Pesquisa Brasileira em Odontopediatria e Clínica Integrada 2021; 21:e0228
https://doi.org/10.1590/pboci.2021.098
ISSN 1519-0501 / eISSN 1983-4632

ORIGINAL ARTICLE

Can Schoolchildren Substitute Mothers' Reports of Cariogenic Foods Consumption?

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Academic Editor: Burak Buldur

Received: 01 December 2020 / **Review:** 04 February 2021 / **Accepted:** 07 February 2021

How to cite: Dreher IL, Herrmann R, Ferreira FM, Casagrande L, Lenzi TL. Can schoolchildren substitute mothers' reports of cariogenic foods consumption? Pesqui Bras Odontopediatria Clín Integr. 2021; 21:e0228. https://doi.org/10.1590/pboci.2021.098

ABSTRACT

Objective: To investigate the influence de two instruments for evaluation of cariogenic foods consumption by schoolchildren. **Material and Methods:** The convenience sample comprised of 30 active-caries children (7-10 years old) attended in a public dental clinic and their mothers, who have not received dietary orientation before study. A trained evaluator administered the Previous Day Food Questionnaire (PDFQ) to children and other examiner applied the 24-hour dietary recall with mothers. Internal consistency between PDFQ and 24-hour dietary recall regarding frequency of sugar intake was calculated using intraclass correlation coefficient. Bivariate analyses (Mann-Whitney test) were performed to investigate the factors associated with frequency of sugar intake when using both instruments (α=0.05). **Results:** A moderate correlation (ICC = 0.51; 95%CI: -0.04–0.77; p=0.03) was found between instruments. Mean frequency of sugar intake reported by mothers and children was 3.5 (± 1.8) and 3.7 (± 1.5) times a day, respectively. When using the PDFQ, the frequency of cariogenic foods consumption varied depending on frequency of toothbrushing, i.e., children that had higher frequency of sugar intake brushed their teeth at least two times a day (p=0.016). **Conclusion:** Previous Day Food Questionnaire applied with schoolchildren could substitute the mothers' reports of cariogenic foods consumption when dietary interventions for controlling dental caries are necessary. If doubts remain regarding the children's response, mothers should be consulted.

Keywords: Child; Diet, Cariogenic; Dental Caries.

Introduction

Dental caries is a biofilm-mediated, sugar-driven, multifactorial disease that results in the imbalance of demineralization and remineralization of dental hard tissues [1,2]. Consumption of free sugars (i.e. sugars added to foods and drinks and sugars naturally present in honey, syrups, fruit juices, and fruit juice concentrates) is of critical importance to the development of dental caries [3-6]. A high frequency of intake of sugars leads to prolonged acid production from tooth adherent bacteria and to a shift in the composition of the oral microbiota and biofilm pH. If sustained, tooth structures are demineralized [1].

Despite protective role of fluoride in the controlling of dental caries, restrict sugar consumption has a role to play in the prevention of the disease [5,7]. Moreover, dental caries shares common risk factors with other non-communicable diseases associated with excessive sugar consumption, such as obesity [8], and diabetes [9]. There is consistent evidence to support potentially modifiable correlates/determinants of sugar-sweetened beverage consumption in young children acting at parental (modelling) [10], child (TV viewing/screen time and snack consumption) and environmental (school policy) levels [8]. Thus, the evaluation of dietary habits is fundamental in the Pediatric Dentistry clinic.

The measurement of sugar intake is commonly based on food frequency questionnaire, diary or a 24-hour dietary recall [11-13]. Food diary is an inventory method in which the professional weighs all sugary foods and drinks consumed by children usually over the three-day period (including a weekend day). The major limitation is that the questionnaire is fill out by parents/guardians and they tends to inform only foods and drinks consumption during main meals, omitting those consumed between main meals [13].

The 24-hour dietary recall is performed with parents/guardians of the child by interview. The report begin with foods and drinks consumed on the previous day. The professional asks the questions, taking care not to induce answers, being possible to record items that the interviewee did not initially mention [11].

Parents/guardians, oftentimes, are not able to provide complete information on food and drink intake during school hours, and children are too young to self-report or to fill meal frequency questionnaires [14]. In this sense, a structured and illustrated tool called Previous Day Food Questionnaire (PDFQ) was developed to measure food intake in children between six and eleven years old [15]. The questionnaire provides information on items such as the choice of food groups consumed on a typical day, considering 6 daily eating occasions [15,16]. The questionnaire was previously validated with a sample of Brazilian children and can be used for assessing food and meal patterns [15]. However, to the best of the knowledge, no previous study used this tool to investigate cariogenic foods consumption.

Considering that dietary intake is difficult to measure, and any single method cannot assess dietary exposure perfectly [17], this study aimed to investigate if there is correlation between schoolchildren and mothers' reports on sugar intake frequency in order to identify if the self-report by PDFQ can be used alone or associated with mothers' report. The secondary aim was to assess the factors associated with sugar intake frequency.

Material and Methods

Ethical Aspects

The local Research Ethics Committee approved the research protocol (CAAE No. 04269718.0.0000.5347). For the collection of data, the parents or guardians signed written informed consent. The personal information of the patients was kept confidential.

Sample Collection

This cross-sectional study was conducted at the Children and Youth Dental Clinic, School of Dentistry, Federal University of Rio Grande do Sul (UFRGS), Porto Alegre, Brazil. This public pediatric dental clinic treats children at a low charge, who are mainly from low socioeconomic backgrounds.

The convenience sample comprised of 30 active-caries children (7-10 years old), attended during 1-year period (2019), who have not received dietary orientation before study. Non-cooperative children or patients with compromised systemic health were excluded from the study. The participants were recruited by verbal invitation during routine dental appointments at the clinic.

Training of Evaluators

Two examiners (I.L.D. and R.H.) underwent a total of 8 h of specific training session involving theoretical explanations about instruments for dietary evaluation and their application to five children and respective parents/guardians not involved in the study. The responsible for training session was a benchmark examiner (T.L.L.) with experience in cariogenic diet evaluation.

Dietary Assessment

A trained evaluator (R.H.) administered the Previous Day Food Questionnaire (PDFQ) [15] to children and other examiner (I.L.D.) applied the 24-hour dietary recall with mothers. The evaluator systematically asked for each mother about all foods and drinks consumed by child on the previous day, taking care not to induce answers.

In the PDFQ [15], children were asked to detail their food consumption on the previous day at 6 daily eating occasions that were chronologically ordered (breakfast, mid-morning snack, lunch, afternoon snack, dinner, and evening snack), based on 21 drawings of selected foods or food groups: bread and biscuits, chocolate milk, coffee with milk, milk, yogurt, cheese, rice, soft drinks, sweets, salty snacks, French fries, pizza and hamburger, fruits, beans, pasta, fish and seafood, beef and poultry, 100% fruit juices, leafy vegetables, cooked vegetables, and vegetable soup (Figure 1). The foods and food groups were chosen in order to take into account the food patterns of children in this age group, food presented in school menus and foods recommended in the guidelines for Brazilian population [18].

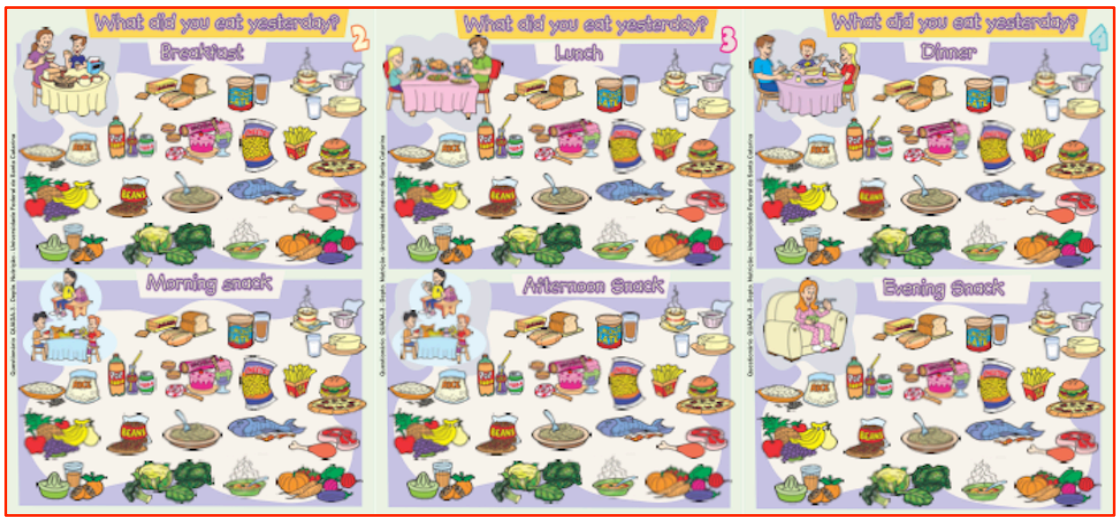

Figure 1. Previous day food questionnaire.

Each child received a colored printed version of the questionnaire and a colored pencil. The examiner, using vocabulary and gestures appropriate for the age group, explained the purpose of each question and the procedure to be adopted for filling out the questionnaire. Furthermore, the children were asked whether they consumed other foods that were not included in the instrument and were instructed to write the name of the food on the part referring to the meal in question. The interviews were held independently with mothers and children, who had received no prior warning that they would be interviewed to avoid any changes in the dietary habits.

We classified the foods based on their densities of refined sugar or other simple carbohydrates and/or previously reported associations with caries in the literature [19]. The items categorized as cariogenic were: added sugar, sweets, chips, chocolate milk, coffee (sugar added), soft drinks, and salty snacks.

Data Collection

Both evaluators collected from clinical records the following individual and clinical characteristics: gender (boys or girls), child's age, brushing frequency (once a day or at least twice a day); flossing use (yes or no), visible plaque index (less or more than 20%) [20], gingival bleeding index (less or more than 20%) [20], and caries experience (decayed, missing, and filled teeth – dmft).

Statistical Analysis

The descriptive analysis provides the distribution summary of the sample characteristics. Intraclass correlation coefficient and respective 95% confidence interval was calculated to evaluate the internal consistency of the PDFQ and 24-hour dietary recall considering the frequency of sugar intake. The strength of correlation can be interpreted as follows: < 0.20: Poor; 0.21-0.40: Fair; 0.41-0.60: Moderate; 0.61-0.80: Good; 0.81-1.00: Excellent [21]. Bland-Altman plot was also used to determine the agreement between two instruments.

Bivariate analyses (Mann-Whitney Test) were performed to investigate the associated factors with frequency of sugar intake when using PDFQ and 24-hour dietary recall. A significance level of 5% was considered. Data analyses were performed with SPSS software, version 22 (SPSS Inc., Chicago, IL, USA).

Results

The sample was comprised of 30 children (15 boys and 15 girls) with average age of 8 years old (± 1.0 years), presenting a dmft index mean of 4.7 (± 3.4) and active carious lesions mean of 6.4 (± 3.4). All children used standard fluoride toothpaste (≥1.000 ppmF) and most them (90%) brushed their teeth at least two times a day. Clinical and demographic characteristics of children are summarized in Table 1. All mothers had more than 8 years of formal education with average age of 29.1 years old (± 2.5 years).

Table 1. Clinical and demographic characteristics.

Variables	N (%)
Gender	
Girls	15 (50.0)
Boys	15 (50.0)
Frequency of Brushing	
Once a Day	3 (10.0)
At Least Two Times	27 (90.0)
Visible Plaque Index	
< 20%	19 (63.3)

> 20%	11 (36.7)
Gingival Bleeding Index	
< 20%	17 (56.7)
> 20%	13 (43.3)
Caries Experience (dmft)	
Until 3	15 (50.0)
> 3	15 (50.0)

Table 2 describes the feeding pattern of children reported by them and their mothers. Main sugar intake fonts reported by mothers and children were soft drinks and sweets. Fruit juices consumption was the most relevant divergence between children and mothers.

Table 2. Percentage distribution of food choices and meals patterns.

Food Groups	Children	Mothers
Bread and Biscuits	76.7	56.7
Chocolate Milk	60.0	56.7
Coffee with Milk	26.7	23.3
Milk	3.3	3.3
Yogurt	6.7	3.3
Cheese	3.3	20.0
Rice	76.7	70.0
Soft Drinks	53.3	76.7
Sweets	73.3	70.0
Salty Snacks	3.3	6.7
French Fries	0.0	3.3
Pizza and Hamburger	20.0	6.7
Fruits	46.7	26.7
Beans	50.0	50.0
Pasta	43.3	30.0
Beef and Poultry	86.7	80.0
100% Fruit Juices	66.7	3.3
Leafy or Cooked Vegetables	30.0	23.3
Vegetable Soup	10.0	10.0

A moderate correlation (Intraclass Correlation Coefficient = 0.51; 95%CI: -0.04-0.77; p=0.03) regarding frequency of sugar intake was found between PDFQ and 24-hour dietary recall. Mean frequency of sugar intake reported by mothers and children was 3.5 (± 1.8) and 3.7 (± 1.5) times a day, respectively (Table 3).

Table 3. Frequency of sugar intake reported by children and mothers.

Frequency of Sugar Intake	Children	Mothers
1 Time a Day	3.2%	10.0%
2 Times a Day	10.0%	26.7%
3 Times a Day	26.7%	16.7%
4 Times a Day	26.7%	20.0%
5 Times a Day	16.7%	20.0%
6 Times a Day	16.7%	6.6%
Mean of Daily Frequency of Cariogenic Foods	3.7 (± 1.5)	3.5 (± 1.8)

Bland-Altman plots (Figure 2) showed that the average of the differences between to instruments was -0.23 (not statistically significant different from 0), meaning that PDFQ and 24-hour dietary recall correlation were in agreement (p=0.51). Linear regression model showed that there was proportion bias between the frequency of sugar intake reported by both instruments (p=0.26), showing that there was homogeneous distribution.

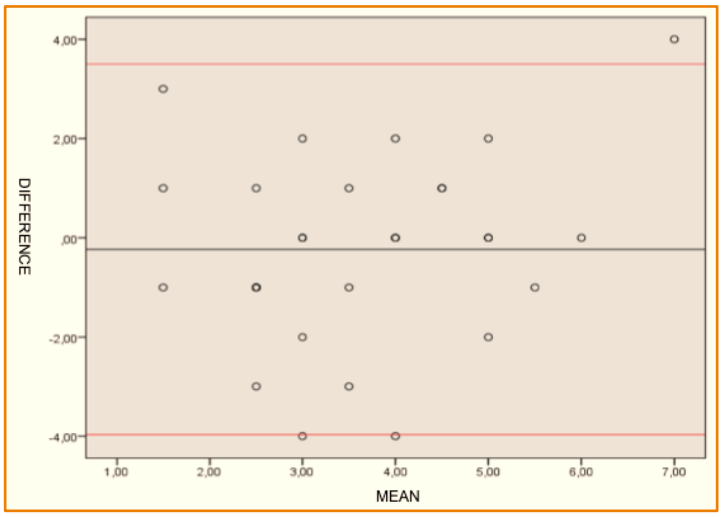

Figure 2. Bland-Altman plot shows the mean difference between the two instruments.

Bivariate analyses results are shown in Table 4. When using PDFQ, the frequency of cariogenic foods consumption varied depending on frequency of toothbrushing, i.e., children that had higher frequency of sugar intake brushed their teeth at least two times a day (p=0.016).

Table 4. Associated factors with frequency of sugar intake when using PDFQ and 24-hour dietary recall.

Variables	Frequency of Sugar Intake							
	PDFQ				24-Hour Dietary Recall			
	Percentil			p-value*	Percentil			p-value*
	25	50#	75		25	50#	75	
Gender								
Girls	3	3	4.5	0.420	2	3	5	0.800
Boys	3.5	4	5		2	3	5	
Frequency of Toothbrushing								
Once a Day	0.5	1.0	2.0	0.016	2.5	3.0	3.0	0.439
At Least Two Times	3.0	4.0	5.0		2.0	4.0	5.0	
Visible Plaque Index								
< 20%	3.0	4.0	5.0	0.454	2.0	4.0	5.0	0.709
> 20%	2.5	3.0	4.5		2.0	3.0	3.5	
Gingival Bleeding Index								
< 20%	3.0	4.0	4.0	0.535	2.0	4.0	5.0	0.551
> 20%	3.0	4.0	5.0		2.0	3.0	4.0	
Caries Experience (dmft)								
Until 3	3.5	4.0	5.0	0.121	2.5	5.0	5.0	0.063
> 3	3.0	3.0	4.0		2.0	3.0	3.5	

#Median; *Mann-Whitney Test.

Discussion

This is the first study that used the PDFQ to analyze cariogenic foods consumption by schoolchildren. The internal consistency and agreement between mothers' report with 24-hour dietary recall and children' information using the PDFQ about sugar intake was investigated.

Both instruments consist of a single day recall about food consumption. They are based on the recent memory of individuals, minimizing memory bias. Despite these advantages, it is almost impossible to obtain the total food intake using both instruments. PDFQ was previously validated for evaluation of food consumption of schoolchildren using the 24-hour dietary recall as reference method [15].

The association between dental caries and a diet rich in sugary foods and drinks is well established in the scientific literature [3,7,22]. The relative contribution of the frequency versus the amount of sugar intake is difficult to discriminate because of the high correlation between frequency and amount. However, reducing the amount without reducing the frequency does not seem to be an effective caries preventive approach in contrast to the reciprocity [22]. Goals set in terms of frequency may also be more tangible for patients to follow than goals set in amount [22].

In this study, a moderate correlation (0.51 95%CI -0.04-0.77; p=0.03) was found between instruments regarding frequency of sugar intake. Additionally, Bland-Altman plot showed that instruments are in agreement. It was speculated that a higher reliability would be observed if the sample was higher. Mean frequency of sugar intake reported by mothers and schoolchildren was 3.5 (± 1.8) and 3.7 (± 1.5) times a day, respectively. PDFQ limits the evaluation of frequency of sugar intake up to six times a day (breakfast, mid-morning snack, lunch, afternoon snack, dinner, and evening snack). Nonetheless, it is important to note that a higher proportion of children rather than mothers reported cariogenic foods and drinks consumption 6 times a day.

Main sugar intake fonts reported by mothers and children were soft drinks and sweets, in line with previous reports [23-25]. On the other hand, consumption of bread and biscuits was more frequent by report of children than mothers. Children spend a large portion of the day in the school and mothers tend to inform only the foods and drinks consumption at home. Thus, the frequency of sugar intake may be underestimate by mothers' report. Moreover, foods pattern away from home is associated with a higher consumption of soft drinks, and lower consumption of fruits, vegetables and milk [26]. Fruit juices consumption was the higher divergence between children and mothers. While 66.7% children reported to drink 100% fruit juices, only 3.3% mothers informed its consumption by children. This result is in line with the difference in the frequency of soft drinks consumption reported by children (53.3%) and mothers (76.7%). It may be explained because many children do not know to differentiate natural fruit juices and fruit drinks.

Prospective cohort studies in children and adolescents found no association or inverse association between 100% fruit juice intake and dental caries [27]. The consumption of milk and yogurt reported by both children and mothers was low. A recent systematic review found that probiotic-containing dairy products such as milk and yogurt are beneficial for oral health, reducing *Streptococcus mutans*, *Lactobacillus spp.* levels and increasing salivary pH [28].

It has been shown that children who consume foods and drinks with added sugar more frequently (≥4) are more likely to develop dental caries than children who have a sugar-free diet [29]. Drinking fluoridated water frequently helped ameliorate the deleterious effect of sugar consumption on children's dental caries experience [29]. In the present study, there was no statistically significant association between frequency of sugar intake and caries experience (dmft). Dental caries has a long course of progression due to its accumulative nature. On the other hand, PDFQ and 24-hour dietary recall provide information about recent eating habits, which represents only the most recent history of the condition while caries experience involves also past history of the disease.

Children that had higher frequency of sugar intake, measured by PDFQ, brushed their teeth at least two times a day (p=0.016). An increase in the toothbrushing frequency may be a measure adopted by parents to compensate the higher frequency of cariogenic foods consumption. It is important to highlight that all children were caries-active and the majority of them brushed their teeth at least two times a day. It has been shown that the use of fluoride by appropriate toothbrushing twice a day significantly reduces the association between

caries and sugar intake [7,22]. Conversely, a previous study [11] demonstrated an increase in the prevalence rate of untreated dental caries in preschool children for each additional daily contact with cariogenic foods, independent of the brushing frequency (up to once day or more than once day).

Therefore, within the limitations of the study, PDFQ applied with schoolchildren could substitute the mothers' reports of cariogenic foods consumption when dietary interventions for controlling dental caries are necessary. If doubts remain regarding the children's response, mothers should be consulted.

Conclusion

The correlation between reports of schoolchildren and mothers regarding the frequency of cariogenic foods and drinks consumption was moderate. Children that had higher frequency of sugar intake based on their reports also presented a higher toothbrushing frequency.

Authors' Contributions

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All authors declare that they contributed to critical review of intellectual content and approval of the final version to be published.

Financial Support

None.

Conflict of Interest

The authors declare no conflicts of interest.

Data Availability

The data used to support the findings of this study can be made available upon request to the corresponding author.

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