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Appetite

Association of personal characteristics and cooking skills with vegetable consumption frequency among university students

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1. Introduction

Transitioning to adulthood and university can lead to life changes, including increased autonomy in decision-making and responsibility over one's own food choices (Stok et al., 2018). At this important stage of life, many university students establish unhealthy eating behaviours that may have long-term implications (Deforche et al., 2015; Sprake et al., 2018; Beaudry et al., 2019). Studies have shown that university students have high consumption of fast food, snacks, sweets, soft drinks, and alcoholic beverages, as well as a low intake of fish, grains, fruits, and vegetables (Bernardo et al., 2017b). Students reported the following factors as barriers to healthy eating: convenience of packaged and fast foods; low availability, limited access to, and high costs of healthy foods; and lack of time, space, utensils, motivation, and skills for cooking at home (Kabir, Miah, & Islam, 2018; Hilger-Kolb & Diehl, 2019). Home meal preparation is associated with higher diet quality resulting from a high fruit, vegetable, and whole grain intake; low sugar intake; high breakfast and lunch consumption frequency; and low fast-food consumption (Laska et al., 2012; Hartmann et al., 2013; Mills et al., 2017; Hagmann, Siegrist, & Hartmann, 2020).

The World Health Organization (WHO) recommends a daily fruit and vegetable consumption of 400 g or five servings (WHO, 2003). In Brazil, population data showed that individuals aged 18 to 24 years (n = 7 237) have the lowest fruit and vegetable consumption among all age groups, with only 19% consuming five or more daily fruit and vegetable servings (Brazil, 2020). Fruits and vegetables are important sources of vitamins, minerals, fibre, and bioactive compounds but differ in nutritional composition, cultural use patterns,

and health impacts (Slavin & Lloyd, 2012). Few studies have investigated vegetable consumption separate from fruit consumption (Appleton et al., 2016). Existing data have shown a trend towards a greater intake of fruits stemming from their convenience and sweet taste (Trudeau et al., 1998; Nicklas et al., 2013). Some obstacles to vegetable consumption include the time required for purchase and preparation, lower sensory appeal, perishability, and high cost compared with fruits (de Leon, Jahns, & Casperson, 2020).

A review study conducted by Rodrigues et al. (2019) examined 71 articles about vegetable consumption by university students and found that only three studies (conducted in Italy, Japan, and Germany) focused exclusively on vegetables. The sociodemographic, health, and personal characteristics associated with increased vegetable consumption were found to be female sex, living with parents, high socioeconomic status, low body mass index (BMI), normal blood pressure, final years of undergraduate study, high level of physical activity, high knowledge of nutrition, high importance given to a healthy diet, regular self-care, breakfast consumption, low alcohol consumption, and low energy diet. In addition, the study revealed that Brazilian students had the lowest frequencies of vegetable consumption among all study populations analysed (Rodrigues et al., 2019).

Given the few international studies and lack of Brazilian studies exclusively on vegetable consumption by university students, this paper sought to investigate vegetable consumption frequency among university students in the metropolitan area of a Brazilian capital and analyse its association with personal and sociodemographic characteristics and cooking skills.

2. Methods

2.1. Population and study site

The target population included undergraduate students enrolled in universities in the metropolitan area of a capital city in Brazil. Inclusion criteria were age 16 years and older, enrolment in an undergraduate course at the time of data collection, and willingness to participate in the study indicated by signing an informed consent form.

Recruitment lasted two months. Participants were recruited from classrooms and at the entrance of university restaurants through flyers containing a QR code, via e-mail and social media, and through links posted on university and research group websites. Participants were selected from 10 universities, 8 private and 2 public, by convenience sampling and all the responders were included in the study.

2.2. Sample size calculation

For sample size calculation, we considered the total number of university students in the study region (N = 36 888). Assuming an expected daily vegetable consumption frequency of 50%, a random error of 5%, a sample design effect of 1.0, and a participant loss of 10%, we calculated that a minimum sample size of 420 individuals should be sought. Final collected sample was n = 525. Calculation was performed using Open Epi version 3.01[1].

2.3. Data collection

Data were collected through an online questionnaire created using Google Forms. This study analysed three sections of the questionnaire: (i) personal characteristics, (ii) cooking skills and healthy eating habits (Jomori et al., 2017), and (iii) vegetable consumption frequency. The first section of the questionnaire requested information on sex, age, parental

[1] Available at https://www.openepi.com/Menu/OE_Menu.htm

education, self-reported weight and height (for BMI calculation), undergraduate course, and living arrangement. Participants were also asked to inform the amount of time they had available for cooking, whether they knew how to cook, with whom they had learned how to cook, and where they had their main daily meals.

Cooking skills were assessed by using an instrument developed by Jomori et al. (2017). On the basis of a review study, Jomori et al. (2018) conceptualised cooking skills as confidence in applying individual knowledge to perform cooking tasks that range from menu planning and food purchase to meal preparation. Therefore, cooking skills encompass and reflect behaviours related to healthy eating. The instrument contains eight dimensions composed of different indicators, as described in Table 1.

Table 1

Dimensions and indicators of the instrument used for assessing cooking skills and healthy eating practices in university students.

Dimension	Description	Indicators	Example
Availability and accessibility of fruits and vegetables at home	Fruits and vegetables available for home preparation and consumption over the previous week	Eight questions worth 1 point for each 'yes' response and 0 points for each 'no' response	- Did you have raw or cooked vegetables in your home last week?
Cooking attitudes	Level of agreement with statements about time availability, accessibility, and engagement in cooking activities	Seven items rated on a 5-point Likert scale ranging from 'strongly disagree' to 'strongly agree'	- I do not like to cook because it takes too much time. - I like trying new recipes.
Cooking behaviour at home	Frequency of meal preparation at home	Six items rated on a 5-point Likert scale ranging from 'never' to 'every day'	- Prepare meals from basic ingredients (such as whole fresh produce, raw

			chicken, etc).
Cooking behaviour away from home	Frequency of consumption of away-from-home foods and leftovers	Five items rated on a 5-point Likert scale ranging from ‘never’ to ‘every day’	- Eat lunch away from home.
Self-efficacy for using basic cooking techniques	Degree of confidence in performing basic cooking activities	Eighteen items rated on a 5-point Likert scale ranging from ‘not confident at all’ to ‘extremely confident’	- Follow a written recipe. - Use basic cooking techniques.
Self-efficacy for using fruits, vegetables, and seasonings	Degree of confidence in using fruits, vegetables, and seasonings during cooking	Nine items rated on a 5-point Likert scale ranging from ‘not confident at all’ to ‘extremely confident’	- Fresh or frozen green vegetables (ex: broccoli, spinach)
Produce consumption self-efficacy	Degree of confidence in meeting recommendations for consumption of fruits and vegetables	Three items rated on a 5-point Likert scale ranging from ‘not confident at all’ to ‘extremely confident’	- Eat fruits and vegetables at every meal, every day
Knowledge of cooking techniques	Level of cooking knowledge	Eight multiple-choice questions worth 1 point for each correct response	- What is the term for preparing all ingredients, gathering equipment, and organizing your area before beginning to cook?

Note: Brazilian Cooking Skills and Healthy Eating Questionnaire (Jomori et al., 2017).

Regarding vegetable consumption, the students were asked in which meals they usually included these foods, which vegetables they consumed the most and which they liked the least. The online questionnaire also included a question about vegetable consumption frequency (‘how often do you eat vegetables?’) with five possible answers: ‘never’, ‘once or twice a month’, ‘once a week’, ‘several times a week’, and ‘every day’. Despite the complexity of defining vegetables either by botanical or culinary descriptors, a definition

based on the discussion from Rodrigues et al. 2018' review paper was provided to participants: 'Vegetables are plants that are used for human consumption, such as, for example, courgette, squash, chard, watercress, artichoke, garlic, lettuce, chicory, beetroot, aubergine, broccoli, onion, carrot, chayote, collard, cauliflower, spinach, cucumber, bell pepper, cabbage, radish, rocket, tomato, and green beans. The following roots and tubers are not considered vegetables for the purposes of this study: cassava, potatoes (e.g. common and sweet potatoes), arracacha, yam, and taro. Other foods that are not included are corn, peas, beans, chickpeas, grains, mushrooms, and fruits.'

2.4. Data processing and statistical analysis

Questionnaire data were exported to an Excel spread sheet, coded, and then analysed in Stata version 13.0. Data were first subjected to descriptive statistics for determination of absolute and relative frequencies of categorical variables. Cooking skill scores are expressed as mean and standard deviation, given the symmetry of data. Frequency of vegetable consumption was the outcome variable. To explore the association between personal characteristics and vegetable consumption frequency (divided into five categories), we applied Pearson's chi-squared test. The association between cooking skill dimension scores and vegetable consumption frequency was investigated using analysis of variance with Bonferroni post hoc test. Associations between cooking skills and daily vegetable consumption were assessed by grouping consumption frequencies into daily and less than once a day (sum of the first four categories). Crude and adjusted logistic regression analyses were performed. Sex and age were treated as adjustment variables, as supported by the general literature, as were variables associated with the outcome of the crude analysis.

Results are expressed as odds ratios (OR) and 95% confidence intervals (CI). For all analyses, a significance level of $p < 0.05$ was adopted.

2.5. Ethical considerations

This research was approved by the Human Research Ethics Committee of the Federal University of Santa Catarina (UFSC) (protocol No 1 318 443) and was conducted in accordance with the human research ethical principles of Brazilian Resolution No 466/2012 (Brazil, 2012).

3. Results

3.1. Characteristics of the study population

Sample (N = 525) characteristics are described in Table 2. Most students were female (75%) and aged under 25 years (67%) (mean age of 24 years). Overweight or obesity was observed in 27.5% of students. About 70% of the participants reported having 1–3 hours available per day for cooking at home and 85% reported knowing how to cook. Lunch was mainly consumed away from home or at home with ordered meals (delivery service) (59%), whereas dinner was mainly consumed at home (80%). Among those who ate lunch away from home, 72% reported having lunch exclusively at university restaurants. The majority of participants (77%) reported learning how to cook from family members. Other learning sources were the internet (49%), self-learning (33%), friends (18%), cookbooks (18%), TV programs (16%), and cooking classes (9%) (data not shown).

146 *3.2. Frequency of vegetable consumption*

147

148 Less than half (45%) of evaluated students reported consuming vegetables daily. The main
149 meals in which vegetables were consumed were lunch (95%) and dinner (53%) (Table 2).
150 Participants that reported consuming vegetables ‘daily’, compared to ‘never’, had higher
151 cooking skill scores for availability and accessibility of fruits and vegetables at home
152 (<0.001); self-efficacy for using fruits, vegetables, and seasonings (<0.001); and produce
153 consumption self-efficacy (<0.001). In addition, regarding cooking attitudes and self-efficacy
154 for using basic cooking techniques, higher scores were found in daily vegetable consumption
155 compared to ‘once a week’; while cooking behaviour at home had higher scores in ‘daily’
156 consumption compared with ‘every day’.

157

158 **Table 2**

159 Sociodemographic and personal characteristics of Brazilian university students (*N* = 525) stratified by vegetable consumption frequency.

Variable	Total *N* (%)	Vegetable consumption frequency (%)					*p*-value
		Never *n* = 9 (1.71%)	Once or twice a month *n* = 21 (4%)	Once a week *n* = 52 (9.9%)	2–6 times a week *n* = 206 (39.2%)	Every day *n* = 237 (45.1%)	
Sex							
Female	392 (74.67)	6 (1.53)	16 (4.08)	39 (9.95)	150 (38.27)	181 (46.17)	0.899†
Male	133 (25.33)	3 (2.26)	5 (3.76)	13 (9.77)	56 (42.11)	56 (42.11)	
Age (years) - mean (SD)	24.1 (6.33)	21.1 (4.28)	26.2 (8.9)	22.2 (4.71)	24.3 (6.52)	24.3 (6.20)	0.0535††
<25 years	351 (66.86)	8 (2.28)	13 (3.70)	41 (11.68)	134 (38.18)	155 (44.16)	0.191†
≥25 years	174 (33.14)	1 (0.57)	8 (4.60)	11 (6.32)	72 (41.38)	82 (47.13)	
Level of maternal education							
Less than high school	154 (29.33)	3 (1.95)	4 (2.60)	16 (10.39)	66 (42.86)	65 (42.21)	
High school or some college	154 (29.33)	1 (0.65)	9 (5.84)	18 (11.69)	63 (40.91)	63 (40.91)	0.407†
Undergraduate degree or higher	217 (41.33)	5 (2.30)	8 (3.69)	8 (3.69)	77 (35.48)	109 (50.23)	
Level of paternal education							
Less than high school	169 (32.19)	2 (1.18)	9 (5.33)	17 (10.06)	75 (44.38)	66 (39.05)	
High school or some college	175 (33.33)	2 (1.14)	7 (4.00)	20 (11.43)	72 (41.14)	74 (42.29)	0.151†
Undergraduate degree or higher	181 (34.48)	5 (2.76)	5 (2.76)	15 (8.29)	59 (32.60)	97 (53.59)	
Overweight/obese							
No	379 (62.47)	7 (1.85)	11 (2.90)	36 (9.50)	142 (37.47)	183 (48.28)	0.052†
Yes	144 (27.53)	2 (1.39)	10 (6.94)	16 (11.11)	64 (44.44)	52 (36.11)	
Undergraduate course							
Health Sciences	205 (39.05)	6 (2.93)	8 (3.90)	24 (11.71)	70 (34.15)	97 (47.32)	0.160†
Other	320 (60.95)	3 (0.94)	13 (4.06)	28 (8.75)	136 (42.5)	140 (43.75)	
Living arrangement (I)							
With children	127 (24.19)	3 (2.36)	3 (2.36)	12 (9.45)	47 (37.01)	62 (48.82)	
With parents and/or grandparents	318 (60.57)	6 (1.89)	17 (5.35)	36 (11.32)	119 (37.42)	140 (143.6)	0.178†
Alone or with friends	80 (15.24)	0 (0.0)	1 (1.25)	4 (5.00)	40 (50.00)	35 (43.75)	
Living arrangement (I)							

With children	127 (24.19)	3 (2.36)	3 (2.36)	12 (9.45)	47 (37.01)	62 (48.82)	0.684[†]
Without children	398 (75.81)	6 (1.51)	18 (4.52)	40 (10.05)	159 (39.95)	175 (43.97)	
Living arrangement (III)							
With parents and/or grandparents	232 (44.19)	4 (1.72)	11 (4.74)	28 (12.07)	86 (37.07)	103 (44.40)	0.543[†]
Without parents or grandparents	293 (55.81)	5 (1.71)	10 (3.41)	24 (8.19)	120 (40.96)	134 (45.73)	
Do you have kids?							
No	488 (92.9)	9 (1.84)	19 (3.89)	49 (10.04)	193 (93.69)	218 (91.98)	-
Yes	37 (7.1)	0 (0.0)	2 (5.41)	3 (8.11)	13 (35.14)	19 (51.35)	
Time available for cooking (*n* = 518)							
<1 h	130 (25.10)	2 (1.54)	6 (4.62)	20 (15.38)	48 (36.92)	54 (41.54)	0.445[†]
1–3 h	365 (70.46)	7 (1.92)	13 (3.56)	29 (7.95)	146 (40.00)	170 (46.58)	
>3 h	23 (4.44)	0 (0.0)	1 (4.35)	1 (4.35)	10 (43.48)	11 (47.83)	
Do you know how to cook?							
Yes	444 (84.57)	6 (1.35)	16 (3.60)	34 (7.66)	177 (39.86)	211 (47.52)	**<0.001**[†]
No	81 (15.43)	3 (3.70)	5 (6.17)	18 (22.22)	29 (35.80)	26 (32.10)	
Where do you usually have lunch?							
University restaurant	162 (30.86)	4 (2.47)	3 (1.85)	13 (8.02)	63 (38.89)	79 (48.77)	0.477[†]
Eat at home or bring homemade food	217 (41.33)	2 (0.92)	12 (5.53)	20 (9.22)	88 (40.55)	95 (43.78)	
Eat away from home or use food delivery services	63 (26.58)	3 (2.05)	6 (4.11)	19 (13.01)	55 (37.67)	63 (43.15)	
Where do you usually have dinner?							
University restaurant	41 (7.81)	3 (7.32)	0 (0.0)	2 (4.88)	16 (39.02)	20 (48.78)	**0.017**[†]
Eat at home or bring homemade food	421 (80.19)	3 (0.71)	18 (4.28)	43 (10.21)	162 (38.48)	195 (46.32)	
Eat away from home or use food delivery services	22 (9.28)	3 (4.76)	3 (4.76)	7 (11.11)	28 (44.44)	22 (34.92)	
Cooking skills – mean (SD)							
Availability and accessibility of fruits and vegetables at home	5.92 (1.94)	3 (2.5)[b,c,d,e]	5.71 (2.14)[a]	4.94 (2.28)[a,d,e]	5.79 (1.85)[a,c,e]	6.38 (1.72)[a,c,d]	**<0.001**[††]
Cooking attitudes	3.64 (0.69)	3.52 (0.92)	3.34 (0.80)	3.31 (0.75)[d,e]	3.61(0.66)[c]	3.77 (0.65)[c]	**<0.001**[††]
Cooking behaviour at home	3.30 (0.82)	3.11 (0.87)	3.25 (0.75)	3.18 (0.92)	3.134 (0.81)[e]	3.47 (0.78)[d]	**<0.001**[††]
Cooking behaviour away from home	2.35 (0.73)	2.91 (1.09)	2.26 (0.67)	2.33 (0.91)	2.36 (0.68)	2.33 (0.71)	0.205[††]
Self-efficacy for using basic cooking techniques	3.72 (0.75)	3.46 (0.95)	3.5 (0.85)	3.25 (0.87)[d,e]	3.70 (0.74)[c]	3.86 (0.60)[c]	**<0.001**[††]
Self-efficacy for using fruits, vegetables, and seasonings	3.84 (0.84)	3.10 (1.02)[e]	3.41 (1.05)[e]	3.25 (0.88)[d,e]	3.82 (0.79)[c,e]	4.06 (0.74)[a,b,c,d]	**<0.001**[††]
Produce consumption self-efficacy	3.58 (1.04)	2.18 (1.01)[d,e]	2.35 (1.02)[d,e]	2.69 (1.00)[d,e]	3.45 (0.95)[a,b,c,e]	4.04 (0.81)[a,b,c,d]	**<0.001**[††]

Knowledge of cooking techniques	5.18 (1.82)	3.55 (1.01)[d,e]	4.76 (1.81)	3.90 (1.90)[d,e]	5.28 (1.82)[a,c]	5.46 (1.68)[a,c]	**<0.001**[††]

Notes: SD, standard deviation. [†] Pearson's chi-squared test. [††] One-way analysis of variance followed by Bonferroni post hoc test. Significant values ($p < 0.05$) are shown in bold. [a] Significant difference compared with 'Never'. [b] Significant difference compared with 'Once or twice a month'. [c] Significant difference compared with 'Once a week'. [d] Significant difference compared with '2–6 times a week'. [e] Significant difference compared with 'Every day'.

The most frequently consumed vegetables were carrots (72%), lettuce (59%), tomatoes (47%), broccoli (44%), and beetroot (34%). The least preferred vegetables were rocket (19.6%), chayote (16.2%), watercress (12.6%), aubergine (12.6%), and radish (12.4%) (data not shown).

No differences in vegetable consumption were observed between sex or age groups. Among students who ate away from home or used food delivery services, 35% reported consuming vegetables daily. Among students who dined exclusively at university restaurants, however, 49% (p = 0.017) reported having a daily consumption of vegetables. Overall, cooking skill scores differed significantly according to vegetable consumption frequency categories, with the exception of scores for 'Cooking behaviour away from home' (p = 0.205). Most students (85%) reported knowing how to cook, which was significantly associated with daily vegetable consumption ($p < 0.001$) compared with not knowing how to cook.

3.3. Factors associated with daily vegetable consumption

The factors associated with daily vegetable consumption are detailed in Table 3. Paternal education level (undergraduate degree or higher) was positively associated with daily vegetable consumption (OR, 1.80; 95% CI, 1.18–2.76; p = 0.007). Overweight or obese students were 40% less likely to consume vegetables daily than normal-weight students (OR, 0.60; 95% CI, 0.41–0.90; p = 0.013). In addition, higher scores on all cooking skill dimensions, except for 'Cooking behaviour away from home', were associated with higher vegetable consumption.

Table 3

Factors associated with daily vegetable consumption among university students (N = 525) in Santa Catarina State, Brazil, 2020.

Variable	Daily vegetable consumption	
	Crude OR (95% CI)	*p*-value
Sex		
Female	1.00	
Male	1.18 (0.80–1.75)	0.415
Age		
<25 years	1.00	
≥25 years	1.13 (0.78–1.62)	0.520
Level of maternal education		
Less than high school	1.00	
High school or some college	0.95 (0.60–1.49)	0.817
Undergraduate degree or higher	1.38 (0.91–2.09)	0.128
Level of paternal education		
Less than high school	1.00	
High school or some college	1.14 (0.74–1.76)	0.542
Undergraduate degree or higher	1.80 (1.18–2.76)	**0.007**
Overweight/obese		
No	1.00	
Yes	0.60 (0.41–0.90)	**0.013**
Undergraduate course		
Other	1.00	
Health Sciences	1.15 (0.81–1.64)	0.423
Living arrangement (I)		
With children	1.00	
With parents and/or grandparents	0.82 (0.54–1.24)	0.359
Alone or with friends	0.81 (0.46–1.43)	0.477

Living arrangement (I)		
With children	1.00	0.606
Without children	1.16 (0.66–2.04)	
Living arrangement (III)		
With parents and/or grandparents	1.00	
Without parents or grandparents	0.67 (0.42–1.08)	0.103
Do you have kids?		
No	1.00	0.715
Yes	0.83 (0.31–2.21)	
Time available for cooking (*n* = 518)		
<1 h	1.00	
1–3 h	1.22 (0.82–1.84)	0.322
>3 h	1.29 (0.53–3.14)	0.575
Where do you usually have lunch?		
University restaurant	1.00	
Eat at home or bring homemade food	0.82 (0.54–1.23)	0.335
Eat away from home or use food delivery services	0.80 (0.51–1.25)	0.324
Where do you usually have dinner?		
University restaurant	1.00	
Eat at home or bring homemade food	0.91 (0.48–1.72)	0.763
Eat away from home or use food delivery services	0.56 (0.25–1.26)	0.161
Cooking skills		
Availability and accessibility of fruits and vegetables at home	1.27 (1.14–1.40)	**<0.001**
Cooking attitudes	1.65 (1.27–2.14)	**<0.001**
Cooking behaviour at home	1.63 (1.30–2.04)	**<0.001**
Cooking behaviour away from home	0.94 (0.74–1.20)	0.599
Self-efficacy for using basic cooking techniques	1.63 (1.28–2.07)	**<0.001**
Self-efficacy for using fruits, vegetables, and seasonings	1.89 (1.45–2.30)	**<0.001**
Produce consumption self-efficacy	2.56 (2.07–3.18)	**<0.001**
Knowledge of cooking techniques	1.17 (1.06–1.30)	**0.001**

Notes: OR, odds ratio; CI, confidence interval. Data were subjected to logistic regression. Significant values ($p < 0.05$) are shown in bold.

3.4. Vegetable consumption and cooking skills: multivariate analysis

After adjusting for paternal education level and overweight/obesity status, associations between the seven cooking skill dimensions and vegetable consumption frequency remained significant (Table 4). A 1-point increase in 'Availability and accessibility of fruits and vegetables at home' corresponded to a 27% increase in the chance of consuming vegetables daily (OR, 1.27; 95% CI, 1.15–1.41; $p < 0.001$). Similar results were found by adjusting for sex, age, paternal education, and overweight/obesity status (OR, 1.27; 95% CI, 1.14–1.40; $p < 0.001$). By adjusting for paternal education and overweight/obesity status, we found that a 1-point increase in 'Self-efficacy for consuming fruits and vegetables' increased the chances of daily vegetable consumption by 2.52 times (95% CI, 2.03–3.12; $p < 0.001$). Another important finding, as it relates to modifiable skills, was the association between 'Self-efficacy for using fruits, vegetables, and seasonings' and with higher odds of daily vegetable consumption (OR 1.88 (95% CI 1.49–2.37; p< 0.001). As in the crude analysis, no association was found between 'Cooking behaviour away from home' and daily vegetable consumption.

Table 4

Association between cooking skill scores and daily vegetable consumption among university students ($N = 525$) in Santa Catarina, Brazil, 2020.

Variable	Daily vegetable consumption			
	OR1 (95%CI)	***p*-value**	**OR2 (95%CI)**	***p*-value**
Availability and accessibility of fruits and vegetables at home	1.27 (1.15–1.41)	**<0.001**	1.27 (1.14–1.40)	**<0.001**

Cooking attitudes	1.70 (1.31–2.22)	**<0.001**	1.67 (1.28–2.18)	**<0.001**
Cooking behaviour at home	1.61 (1.29–2.03)	**<0.001**	1.62 (1.28–2.04)	**<0.001**
Cooking behaviour away from home	0.95 (0.74–1.21)	0.677	0.96 (0.75–1.22)	0.743
Self-efficacy for using basic cooking techniques	1.71 (1.34–2.18)	**<0.001**	1.68 (1.31–2.15)	**<0.001**
Self-efficacy for using fruits, vegetables, and seasonings	1.88 (1.49–2.37)	**<0.001**	1.86 (1.47–2.36)	**<0.001**
Produce consumption self-efficacy	2.52 (2.03–3.12)	**<0.001**	2.51 (2.02–3.11)	**<0.001**
Knowledge of cooking techniques	1.16 (1.05–1.28)	**0.003**	1.15 (1.04–1.28)	**0.006**

Notes: OR1, odds ratio adjusted for paternal education and overweight/obesity; OR2, odds ratio adjusted for gender, age, paternal education, and overweight/obesity; CI, confidence interval. Data were subjected to logistic regression. Significant values ($p < 0.05$) are shown in bold.

4. Discussion

This study presents data on the frequency of vegetable consumption and its association with personal characteristics and cooking skills in a significant sample of Brazilian university students. Less than 50% of participants consumed vegetables daily. High paternal education level, not being overweight or obese, and high scores on seven of the eight cooking skill dimensions were positively associated with higher daily frequency of vegetable consumption. These findings are similar to the results presented in the review from Rodrigues et al. (2019), in which the mean frequency of daily vegetable intake was 40.2%, varying from 11.2% to 72.4%. Additionally, comparable to the present study, lower BMI and being from higher income family were among the associated factors with increased intake (Rodrigues et al. 2019).The majority of students analysed in this study were female, corroborating previous reports of greater female participation in eating behaviour studies (el Ansari, Suominen, & Berg-beckhoff, 2015; Muñoz de Mier et al., 2017). Such findings indicate that women have a greater concern about food habits (Sousa, José, & Barbosa, 2013; el Ansari, Suominen, & Berg-Beckhoff, 2015). The high percentage of participants enrolled in health sciences courses

(40%) also agrees with previous studies showing that enrolment in food and nutrition or health-related courses is associated with greater interest in food and diet quality (Matthews, Doerr, & Dworatzek, 2016).

It was identified that 27.5% of the participants were overweight, in line with Brazilian population-based studies. The 2008–2009 Brazilian Consumer Expenditure Survey revealed that 27.1% of individuals aged 20–24 years were overweight (IBGE, 2010). More recent data obtained by the 2019 Surveillance System for Risk and Protective Factors for Chronic Diseases by Telephone Survey (Vigitel) showed that 30.1% of individuals aged 18 to 24 years were overweight or obese (Brazil, 2020). This trend is seen globally, as evidenced by the results of studies with university students in Iran (Mansouri et al., 2020), Cameroon (Choukem et al., 2017), and the United States of America (Yahia et al., 2016).

In this study, overweight or obese university students had a lower frequency of daily vegetable consumption. These data are comparable to those of Muñoz de Mier et al. (2017), who found that overweight or obese university students in Spain consumed vegetables less frequently than normal-weight individuals. Similarly, a study with university students in Pakistan found a positive association between frequency of daily vegetable consumption (1 to 2 times a day) and low BMI (Irfan, Jabbar, & Hameed, 2019).

The majority (70%) of participants reported having 1 to 3 hours available for cooking per day, and the mean time spent in the activity was 1 hour and 22 minutes. These results are markedly different from those reported in other studies. Namin et al. (2020) investigated the eating habits of 248 college students in the United States of America and found that the mean time available for cooking was 0.5 to 1 hour. In a study with undergraduate students from England and Canada (N = 3 354), participants reported having an average of 38.8 minutes/day to cook on weekdays and 51.9 minutes/day to cook on weekends (Seabrook, Dworatzek, & Matthews, 2019). Whereas time availability is considered a stimulus to prepare

meals at home (Jones et al., 2014), lack of time may be a barrier to healthy eating (Murray et al., 2016).

A significant difference in daily vegetable intake was observed between students who dined at university restaurants (49%), at home or with homemade food (46%) and those who dined away from home, at restaurants and cafes, or with food from delivery services at (35%). However, no associations were observed between lunch place and vegetable consumption, attributed to the fact that about 31% of participants reported having lunch at university restaurants. This finding suggests that, in Brazil, eating meals at university restaurants favours vegetable consumption. Public university restaurants, which are subsidised by the Brazilian federal government, provide healthy meals at an affordable price, stimulating healthier eating habits among their customers. A Brazilian study investigating the effect of eating at a university restaurant on student diets (N = 1 131) showed an increase in vegetable consumption and a reduction in processed and ultraprocessed food consumption. Nevertheless, even among individuals who frequently ate at the university restaurant, fruit and vegetable consumption was lower than the recommended (Perez et al., 2019).

In the current study, 26.6% of students reported having lunch away from home. Studies suggest that away-from-home meal consumption is associated with low diet quality (Guthrie, Lin, & Frazao, 2002; Cunha et al., 2018) and high ultraprocessed food consumption (Andrade et al., 2020). In addition to university restaurants, self-service restaurants, commonly found in Brazil, may promote healthy eating habits. In this type of food establishment, customers choose from a variety of options at a buffet bar, including salads, and pay by weight of food. Given the diversity of preparations, affordable prices, and convenience, these self-service restaurants can stimulate healthy away-from-home food choices (Santos et al., 2011; Rodrigues et al., 2012).

The results of the present study indicate a significant association between paternal education level and daily vegetable consumption. Level of schooling is often related to family income. Parents with higher education are often better prepared to guide their children in adopting a healthy lifestyle (Gamage & Jayawardana, 2018). Education level may also be associated with increased knowledge about nutrition and greater ability to translate this knowledge into healthy eating habits (Hiza et al., 2013).

Most students (85%) reported knowing how to cook. This variable was significantly associated with daily vegetable consumption ($p < 0.001$), corroborating studies that found a positive relationship between frequency of home meal preparation and healthy eating habits (Thorpe et al., 2014; Wolfson & Bleich, 2015; Wolfson, Leung, & Richardson, 2020). A study with university students carried out in Spain found a higher intake of processed and ready-to-eat foods among students who reported not knowing how to cook. The authors argued that knowing how to cook does not imply the use of fresh foods, as cooking is also related to other factors, such as time and utensil availability and planning (Garcia, Svoboda, & Ruiz, 2016). However, in our study, the amount of time available for cooking was not associated with vegetable consumption.

We found an association between cooking skill scores and daily vegetable consumption. Similar findings were reported by Hanson et al. (2019). The authors observed that cooking four to seven times a week and preparing meals from basic ingredients were associated with higher fruit and vegetable consumption and lower BMI in college students. These results underscore the importance of stimulating home meal preparation through cooking interventions aimed at university students (Bernardo et al., 2017b; Reicks et al., 2018; Hasan et al., 2019). Also, an important perceived barrier for consumption among adults is not liking the taste of vegetables (Santos et al., 2019), therefore being self-confident to prepare and use fruits, vegetables and seasonings might overcome this obstacle. Considering this,

interventions aimed at providing information to help individuals to feel more self-efficacious when cooking can play a significative role to increase consumption.

The dimension 'Cooking behaviour away from home' was the only not associated with vegetable consumption, indicating that the frequency with which university students eat meals away from home does not influence the frequency of vegetable consumption. As previously discussed, this finding is likely associated with the availability of healthy meals in Brazilian university restaurants.

A limitation of the present study is that students from one Brazilian capital only (Santa Catarina State, Southern Brazil) were evaluated, precluding generalisation of the results. The findings may not, therefore, reflect the reality of university students in other parts of the country. However, it should be noted that the southern region has the highest percentage of individuals enrolled in universities compared with other Brazilian regions (Brazil, 2013). Participant weight and height (used for BMI estimation) were self-reported, which might have resulted in underestimation of weight or overestimation of height. However, self-reported weight and height have been used in epidemiological studies and may be considered a valid measure to improve the accuracy of collected data (Ekström, Kull, Nilsson, & Bergström, 2015; Hastuti, Rahmawati, & Suriyanto, 2017). Another possible limitation was that frequency of intake is prone to measurement error, particularly with recall long periods. Despite this, the data obtained in this study provide important data to broadly explore how often vegetables are consumed among university population. Additionally, the authors understand that the university students represent an important part of the population for public health action but acknowledge that other groups in this age group are also important and should be addressed in further investigations. Some of the strengths of this study include the use of an online, low-cost instrument validated to assess cooking skills among university students, which allowed optimising data collection and analysis. Our results can contribute to

the development and strengthening of public policies, given the scarcity of eating behaviour studies focused on this population group.

5. Conclusion

It is important to understand the factors influencing vegetable consumption among university students because behaviours acquired at this stage of life can last throughout adulthood. Cooking skills were positively associated with vegetable consumption frequency. The findings of the present study are relevant in view of the scarcity of research on the topic and may be useful to guide public health strategies aimed at increasing vegetable consumption among this population. Public policies that encourage the development of cooking skills can be used to promote behavioural changes and stimulate the adoption of healthier eating habits. Additionally, public and private sector can work to provide a healthy university environment, such as the possibility of having healthy and balanced meals at university restaurants for an affordable price, or canteens offering healthy and avoiding unhealthy foods. The implementation of such policies is paramount for promoting better food habits among university students.

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Author contributions

GLB and VMR led the conceptualisation and drafting of this paper with support from BSB and PLU. DBH was responsible for data analysis. GLB, VMR, BSB, PLU, DBH, ACF, SSM, SBC, JB, and HH revised and edited the manuscript, under the supervision of RPCP.

Declarations of competing interest

No conflicts are noted by the co-authors.

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Ethical considerations

This research was approved by the Human Research Ethics Committee of the Federal University of Santa Catarina (UFSC) (protocol No 1 318 443) and was conducted in accordance with the human research ethical principles of Brazilian Resolution No 466/2012 (Brazil, 2012).

We wish to confirm that there are no known conflicts of interest associated with this publication and there has been no significant financial support for this work that could have influenced its outcome. We confirm that the manuscript has been read and approved by all named authors and that there are no other persons who satisfied the criteria for authorship but are not listed. We further confirm that the order of authors listed in the manuscript has been approved by all of us. We confirm that we have given due consideration to the protection of intellectual property associated with this work and that there are no impediments to publication, including the timing of publication, with respect to intellectual property. In so doing we confirm that we have followed the regulations of our institutions concerning intellectual property. We further confirm that any aspect of the work covered in this manuscript that has involved people has been conducted with the ethical approval of all relevant bodies and that such approvals are acknowledged within the manuscript. We understand that the Corresponding Author is the sole contact for the Editorial process (including Editorial Manager and direct communications with the office). She is responsible for communicating with the other authors about progress, submissions of revisions and final approval of proofs. We confirm that we have provided a current, correct email address which is accessible by the Corresponding Author and which has been configured to accept email from: v.mellorodrigues@yahoo.com.br