ORIGINAL ARTICLE

HEALTH LITERACY AND EATING-RELATED BEHAVIORS STRATIFIED BY THE PRESENCE OF COMORBIDITIES IN BRAZILIAN SCHOOL TEACHERS

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Highlights: (1) Adequate health literacy was associated with consulting of food label information. (2) Adequate health literacy was associated with lower sugar consulting in diabetes. (3) Health literacy often promotes healthy eating, but some inconsistencies remain.

PRE-PROOF
(as accepted)
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HEALTH LITERACY AND EATING-RELATED BEHAVIORS STRATIFIED BY THE PRESENCE OF COMORBIDITIES IN BRAZILIAN SCHOOL TEACHERS

ABSTRACT

This study aimed to analyze the cross-sectional association between health literacy and eating-related behaviors (usage of nutrition labels and eating behaviors) in public school teachers, from a large city in southern Brazil. Health literacy was assessed using the Newest Vital Sign instrument. Poisson regression models were adjusted for sociodemographic covariates, and the analysis was stratified by the presence of obesity, hypertension, diabetes, and dyslipidemia. Among the 961 schoolteachers studied, 37.0% were classified as having adequate health literacy. Adequate health literacy was associated with more frequent verification of calories (results given in relation to prevalence ratio and confidence interval 95%: 1.34; 1.13-1.58), sodium (1.27; 1.11-1.46), unsaturated fat (2.36; 1.53-3.65) and trans fat (1.81; 1.39-2.36), more frequent use of such information to guide food consumption (1.23; 1.02-1.49), as well as lower frequent consumption of ultra-processed food (0.62; 0,41-0.93). However, adequate health literacy was also associated with a lower frequency of checking sugars or simple sugars (0.53; 0.33-0.87) on food labels, a higher prevalence of frequent consumption of sweetened carbonated beverages (1.23; 1.03-1.64), while failed to correlate with important healthy eating-related behaviors, such as consumption of fruits and vegetables. Analysis stratified by the presence of comorbidities suggest that adequate health literacy was associated with consulting only a few items on food labels and showed few associations with eating habits. These results suggest that, at least for school teachers, health literacy has a discrete association on information seeking and eating habits.

Keywords: Health Literacy, Food Labeling, Eating Behaviors; Feeding Behavior.

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LETRAMENTO EM SAÚDE E COMPORTAMENTOS ALIMENTARES ESTRATIFICADOS PELA PRESENÇA DE COMORBIDADES EM PROFESSORES BRASILEIROS DA REDE PÚBLICA

RESUMO

Este estudo teve como objetivo analisar a associação transversal entre letramento em saúde (LS) e comportamentos alimentares (uso de rótulos nutricionais e comportamentos alimentares) em professores de escolas públicas, de uma grande cidade do Sul do Brasil. O LS foi avaliada por meio do instrumento Newest Vital Sign. Modelos de regressão de Poisson foram ajustados para

covariáveis sociodemográficas e a análise foi estratificada pela presença de obesidade, hipertensão, diabetes e dislipidemia. Dos 961 professores estudados, 37,0% foram classificados com LS adequado. O LS adequado foi associado à verificação mais frequente de calorias (Razão de prevalência [RP]:1,34; Intervalo de confiança [IC] 95%: 1,13-1,58), sódio (RP:1,27; IC 95%:1,11-1,46), gordura insaturada (RP :2,36; IC95%:1,53-3,65) e gordura trans (RP:1,81; IC95%:1,39-2,36), uso mais frequente dessas informações para orientar o consumo alimentar (RP:1,23; IC95%:1,02- 1,49), bem como menor consumo frequente de alimentos ultraprocessados (RP:0,62; IC95:0,41-0,93). No entanto, o LS adequado também foi associado a uma menor frequência de verificação de açúcares ou açúcares simples (RP:0,53; IC 95%:0,33-0,87) nos rótulos dos alimentos, a uma maior prevalência de consumo frequente de bebidas carbonatadas açucaradas (RP:1,23; 95 % IC) :1,03-1,64), mas não conseguiu se correlacionar com importantes comportamentos alimentares saudáveis, como o consumo de frutas e vegetais. A análise estratificada pela presença de comorbidades sugere que o LS adequado esteve associado à consulta de apenas alguns itens nos rótulos dos alimentos e apresentou poucas associações com os hábitos alimentares. Estes resultados sugerem que, pelo menos para os professores, o LS tem um efeito discreto na procura de informação e nos hábitos alimentares.

Keywords: Literacia em Saúde, Rotulagem de Alimentos, Comportamentos Alimentares

INTRODUCTION

There has been a consistent, global increase in life expectancy and, consequently, an increase in the frequency of diseases associated with aging, especially noncommunicable diseases (NCDs), which currently are the main cause of death worldwide.[1] In Brazil, NCDs, especially circulatory diseases, have been the main cause of death in the last four decades.[2] Therefore, as part of an effective health policy to prevent NCDs, improvement of health education, which includes health information, aiming to reduce the consumption of sodium, sugar, cholesterol, and saturated fatty acids is strategic.[3,4]

Providing health education can assist individuals to surpass the stages of contemplation and preparation, toward a healthier lifestyle, i.e., it can improve the understanding of the nutritional context, allowing for each individual to create healthy eating strategies.[3] However, the availability of information related to recommended eating behaviors, based on international

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studies and manuals, may not be sufficient to alter these behaviors. The lack of consensus about some behaviors and the persistent circulation of inconsistent information concerning certain foods (egg, light, diet, among others) can negatively influence the decision on which foods should be consumed. This scenario may still be influenced by cultural aspects,[5] access to healthy food,[6] working environment conditions,[7,8] income, education, and understanding of the recommendations.[9] Among these variables, the understanding of health recommendations and their impact on eating-related behaviors have been highlighted in the scientific literature[4,10] with possible impacts on eating behaviors.[11,12]

Among the main concepts used to estimate the comprehension of food recommendations, health literacy (HL), food literacy and nutritional literacy are noteworthy. HL is a general construct that encompasses knowledge, motivations, and competencies for accessing, understanding, and applying health information for everyday judgment and decision making, including aspects of diet.[11,12] In other words, people with adequate HL could access more information, such as the composition of food, and use that information to advance the stages of change to healthier eating habits.[3,11]

Whereas food consumption changes over time,[8] it is expected that individuals with adequate HL will have advantages in acquiring health information and, consequently, adopting healthier habits.[12] In this regard a cross-sectional study with an unadjusted analysis of a small sample (n=103) of young adults, no association was found between HL and the different stages of eating behavior.[13] Studies evaluating interventions to improve HL in patients with NCDs reported positive associations on eating behaviors.[14] However, it is known that a series of factors, such as work-related[7,8] and physiological[7], can influence or be influenced by food consumption, generating a complex scenario, in which several variables need to be adjusted. Thus, the presence of a positive association between HL and healthier eating-related behaviors is still unclear for patients susceptible to NCDs, whereas intervention, such as educational actions, seem to have a positive impact.

Considering that any analysis on these issues can be influenced by a variety of confounding factors and aspects related to work, education[4] and access to healthy food,[6] selecting a population with high schooling and similar characteristics can facilitate the demonstration of possible associations regarding HL and eating habits.

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Thus, teachers constitute a homogeneous, highly educated population, allowing a more controlled and unbiased observation of variables related to HL. Moreover, given their potential to positively influence students on the implementation of healthy habits. Therefore, understanding the role of HL in eating-related behaviors in this population may be useful in guiding strategies for health promotion. Therefore, the present study aimed to investigate the association between HL and eating-related behaviors (usage of nutrition labels and eating behaviors) in teachers.

METHODS

This was a cross-sectional study performed with elementary and secondary schoolteachers as a part of the Pro-Mestre study, conducted between 2012 and 2013 to analyze health, lifestyle, and working aspects.[8,15] In brief, the study included a census of teachers from the 20 largest elementary and secondary public schools (with more than 70 teachers) in Londrina, a medium-sized city in southern Brazil. No sampling project was carried out within the schools selected to compose the study. The inclusion criteria were as follows: teaching in a classroom for at least one period in a week; being responsible for one or more subjects; and not being licensed during the research data collection or 30 days after the end of the study. Data collection occurred between August 2012 and June 2013 through a self-administered questionnaire and personal interviews conducted by trained undergraduate and graduate students. The study was preceded by a pilot study in three state schools in a neighboring city (Cambé) with characteristics similar to those of the schools included in the study. During the pilot study, in addition to improving the research instrument, all student interviewers were accompanied, in at least three interviews, by the research team with the aim of standardizing the collection strategy. [8,15]

In this study, HL was considered the independent variable. Data were collected using the Newest Vital Sign (NVS) scale, validated for the Brazilian Portuguese language.[16] NVS is a tool that uses an ice cream nutritional information label as a scenario, and asks six questions involving the HL construct. The number of correct answers are added together, composing a score of 0-6 points. Individuals with ≥4 points are considered to have adequate HL.[16]

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The dependent variables were divided into the verification of nutritional information and eating behaviors, nominated for this article jointly as eating-related behaviors. The verification of nutritional information included nutrition label verification in the last 12 months (yes or no) and the items checked on nutrition labels. For this variable, participants were asked "What items/ingredients do you usually see in these tables?", answer options were not provided. Based on the answers, dichotomous variables were created related to the verification (yes or no) of the main nutritional label items: calories, carbohydrates, sugars or simple sugar, sodium, cholesterol, total fat, unsaturated fat, saturated fat, and trans fat.

The eating-related behaviors variables were weekly frequency of change in food consumption due to nutritional information, eating while watching television or using the computer, consumption of snacks and candies between meals, consumption of sweeteners instead of sugar, removal of visible fat from red meat, removal of skin from chicken meat, consumption of light or skimmed foods (dichotomized as non-frequent: never/rarely/sometimes, and frequent: frequently/always), weekly frequency consumption of ultra-processed foods, meal replacement for snacks, consumption of sweetened carbonated beverages, and consumption of fruits and other vegetables, (dichotomized as non-frequent: never/1 to 3 times per month/1 to 2 times per week, and frequent: 3 to 6 times per week/daily). Although there is no certainty about the association (health benefit or harm) of some of these habits,[17] they were included to assess whether the appropriate HL could influence the identification of potentially important behaviors.

Information on the following variables that may influence HL and/or eating-related behaviors was also obtained, as they are considered potential confounders: sex (female or male), age (years), cohabitation (live alone or live with a partner), approximate monthly family income (<USD 1.500, USD 1.500-USD 2.499 or ≥USD 2.500) (USD 1 = BRL 2,02 at middle point of baseline, January 2013), and education level (university, specialization or graduate courses).

The process of double typing and data consolidation was performed using Epi Info version 3.5.2. Data were analyzed using IBM SPSS version 20.0. The association between HL and possible confounding variables was evaluated by the Mann-Whitney test (continuous variable) or Chi-square test (categorical variables). To understand the association between HL and dependent variables, the Poisson regression model was performed with a robust variance adjusted for potential confounders, which estimate the prevalence ratio (PR) and their

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respective 95% confidence intervals (CI). The impact of HL in the verification of nutritional information and eating behaviors, stratified analysis were performed separately for obese, individuals with body mass index ≥30 kg/m² (calculated using self-reported weight and height), and for individuals with hypertension, diabetes and dyslipidemia (self-report of the medical diagnosis). A statistical significance level lower than 0.05 was adopted in all tests. The project was approved by the local Human Research Ethics Committee (No. 2562/2012). All participants were informed about the study objectives and signed a consent form.

RESULTS

In the 20 schools in which the research was carried out, 1126 teachers were located. Of these, 85 (7.5%) were not interviewed after 5 attempts, and 63 (5.9%) refused to participate, resulting in 978 (86.9%) teachers interviewed (Figure 1). Among the respondents, there were 17 losses due to not answering all NVS questions, so the final sample was composed of 961 (85.3%) individuals. The population was predominantly female (68.5%), with a mean age of 42.1 years, ranging from 19 to 68 years.

Adequate HL was found in 37.0% of the population, with was inversely associated with age, with a decrease in adequate HL in older subjects, and with the absence of hypertension (Table 1). Nutrition label verification in the last 12 months was reported by 63.5% of teachers. Among those who consulted this information, sodium was the most verified item (Table 2). Frequent consumption of fruits and vegetables was reported by 65.1% and 79.2% of respondents, respectively (Table 3).

In the adjusted analysis, compared with inadequate HL, teachers reporting adequate HL had a higher prevalence of verifying information on calories, sodium, unsaturated fat, saturated fat, and trans fat. Individuals with obesity and dyslipidemia with adequate HL presented a higher prevalence of verification of the fat profile of foods. However, adequate HL was not associated with frequent consultation of key elements, such as sodium and sugars or simple sugar, respectively by individuals with hypertension and diabetes (Table 4). Adequate HL was associated with a higher prevalence of change (self-reported) in food consumption due to nutritional information, frequent consumption of sweetened carbonated beverages and

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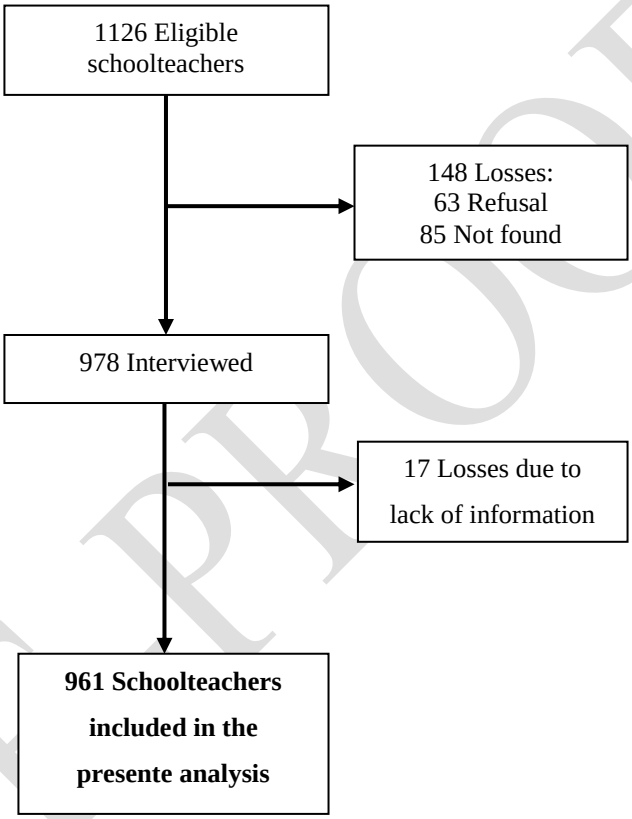
sweeteners instead of sugar, besides lower prevalence of frequent consumption of ultra-processed food (Table 4).

Figure 1 – Flow diagram for study participants.



Source: The Authors.

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Table 1 – Prevalence of health literacy (HL) in relation to sociodemographic and health characteristics of teachers of the state school system of Londrina/PR, Brazil, 2012-2013 (n=961).

Variables	Inadequate HL	Adequate HL	p-value*	Total
Total	605 (63.0)	356 (37.0)		961 (100.0)
Age (years), median (Q1; Q3)	44 (35.3; 51.0)	38 (31.3; 45.9)	**<0.001**	42 (33.5; 49.2)
Sex, n (%)			0.091	
Feminine	426 (64.7)	232 (35.3)		658 (68.5)
Male	179 (59.1)	124 (40.9)		303 (31.5)
Monthly household income (USD), n (%)[b]			0.052	
≥2.500	223 (58.1)	161 (41.9)		384 (40.4)
1.500- 2.499	214 (65.2)	114 (34.8)		328 (34.5)
<1.500	159 (66.5)	80 (33.5)		239 (25.1)
Marital status, n (%)†			0.114	
Live together	341 (60.8)	220 (39.2)		561 (58.9)
Live alone	258 (65.8)	134 (34.2)		392 (41.1)
Education level, n (%)†			**0.009**	
Master or doctorate	69 (52.7)	62 (47.3)		131 (13.7)
Specialization	458 (65.5)	241 (34.5)		699 (73.3)
Graduate	72 (58.1)	52 (41.9)		124 (13.0)
Body mass index, n (%)†			0.403	
≥30	105 (65.6)	55 (34.4)		160 (16.7)
25-29.9	201 (59.6)	134 (40.4)		335 (35.1)
18.5-24.9	284 (63.7)	162 (36.3)		446 (46.8)
<18.5	10 (76.9)	3 (23.1)		13 (1.4)
Systemic arterial hypertension, n (%)			**0.009**	
Yes	106 (72.6)	40 (27.4)		146 (15.2)
No	499 (61.2)	316 (38.8)		815 (84.8)
Diabetes mellitus, n (%)			0.069	
Yes	32 (76.2)	10 (23.8)		42 (4.4)
No	573 (62.4)	346 (37.6)		919 (95.6)
Dyslipidemia, n (%)			0.649	
Yes	95 (64.6)	52 (35.4)		147 (15.3)
No	510 (62.7)	304 (37.3)		814 (84.7)

* Obtained with the Mann-Whitney test (continuous variable) or with the Chi-square test (categorical variables). † The total number of participants was different for these variables, as 10, 8, 7, and 7 participants did not answer, respectively, the questions about income, marital status, education level, and anthropometric measurements. Q1 = division between the 1st and 2nd quartile. Q3 = division between the 3rd and 4th quartile.
Source: The Authors.

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Table 2 – Prevalence of health literacy (HL) and verification of nutrition label information for teachers of the state school system of Londrina/PR, Brazil, 2012-2013 (n=961).

Verification of *	Inadequate HL	Adequate HL	Total
Nutrition label			
No	236 (67.2)	115 (32.8)	351 (36.5)
Yes	369 (60.5)	241 (39.5)	610 (63.5)
Only those who consult nutrition information labels (n=610)			
Calories			
No	218 (69.2)	97 (30.8)	315 (51.6)
Yes	151 (51.2)	144 (48.8)	295 (48.4)
Carbohydrates			
No	303 (62.9)	179 (37.1)	482 (79.0)
Yes	66 (51.6)	62 (48.4)	128 (21.0)
Sugar or simple sugar			
No	315 (58.8)	221 (41.2)	536 (87.9)
Yes	54 (73.0)	20 (27.0)	74 (12.1)
Sodium			
No	173 (69.2)	77 (30.8)	250 (41.0)
Yes	196 (54.4)	164 (45.6)	360 (59.0)
Cholesterol			
No	352 (60.5)	230 (39.5)	582 (95.4)
Yes	17 (60.7)	11 (39.3)	28 (4.6)
Total fat			
No	253 (62.6)	151 (37.4)	404 (66.2|)
Yes	116 (56.3)	90 (43.7)	206 (33.8)
Unsaturated fat			
No	337 (63.0)	198 (37.0)	535 (87.7)
Yes	32 (42.7)	43 (57.3)	75 (12.3)
Saturated fat			
No	305 (62.2)	185 (37.8)	490 (80.3)
Yes	64 (53.3)	56 (46.7)	120 (19.7)
Trans fat			
No	286 (65.7)	149 (34.3)	435 (71.3)
Yes	83 (47.4)	92 (52.6)	175 (28.7)

* Descriptive analysis presented in n (%).
Source: The Authors.

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Table 3 – Prevalence of health literacy (HL) in relation to eating-related behaviors of teachers of the state school system of Londrina/PR, Brazil, 2012-2013 (n=961).

Variables*	Inadequate HL	Adequate HL	Total
Change in food consumption due to nutritional information			
Non-frequent	215 (62.1)	131 (37.9)	346 (56.7)
Frequent	154 (58.3)	110 (41.7)	264 (43.3)
Eating while watching television or using a computer			
Non-frequent	427 (65.3)	227 (64.7)	654 (68.1)
Frequent	178 (58.0)	129 (42.0)	307 (31.9)
Consumption of ultra-processed foods			
Non-frequent	532 (61.9)	328 (38.1)	860 (89.5)
Frequent	73 (72.3)	28 (27.7)	101 (10.5)
Consumption of snacks and candies between meals			
Non-frequent	520 (63.7)	296 (36.3)	816 (84.9)
Frequent	85 (58.6)	60 (41.4)	145 (15.1)
Replacement meal for snacks			
Non-frequent	486 (64.5)	268 (35.5)	754 (78.5)
Frequent	119 (57.5)	88 (42.5)	207 (21.5)
Consumption of sweetened carbonated beverages			
Non-frequent	414 (67.2)	202 (32.8)	616 (64.1)
Frequent	191 (55.4)	154 (44.6)	345 (35.9)
Consumption of sweeteners instead of sugar			
Non-frequent	445 (64.3)	247 (35.7)	692 (72.0)
Frequent	160 (59.5)	109 (40.5)	269 (28.0)
Removal of visible fat from the red meat†			
Non-frequent	214 (63.9)	121 (36.1)	335 (36.5)
Frequent	361 (61.8)	223 (38.2)	584 (63.5)
Removal of skin from chicken meat†			
Non-frequent	168 (58.9)	117 (41.1)	285 (31.3)
Frequent	400 (64.0)	225 (36.0)	625 (68.7)
Consumption of light or skimmed foods			
Non-frequent	382 (64.1)	214 (35.9)	596 (62.0)
Frequent	223 (61.1)	142 (38.9)	365 (38.0)
Consumption of fruits			
Non-frequent	196 (58.5)	139 (41.5)	335 (34.9)
Frequent	409 (65.3)	217 (34.7)	626 (65.1)
Consumption of vegetables			
Non-frequent	124 (62.0)	76 (38.0)	200 (20.8)
Frequent	481 (63.2)	280 (36.8)	761 (79.2)

* Descriptive analysis presented in n (%). † The total number of participants was different for these variables, as 42 participants reported not consuming red meat and 51 reported not consuming chicken meat.
Source: The Authors.

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HEALTH LITERACY AND EATING-RELATED BEHAVIORS STRATIFIED BY THE PRESENCE OF COMORBIDITIES IN BRAZILIAN SCHOOL TEACHERS

Table 4 – Association between adequate Health Literacy* in relation to verification of nutrition label information and eating-related behaviors of teachers of the state school system of Londrina/PR, Brazil, 2012-2013.

Verification of	All teachers†‡ (n=961)	Obeses†‡ (n=160)	Hypertension†‡ (n=146)	Diabetes†‡ (n=42)	Dyslipidemia†‡ (n=147)
Nutrition label	1.10 (0.99-1.22)	1.06 (0.81-1.38)	1.18 (0.87-1.62)	0.76 (0.41-1.42)	0.95 (0.74-1.21)
	Only those who verify nutrition information labels				
	n=610	n=102	n=92	n=30	n=103
Calories	1.34 (1.13-1.58)**	1.28 (0.89-1.83)	2.33 (1.19-4.58)§	2.27 (0.45-11.56)	1.70 (1.14-2.53)**
Carbohydrates	1295 (0.94-1.77)	2.17 (0.91-5.15)	0.97 (0.31-3.00)	0.62 (0.14-2.85)	1.33 (0.50-3.51)
Sugar or simple sugar	0.53 (0.33-0.87)§	0.81 (0.21-3.19)	0.14 (0.03-0.64)§	0.48 (0.01-1.51)	0.43 (0.11-1.72)
Sodium	1.27 (1.11-1.46)**	1.17 (0.82-1.66)	1.34 (0.99-1.81)	2.14 (0.92-4.96)	1.25 (0.88-1.78)
Cholesterol	1.33 (0.59-2.98)	1.09 (0.07-17.12)	5.01 (0.54-46.78)	0.89 (0.74-1.07)	1.00 (0.14-7.42)
Total fat	1.24 (0.99-1.57)	2.50 (1.31-4.79)**	1.44 (0.67-3.07)	1.63 (0.56-4.78)	1.89 (1.14-3.16)§
Unsaturated fat	2.36 (1.53-3.65)‡‡	8.14 (1.97-33.69)**	2.76 (0.47-16.39)	1.29 (0.12-13.72)	7.12 (2.87-17.65)‡‡
Saturated fat	1.52 (1.08-2.13)§	3.15 (1.26-7.91)§	1.29 (0.43-3.89)	0.93 (0.12-7.33)	2.53 (1.21-5.28)§
Trans fat	1.81 (1.39-2.36)‡‡	2.46 (1.04-5.81)§	2.32 (1.01-5.35)§	4.59 (1.12-18.76)§	2.27 (1.36-3.75)**
Frequent					
Change in food consumption due to nutritional information	1.23 (1.02-1.49)§	0.79 (0.46-1.36)	0.95 (0.54-1.69)	1.52 (0.70-3.29)	1.64 (0.95-2.86)
Eating while watching television or using a computer	1.13 (0.93-1.37)	1.41 (0.93-2.15)	1.37 (0.76-2.47)	2.02 (0.50-8.14)	0.94 (0.58-1.53)
Consumption of ultra-processed foods	0.62 (0,41-0.93)§	1.11 (0.43-2.86)	1.76 (0.49-6.31)	1.07 (0.92-1.25)	1.27 (0.49-3.26)
Consumption of snacks and candies between meals	1.09 (0.79-1.50)	1.62 (0.78-3.34)	1.69 (0.48-5.93)	8.37 (0.76-92.42)	1.13 (0.49-2.59)
Meal replacement for snacks	1.22 (0.95-1.57)	1.41 (0.77-2.56)	1.61 (0.87-2.98)	1.42 (0.66-3.05)	1.31 (0.69-2.45)
Consumption of sweetened carbonated beverages	1.23 (1.03-1.46 §	2.03 (1.41-2.94)‡‡	2.53 (1.51-4.24)**	3.25 (0.93-11.34)	2.06 (1.23-3.46)**
Consumption of sweeteners instead of sugar	1.34 (1.09-1.64)**	1.02 (0.63-1.63)	1.54 (1.01-2.38)§	0.58 (0.27-1.24)	1.09 (0.68-1.75)
Removal of visible fat from the red meat	1.05 (0.95-1.17)	1.08 (0.81-1.45)	0.79 (0.57-1.12)	1.11 (0.74-1.66)	1.10 (0.89-1.36)
Removal of skin from chicken meat	0.98 (0.89-1.08)	0.81 (0.62-1.05)	0.79 (0.56-1.14)	1.11 (0.68-1.80)	1.04 (0.79-1.36)
Consumption of light or skimmed foods	1.14 (0.96-1.34)	1.06 (0.71-1.58)	0.93 (0.61-1.43)	0.44 (0.17-1.19)	1.46 (0.98-2.17)
Consumption of fruits	0.96 (0.87-1.06)	0.89 (0.66-1.19)	0.88 (0.64-1.21)	1.01 (0.66-1.54)	0.84 (0.64-1.09)
Consumption of vegetables	1.01 (0.94-1.08)	0.79 (0.64-0.98)§	0.83 (0.66-1.04)	0.97 (0.71-1.32)	0.98 (0.82-1.17)

* Using inadequate health literacy as a reference category. † Prevalence ratio (Confidence Interval 95%). ‡ Model adjusted by: age, sex, monthly household income, marital status, and schooling. §p <0.05. **p <0.01. ‡‡p <0.001.
Source: The Authors

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DISCUSSION

The prevalence of adequate HL in our study was 37.0%. The reported prevalence of adequate HL varies widely, ranging from 33% to 71%, probably because of differences in population, sample size, and methodology.[18] Adequate HL is associated with a higher prevalence of search for nutritional information on food labels, especially sodium and fat profiles, indicating a potential positive influence of HL on healthy eating patterns. Paradoxically, however, the associations found between HL and eating-related behaviors are weak and insufficient to suggest a protective association of adequate HL.

The association between adequate HL and younger age,[13,16] higher educational level,[19] and lower prevalence of hypertension[20,21] found in the present study are supported in the literature, with the main justifications being the greater search for information from younger individuals, the relationship between education and literacy (in general), and the possible protection generated by adequate HL. The association between adequate HL and higher prevalence of search for nutritional components (calories, sodium and fat profile) in the general population and with some NCDs corroborates the protective potential of HL[11,13] and may reinforce the importance of HL for the search for nutritional information as an important step in improving the quality of food.[4]

However, contrary to the theoretical construct of HL,[11,12] adequate HL did not associate with the verification of nutritional labels for all individuals, consultation of calories for obese or cholesterol for individuals with dyslipidemia, indicating a moderate action to search for information for choosing healthy foods. The lack of association between HL and consult nutritional information has already been reported,[13,22] but no studies have investigated the association between consulting specific nutrition label items. The lower prevalence of consultation of sugar or simple sugar may be due to the greater appeal for items such as sodium and fats, which may indicate that the search for information is mostly directed by common sense. However, for diabetics, greater verification of sugar or simple sugar would be expected, and the association in the opposite direction may indicate a strong limitation of the role of HL in the search for information. Even without observing a consistent increase in the consultation of

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nutritional information, HL remains, theoretically, with the potential for better use of this information,[11,12,22] which could have an association on eating-related behaviors.[3]

Adequate HL was associated with a higher prevalence of frequent change in food consumption due to nutritional information, in all individuals of the study, which seems to support the theoretical assumption of better use of information for healthy actions.[11,12,22] Another finding that seems to point in this direction is the association of adequate HL with a lower prevalence of frequent consumption of ultra-processed food, which may be a reflection of the greater consultation of sodium on food labels. However, the lowest prevalence of frequent consumption of vegetables for obese individuals and the highest prevalence of frequent consumption of sweetened carbonated beverages, for individuals with obese, hypertensive, dyslipidemia and general populations, are associations contrary to the theoretical assumption.[11,12,22] In addition, the absence of association with some eating-related behaviors consolidated in the literature and common sense, such as consumption of fruits and vegetables, demonstrate a weak role of HL in these behaviors in a highly educated population.

There is still no consensus in the literature about the impact of HL on eating-related behaviors. Some authors found an association between adequate HL and consumption of fruit and vegetables[23,24] more often, in analysis not controlled by adjustment factors. Other studies, such as the present, found no relationship between HL and consumption of fruits or vegetables,[9] avoid consumption of fatty foods,[25] lower fat meats, removal of visible fat from red meat or skin from chicken[25], and dietary quality[13] in populations of different educational levels. Despite the few studies found, the methodological differences, and some favorable statistical associations, in populations with varied education and in high education, HL has minimal association in consultation nutrition labels and a debatable e association in eating-related behaviors, even for patients with hypertension, diabetes, dyslipidemia, or obesity. For the evaluation of HL with eating-related behaviors, it is important to highlight the need for adequate control factors or stratification of the analysis because several other sociodemographic[13,19] and comorbid[10] factors may interfere with the associations.

Thus, recognizing the limitations of a cross-sectional study, but supported by the lack of consensus in the literature, it seems that the adequate HL is not sufficient to

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promote a change in eating-related behaviors,[13] not even in patients with NCDs. Studies that perform interventions to improve HL in patients with NCDs[14] perform several other actions, which not only improve HL. Thus, it is possible that behavior change was influenced by the interaction between HL and different variables,[8,11] as the entire context of greater social support and information passed on in a didactic way, and not exclusively for HL, which would justify the observation of change in just some aspects of the eating-related behaviors.[14]

Perhaps the evaluation of constructs similar to that of HL, such as food literacy and nutritional literacy show better results in association with eating-related behaviors. Nutritional literacy can be more clearly associated with actions the search for information and actions of contemplation (based in the transtheoretical model of behavior change),[3] whereas food literacy may be more related to actions and behavior change.[26] However, it is important to consider that HL and its association on the search for information and, mainly, eating-related behaviors, is part of a much broader and more complex context. Searching for information and correctly interpreting it is one of the steps that can help the adoption of healthy eating-related behaviors, but on its own, it seems to be very small. Therefore, the incentive to improve the quality of food must also consist of access to healthy foods and social appreciation of the consumption of these foods,[27] in addition to policies that discourage the consumption of ultra-processed foods.[27,28]

This study presents the possible limitations of the use of self-reported variables (which may contain memory bias) and the collection in the school environment. In addition, it was not possible to explore the food literacy and nutritional literacy constructs because of the lack of specific tools validated for this purpose in Brazil. Finally, the subgroup analysis carried out have a low sample size, which compromises the power of the results presented. Strengths included the size of the population analyzed, the use of a validated tool to identify HL in the research population, and the inclusion of covariates that allowed the control of potential confounders of the associations under study. In addition, the present study realized analysis of the population stratified by comorbidities, which verified that HL had no impact on eating-related behaviors even for patients with hypertension, diabetes, dyslipidemia, or obesity. This study emphasizes the importance of longitudinal observational studies on the subject, with the expansion of research-

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related dietary conduct, and the use of international tools to identify HL and other related constructs.

CONCLUSION

Accordingly, the present study provides evidence that although HL can assist in information processes, however, HL seems to have no consistent association with eating-related behaviors in school teachers, independent of sociodemographic variables. The absence of association in a highly educated population, even for individuals with NCDs, may indicate an even weaker association in individuals with less education. Given the associations found, HL may not be an appropriate construct for predicting the consultation of nutrition labels or eating behaviors. Thus, it is suggested to perform longitudinal studies also employing food literacy and nutritional literacy scales for the teacher population and the general population, stratified by comorbidities, as a way to better understand causality and the difference between populations.

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