4	Height	
	<115 cm	49 (32.6%)
	116–130 cm	63 (42%)
	>130 cm	38 (25.4%)
5	Parental education (preferably mothers)	
	Below 12th class	13 (8.6%)
	Graduate	67 (44.6%)
	Postgraduate	29 (19.4%)
	Don't know	41 (27.4%)

**Table 1:** Proforma for recording 24-hour recall diet chart

S. No.	Time of intake	Type of food/drink	Quantity
–	–	–	–
–	–	–	–
–	–	–	–

**Table 3:** The total sugar exposure for 150 students using a 24-hour diet chart

S. No.	Sugar exposure	Frequency (%)
1	<10	22 (15%)
2	Between 10 and 15	59 (39%)
3	>15	69 (46%)

**Table 4:** Different variety of foods and beverages consumed by the children (*n* = 150)

S. No.	Categories	Food items	Frequency (%)
1	Homemade foods	Chapati/paratha and vegetables	68 (45%)
		Rice	26 (17%)
		Salad	21 (14%)
		Poha/upma	42 (28%)
		Halwa	15 (10%)
		Other items	5 (3%)
2	Packaged snacks	Chips and namkeen	6 (4%)
3	Fruits	Fruits	25 (16%)
4	Bread and biscuits	Bread/sandwich	21 (14%)
		Biscuit	33 (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%)

was not much as chapatti and vegetables (45%) followed by poha/upma (28%) was found to be most common foods consumed by the school children. Beverages such as cold drinks were consumed by a very less number (6%) of school children. Our study's results were consistent with those of Bamba et al.'s study,<sup>10</sup> which found that school children's most commonly consumed foods were chapatti (49%) followed by vegetables (42%), bread (38%), snacks (26%), and rice (21%) and that their least frequently consumed foods were coffee/tea and cold beverages. A cross-sectional study of 259 preschool children in New South Wales found that 92% of children's lunch boxes contained sandwiches and home-cooked meals, followed by fresh fruit, and 60% contained one portion of complementary food.<sup>11</sup> Another study conducted among English children in Norwich found that 47% of children consumed fruit squash at school.<sup>12</sup> This finding was in contrast to the various studies conducted in the past. Sanigorski et al. in their study found that the main content of lunch box was sandwich, a piece of fruit, several snacks, and a drink among school children of Australia and concluded that all Australian school children had some form of "junk food" in their packed lunches, with a mean of  $3.1 \pm 0.1$  servings.<sup>13</sup> In our study, chips and biscuits were consumed by 4 and 22% of school children, respectively. These foods are considered to be highly cariogenic as they stick to the teeth and cause the dissolution of the tooth for a longer period of time. In their study, Iftikhar et al. found that the prevalence of caries was 3.89 [95% confidence interval (CI), 2.16–7.01] times and 4.28 (95% CI, 2.09–8.78) times higher than that of biscuits ( $p = 0.0001$ ) and in their study children who eat potato chips ( $p = 0.0001$ ), respectively.<sup>14</sup> Furthermore, they also found that snack foods and drinks were consumed by a high percentage of school children, and the incidence of dental caries was experienced more in children with poor dietary habits as compared to children with no good dietary habits.<sup>14</sup> A study by Rees et al. reported that very few packed lunches in the United

Kingdom contained vegetables and fruit was particularly low in school meals.<sup>15</sup> In the United States, 45% brought snacks, and 41% of the elementary school children brought lunch to school on any given day.<sup>16</sup> A study conducted by Sayegh et al. showed that the savory items were the most frequently consumed food by school children, 85% of children consumed milk/tea with sugar, 76% regularly ate confectionery items and biscuits/cakes were taken by 71% of children. No obvious differences were found in eating habits among children of same age.<sup>17</sup> In a study by Sangster et al., 15 Sydney day centers found that lunch boxes did not meet the criteria set out in New South Wales Department of Health guidelines.<sup>18</sup> This difference in the lunch box contents could be due to the difference in dietary habits between various countries.

It has been well established that the foods consumed, particularly vegetables and fruits are very important for the improvement of overall health, enhancement of lifespan, and prevention of diseases like cardiovascular diseases, stroke, hypertension, diabetes, obesity, and certain types of cancer. The carbohydrate-rich content of lunch box is not only associated with dental caries but also with several diseases caused due to high consumption of junk foods like obesity or increased weight among children which in turn has significant short and long-term health implications. The International Obesity Task Force (IOTF) has reported that about 10% of the world's school-aged children are overweight or obese.<sup>19</sup> Beverages were consumed by less number of children in our study but finding from Kelly et al. found that almost half of all preschool children's lunch boxes contained extra beverages. According to the World Health Organization, there is a probable association between extra food/drink consumption and the increased risk of obesity.<sup>20</sup>

In India, a program known as the "Mid-day meal program" was launched by the government to provide afternoon meal and milk to the school children of every government and government-aided primary schools. The program stated to provide a minimum content of 300 calories of energy and 8–12 gm protein per day for a minimum of 200 days to the schools' children. In 2001, it became mandatory to give a mid-day meal to all primary and later extended to upper primary school children studying in the government and government-aided schools. This scheme benefitted 140 million children in government-assisted schools across India in 2008, strengthening child nutrition and literacy. This program became quite successful and popular and more programs should be launched by the government to promote the health and well-being of the nation's children.<sup>21</sup>

We have tried our level best to explore the cariogenic content of the lunch box but in spite of that, a few limitations do exist in our study that need to be addressed. First of all, we were unable to measure the prevalence of the dental caries of the selected school children. Secondly, the association between dental caries and cariogenic content of the lunch box could not be explored and lastly, follow-up of the children was not done. Hence, more cross-sectional and clinical trials should be conducted on the present topic by addressing the abovementioned limitations to explore this vital topic and also to motivate parents about the ill effects of it.

## CONCLUSION

Although our study found that the majority of food consumed in school is brought from home to be less cariogenic, parents need to be encouraged to remove energy-dense snacks from their children's lunch boxes and replace them with fruit and other

nutritious alternatives. It is the responsibility of not only the parents but also the dental health professionals and schoolteachers to keep an eye on the eating habits of the children, discourage them from consuming foods rich in carbohydrate and sugar, and encourage them to adopt a healthy diet.

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