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Effect of the day and the number of days of application on reproducibility of a questionnaire to assess the food intake in schoolchildren

Efeito do dia e do número de dias de aplicação na reprodutibilidade de um questionário de avaliação do consumo alimentar de escolares

Fernanda Machado Perazi[I] iD, Emil Kupek[II] iD, Maria Alice Altenburg de Assis[I] iD,
Luciana Jeremias Pereira[I] iD, Vanessa Guimarães Cezimbra[I] iD, Marina Tissok de Oliveira[I] iD,
Francilene Gracieli Kundradi Vieira[I] iD, Patrícia Faria Di Pietro[I] iD, Patrícia de Fragas Hinnig[I] iD

ABSTRACT: *Introduction:* The Food Intake and Physical Activity of School Children (Web-CAAFE) is an online questionnaire developed to monitor the diet and physical activity of Brazilian schoolchildren. The study aimed to evaluate the effect of the day of the week and the number of applications on Web-CAAFE reproducibility. *Methods:* Schoolchildren in grades 2 to 5 of two municipal schools in Florianópolis (n = 197) filled out the Web-CAAFE twice in the same day, of which 113 filled out the instrument in three non-consecutive days. The analysis was performed using the intraclass correlation (ICC) and logistic regression was used to evaluate the factors associated with poor reproducibility. *Results:* The reproducibility of the questionnaire was significantly lower for children who filled out their consumption mostly on weekends in relation to weekdays (OR = 2.93; p = 0.045), and was significantly better in girls in relation to boys (OR = 0.29; p< 0.001). Higher CCI was observed on the second and third day of Web-CAAFE application in relation to the first day. These results are relevant for planning future studies that use dietary assessment instruments in children, especially on evaluation of their validity and reproducibility. *Conclusions:* The results suggest that at least two days provides acceptable reproducibility results of the Web-CAAFE and that the weekend recall may reduce the reproducibility.

Keywords: Food consumption. Child. Internet. Surveys and questionnaires. Reproducibility of results.

[I]Postgraduate Program in Nutrition, Universidade Federal de Santa Catarina – Florianópolis (SC), Brazil.
[II]Department of Public Health, Universidade Federal de Santa Catarina – Florianópolis (SC), Brazil.
Corresponding author: Patrícia de Fragas Hinnig. Avenida do Campeche, 1.830, bloco 1C, apto. 301, Campeche, CEP: 88063-300, Florianópolis, SC, Brazil. E-mail: phinnig@yahoo.com.br

RESUMO: *Introdução:* O questionário de Consumo Alimentar e Atividade Física de Escolares (*Web*-CAAFE) foi desenvolvido para o monitoramento da dieta e atividade física de escolares brasileiros. Este estudo buscou avaliar o efeito do dia da semana e do número de aplicações na reprodutibilidade do *Web*-CAAFE. *Metodologia:* Escolares do 2º ao 5º ano (n = 197) de Florianópolis preencheram o *Web*-CAAFE por duas vezes no mesmo dia, dos quais 113 o fizeram em três dias não consecutivos. Avaliou-se a reprodutibilidade por meio da correlação intraclasse (CCI) e da regressão logística, para avaliação dos fatores associados à pior reprodutibilidade. *Resultados:* Observaram-se piores resultados de reprodutibilidade para o preenchimento do consumo nos finais de semana em relação àqueles que responderam em dias da semana (*odds ratio* — OR = 2,93; p = 0,045) e melhores resultados em meninas em relação aos meninos (OR = 0,29; p < 0,001). O preenchimento do consumo realizado nos segundo e terceiro dias apresentou melhor reprodutibilidade que o realizado no primeiro. Esses resultados são relevantes para o planejamento de futuros estudos que utilizem instrumentos de consumo alimentar em crianças, em especial sobre avaliação de sua validade e reprodutibilidade. *Conclusões:* Os resultados sugerem que pelo menos dois dias de aplicação do *Web*-CAAFE forneçam resultados aceitáveis de reprodutibilidade, e que o preenchimento referente ao fim de semana pode reduzi-la.

Palavras-chave: Consumo de alimentos. Criança. Internet. Inquéritos e questionários. Reprodutibilidade dos testes.

INTRODUCTION

The development of *online* instruments for the collection of dietary data requires rigorous usability techniques, in addition to studies of validity and reproducibility in the target population, as the goal is to generate high quality data to offer information that subsidize public policies[1]. The quality of data collection implies that there is a high investment of human and financial resources, barriers that have been overcome in recent years because of technological innovations, such as computers, tablets and smartphones[2-5].

The "Food Consumption and Physical Activity of Schoolchildren" (*Consumo Alimentar e Atividades Físicas de Escolares* - Web-CAAFE) questionnaire was developed as a computerized monitoring system for students from the 2nd to the 5th grades of elementary school, and considers the cognitive skills of children aged 7 to 10 years old. Details on the development of the questionnaire, the definition of the included food items, usability tests, the validity and the reproducibility have been described in other publications[6-9]. Web-CAAFE is easy to use in schools that have a computer room and internet, and it can be applied repeatedly to obtain individual data on regular consumption, according to the recommendations regarding the use of multiple 24-hour recalls (R24h)[10].

However, for logistical reasons, the instrument has been administered in a single day, in large-scale surveys conducted in public schools in São Paulo and Florianópolis[11], generating consumption data at the group level. In future surveys, the questionnaire will be applied for at least two days, as it is important to evaluate the reproducibility of the instrument on weekdays and over the weekend. It is necessary to investigate whether reproducibility

improves with the increase in the number of times the instrument is used, considering that new technologies introduce new challenges, including the need for computer skills[1,5].

Periodic reproducibility studies are necessary to help reduce errors in the estimates provided by the instruments[12]. Good reproducibility indicates good precision, and it is also assumed to be a condition of validity[13].

This study was carried out to evaluate the effect of the day of the week and the number of days the questionnaire was applied on the reproducibility of Web-CAAFE. The first hypothesis was that reproducibility would be worse over the weekend, based on the knowledge that it is more difficult to remember foods consumed less often[14]; and the second hypothesis was that the reproducibility would be better with the increase in the number of days the instrument was applied, based on the theory of learning, regarding the use of the tool[3,15].

METHODS

This was a test-retest methodological study. Students from the 2nd to the 5th grades of elementary school from two public schools in Florianópolis (SC) participated in the study. One school from the first tertile of the census sector income of the school location area and another one from the third tertile of 19 eligible schools were randomly selected, with classes from the 2nd to the 5th grades in the morning and afternoon periods. Ten classes were drawn (two from each grade in both periods), with the exception of the 4th and 5th grades, in which three classes were drawn, due to the reduced number of students authorized to participate in the research.

To calculate the sample, the mean intraclass correlation coefficient was considered $r_{icc} = 0.485$, standard deviation of 0.276[7], 20% improvement in reproducibility after the first day of reporting, r_{icc} expected from 0.70[13] and 90% study power, one-tailed hypothesis test, totaling 154 children. Adding 20% to the possible losses, the final sample resulted in 185 children.

The following inclusion criteria were considered: present at school on at least one day of collection, having the signed Free and Informed Consent Form (ICF) and the signed Term of Assent (TA), and not having a pathology referred by the teachers that would prevent them from participating in the study. Of the total of 272 students, 197 participated between September and November 2017 (72.4%). The data collection flowchart is described in Supplementary Figure 1.

This study was approved by the Human Research Ethics Committee of the Universidade Federal de Santa Catarina (UFSC), under the Certificate of Presentation for Ethical Appreciation (*Certificado de Apresentação para Apreciação Ética* - CAAE) No. 63089016.9.0000.0121.

INSTRUMENT

Web-CAAFE is a self-reporting questionnaire regarding food consumption, physical activity and sedentary behaviors from the previous day (http://www.caafe.ufsc.br/public/

uploads_midias / 1381079027.pdf). The Web-CAAFE system was designed based on the researchers' experience in reproducibility and validity studies carried out with the Typical Food and Physical Activity Day (*Dia Típico de Alimentação e Atividade Física* - DAFA) questionnaires[16], Previous Day Food Questionnaire (*Questionário Alimentar do Dia Anterior* - QUADA), versions QUADA-2[17,18] and QUADA-3[19], and Previous Day Physical Activity Questionnaire (*Questionário de Atividade Física do Dia Anterior* - QUAFDA)[20]. Data obtained from epidemiological surveys using the DAFA and QUADA-3[21-24] questionnaires also supported the design of this instrument. Its development involved formative research, which included: a literature review on the existing online instruments, focus groups, meeting with the researchers involved, the presence of a professional specialized in child psycho-pedagogy and information regarding the computer rooms of public schools in the municipal education system of Florianópolis[6,22].

Web-CAAFE is a computerized instrument with audio and it is animated by an avatar (personified object to demonstrate a self-image in virtual environments) that conducts the interview. It is not structured like traditional R24h methods (open questions) or food frequency questionnaires (with various frequency categories that cover more than one day of consumption). The instrument is about remembering the previous day and whether the foods consumed were considered healthy or not.

The food consumption session was divided into six food events (breakfast, morning snack, lunch, afternoon snack, dinner and evening snack). In this session, the avatar asked "What did you eat yesterday?", sequentially, for the six daily meals, each illustrated with the same 31 food/beverage icons, so that the child clicks on the items consumed, allowing the analysis of the daily frequency (zero to six times). The instrument does not specify food quantities and, therefore, does not provide total energy consumption.

To evaluate reproducibility, the same student completed the instrument twice on the same day, with an average interval of two hours between each time. The students were not previously informed about the retest, but they could decline participating in it. The test-retest was carried out on three non-consecutive days (57.4% of the sample), preferably on a weekend (Sunday). Before filling it out, students received standardized instructions from trained researchers. As there was no class on Saturdays or Sundays, it was not possible to obtain data on food consumption for Fridays and Saturdays.

INDEPENDENT VARIABLES

A socioeconomic questionnaire with questions about parents' education and having computer at home was sent to parents or guardians. The mother's education level was used as a proxy of income, since a higher level of education seems to be related to a better socioeconomic level[25]. Schooling was grouped into: 0 to 8 years of study, 9 to 11 years and greater than or equal to 12 years. The presence of a computer was included because the skills that come with its use can improve the usability of Web-CAAFE[5].

Weight and height were collected using standardized techniques[26]. For weight, we used a Marte® portable digital scale model PP 180, with a capacity of up to 180 kg and a precision of 100 g. For height, an AlturaExata® stadiometer was used, with an accuracy of 1 mm. Body mass index (BMI) was classified through the growth curves of the World Health Organization (WHO)[27] and it was defined that children who had a BMI Z score for age ≥ +1 were overweight[27]. The other students were grouped in the category, not overweight

STATISTICAL ANALYSIS

The data was entered in duplicate in the Epi Info program, version 3.5.1. Food consumption data were exported from Web-CAAFE to Excel and analyzed using the Stata program, version 13.0.

To describe the qualitative variables, absolute and relative frequency were used. The children's ages were described by means and standard deviation. To assess reproducibility, the intraclass correlation coefficient (ICC) was used. In this case, the first, second and third days of application of Web-CAAFE refer to the first, second and third visit of the researchers to the school.

In order to verify whether increasing the number of days of application of the questionnaire would improve the ICC, an analysis was conducted with the students who answered three days of Web-CAAFE. For this, the first, second and third days indicate the chronological order in which each child completed it. The ICC values were interpreted as poor (ICC ≤ 0.40), moderate to good (ICC = 0.41 - 0.75) and excellent (ICC> 0.75) reproducibility[28].

Factors associated with reproducibility for the total number of participants were assessed using logistic regression, using the total percentage difference in frequency of all food items consumed for the day between the second and first application as the outcome variable, using the formula Equation 1:

$$\text{Difference\%} = [(\text{sum of items during the 2}^{nd}\text{ application - sum of items during the 1}^{st}\text{ application}) / \text{sum of items during the 1}^{st}\text{ application}] \times 100 \qquad (1)$$

When the child filled it out more than one day, this calculation was performed for each day and, subsequently, the average was calculated. The dependent variable was classified as: above the median of the percentage difference (considered as the worst reproducibility) and below the median (best reproducibility). The independent variables analyzed were sex, age, school period, mother's education, child being overweight, having a computer at home, number of days filling it out, and day of the week it was filled out. The variable "day of the week it was filled out" was classified into three categories:
- majority on weekdays (62.9% of children),
- one day of the week and one on Sunday (24.4%),
- majority on Sundays (12.7%).

The crude analysis was carried out and variables that were associated with a level of significance ≤ 0.20 were included in the adjusted analysis. Age was included, as younger children may find it more difficult to remember the foods they consumed[6,8,29].

RESULTS

A total of 197 students participated in the study, 53.3% were female, 52.8% were 7 to 9 years old (mean = 9.3 years, standard deviation - sd = 1.4 years) and 50.3% were from the evening period. Most students (59.5%) were in the 4th and 5th grades, had a computer at home (54.6%) and completed three days of Web-CAAFE (57.4%). The prevalence of being overweight was 31%, and most mothers had 9 to 11 years of schooling (51.9%). Most questionnaires were completed on weekdays (65.7%). The most consumed food items on weekdays and on Sunday were rice, beans and meats. On Sunday, soft drinks and bread also made up the list of the most consumed items (data not shown). For students who responded to three applications of Web-CAAFE (n = 113), the data show that the items rice, beans, meat, soft drinks, bread and water were among the most consumed (data not shown).

Table 1 describes the ICCs of food items according to the day of completion (day of the week or weekend). The ICC values varied from 0.31 for instant pasta to 0.90 for breads (first day) during the days of week and 0.22 for instant pasta (first day) to 0.85 for bread of cheese (second day) on the weekends. The average ICC values for weekdays was higher than for weekends in the first application, but was similar in the second. Vegetables, eggs, cake, cheese and coffee with milk had significantly higher ICCs on weekdays. On the other hand, juice and breakfast cereal had significantly higher coefficients in the weekend reports. In the second round, the salty snacks and fish items had significantly higher coefficients on weekdays, while for cheese bread and milk, statistically higher coefficients were observed on weekends (Table 1). It was not possible to compare days of the week and weekends on the third day of application, as all of the questionnaires on that day were conducted on weekdays.

Table 2 presents the ICCs of the groups and food items in schoolchildren who completed the Web-CAAFE in the three days, to verify whether the increase in the number of days raised the ICC. The second and third days showed coefficient averages equal to and higher than the first (r = 0.71 *versus* 0.62). The ICCs for sweets, fruits, vegetable soup, juice and vegetables were significantly higher on the second day. The ICC of pizza/hamburger/hot dog, cake, instant pasta, sausages and French fries were significantly higher on the third day (Table 2).

Female students were 71% less likely to belong to the group with the worst reproducibility when compared to male students (odds ratio - OR =0.29; 95% confidence interval — 95%CI 0.16; 0.53). A higher chance of worse reproducibility was observed in the questionnaires of children who completed the majority consumption on weekends compared to the days of the week (OR = 2.93; 95%CI 1.02; 8.41) (Table 3).

Table 1. Reproducibility test-retest of food items according to the day of the week in schoolchildren from 7 to 13 years old. Florianópolis, 2017.*

Items	First day (n = 176)		Second day (n = 167)	
	Weekday (n = 97) ICC (95%CI)	Sunday (n = 78) ICC (95%CI)	Weekday (n = 86) ICC (95%CI)	Sunday (n = 81) ICC (95%CI)
Salty Snacks	0.70 (0.57 – 0.80)	0.41 (0.22 – 0.60)	**0.64 (0.51 – 0.78)**	**0.24 (0.03 – 0.45)**
Fish	0.50 (0.34 – 0.65)	0.56 (0.40 – 0.71)	**0.84 (0.78 – 0.91)**	**0.49 (0.32 – 0.65)**
Pizza	0.55 (0.41 – 0.70)	0.50 (0.33 – 0.67)	0.45 (0.26 – 0.63)	0.53 (0.38 – 0.69)
Sweets	0.50 (0.35 – 0.65)	0.31 (0.11 – 0.52)	0.73 (0.62 – 0.84)	0.66 (0.54 – 0.78)
Meat	0.70 (0.60 – 0.80)	0.64 (0.51 – 0.77)	0.72 (0.61 – 0.83)	0.74 (0.64 – 0.84)
Fruits	0.68 (0.60 – 0.79)	0.48 (0.31 – 0.66)	0.73 (0.62 – 0.83)	0.81 (0.73 – 0.88)
Soft drinks	0.76 (0.68 – 0.85)	0.73 (0.62 – 0.83)	0.72 (0.61 – 0.83)	0.68 (0.56 – 0.79)
Mashed potatoes	0.64 (0.52 – 0.80)	0.38 (0.20 – 0.57)	0.62 (0.48 – 0.76)	0.59 (0.45 – 0.73)
Legumes	**0.82 (0.75 – 0.90)**	**0.35 (0.15 – 0.54)**	0.69 (0.57 – 0.81)	0.73 (0.64 – 0.83)
Eggs	**0.70 (0.60 – 0.81)**	**0.33 (0.13 – 0.53)**	0.72 (0.61 – 0.83)	0.76 (0.67 – 0.85)
Instant Pasta	0.31 (0.12 – 0.50)	0.22 (0.01 – 0.44)	0.78 (0.70 – 0.87)	0.81 (0.73 – 0.88)
Vegetables	0.61 (0.49 – 0.74)	0.53 (0.37 – 0.69)	0.76 (0.67 – 0.86)	0.57 (0.42 – 0.71)
Pasta	0.60 (0.47 – 0.73)	0.34 (0.14 – 0.54)	0.73 (0.62 – 0.83)	0.69 (0.57 – 0.80)
Farofa (Fried flour)	0.54 (0.40 – 0.70)	0.60 (0.46 – 0.74)	0.70 (0.58 – 0.81)	0.61 (0.48 – 0.75)
Sausages	0.60 (0.44 – 0.71)	0.73 (0.63 – 0.84)	0.62 (0.48 – 0.76)	0.55 (0.40 – 0.70)
Chocolate milk	0.58 (0.44 – 0.71)	0.63 (0.50 – 0.80)	0.82 (0.74 – 0.89)	0.76 (0.67 – 0.85)
Juice	**0.44 (0.27 – 0.60)**	**0.71 (0.61 – 0.82)**	0.75 (0.65 – 0.85)	0.79 (0.71 – 0.87)
Beans	0.80 (0.73 – 0.87)	0.84 (0.77 – 0.90)	0.72 (0.61 – 0.83)	0.80 (0.73 – 0.88)
Cake	**0.66 (0.55 – 0.77)**	**0.30 (0.10 – 0.51)**	0.56 (0.40 – 0.72)	0.73 (0.62 – 0.83)
French fries	0.47 (0.31 – 0.63)	0.61 (0.47 – 0.75)	0.55 (0.39 – 0.71)	0.53 (0.37 – 0.68)
Cream cookies	0.76 (0.67 – 0.84)	0.80 (0.71 – 0.90)	0.47 (0.29 – 0.65)	0.63 (0.50 – 0.76)
Breads	0.90 (0.82 – 0.92)	0.73 (0.63 – 0.84)	0.69 (0.56 – 0.81)	0.79 (0.71 – 0.87)
Breakfast cereal	**0.48 (0.32 – 0.63)**	**0.75 (0.65 – 0.85)**	0.65 (0.51 – 0.78)	0.70 (0.59 – 0.81)
Yoghurt	0.74 (0.65 – 0.83)	0.63 (0.50 – 0.76)	0.59 (0.44 – 0.74)	0.64 (0.52 – 0.77)
Cheese	0.78 (0.71 – 0.86)	0.44 (0.26 – 0.62)	0.83 (0.76 – 0.90)	0.62 (0.49 – 0.76)
Rice	0.72 (0.62 – 0.82)	0.72 (0.61 – 0.83)	0.81 (0.73 – 0.89)	0.64 (0.51 – 0.77)
Water	0.70 (0.60 – 0.80)	0.62 (0.50 – 0.76)	0.71 (0.59 – 0.82)	0.77 (0.69 – 0.86)
Vegetable soup	0.38 (0.20 – 0.56)	0.58 (0.43 – 0.73)	0.51 (0.34 – 0.68)	0.66 (0.54 – 0.78)
Coffee with Milk	0.83 (0.77 – 0.89)	0.60 (0.44 – 0.74)	0.82 (0.74 – 0.89)	0.82 (0.75 – 0.89)
Cheese bread	0.53 (0.39 – 0.68)	0.68 (0.56 – 0.80)	**0.56 (0.40 – 0.71)**	**0.85 (0.79 – 0.91)**
Milk	0.66 (0.55 – 0.77)	0.58 (0.43 – 0.73)	**0.49 (0.31 – 0.66)**	**0.78 (0.70 – 0.86)**
Average	**0.63**	**0.56**	**0.68**	**0.68**

*The values in bold indicate a statistically significant difference between the intraclass correlation coefficients (ICC) presented on weekdays and weekends; CI95%: 95% confidence interval.

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Table 2. Reproducibility test-retest of food items in schoolchildren aged 7 to 13 years old with three non-consecutive days (n = 113). Florianópolis, 2017.*

Food items	Applications		
	1st ICC (95%CI)	2nd ICC (95%CI)	3rd ICC (95%CI)
Meat	0.72 (0.63 – 0.81)	0.73 (0.65 – 0.82)	0.75 (0.67 – 0.83)
Sweets	**0.52 (0.38 – 0.65)**	**0.74 (0.66 – 0.83)**	0.73 (0.64 – 0.81)
Fruits	**0.58 (0.46 – 0.71)**	**0.82 (0.76 – 0.88)**	0.66 (0.56 – 0.77)
Pizza	**0.52 (0.40 – 0.65)**	**0.55 (0.42 – 0.70)**	**0.84 (0.78 – 0.89)**
Fish	0.70 (0.60 – 0.80)	0.56 (0.44 – 0.70)	0.66 (0.55 – 0.76)
Salty snacks	0.66 (0.56 – 0.77)	0.55 (0.42 – 0.68)	0.73 (0.65 – 0.82)
Chocolate milk	0.62 (0.50 – 0.73)	0.77 (0.69 – 0.84)	0.72 (0.63 – 0.81)
Water	0.70 (0.60 – 0.79)	0.79 (0.71 – 0.86)	0.72 (0.63 – 0.81)
Rice	0.75 (0.67 – 0.83)	0.80 (0.73 – 0.87)	0.80 (0.7 – 0.87)
French fries	0.55 (0.42 – 0.70)	**0.47 (0.35 – 0.63)**	**0.73 (0.64 – 0.81)**
Cream cookies	0.82 (0.76 – 0.88)	0.60 (0.46 – 0.71)	0.72 (0.64 – 0.81)
Cake	**0.50 (0.34 – 0.64)**	0.70 (0.60 – 0.78)	**0.82 (0.76 – 0.88)**
Coffee with Milk	0.78 (0.71 – 0.85)	0.82 (0.75 – 0.90)	0.76 (0.68 – 0.84)
Breakfast cereal	0.63 (0.51 – 0.74)	0.66 (0.56 – 0.77)	0.54 (0.41 – 0.67)
Sausages	0.67 (0.57 – 0.80)	**0.59 (0.47 – 0.71)**	**0.82 (0.76 – 0.88)**
Farofa (Fried flour)	0.60 (0.46 – 0.71)	0.67 (0.57 – 0.77)	0.77 (0.70 – 0.85)
Beans	0.84 (0.79 – 0.90)	0.80 (0.72 – 0.86)	0.80 (0.72 – 0.86)
Yoghurt	0.57 (0.45 – 0.70)	0.68 (0.60 – 0.79)	0.77 (0.69 – 0.84)
Legumes	0.60 (0.50 – 0.72)	0.80 (0.71 – 0.85)	0.69 (0.60 – 0.78)
Milk	0.71 (0.62 – 0.80)	0.73 (0.65 – 0.82)	0.69 (0.60 – 0.79)
Instant Pasta	**0.27 (0.10 – 0.45)**	0.74 (0.66 – 0.83)	**0.83 (0.77 – 0.90)**
Pasta	0.66 (0.55 – 0.76)	0.79 (0.72 – 0.86)	0.72 (0.63 – 0.81)
Eggs	0.70 (0.59 – 0.80)	0.80 (0.73 – 0.87)	0.76 (0.70 – 0.84)
Breads	0.80 (0.73 – 0.89)	0.75 (0.67 – 0.83)	0.75 (0.66 – 0.83)
Cheese bread	0.64 (0.53 – 0.75)	0.74 (0.66 – 0.82)	0.72 (0.63 – 0.81)
Mashed potatoes	0.42 (0.27 – 0.58)	0.66 (0.56 – 0.77)	0.66 (0.56 – 0.77)
Soft drinks	0.76 (0.69 – 0.84)	0.77 (0.70 – 0.85)	0.57 (0.45 – 0.70)
Vegetable soup	**0.28 (0.11 – 0.45)**	**0.65 (0.55 – 0.76)**	0.40 (0.25 – 0.56)
Juice	**0.56 (0.44 – 0.69)**	**0.78 (0.71 – 0.86)**	0.55 (0.42 – 0.70)
Cheese	0.65 (0.54 – 0.76)	0.70 (0.61 – 0.80)	0.79 (0.72 – 0.86)
Vegetables	**0.45 (0.30 – 0.60)**	**0.70 (0.61 – 0.80)**	0.58 (0.46 – 0.70)
Average	**0.62**	**0.71**	**0.71**

*The values in bold indicate a statistically significant difference between the intraclass correlation coefficients (ICC) presented on the different days the instrument was applied; CI95%: 95% confidence interval.

Table 3. Factors associated with the worst reproducibility of food consumption via the Food Consumption and Physical Activity questionnaire of Schoolchildren (*Web*-CAAFE - *Consumo Alimentar e Atividade Física de Escolares*) in schoolchildren aged 7 to 13 years old. Florianópolis, 2017.

Variables	N	OR* adjusted	95%CI	p
Sex				
Male	92	1.0		
Female	105	0.29	0.16; 0.53	< 0.001
Age (years)				
7 to 9	104	1.0		
10 to 13	93	0.78	0.42; 1.44	0.426
Number of days it was filled out				
1	19	1.0		
2	65	1.40	0.37; 5.34	0.618
3	113	0.73	0.22; 2.36	0.595
The day of the week it was filled out				
Mostly on weekdays	124	1.0		
One filled out on a weekday and one on Sunday	48	0.77	0.29; 2.07	0.601
Mostly on Sunday	25	2.93	1.02; 8.41	0.045

*logistic regression adjusted by sex, age, number of days completed and day of the week completed; OR: odds ratio; CI95%: 95% confidence interval.

The variables school period, mother's schooling, being overweight and having a computer at home were not associated with the worst reproducibility in the crude analysis (p > 0.2) and, therefore, were not included in the multivariate analysis (data not shown).

DISCUSSION

The day of the week of applying Web-CAAFE had an effect on reproducibility, both from ICC values and from the regression analysis. Worse results were obtained for filling it out on weekends in relation to the days of the week. This result confirms the first hypothesis of the study, considering that the literature describes that normal dietary foods, which are more often consumed on days of the week, are recalled more easily than foods consumed more irregularly on weekends, which usually vary widely in consumption[14,29,30]. Foods such as rice and beans, typical of the Brazilian diet[31], showed excellent reproducibility results regardless of the day of the week evaluated.

Reproducibility was also worse for boys compared to girls, which is in line with other studies that showed that girls produced more reproducible food consumption reports[32-35] and that, in relation to validity, boys are more likely to omit what they eat[36,37]. In the validity analysis of the Web-CAAFE in Feira de Santana, there were no differences in the probabilities of correctness, omission and intrusion in relation to sex[9].

In the present study, higher ICC values were observed in the second and third days of completion compared to the first, reinforcing the hypothesis that reproducibility improved after at least two days of filling out the questionnaire, suggesting that memory and learning have an effect in the use of the instrument[38]. Few studies have been published on the effect of the number of application days on the evaluation of reproducibility of methods for assessing food consumption in the age group from 7 to 10 years old. Published studies point to better results of reproducibility and validity the more days there are of reporting[15,38]. A study conducted with African adolescents suggested that four R24h would be sufficient to provide better reproducibility results[15]. Another study conducted with American 4th graders showed better validity results on the third day of reporting, when compared to the first.

Better ICC results were observed on the second day when compared to the first day for filling out the fruits, vegetables and legumes, which is in agreement with the study conducted in Feira de Santana, which indicated a higher probability of correctness in relation to these foods in the second completion of the *Web-CAAFE* (retest)[9]. A study on the reproducibility and validity of a computerized R24h conducted with American children aged 9 to 11 years observed an overestimation on the consumption report the first time versus the second[3].

In general, moderate to good reproducibility was observed for most food items. Lower reproducibility results of computerized instruments were observed in the United Kingdom and Canada[4,5]. The reproducibility of a computerized instrument (Myfood24) with English adolescents aged 11 to 18 years old showed CCI results ranging from 0.27 for vegetables to 0.54 for fruits[5]. The reproducibility of the Web-Survey of Physical Activity and Nutrition (Web-SPAN) was analyzed in Canadian schoolchildren aged 11 to 15 years old and the results showed ICC values ranging from 0.37 to 0.64 for the nutrients evaluated[4].

In the reproducibility study of the Synchronized Nutrition and Activity Program (SNAP™) conducted with English schoolchildren aged 7 to 15 years old, good reproducibility was observed for the groups of fruits, sweets and snacks in the meals held at school. However, the averages observed between applications for the three food groups in the total daily meals were statistically different, and therefore not reproducible[3]. In the present study, although the analysis used is different, good reproducibility was observed for the fruits, sweets and pizza / hamburger / hot dogs (ICC = 0.60 – 0.67). Nevertheless, when analyzing the reproducibility between weekdays and weekends, low reproducibility for sweets (ICC = 0.31) and moderate reproducibility for fruits (ICC = 0.67) were observed on a weekend day; and moderate for pizza / hamburger / hot dogs on weekdays (ICC = 0.45).

Among the limitations of the present study, it is worth mentioning that not all participants were included in the analyses considering the three days of application, because some students were absent on some days when the instrument was applied. This fact may have influenced the results due to the loss of statistical power, mainly due to the reduction in the number of weekend days analyzed. In addition, 19% of the participants in the present study completed Web-CAAFE only on weekdays due to logistical difficulties and scheduling with participating schools. It is worth noting that the validity of the completion of the test and retest is unknown, because no reference method was used (e.g., direct observation of food). This type of study, using the *Web*-CAAFE, was previously conducted in Feira de Santana[9].

This is the first study that evaluated the joint effect of the day of the week and the number of days of application on the reproducibility of a food consumption assessment instrument. Its results are relevant for the planning of future large-scale studies with online instruments for children, and brings complementary knowledge in nutritional epidemiology, especially for the evaluation of validity and reproducibility of these resources.

CONCLUSION

The results showed that:
- Web-CAAFE showed moderate to good reproducibility for most food items;
- reproducibility was higher in weekday applications;
- the second and third days resulted in better reproducibility based on the ICC assessment;
- girls showed better reproducibility.

The results suggest the need to apply at least two days of Web-CAAFE to ensure better reproducibility results. Although completing the application on the weekend is less reproducible, it is recommended that the information on food consumption for that day be evaluated. It is suggested that the researcher, before applying the instrument, place the child in the context of the weekend, besides offering the standardized guidance already provided before the application of the questionnaire, to facilitate the recall of the consumption of food consumed in an episodic way. Future studies are needed in private schools, with students of better socioeconomic status, in order to verify the consistency of the results of worse reproducibility over the weekend.

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