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ORIGINAL ARTICLE / *ARTIGO ORIGINAL*

Consistency evaluation of values of weight, height, and body mass index in Food Intake and Physical Activity of School Children: the quality control of data entry in the computerized system

Avaliação da consistência de valores de peso, altura e índice de massa corporal no questionário Consumo Alimentar e Atividade Física de Escolares: o controle da qualidade da entrada de dados no sistema

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ABSTRACT: ***Introduction:*** The quality control of data entry in computerized questionnaires is an important step in the validation of new instruments. The study assessed the consistency of recorded weight and height on the Food Intake and Physical Activity of School Children (Web-CAAFE) between repeated measures and against directly measured data. ***Methods:*** Students from the 2nd to the 5th grade (n = 390) had their weight and height directly measured and then filled out the Web-CAAFE. A subsample (n = 92) filled out the Web-CAAFE twice, three hours apart. The analysis included hierarchical linear regression, mixed linear regression model, to evaluate the bias, and intraclass correlation coefficient (ICC), to assess consistency. Univariate linear regression assessed the effect of gender, reading/writing performance, and computer/internet use and possession on residuals of fixed and random effects. ***Results:*** The Web-CAAFE showed high values of ICC between repeated measures (body weight = 0.996, height = 0.937, body mass index – BMI = 0.972), and regarding the checked measures (body weight = 0.962, height = 0.882, BMI = 0.828). The difference between means of body weight, height, and BMI directly measured and recorded was 208 g, -2 mm, and 0.238 kg/m², respectively, indicating slight BMI underestimation due to underestimation of weight and overestimation of height. This trend was related to body weight and age. ***Conclusion:*** Height and weight data entered in the Web-CAAFE by children were highly correlated with direct measurements and with the repeated entry. The bias found was similar to validation studies of self-reported weight and height in comparison to direct measurements.

Keywords: Surveys and questionnaires. Body height. Body weight. Body mass index. Child. Adolescent.

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RESUMO: ***Introdução:*** O controle da qualidade da entrada de dados em questionários informatizados é etapa importante na validação de novos instrumentos. Este estudo avaliou a consistência de registros de peso e altura no Questionário Consumo Alimentar e Atividade Física de Escolares (Web-CAAFE) entre aplicações repetidas e contra dados aferidos. ***Métodos:*** Escolares do 2º ao 5º ano (n = 390) tiveram peso e altura aferidos e, em seguida, preencheram o Web-CAAFE. Uma subamostra (n = 92) completou o instrumento 2 vezes com 3 horas de intervalo. A análise incluiu regressão linear hierárquica, modelo misto de regressão linear, para avaliar vieses, e coeficiente de correlação intraclasse (CCI), para verificar a consistência dos dados. A regressão linear univariada avaliou o impacto de: sexo; desempenho na leitura/escrita; e posse e uso de computador/internet nos resíduos dos efeitos fixos e randômicos. ***Resultados:*** O Web-CAAFE exibiu valores altos de CCI entre aplicações repetidas (peso = 0,996, altura = 0,937, índice de massa corporal – IMC = 0,972) e com relação às medidas aferidas (peso = 0,962, altura = 0,882, IMC = 0,828). A diferença entre as médias de peso, altura e IMC aferidos e digitados foi de 208 g, -2 mm e 0,238 kg/m², respectivamente, indicando leve subestimação do IMC em razão da subestimação do peso e da superestimação da altura. Essa tendência relacionou-se ao peso corporal e à idade. ***Conclusão:*** Peso e altura digitados no Web-CAAFE foram fortemente correlacionados com medidas diretas e digitação repetida. O viés encontrado foi similar ao relatado em estudos de validação de instrumentos de autorrelato de peso e altura comparados a medidas diretas.

Palavras-chave: Inquéritos e questionários. Estatura. Peso corporal. Índice de massa corporal. Criança. Adolescente.

INTRODUCTION

The search for the development of questionnaires applied by using computers in epidemiological studies is growing. There are instruments addressed to children and adolescents, aiming at assessing dietary intake[1-5], physical activity[6], or multiple constructs, including nutritional status based on body mass index (BMI)[7-10].

Computerized questionnaires have advantages in comparison to traditional printed tools, since they reduce the costs with the reproduction of forms, allow obtaining data from large samples in several locations, simultaneously[11] and reduce potential biases[12] by eliminating the data entry stage[13] and by providing more anonymity and privacy for the participant[14,15].

The Questionnaire Dietary Intake and Physical Activity of Students (Web-CAAFE)[16] was carried out for a monitoring system focusing on dietary intake and physical activities of students aged from 7 to 10 years.

In studies conducted with students from the public elementary school in Florianópolis, Santa Catarina, the Web-CAAFE had proper usability[17] and validity in the evaluation of food intake[18], and it also proved to be a viable instrument to evaluate the fulfillment of nutritional recommendations[19]. The instrument also had the proper validity and reproducibility in the evaluation of physical activities and dietary intake of students in Feira de Santana, Bahia[20,21].

In the conception of Web-CAAFE, fields to fill out weight and height were also included to provide data to calculate the BMI and the diagnosis of nutritional status, by age and sex, using the reference curve from the World Health Organization (WHO)[22]. Aiming at providing information for a monitoring system, the recommendation is that the quality

control regarding weight and height data be conducted by trained professionals, both in entry and in data[13].

The objective of this study was to assess the consistency of weight and height data typed in Web-CAAFE, as well as the calculated BMI, compared to the measures checked and the repeated entry, providing information for quality control in data entry in the computerized system.

METHODS

The study to assess the validity and reproducibility of Web-CAAFE among students from elementary school was conducted from May to August, 2014, in the city of Feira de Santana, Bahia (Northeast Brazil). The study included the validation of the physical activity[20] and dietary intake sections[21] in Web-CAAFE. This study focused on assessing the quality of entry of weight and height data. The consistency of data was evaluated according to age, sex, academic performance and use of computers and internet.

This was a convenience sample, composed of all students from the 2nd to the 5th grades in a public, part-time school, from the state education network from Feira de Santana, Bahia. The school was selected because it met the research protocol (being a public elementary school, having the approval of the director and professors to collaborate in the evaluation of performance of the students, having a computer room, with access to internet and school meals). The target-audience to use the Web-CAAFE included students from the 2nd to the 5th grades of elementary school, because the instrument was built based on the cognitive skills of children aged between seven and ten years. In the school selected the age group of the students from the 2nd to the 5th grades ranges from 7 to 15 years.

Sample size was calculated based on a previous study conducted to validate the instrument of dietary intake for students[23], with the following parameters: expected sensitivity of 75%, margin of error of 20% for the lower limit of this sensitivity, and prevalence of 50%, therefore obtaining a minimum sample of 124 children[24].

The study was approved by the Research Ethics Committee of Universidade Estadual de Feira de Santana – CEP/UEFS (CAAE: 19499913.3.0000.0053). Participants obtained a written authorization from the tutors and signed an assent form.

In the first stage of the study, all participants took anthropometric measurements and filled out the Web-CAAFE questionnaire afterwards. The anthropometric measurements were taken in the computer room of the school, before the children used the computers, and the height and body weight values were written on a label attached to the class diary of the students for consultation (without decimal points for body weight and only two for height).

A sub-sample of 93 students was selected randomly among those who concluded the first stage, and their height and weight were measured again. On the next day, the students filled out the Web-CAAFE twice, once in the beginning of the school shift, and again at the end. The values of height and weight were also written in the class diaries, and consultation

was allowed during the filling out of the Web-CAAFE. The interval in-between the repeated entry was three hours, considering the part time stay at school of approximately five hours in each shift (morning or afternoon). Therefore, two direct measurements of weight and height were taken, and there were three entries of these measurements in Web-CAAFE for each child participating in both stages of the study.

The sub-sample size was calculated based on the mean (33.3 kg) and on the standard deviation (SD) of weight (11.46) in the validity stage. The sample was calculated considering the following parameters:

1. Expectation of the mean difference between stages equal to zero, and SD equal to 11.46 kg;
2. Sampling size sufficient to detect a 10% difference in the initial mean (33.3 kg) or more.

The errors of types I (alpha) and II (beta) were established at 0.05 and 0.20, respectively. Therefore, the sample size for the second stage of the study was 93.

The anthropometric measurements were taken by a team of trained researchers, according to the standards in the literature[25]. Body weight was measured with a digital scale (accuracy of 100 g and maximum capacity of 180 kg, from Wiso®, model Ultra Slim W801). To measure height, a portable, collapsible stadiometer was used, with platform and square (213 cm of maximum height and 0.1 cm of accuracy, from Altura Exata®). The weight was measured while the children were barefoot, and wearing the school uniform. Height was measured with the children barefoot, without ornaments on the head and aligned with the Frankfurt plan.

The performance at reading and writing was assessed by the teacher in charge of the class, using a form containing a hedonic scale (0 = very poor, 1 = poor, 2 = regular, 3 = good, 4 = excellent). The criteria established for the evaluation of the reading were: fluency, intonation in paragraphs, punctuation, recognition of the theme and explicit information in the text, and identification of linguistic marks that show the speaker and interlocutor. For the performance in writing, the following items was considered: knowledge of small and capital letters, distinction of homorganic consonants, domain of the writing of the works influenced by the characteristics of speech, application of orthography rules regarding the signaling of nasalization, and ability to write the words, sentences and texts correctly.

To assess the experience of each child with the use of computers and the internet, the following questions were asked:

1. "Do you have a computer (or notebook) in your house?";
2. "Is there internet in the computer (or notebook) in your house?";
3. "Do you use the computer (or notebook) in your house?".

STATISTICAL ANALYSIS

For the variables in continuous scale and without normal distribution, the analysis included the description of the sample by using the median and minimum and maximum

values, the relative frequency of categorical variables (%) and the hierarchic linear regression with three levels: student, method (measures and entry in Web-CAAFE) and repetition for both methods. To assess the biases in the records of Web-CAAFE, besides the fixed effect for the difference between methods, the regression considered the repetition of measurements and their interaction with methods such as random effects.

The intraclass correlation coefficient (ICC) was calculated to assess the reliability of the records in repeated entries in Web-CAAFE, and to assess the correlation between the measurements and the records in the questionnaire.

The ICC for the reliability of the records in repeated entries was calculated as the squared root of the variance between the direct measurement and the entry in Web-CAAFE, divided by adding that to the variance between the repeated entries. The ICC between methods was determined with the same numerator, however, excluding the variance between the subjects of the previous denominator. The model parameters, including the standard error and the corresponding 95% confidence interval (95%CI) values, were estimated by the maximum-likelihood estimation.

The analyses excluded the records of body weight and height from Web-CAAFE as follows:

1. When it exceeded the amplitude of the measured values; and
2. When it was outside the interval of $\overline{X} \pm 3$ SD of the population of reference[22] for each age range of the students, since in a routine application of Web-CAAFE, like a monitoring system, there might not be measurements to assess its accuracy.

This procedure was adopted to eliminate the extreme, biologically implausible values of body weight and height, which would affect the analyses.

The impact of gender, school performance in reading/writing, possession and use of a computer/internet at home on the residuals of the fixed and random effects was assessed by using the univariate linear regression, after the hierarchical analysis. The relationship between the residue and the outcomes – body weight and height registered in Web-CAAFE and BMI calculated based on these measurements – was assessed graphically. The hypothesis tests were conducted considering the significance of p = 5%.

The body weight and height values measured in the two stages among the children in the sub-sample were compared with the Student's t-test.

RESULTS

Of a total of 453 students, 416 accepted to participate and received an authorization from parents or tutors. Of these, 390 completed the first stage of the study [mean age (years) ± DP = 9.53 ± 1.53 years; 50.3% girls]. The sub-sample of the second stage resulted on valid data of 92 students (9.39 ± 1.41 years; 51.1% girls).

In the sample of the first stage of the study, there was balance between the proportions of students as to gender, school year and age, showing 13.8% of students who were older

in relation to the school year (11 – 15 years of age). Very poor and poor performances were observed in reading and writing in 28.2 and 24.2% of the sample, respectively. Almost 2/3 of the students claimed to own a computer in their household, however, less than half of

Table 1. Characteristics of the participants.

Variable	Sample†	Sub-sample‡
	n (%)	n (%)
Age (years)		
7	72 (18.4)	17 (18.5)
8	73 (18.6)	18 (19.6)
9	97 (24.7)	27 (29.3)
10	96 (24.5)	19 (20.7)
11	32 (8.2)	7 (7.6)
12 – 15	22 (5.6)	4 (4.3)
Reading performance[a]		
Very poor	14 (9.2)	2 (5.4)
Poor	29 (19.0)	5 (13.5)
Regular	52 (34.0)	14 (37.8)
Good	39 (25.5)	12 (32.4)
Excellent	19 (12.4)	4 (10.8)
Writing performance[a]		
Very poor	14 (9.2)	3 (8.1)
Poor	23 (15.0)	4 (10.8)
Regular	46 (30.1)	10 (27.0)
Good	57 (37.3)	15 (40.5)
Excellent	13 (8.5)	5 (13.5)
Having a computer in the household[b]		
No	138 (36.5)	31 (34.4)
Yes	240 (63.5)	59 (65.6)
Accessing the internet in the household[b]		
No	174 (46.0)	43 (47.8)
Yes	204 (54.0)	47 (52.2)
Using a computer in the household[b]		
No	168 (44.4)	34 (37.8)
Yes	210 (55.6)	56 (62.2)

†Sample in the first stage (n = 390); ‡Sub-sample in the second stage (n = 92); [a]n = 153 in the first stage and n = 37 in the second stage; [b]n = 378 in the first stage and n = 90 in the second stage.

them used it or had access to the internet (Table 1). The characteristics of the sub-sample were similar. Table 2 presents median, maximum and minimum body weight, height and BMI values of the students, according to sex and age.

Table 2. Values of body weight, height and body mass index measured and registered by students in the Questionnaire Dietary Intake and Physical Activity of Students.

Variables	Direct measurements					
	Weight (kg)		Height (m)		BMI (kg/m^2)	
	n	Median[a] (min. – max.)	n	Median[a] (min. – max.)	n	Median[a] (min. – max.)
Sex						
Male	239	33 (20 – 68)	239	1.38 (1.09 – 1.83)	239	17.1 (12.2 – 30.4)
Female	243	32 (17 – 69)	243	1.35 (1.03 – 1.65)	243	17.36 (11.2 – 31.6)
Age (years)						
7	87	26 (17 – 44)	87	1.25 (1.03 – 1.45)	87	16.16 (12.8 – 28.2)
8	92	29 (19 – 61)	92	1.30 (1.04 – 1.45)	92	17.67 (13.7 – 31.6)
9	124	33 (21 – 59)	124	1.37 (1.23 – 1.54)	124	17.27 (13.0 – 24.9)
10	115	35 (23 – 65)	115	1.43 (1.14 – 1.62)	115	17.22 (11.2 – 30.4)
11	39	37 (27 – 66)	39	1.48 (1.33 – 1.63)	39	18.02 (13.7 – 28.2)
12 – 15	25	46 (26 – 69)	25	1.54 (1.22 – 1.83)	25	17.97 (13.6 – 31.5)
Web-CAAFE						
Sex						
Male	227	33 (20 – 66)	198	1.39 (1.10 – 1.65)	184	17.57 (12.2 – 31.9)
Female	231	32 (20 – 68)	217	1.36 (1.04 – 1.65)	203	17.57 (11.4 – 43.8)
Age (years)						
7	68	27 (20 – 54)	48	1.24 (1.07 – 1.40)	40	17.51 (14.1 – 28.8)
8	78	29.5 (20 – 60)	78	1.30 (1.04 – 1.44)	71	18.11 (13.9 – 31.6)
9	128	33 (21 – 59)	122	1.37 (1.22 – 1.54)	114	17.46 (13.2 – 30.9)
10	118	34 (23 – 68)	103	1.42 (1.19 – 1.58)	101	17.08 (11.4 – 31.0)
11	42	38 (27 – 62)	40	1.47 (1.10 – 1.63)	39	18.09 (17.7 – 43.8)
12 – 15	24	46 (26 – 68)	24	1.53 (1.23 – 1.65)	22	18.03 (13.6 – 30.2)

BMI: body mass index; Web-CAAFE: Questionnaire Dietary Intake and Physical Activity of Students; [a]Values calculated based on the sum of all repeated measurements, with 390 individuals recorded in the Web-CAAFE and one measurement in the first stage of the study, and 92 individuals with two records in Web-CAAFE and one measurement in the second stage (n = 482).

There was no difference in the measurements of body weight (-1.01 kg; 95%CI -3.52 – 1.49) and height (-6.07 cm; 95%CI -2.88 – 0.31) measured between the two stages of the study for the children in the sub-sample.

Body weight and height typed in the Web-CAAFE and the resulted BMI presented ICC values higher than 0.90 for reliability (Table 3). The correlation between records in Web-CAAFE and the measurements was strong, higher for body weight (> 0.95) and a bit lower for height and BMI (> 0.80).

The difference between the mean values (bias) of body weight recorded in Web-CAAFE and measured was 677 g, that is, 2.0% (95%CI -0.5 – 4.6%) of the measurement (Table 3). The corresponding differences for height and BMI were 1 cm or 0.73% (95%CI 0.0 – 1.46%) and 0.39 kg/m² or 2.11% (95%CI -0.11 – 4.49%), respectively.

However, these differences did not include the random variation of the measurements, which needs to be considered to calculate the bias attributed to Web-CAAFE. With such an adjustment, the mean bias in body weight, height and BMI records made in Web-CAAFE decreased to 208 g, 2 mm and 0.238 kg/m², respectively. Therefore, the biases attributed to Web-CAAFE indicated a mild underestimation of BMI as a consequence of the underestimation of body weight and the overestimation of height. The residuals of the random effects among students represented a summary effect of the factors that influenced the records of body weight in Web-CAAFE, but were absent from the model. The residuals were related with the students' age and with the quartiles of body weight and height typed into the Web-CAAFE (data not shown), and BMI resulting from these measurements. The negative residue meant the underestimation of BMI resulting from the typed weight and height, and the positive results indicated the overestimation.

The students with lower BMI indexes calculated based on measured weight and height (1st quartile) were prone to the underestimation of BMI, based on the data registered in

Table 3. Consistency of values of body weight, height and body mass index recorded in the Questionnaire Dietary Intake and Physical Activity of Students.

Parameters	Outcomes		
	Weight (kg)	Height (m)	BMI (kg/m²)
Measured values	33.84 (32.99; 34.69)	1.36 (1.35; 1.37)	18.05 (17.73; 18.36)
Values registered in Web-CAAFE	34.53 (33.68; 35.39)	1.37 (1.36; 1.38)	18.44 (18.03; 18.86)
Bias[a] attributable to the record in Web-CAAFE	0.208 (-0.032; 0.449)	-0.002 (-0.006; 0.002)	0.238 (0.028; 0.448)
ICC[b] (applications repeated in Web-CAAFE)	0.996	0.937	0.972
ICC[b] (records in Web-CAAFE *versus* measurements)	0.962	0.882	0.828

BMI: Body Mass Index; Web-CAAFE: Questionnaire Dietary Intake and Physical Activity of Students; [a]Difference between the measured values and those registered in Web-CAAFE; [b]intraclass correlation coefficient

Web-CAAFE, whereas those with higher values (4th quartile) had a strong tendency of overestimation, especially the older ones (Figure 1).

There was no statistically significant association between random residuals and gender, school performance of reading/writing, possession and use of a computer, as well as internet in the household, in the univariate linear regression analyses (details not shown).

The correlation between the residuals of the fixed effects and the outcome variables was close to zero (details not shown). The same relation was observed with the variables of the univariate analyses. However, the residuals of the random effects presented a linear relation with the outcome variables and the age of the children.

The magnitude and variation of random residuals increased with the second entry in Web-CAAFE, and reduced in the third entry. For weight, the means were -24 g (95%CI -33 – -16 g), 96 g (95%CI 66 – 127 g) and 10 g (95%CI -14 – 35 g), respectively, in the first, second and third entries. For height, the means obtained in these entries were, in the same order, -2 mm (95%CI -3 – 1 mm), 6 mm (95%CI 4 – 8 mm) and 2 mm (95%CI -1 – 6 mm).

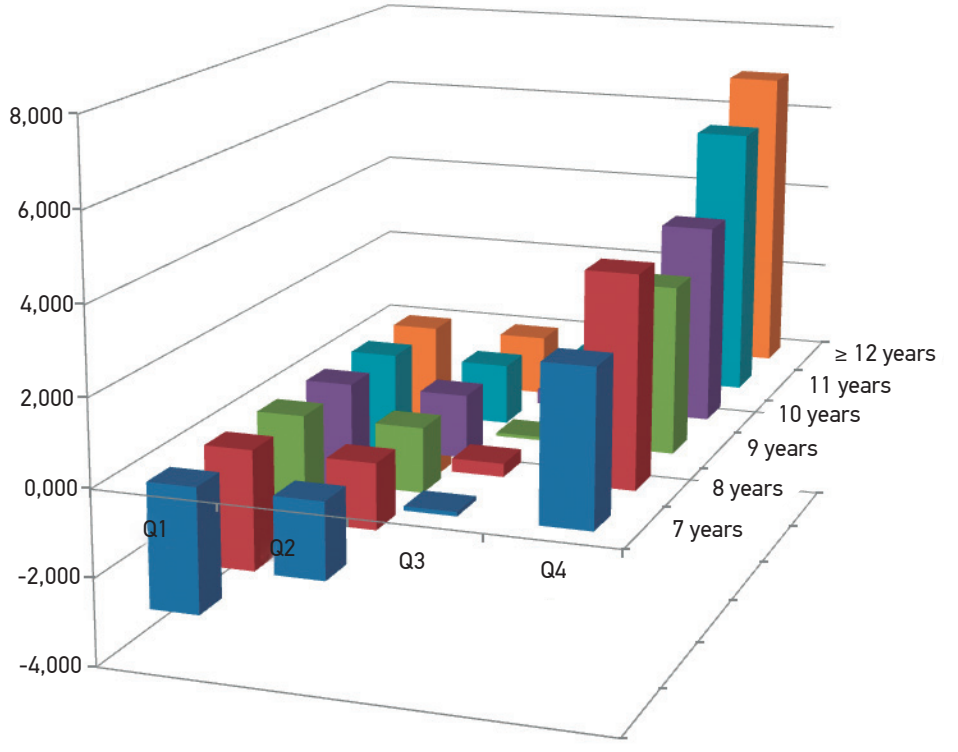

Figure 1. Relationship between the residuals and body mass index records in the Questionnaire Dietary Intake and Physical Activity of Students, according to age and body mass index quartiles based on measured body weight and height.

DISCUSSION

Records of body weight and height in Web-CAAFE, as well as the resulted BMI based on these measurements, showed strong correlation between the repeated entries and in comparison with the measurements, being higher for body weight and a bit lower for height and BMI.

There was a minor bias attributed to Web-CAAFE, of 2%, in the measured value for body weight, and less than 1% for height, having an impact of 2.11% on BMI. This finding led to a mild underestimation of BMI as a consequence of the underestimation of body weight and the overestimation of height.

Direct comparisons between these results and those of similar studies are not possible to be made, considering the significant methodological differences. This study assessed the quality of entry in the system, and not the validity and reproducibility of the report of weight and height, since the anthropometric measurements were confirmed before filling out the Web-CAAFE and the students were instructed to check the values written down in the class diary, unlike what has been done in other studies[7,26-32].

Considering that, curiously, the tendency of BMI underestimation found, such as the effect of the underestimation of body weight and the overestimation of height, was similar to that reported in validations of the self-report of body weight and height among students[27,29-31].

In this study, students with difficulties to read and write were also benefitted by the access to the measurements, since the awareness of their own anthropometric measures improves the quality of the report[25]. Still, there was a tendency to underestimate body weight and overestimate height. That indicated that other factors explain these biases – besides gender, age, skills to read and write, experience with the use of computers and the internet, or the knowledge of their own measurements – such as body dissatisfaction, and factors associated with bias in the report of body weight among adolescents[33].

The reduction of the magnitude and the variation of random effects for values of weight and height, observed between the second and third application of Web-CAAFE, can be owed to three factors:

1. the short interval of time (three hours), benefitting memory;
2. the learning of the processes required to fill out the questionnaire; and
3. the reduction in the children's reactiveness, considering their previous experience with the instrument.

Besides, the first and the second application of Web-CAAFE occurred in a longer interval of time (one month), indicating that the increased magnitude and the variation of the random effects among them can be related with the loss of the novelty of the instrument, which may have caused fewer attention and motivation of the participants. The graphs of the residues of the random effects among the students, according to age and the quartiles of the respected measurements, revealed the tendency to underestimate weight, height and the resulted BMI by the Web-CAAFE among the students in the first quartile, whereas those in the higher quartile tended to overestimate these measures, with visible influence of age. This result is conflicting in relation to the scientific literature, because, among adolescents[34] and children[27], it is

common that overweight or obesity lead to the underestimation of real weight and BMI based on self-report. This peculiar result suggests the realization of new studies, with population-based samples, in order to reach more consistent conclusions. The random residues among the evaluated subjects were not associated with the possession and use of computers/internet in the household, nor with school performance in reading/writing. This indicates that the lack of previous experience with computers and/or the fact that the child is not completely literate did not change the quality of the weight and height recorded in the analyzed sample. However, this result should be interpreted carefully, because it may have been influenced by the limited number of subjects with information available about school performance, or by the use of a learning assessment tool built especially for this study, which has not been previously validated.

The use of a computer in the household did not change the accuracy and the reliability of the dietary intake report in Web-CAAFE among the students in Feira de Santana[21].

On the other hand, the performance in the report of dietary intake and physical activities in Web-CAAFE was worse among the students in Florianópolis, Santa Catarina, who did not own a computer and were attending the 2nd and 3rd grades[17,18], that is, they are supposedly less capable of reading and writing, when compared to students in the 4th and 5th grades.

The record of weight and height in Web-CAAFE requires the participants to type in only two numerical digits for weight and three for height, without worrying about separating integer and decimal values, using the comma or the dot, since this is done by the system. Besides, an animated avatar instructs the person, using audio and text presented in balloons. Together, these facilities require little ability to read and write, and can explain partially the results obtained.

In a previous study about the usability of Web-CAAFE[17], it was observed that, in the first part of the questionnaire (including weight and height data, name of the child and mother or tutor), the students presented a higher mean score of errors related with inconsistent responses, especially regarding: answering that the questionnaire had been filled out before it actually was; and entry the name incorrectly. Errors in data entry about weight and height were less frequent.

A potential limitation of the current study is that the absence of information about the school performance of about 2/3 of the students analyzed may have camouflaged the relationship between the ability to read and write and the quality of the record in Web-CAAFE. Besides, the convenience sample restricts the generalization of the results found.

The strong aspects of the study include a sample reasonably large to detect small differences between direct measures of body weight and height and the record in Web-CAAFE. They also include the use of advanced statistical methods, with higher power of detection of errors types I and II, which would allow assessing the variation of the measures. This would be owed to the use of all information available for all levels of hierarchic linear regression, instead of reducing the analytical sample for the students who completed all of the repetitions of the measurements assessed and the entries in Web-CAAFE. The adjustment of the bias calculation by the variation of the measurements is an important innovation to be used in subsequent studies to validate Web-CAAFE. Therefore, even though the regression analysis used has adopted only one independent variable (record in Web-CAAFE) as a fixed effect, it is multivariate, since it also estimated the random effects between the subjects and the reproducibility of the records.

CONCLUSION

The weight and height records in Web-CAAFE showed strong correlation with the measurements assessed and the repeated entries. The bias attributable to Web-CAAFE was minor, but indicated a mild underestimation of BMI, due to the overestimation of health and the underestimation of body weight. As a measure to control the quality of data entry in the system for further studies, and for the monitoring of students at the population level, it is possible to adopt a warning informing the record of weight and height values that are biologically implausible, with subsequent evaluation of the validity and reproducibility of these values, without the individuals disposing of the information about their measurements.

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