

## Food processing knowledge among university students

Conhecimento sobre o processamento de alimentos entre estudantes universitários

Conocimiento sobre procesamiento de alimentos en estudiantes universitarios

Received: 04/01/2022 | Reviewed: 04/10/2022 | Accept: 04/15/2022 | Published: 04/20/2022

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### Abstract

The NOVA classification is not yet widely understood by the entire population and studies evaluating knowledge about the degree of food processing in university students are still scarce. In addition, it is unclear whether there is a difference in knowledge about the degree of food processing between academic areas in universities. Knowing that less knowledge can be a risk factor for risky eating habits, this study aims to assess the knowledge about food processing grade among university students. A cross-sectional study with 977 students. The questionnaire assessed knowledge about the degree of food processing (*in natura*, minimally processed, processed and ultra-processed). A linear regression analysis was used to demonstrate an association between overall knowledge about the degree of food processing and sociodemographic variables, academic areas and initial knowledge about the Brazilian food guide. The overall knowledge mean about the degree of food processing was 2.57 (1.37). The linear regression showed an association between age ( $p < 0.001$ ), having initial knowledge about the guide ( $p = 0.01$ ), being from the area of “Agrarian Sciences” ( $p < 0.001$ ) and “Biological and Health Sciences” ( $p < 0.001$ ) presenting the highest scores in overall knowledge. There was low overall knowledge about the degree of food processing among university students. Federal actions are needed to address this issue.

**Keywords:** Dietary guidelines; Universities; Students; Feeding behavior; Health teaching.

### Resumo

A classificação NOVA ainda não é amplamente compreendida por toda a população e estudos que avaliem o conhecimento sobre o grau de processamento de alimentos em estudantes universitários ainda são escassos. Além disso, não está claro se há diferença no conhecimento sobre o grau de processamento de alimentos entre as áreas acadêmicas das universidades. Sabendo que menos conhecimento pode ser um fator de risco para hábitos alimentares de risco, este estudo tem como objetivo avaliar o conhecimento sobre grau de processamento de alimentos entre estudantes universitários. Trata-se de um estudo transversal com 977 alunos. Um questionário foi utilizado para avaliar o conhecimento sobre o grau de processamento dos alimentos (*in natura*, minimamente processados, processados e ultraprocessados). Uma análise de regressão linear foi utilizada para demonstrar uma associação entre o conhecimento geral sobre o grau de processamento dos alimentos e variáveis sociodemográficas, áreas acadêmicas e conhecimento inicial sobre o guia alimentar da população brasileira. A média geral de conhecimento sobre o grau de processamento dos alimentos foi de 2,57 (1,37). A regressão linear mostrou associação entre idade ( $p < 0,001$ ), ter conhecimento inicial sobre o guia ( $p = 0,01$ ), ser da área de “Ciências Agrárias” ( $p < 0,001$ ) e “Ciências Biológicas e da Saúde” ( $p < 0,001$ ) apresentando as maiores pontuações em conhecimento geral. Houve baixo conhecimento geral sobre o grau de processamento de alimentos entre os universitários.

**Palavras-chave:** Guias alimentares; Universidades; Estudantes; Comportamento alimentar; Ensino em saúde.

## Resumen

La clasificación NOVA todavía no es ampliamente comprendida por toda la población y los estudios que evalúan el conocimiento sobre el grado de procesamiento de los alimentos en los estudiantes universitarios son todavía escasos. Además, no está claro si existe una diferencia en el conocimiento sobre el grado de procesamiento de los alimentos entre las áreas académicas de las universidades. Sabiendo que un menor conocimiento puede ser un factor de riesgo para los hábitos alimentarios perjudiciales, este estudio tiene como objetivo evaluar el conocimiento sobre el grado de procesamiento de los alimentos entre los estudiantes universitarios. Se trata de un estudio transversal con 977 estudiantes. El cuestionario evaluó el conocimiento sobre el grado de procesamiento de los alimentos (*in natura*, mínimamente procesado, procesado y ultraprocesado). Se utilizó un análisis de regresión lineal para demostrar la asociación entre el conocimiento global sobre el grado de procesamiento de los alimentos y las variables sociodemográficas, las áreas académicas y el conocimiento inicial sobre la guía alimentaria brasileña. La media de conocimiento global sobre el grado de procesamiento de los alimentos fue de 2,57 (1,37). La regresión lineal mostró una asociación entre la edad ( $p < 0,001$ ), tener conocimiento inicial sobre la guía ( $p = 0,01$ ), ser del área de "Ciencias Agrarias" ( $p < 0,001$ ) y "Ciencias Biológicas y de la Salud" ( $p < 0,001$ ) presentando las mayores puntuaciones en el conocimiento global. Hubo un bajo conocimiento general sobre el grado de procesamiento de los alimentos entre los estudiantes universitarios. Es necesario emprender acciones federales para abordar esta cuestión.

**Palabras clave:** Directrices dietéticas; Universidades; Estudiantes; Comportamiento alimentario; Enseñanza en la salud.

## 1. Introduction

Increasing modernization and urbanization has driven the population towards a dietary pattern characterized by an increased intake of diets rich in fats, added sugars, and low consumption of fruits, vegetables, and fiber, which contributes to weight gain and increased prevalence of chronic non-communicable diseases (Instituto Brasileiro de Geografia e Estatística, 2020; Schneeman & Mendelson, 2002; Tardido & Falcão, 2006). This consumption pattern is also adopted among individuals belonging to the university community (Feitosa et al., 2010; Mescoloto et al., 2017; Souza & Backes, 2020).

Therefore, there are several initiatives and actions to encourage better eating practices which are used as strategies to promote the population's quality of life and health (Boog, 1999; Costa et al., 2011; Santos, 2005; Teixeira et al., 2013). In this sense, food guides have been used to promote better eating habits and provide guidance on healthy eating practices (Barbosa et al., 2008; Lobo & Martins, 2014; Schneeman & Mendelson, 2002; Verly Junior et al., 2013; Vinholes et al., 2009).

The second edition of the Food Guide for the Brazilian Population (FGBP) (Brasil, 2014) adopts the NOVA classification, classifying foods according to the degree and purpose of industrial processing to which they are submitted and not by nutritional profile (Monteiro et al., 2010). Foods are classified into four groups: *in natura* or minimally processed; processed culinary ingredients; processed foods; and ultra-processed foods (Monteiro et al., 2019). This new approach enabled developing dietary recommendations which are aware of the limitations of the nutritional discourse, bringing sociocultural and socio-environmental approaches, and encouraging the promotion of healthy and adequate eating (Oliveira & Silva-Amparo, 2018). Countries such as Uruguay, Canada, Peru, Ecuador, Israel, and Belgium have also included this classification in their national guidelines (NUPENS-USP, 2021a, 2021b).

Although food guides are developed as tools to make adequate food choices, the FGBP and the NOVA classification is still not widely understood by the entire population. It is necessary to enhance its use by health professionals (Brasil, 2021) so that knowledge of its guidelines helps ensure good adherence to its recommendations. It must also be considered that the non-recognition and/or follow-up of the guidelines proposed by the FGBP for the general population may be attributed to the use of technical terms and concepts, which the population may not clearly understand (Da Silva Oliveira & Silva-Amparo, 2018).

In this perspective, recent studies have shown insufficient knowledge about the new food classification among nutrition students and professional nutritionists (Menegassi et al., 2018; Menegassi et al., 2020). This low overall knowledge of the NOVA classification by this public, holder of knowledge about food and nutrition, may reflect insufficient knowledge of the population about the degree of food processing and healthy eating practices, making it one of the factors that justify the low

adherence to the recommendations of the FGBP in the population and among university students (Barbosa et al., 2020; Instituto Brasileiro de Geografia e Estatística, 2020; Vieira et al., 2002).

Despite presenting insufficient knowledge on the NOVA classification, it is known that nutrition professionals have greater nutritional knowledge when compared to other health areas (Reis & Jaime, 2019), and studies have demonstrated insufficient nutritional knowledge of these professionals as well (Barros et al., 2019; Schaller & James, 2005). Thus, it can be inferred that areas more distant from health majors have lower levels of knowledge; however, recent studies have shown that there is no difference between students' nutritional knowledge from different academic areas (Rêgo et al., 2015; Werner & Betz, 2020).

Regarding eating habits, a study showed that students from the humanities major had better-eating habits than students from the health majors (Garbaccio & Oliveira, 2019); in the same perspective, a study conducted with Brazilian college students showed, although not significantly, that students from the humanities and exact sciences and earth sciences had some healthier eating practices than health area students (Souza & Backes, 2020). Knowing that less knowledge can be a risk factor for risky eating habits (Yahia et al., 2016), these results may infer that students from other academic areas may have some level of nutritional knowledge. It should also be noted that university students, regardless of the area, are current and future opinion makers in society, and this audience is important to reach for health education for the population.

Given this panorama and the scarcity of studies that address an assessment of knowledge about technical terms used in the FGBP in the university population as a whole, this study has as its primary objective to analyze the general knowledge about the degree of food processing in university students; and as a secondary objective, to verify how academic areas are associated with this knowledge).

## **2. Methodology**

### ***Study design and data collection***

This is a cross-sectional study conducted among university students from a public educational institution in northeastern Brazil. The collection occurred from April to May 2015 with 977 students from the first to the fifth academic years from the different teaching areas of the university. Trained students approached participants in the classroom or individually on campus. Before filling out the questionnaire, instructions were given about the instrument, and additional care was taken by interviewing the participants individually so that there was no influence from the interviewees' colleagues in the answers. The study was approved by a Research Ethics Committee under opinion no. 1.917.582, according to Resolution nº 466/2012 of the National Health Council of Brazil, which presents regulatory standards for research involving human beings. All participants expressed their agreement with the study by signing the Informed Consent Form.

### ***Participants***

The sample inclusion criterion was to be a student in the in-person teaching modality and to be aged between 18 and 59 years. The exclusion criterion was being a student from any period of the nutrition course. Next, a survey of the number of students and courses was carried out to select the sample according to the four major areas of undergraduate courses: "Agrarian and Applied Sciences", "Biological and Health Sciences", "Exact Sciences and Engineering", and "Human and Social Sciences". In turn, 31 courses encompassing the morning and afternoon shifts were randomly selected to obtain a significant sample for each study area. So there would be representatives from all teaching departments. The formula for the description of qualitative variables with an infinite population was used to calculate the sample using a proportion of favorable results of 50% and unfavorable results of 50%, with a margin of error of 3.5%, thus obtaining a minimum of 781 questionnaires to be reached (Miot, 2011).

### ***Questionnaire***

The developed instrument was a self-administered questionnaire divided into two sections. The first section contained questions regarding identification and sociodemographic data: e-mail, course, year of admission to the university, course area, period studied, gender, age, and family income. The variable age was used as a continuous variable and categorized according to the median depending on the statistical analysis used. Family income was assessed according to the value of the minimum wage in force at the time of collection. For the analysis, this variable was categorized as: "More than 4 minimum monthly salaries" and "Less than 4 minimum monthly salaries".

The second section comprised five questions. First, the participants were asked about the awareness of the food guide (Brasil, 2014), with yes or no answer options; this question aimed to investigate whether they had had initial contact with the FGBP before this study. Then, four questions regarding the correctness of the terms used Brazilian guide were asked in the following manner: "Do you know how to identify *in natura* foods, yes or no? If yes, give an example."; "Can you identify minimally processed foods, yes or no? If yes, give an example."; "Can you identify processed foods, yes or no? If yes, give an example."; "Can you identify ultra-processed foods, yes or no? If yes, give an example.

Participants were allowed to respond to each question before moving on to the next one. The interviewer did not give verbal commands or hints about the answers to maintain reliability. The examples given by the participants were considered correct if they were in accordance with the NOVA classification and the Food Guide for the Brazilian Population (Brasil, 2014; Monteiro et al., 2019, 2010). Among the 977 participants, this measure demonstrated acceptable, although not strong, internal consistency (Cronbach's  $\alpha = 0.53$ ) (Landis & Koch, 1977).

### ***Scoring***

The sum of correct answers for each example was calculated to create an overall knowledge score about the terms of the degree of food processing. Each correct answer was equivalent to 2.5 points, so that the participants scored between 0-10 in the overall knowledge score. This variable was used as quantitative in the first study aim and regression analysis. Then, four binary dichotomous variables were created for each processing level category to define the correctness and misses of the examples individually for each category (0= correct answers/ 1=wrong answers); this variable was used in the second study aim and regression analysis.

### ***Pilot study and discriminant validation***

The designed questionnaire was tested face validity by three researchers before starting the collection, including a doctor with extensive experience in public health and two Master's students from the research group. Thus, we sought to broaden the critical view of the questionnaire. A pilot study was subsequently applied with 50 students from the first year of the nutrition course who did not participate in the study to verify the clarity of the questions asked to make the questionnaire more understandable for later application. The same-trained students who applied the final version of the questionnaire conducted the pilot study via face-to-face interviews. After the application of the questionnaires, the students were able to give their opinions about the difficulties encountered when filling out the questions. Accordingly, modifications were made to overcome the problems noticed.

After the adjustments made in the pilot study, the questionnaire was applied in 2 groups to determine the discriminant validity. Group 1 was formed by 29 students from the sixth period of nutrition and group 2 by 29 students from the history course. These groups were chosen because students from the humanities course would be a parameter for a low knowledge about the food processing degree in relation to students in the nutrition course. Thus, the purpose of this analysis is to verify whether the questionnaire can differentiate participants at different knowledge levels (Nascimento, Raposo, Brito, & Mendes

Netto, 2013). The results of the discriminant validation showed good performance of the overall knowledge questionnaire on the degree of food processing, with the mean global knowledge of group 1 ( $8.70 \pm 2.55$ ) being significantly higher than that of group 2 ( $1.03 \pm 2.36$ ).

### **Statistical analysis**

Analyzes were performed using the Statistical Package for Social Sciences (SPSS) version 25.0 software program. Quantitative variables were submitted to the Kolmogorov-Smirnov test to verify the data normality. Descriptive analysis was performed by obtaining frequencies and percentages for categorical variables, while mean and standard deviation values were obtained for continuous variables.

Next, five multivariate analyzes were performed. The first analysis was a multiple linear regression with the overall knowledge about the degree of food processing as the dependent variable. Age (continuous), gender, income, course areas, and awareness of the guide were the independent variables tested. A univariate analysis was initially performed, where all variables that presented a significance of  $p < 0.2$  in the simple linear regression were followed for multivariate-adjusted analysis. The stepwise method was used to simultaneously remove variables with weak associations and develop a model that better explained the data distribution and relationship between the different variables. The normality of the residuals was observed for the multiple linear regression analysis, followed by the independence of the residuals using the Durbin-Watson test. The variance inflation factor (VIF) was analyzed to refute the multicollinearity assumptions, and the model significance was analyzed using the regression ANOVA test.

Then, four binary logistic regressions were performed to verify the association between knowledge of each food processing category (*in natura*, minimally processed, processed, and ultra-processed) with the independent variables (categorized age, gender, income, awareness of the guide and course areas). The variables for this analysis were tabulated in a binary form, with 1 for correctness and 0 for error. A univariate analysis was initially performed by calculating the odds ratio, 95% confidence interval, and p-value. All variables that presented a significance of  $p < 0.2$  were included in the adjusted multivariate analysis using the stepwise method. The independent variables in binary logistic regression were considered significant using the Wald statistics, and the models were considered significant using the Omnibus test. The significance level adopted for all multivariate analyses was 5%.

## **3. Results**

Of the 977 students who participated in the study, 55.1% were male, and 54.8% had a family income of more than 4 minimum monthly salaries. The average age was 21.57 years, 22.8% belonged to the area of “Agrarian Sciences”, 25.3% “Biological and Health Sciences”, 23.6% “Exact and Engineering” and 27.3% “Human and Social Sciences” (Table 1). It was also observed that 94.5% reported not having had contact with FGBP and had an average overall knowledge about the food processing degree of 1.36 (2.10).

**Table 1.** Descriptive analysis (n=977).

Variable	Category	Frequency	
		(n)	(%)
Sex	Female	439	44.9
	Male	538	55.1
Family income	> 4 salaries (> USD \$ 562.82)	535	54.8
	1 to 4 salaries (USD \$ 140.70-562.82)	442	45.1
Course Area	Agrarian Sciences	223	22.8
	Biological and Health	247	25.3
	Exact and Engineering	240	24.6
	Human and Social Sciences	267	27.3
Awareness about the guide	No	923	94.5
	Yes	54	5.5
Age	Mean	21.57	
	SD	4.69	
Overall Knowledge	Mean	1.36	
	SD	2.10	

SD: standard deviation. Source: Auhors.

Age ( $\beta=0.14$ ), awareness of the guide ( $\beta=0.07$ ), being from the area of “Agrarian Sciences” ( $\beta=0.16$ ) and being from the “Biological and Health Sciences” ( $\beta=0.12$ ) were associated with greater overall knowledge about the level of food processing in the adjusted linear regression model. The multivariate linear regression model formed a good fit for the data  $F(4.972) = 15.221$ ,  $p < 0.001$ ;  $R^2: 0.059$ . Table 2 shows the crude and adjusted models.

**Table 2.** Overall knowledge about the degree of food processing among university students (n=977).

Independent variables	Crude model		Adjusted model			
	$\beta$ (95%CI)	p	b	$\beta$ (95%CI)	SE	p
<b>Intercept</b>				-0.43 (-1.05; 0.18)	0.31	0.16
<b>Age</b>	0.06 (0.03; 0.09)	<0.001*	0.14	0.06 (0.03; 0.09)	0.01	<0.001*
<b>Sex<sup>a</sup></b>	0.01 (-0.58; 0.27)	0.96	-	-	-	-
<b>Income<sup>b</sup></b>	0.13 (-0.12; 0.40)	0.30	-	-	-	-
<b>Awareness about the guide</b>	0.85 (0.28; 1.42)	0.004*	0.07	0.73 (0.16; 1.29)	0.28	0.01
<b>Agrarian Sciences</b>	0.58 (0.27; 0.90)	<0.001*	0,16	0,82 (0,50; 1,14)	0.16	<0.001*
<b>Biological and Health Sciences</b>	0.38 (0.08; 0.69)	0.01*	0,12	0,60 (0,19; 0,91)	0.16	<0.001*
<b>Exact and Engineering</b>	-0.58 (-0.88; -0.28)	<0.001*	-	-	-	-
<b>Human and Social Sciences</b>	-0.34 (-0.64; -0.05)	0.02*	-	-	-	-

b = standardized Beta;  $\beta$  = Unstandardized Beta; 95%CI= 95 confidence interval; SE = Standard error. a: Female; b: More than 4 minimum monthly salaries.\* Variables analyzed by simple linear regression ( $p < 0.2$ ) that were transferred to adjusted analysis.  $R^2=0.059$ . Source: Auhors.

It was observed that age (OR=1.41; CI 95%: 1.07; 1.86), being from the area of “Agrarian Sciences” (OR=1.76; CI 95%: 1.25; 2.47) and being from the area of “Biological and Health Sciences” (OR =1.77; CI 95%: 1.27; 2.47) were associated with knowledge about *in natura* food category in the logistic regression analysis. Being from the area of “Agrarian Sciences” (OR=3.78; CI 95%: 2.07; 6.90) and being from the area of “Biological and Health Sciences” (OR=2.86; CI 95%: 1.54; 5.31) were associated with knowledge for minimally processed foods. Furthermore, being in the area of “Agrarian Sciences” was the only associated variable for the category of processed foods (OR=1.95; CI 95%: 1.23; 3.08), while income (OR=2.34; CI 95%: 1.35; 4.04), awareness of the guide (OR=3.31; CI 95%: 1.52; 7.23) and being from the area of "Agrarian Sciences" (OR=1.80;

CI 95%: 1.03; 3.12) were associated knowledge about the degree of ultra-processing. Table 3 shows the crude and adjusted logistic regression models for each food processing category.

**Table 3.** Knowledge about the degree of food processing by processing category among university students (n=977).

Dependent Variable	<i>In natura</i>				Minimally Processed				Processed				Ultra-processed			
	Crude model		Adjusted model		Crude model		Adjusted model		Crude model		Adjusted model		Crude model		Adjusted model	
Independent Variables	OR	(95% CI)	OR	(95% CI)	OR	(95% CI)	OR	(95% CI)	OR	(95% CI)	OR	(95% CI)	OR	(95% CI)	OR	(95% CI)
Sex <sup>a</sup>	0.98	0.74; 1.29	-	-	1.24	0.77; 2.00	-	-	0.98	0.63; 1.51	-	-	0.88	0.54; 1.44	-	-
Income <sup>b</sup>	1.01	0.77; 1.33	-	-	0.92	0.57; 1.48	-	-	1.14	0.73; 1.76	-	-	2.12	1.24; 3.62	2.34	1.35; 4.04
Age <sup>c</sup>	1.38	1.05; 1.82	1.41	1.07; 1.86	1.28	0.79; 2.05	-	-	1.27	0.82; 1.95	-	-	0.97	0.60; 1.58	-	-
Awareness about the guide	1.88	1.08; 3.28	-	-	1.91	0.83; 4.39	-	-	1.22	0.50; 2.93	-	-	3.22	1.54; 6.72	3.31	1.52; 7.23
Agrarian Sciences	1.41	1.03; 1.93	1.76	1.25; 2.47	2.33	1.42; 3.82	3.78	2.07; 6.90	1.92	1.21; 3.04	1.95	1.23; 3.08	1.45	0.85; 2.47	1.80	1.03; 3.12
Biological and Health Sciences	1.43	1.05; 1.94	1.77	1.27; 2.47	1.57	0.95; 2.60	2.86	1.54; 5.31	1.12	0.69; 1.81	-	-	1.57	0.94; 2.63	-	-
Exact and Engineering	0.58	0.41; 0.82	-	-	0.30	0.13; 0.66	-	-	0.78	0.46; 1.33	-	-	0.42	0.20; 0.87	-	-
Human and Social	0.81	0.59; 1.11	-	-	0.54	0.29; 1.00	-	-	0.52	0.30; 0.92	-	-	0.82	0.46; 1.44	-	-

OR: Odds Ratio; IC (95%): 95% confidence interval. <sup>a</sup>: Female; <sup>b</sup>: More than 4 minimum monthly salaries; <sup>c</sup>: More than 20 years. Source: Auhors.

#### 4. Discussion

The present study demonstrated low overall knowledge about the degree of food processing among university students. Associated with this knowledge were age, awareness about the food guide, being in the area of “Agrarian Sciences” and “Biological and Health Sciences”. The objective of FGBP is to facilitate the population’s access to knowledge about the determining characteristics of adequate nutrition (Brasil, 2014), and despite low overall knowledge, having an awareness of the guide is associated with greater knowledge about the degree of food processing demonstrates that this objective has been achieved.

It is known that age and being a student in the health field have been associated with greater knowledge about food and nutrition previously (De Vriendt et al., 2009; Mirmiran et al., 2010; Mota et al., 2020). However, for the area of “Agrarian Sciences”, greater knowledge about the processing degree can be justified by the close relationship that courses in this area have with disciplines related to industrial and food processing, such as courses in Agronomic Engineering and Agroindustry, which fall into this area at the university under study. This can also explain the results obtained in the analysis of knowledge by processing category, where being in the “Agrarian Sciences” area was associated with greater knowledge in all analyzed processing categories.

Although the "Biological and Health Sciences" area was associated with overall knowledge, surprisingly, this area was only associated with knowledge of the *in natura* and minimally processed categories in the analysis by processing

category. These results suggest that courses in this area did not update their disciplines so that the knowledge about the new guide and the NOVA classification based on food processing could be understood by students. Thus, these results can be reflected in less knowledge after graduation, and in this sense studies have been carried out in order to emphasize the importance of this knowledge and to train students and health professionals about the guide (Jaime et al., 2018; Menegassi et al., 2018; Reis & Jaime, 2019) so that they become multipliers of this knowledge for the population.

In addition, students who reported a monthly income greater than 4 minimum monthly salaries were 2.34 times more likely to have knowledge about ultra-processed foods. This result is particularly worrisome, as it shows that lower-income students are less likely to have this knowledge. It is known that income has been associated with lower levels of knowledge about food and nutrition (McLeod et al., 2011; Parmenter et al., 2000) and that the level of this knowledge may be related to the consumption and eating behavior of the population (Barbosa et al., 2016). Several studies have already proven the risk of consuming ultra-processed foods for both health and the environment (Canella et al., 2014; Mendonça et al., 2016; Monteiro et al., 2018; Tavares et al., 2012). Therefore, there should be increased federal and health professional efforts to disseminate information on the guide for all, regardless of income.

It is essential to widely disseminate the FGBP and the NOVA classification within the universities so that this knowledge can be one of the factors that promote better eating behavior in students. The results of this study can help managers in the universities and nutritionists, professionals with greater knowledge about the FGBP and technical reference for food and nutrition education actions (Reis & Jaime, 2019) to understand the areas that present the most significant deficits in this knowledge within universities, such as lower-income students and students from the “Human and Social Sciences” and “Exact and Engineering” areas, in addition to enabling the better qualification of students in the health science areas in this knowledge.

Studies involving the knowledge level of university students and even the general public regarding the food processing level are still scarce; this study represents an important work of characterizing nutritional knowledge of terms brought into the FGBP recommendations. However, this study has some limitations, such as the use of a knowledge questionnaire and scoring methods not validated for the specific population and the use of self-reported data; however, we believe that this bias has been minimized by careful analysis of the questionnaires in the pilot analysis and with discriminant validation and reliability tests. The results may also have been influenced by the data collection date since the FGBP was launched in 2014 and the data collection was carried out in 2015, which is insufficient time for knowledge to have been widely disseminated among students outside the nutrition field. It is also noteworthy that only recently FGBP guidance materials were published to disseminate better dietary practices for the population (Brasil, 2021); inferring that little must have changed such knowledge since the present study was carried out. Despite these limitations, the study is a pioneer in assessing knowledge about the terms of the degree of food processing among university students outside the field of nutrition and presents a representative sample within the university under study.

## 5. Conclusion

The university students had low overall knowledge about the degree of food processing and age, awareness about the guide, being in the area of “Biological and Health Sciences” and “Agrarian Sciences” were associated with this knowledge. In the analysis by processing category, it was observed that students in the area of "Agrarian Sciences" were associated with greater knowledge in all categories. In contrast, students in the area of "Biological and Health Sciences" only presented knowledge for *in natura* and minimally processed foods. In addition, having higher income and awareness about the guide were associated with greater knowledge about ultra-processed foods.



Future research should focus on analyzing knowledge about the NOVA classification in the general population, not just college students; and measuring this knowledge using questionnaires designed and validated for this purpose. Thus, food and nutrition education actions are needed in the context of promoting health and healthy eating within the universities in order to reach the most vulnerable students to lack knowledge about the benefits and risks of the degree of food processing.

## Acknowledgments

The authors would like to thank the Institutional Scientific Initiation Scholarship Program (PIBIC) for the technical support. This study was partly funded by the Foundation for Support of Research and Technological Innovation of the State of Sergipe (FAPITEC/SE: PROMOB - 88881 157882/2017-01; and PROEF - 88887.157406/2017-00) and Coordination for the Improvement of Personnel in Higher Education (CAPES – Financing Code 001).

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