DEMETRA
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NOVA food classification: comparison of the knowledge among incoming and outgoing Nutrition students

Classificação de alimentos NOVA: comparação do conhecimento de estudantes ingressantes e concluintes de um curso de Nutrição

Abstract

Introdução: A segunda edição do Guia Alimentar para a População Brasileira utiliza a classificação NOVA de alimentos nas recomendações para uma alimentação saudável. Essa classificação, portanto, desempenha importante papel na formação de nutricionistas. *Objetivo:* Comparar o conhecimento da classificação NOVA de alimentos entre estudantes ingressantes e concluintes de Nutrição. *Métodos*: Estudo transversal realizado em 2016 com estudantes ingressantes e concluintes de um curso de Nutrição do Mato Grosso do Sul. Questionário contendo 30 alimentos foi aplicado com estudantes que os classificaram em: in natura ou minimamente processado, ingrediente culinário processado, processado ou ultraprocessado. O conhecimento foi avaliado por meio de escore de classificações corretas, global e por grupo alimentar. Para análise comparativa, foi utilizado teste U de Mann-Whitney (significância p≤0,05). *Resultados:* Participaram 69 estudantes (64% ingressantes). O escore global de classificações corretas foi significativamente maior (p=0,000) nos concluintes (mediana=17) comparado aos ingressantes (mediana=14). O escore de classificações corretas entre ingressantes e concluintes apresentou diferenças significativas para todos os grupos alimentares, excetuando ingredientes culinários (p=0,117). Entre todos estudantes, o grupo ingrediente culinário obteve o menor percentual de acertos (24,1%), e ultraprocessado, obteve o maior percentual (77,8%). *Conclusão*: Apesar do maior conhecimento dos concluintes em relação aos ingressantes, identificou-se um conhecimento insatisfatório sobre a classificação NOVA em ambos. É importante garantir o aprendizado de estudantes de Nutrição quanto à NOVA, uma vez que esta classificação é central na orientação nutricional da população brasileira e, portanto, passa a ser ferramenta fundamental na atuação do profissional nutricionista.

Palavras-chave: Estudantes. Conhecimento. Alimentos. Guias alimentares.

Resumo

Introduction: The second edition of the Dietary Guidelines for the Brazilian population uses the NOVA food classification for healthy diet recommendations. Therefore, this classification plays an important role in the training of nutritionists. *Objective:* To compare the knowledge of the NOVA food classification among incoming and outgoing Nutrition students. *Methods:* A cross-sectional study was conducted in 2016 involving the incoming and outgoing students of an undergraduate Nutrition course in Mato

Grosso do Sul. A questionnaire containing 30 food items was administered to the students, who classified them into: unprocessed or minimally processed, processed culinary ingredients, processed, and ultra-processed food. The students' knowledge was then evaluated using a score of correct classifications, overall and by food group. The Mann–Whitney U test was used for comparative analysis (significant when p≤0,05). *Results:* A total of 69 students participated (64% were incoming). The overall score of correct classifications was significantly higher (p=0.000) in outgoing students (median=17) than in incoming students (median=14). The score difference of correct classifications between the incoming and outgoing student groups showed significant differences for all food groups, except culinary ingredients (p=0.117). The culinary ingredient group obtained the lowest percentage of correct answers (24.1%), and the ultra-processed food group obtained the highest percentage (77.8%) among all students. *Conclusion:* Although outgoing students had greater knowledge than incoming students, unsatisfactory knowledge was identified on the NOVA classification in both groups. It is important to assure that the Nutrition students learn about the NOVA classification, since this classification is central to the nutritional guidance of the Brazilian population and, therefore, becomes a fundamental tool in the work of the professional nutritionist.

Keywords: Students. Knowledge. Food. Food guides.

INTRODUCTION

Food guides present a set of information about analysis and recommendations on food choice, preparation, and consumption. It also serves as a food and nutrition education tool that helps promote the health of individuals, families, and communities.[1]

Worldwide, more than a hundred countries have already developed their own food guides.[2] In line with the recommendation of the Food and Agriculture Organization of the United Nations, so that countries review their food guides periodically,[2] the Brazilian Ministry of Health published the second edition of the Dietary Guidelines for the Brazilian Population in 2014.[3]

In its second chapter, entitled "The choice of food," the Brazilian Guide presents a new food classification based on the nature, extent, and purpose of food processing. These are classified into four groups: unprocessed or minimally processed foods, processed culinary ingredients, processed and ultra-processed foods.[3]

Therefore, the Guide recommends that the basis of people's food should be composed of unprocessed or minimally processed food and that the consumption of ultra-processed foods should be avoided owing to their high energy density and high sugar, fat, and sodium contents, along with low fiber, vitamin, and mineral contents. This unbalanced nutritional composition favors various diseases and improves the risk of nutritional deficiencies.[3]

This food classification was proposed in 2010 by researchers from the Center for Epidemiological Research in Nutrition and Health (NUPENS) at Universidade de São Paulo (University of São Paulo).[4] In 2014, it was included in the Dietary Guidelines for the Brazilian Population,[3] being revised in 2016 and named NOVA.[4] Its use in the population studies on food, nutrition, and health can be observed in several countries like Brazil,[5-7] the United States,[8] Canada,[9,10] the United Kingdom,[11] Chile,[12,13] Sweden,[14] and France.[15]

Four of the ten recommendations of the Dietary Guidelines for the Brazilian Population[3] directly involve the NOVA classification,[4] which can be used by nutritionists in prescriptions, guidelines, and educational food and nutrition actions with customers, patients, users, caregivers, families, or guardians. This classification, therefore, is a fundamental tool that the Nutrition students and future nutritionists should know.

The objective of this study was to compare the knowledge of the NOVA classification of food among the incoming and outgoing undergraduate Nutrition students.

METHODS

This is a quantitative, cross-sectional, and descriptive study conducted in a higher education institution located in the state of Mato Grosso do Sul, MS, Brazil, that offers a Nutrition course, among others. This location was chosen owing to its proximity and interaction with the researchers. All incoming and outgoing undergraduate Nutrition students regularly enrolled in the 1st semester of 2016 were invited to participate.

The data collection was performed on a non-probabilistic sample selected for convenience. Initially, a list with the names of the incoming and outgoing students enrolled in the 1st half of 2016 was requested from the Nutrition course. The incoming students were approached during the class period and invited to participate in the research. The outgoing students were conducting supervised curricular internships outside the institution and thus were contacted via e-mail and invited to participate in the research at the institution on a date and time determined by the researchers.

A questionnaire adapted from Menegassi et al.[16] was administered to the students who agreed to participate in the research. First, they were instructed to fill in five open-ended questions regarding personal data: name, sex, age, e-mail, and telephone. Afterwards, the students were instructed to classify a list of 30 foods, marking with an "x" the option they thought to be correct according to the NOVA[4] classification as unprocessed or minimally processed, processed culinary ingredients, processed and ultra-processed.

There were 12 unprocessed or minimally processed foods: rice; coffee powder; beef; dried fruit; cassava flour; wheat flour; milk powder; pasteurized milk; ultra-pasteurized milk; frozen manioc; pasta made of flour and eggs; and egg. There were five foods from the processed culinary ingredient group: brown sugar; white sugar; butter; soy oil; and salt. There were six foods from the processed group: canned corn; dried meat; crystallized fruit; bread made with wheat flour, water, salt, and yeast; fruits in syrup; and cheese. The ultra-processed group had seven foods: granola bar; stuffed cookie; chicken nugget; frozen lasagna; loaf bread; powdered drink mix; and soft drink.

The foods were listed alphabetically, which included foods mentioned in the Dietary Guideline for the Brazilian Population[3] as examples of their respective groups.

The items in the questionnaire and the food classifications made by the participants were typed in a Microsoft Office Excel version 2013 spread sheet (Alabama, USA) for data organization. The typing was checked by two researchers (study authors), and errors were corrected.

The students' knowledge of the NOVA food classification was assessed by the correct classification scores. The score was calculated by adding the overall number of foods correctly evaluated (considering the analysis of the four food groups) and by each food group.

The planned data were submitted for statistical analysis using the Statistical Package for the Social Sciences version 22.0 (Chicago, USA). The analysis was based on descriptive statistics and statistic tests for comparative analysis between the groups of incoming and outgoing students. First, the exploratory analysis was performed to characterize the sample, subsequently using the Kolmogorov–Smirnov and Levene tests to evaluate the normality assumptions and homogeneous variances of study variables. The non-parametric Mann–Whitney U test was used because of non-normal data and variance heterogeneity. The significance level of α was considered lower or equal to 0.05. The Cliff delta was used to calculate the size of the obtained effects.[17]

This study was approved by a Research Ethics Committee located in the state of Mato Grosso do Sul (Case No 1.532.398/2016). All ethical issues for research involving human beings were considered according to Resolution 466/12 of the National Health Council. All participants signed an Informed Consent From and received a copy of it.

RESULTS

Of the 84 Nutrition students enrolled in the first term in 2016, 46 were incoming and 25 outgoing, with a total participant count of 71. Eleven incoming and two outgoing students were not present at the time of data collection. Due to filling errors, there was a sample loss of two (n=2) questionnaires (incoming), resulting in a final sample of 69 participants (n=69). Of these 64% (n=44) were incoming and 36% (n=25) were outgoing students. Most of the students were female (96%, n=66).

Figure 1 shows the position measurements (minimum,1st quartile, median, 3rd quartile, maximum), comparing incoming and outgoing students regarding the correct food group and overall classification score.

There was a difference between the groups evaluated, and this is reflected by box displacement on each graph.

Figure 1. Comparison of correct overall and food group classification scores between incoming (n=44) and outgoing students (n=25) of a Nutrition course. Mato Grosso do Sul, 2016.
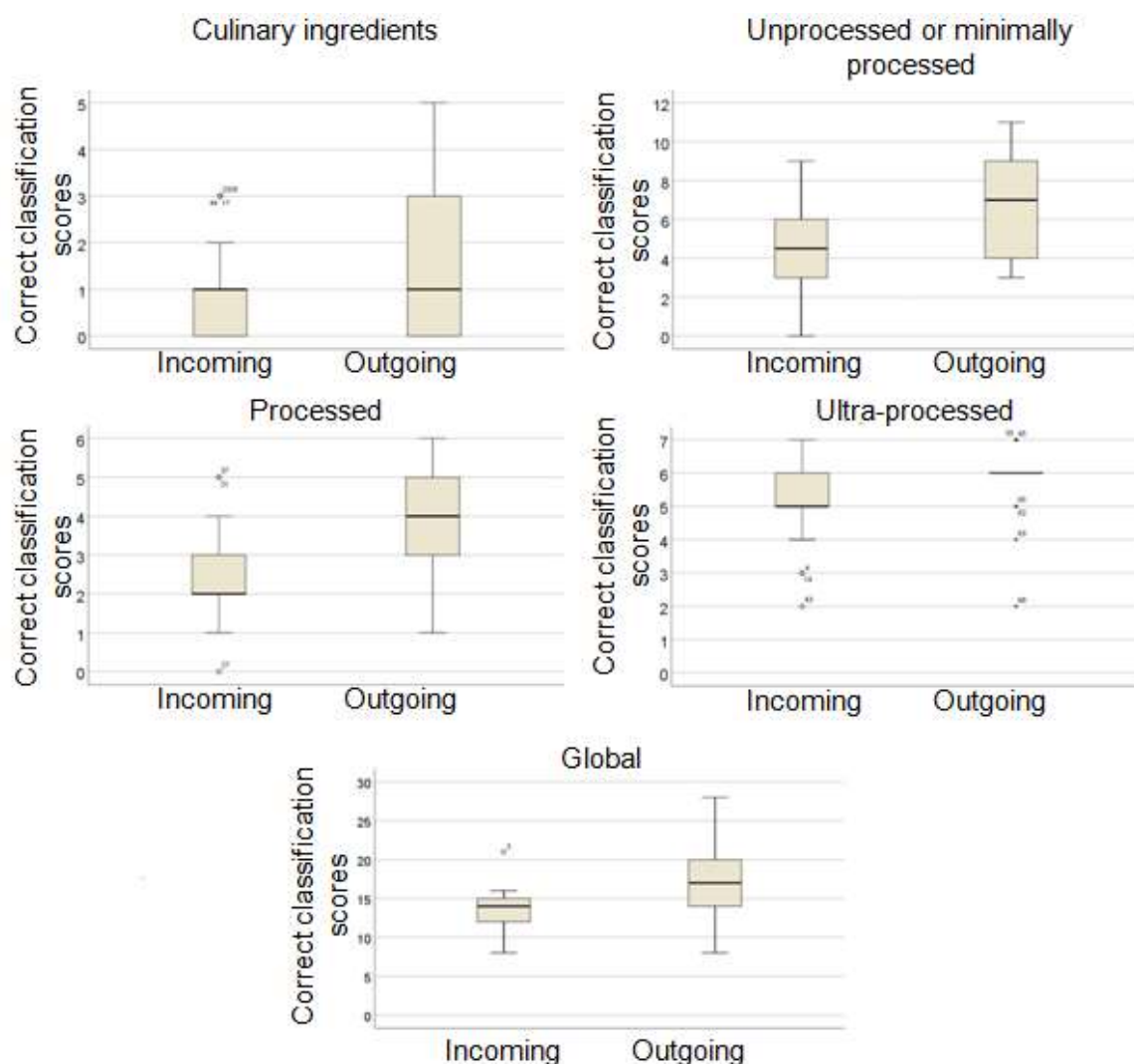
The correct overall rating score was significantly higher (p=0,000) in the group of outgoing students (median=17) than in the group of incoming students (median=14) (Table 1).

Table 1. Correct food group and overall classification scores by incoming (n=44) and outgoing (n=25) students of a Nutrition course. Mato Grosso do Sul, 2016.

Food groups	Score Max.	Incoming		Outgoing		p	Delta of Cliff**
		Med	IQI	Med.	IQI		
Culinary ingredients	5	1.0	0-1	1.0	0-3	0.117	0.274
Unprocessed or minimally processed	12	4.5	3-6	7.0	4-9	0.012 *	0.358

Table 1. Correct food group and overall classification scores by incoming (n=44) and outgoing (n=25) students of a Nutrition course. Mato Grosso do Sul, 2016.

Food groups	Score Max.	Incoming		Outgoing		p	Delta of Cliff**
		Med	IQI	Med.	IQI		
Processed	6	2.0	2-3	4.0	3-5	0.000 *	0.505
Ultra-processed	7	5.0	5-6	6.0	6-6	0.010 *	0.347
Global	30	14.0	12-15	17.0	14-20	0.000 *	0.597

Max. Score = Maximum value of correct classification scores;
Med.= Median;
IQI = Inter-quartile interval.
* Significant difference by the Mann–Whitney's U test when p≤ 0.05.
** Delta of Cliff interpretation scale: insignificant (0.00 < delta <0.14), small (0.14 < delta <0.33), medium (0.33 < delta < 0.47), and large (0.47 < delta < 1.0).

As for the NOVA classification food groups, there was a significant difference in correct classification scores between the incoming and outgoing groups in the unprocessed or minimally processed (p=0.012), processed (p=0,000), and ultra-processed food groups (p=0.010) (Table 1). It was found that 25% of students misclassified all five culinary ingredients, and it was the only food group in which the median of the correct rating score of incoming and outgoing students was the same (Figure 1).

The sizes of the effects of the correct classifications between incoming and outgoing students were analyzed by the Cliff delta test, with medium effects on the unprocessed or minimally processed and ultra-processed groups and great effects on the processed group and overall results. Thus, the group of processed foods presented the highest correct rating score difference between incoming and outgoing students (Cliff delta = 0.505).

The food group that obtained the largest percentage of correct answers was the ultra-processed group (77.8%), followed by processed (52.5%), and unprocessed or minimally processed (43.7%). The culinary ingredients group had the lowest percentage of correct answers (24.1%) (Table 2).

Table 2. Percentage of food classification according to NOVA by the students of a Nutrition course (n=69). Mato Grosso do Sul, 2016.

Groups of food	Foods	(%) Percentual			
		C	F	P	U
Culinary ingredient	White sugar	13.0	7.2	53.6	26.1
	Brown sugar	20.3	42.0	31.9	5.8
	Butter	8.7	7.2	47.8	36.2
	Soil oil	20.3	8.7	50.7	20.3
	Salt	58.0	15.9	24.6	1.4
	Total	24,1	16,2	41,7	18,0

Table 2. Percentage of food classification according to NOVA by the students of a Nutrition course (n=69). Mato Grosso do Sul, 2016.

Groups of food	Foods	(%) Percentual			
		C	F	P	U
Unprocessed or minimally processed	Rice	10.1	52.2	33.3	4.3
	Coffee powder	4.3	46.4	46.4	2.9
	Beef	8.7	76.8	14.5	0.0
	Cassava flour	11.6	53.6	34.8	0.0
	Wheat flour	14.5	30.4	49.3	5.8
	Dried fruit	1.4	34.8	55.1	8.7
	Milk power	0.0	5.8	49.3	44.9
	Pasteurized milk	0.0	30.4	58.0	11.6
	Ultra-pasterurized milk	0.0	13.0	20.3	66.7
	Pasta made of flour and eggs	10.1	21.7	56.5	11.6
	Frozen manioc	4.3	82.6	13.0	0.0
	Egg	20.3	76.8	2.9	0.0
	Total	7.1	43.7	36.1	13.0
Processed food	Crystallized fruit	0.0	14.5	53.6	31.9
	Syrup fruit	1.4	18.8	52.2	27.5
	Canned corn	1.4	10.1	62.3	26.1
	Bread*	8.7	29.0	52.2	10.1
	Cheese	5.8	43.5	42.0	8.7
	Total	3.5	23.2	52.5	20.9
Utra-processed	Granola bar	0.0	8.7	26.1	65.2
	Stuffed cookie	1.4	1.4	10.1	87.0
	Chichen nugget	0.0	0.0	0.0	100.0
	Frozen lasagna	0.0	1.4	7.2	91.3
	Loaf bread	7.2	14.5	62.3	15.9
	Powdered drink mix	0.0	0.0	11.6	88.4
	Soft drink	0.0	0.0	2.9	97.1
	Total	1.2	3.7	17.2	77.8

C= Culinary ingredient; F= Unprocessed or minimally processed; P= Processed; U= Ultra-processed.
* Bread made with wheat flour, water, salt, and yeast.

Most students wrongly classified culinary ingredients as processed foods (41.7%). Salt was the culinary ingredient that obtained the highest percentage of correct answers (58%), and butter had the lowest (8.7%).

The most correctly classified foods that belonged to the unprocessed or minimally processed food group were frozen manioc (82.6%), beef (76.8%), and egg (76.8%). The least correctly classified foods in this group were milk powder (5.8%) and ultra-pasteurized milk (13%).

Canned corn was the most correctly classified (62.3%) food from the processed food group, and cheese was the least correctly classified (42%).

Stuffed cookies (87%), powdered drink mix (88.4%), frozen lasagna (91.3%), soft drinks (97.1%), and chicken nuggets (100%) were the most correctly classified as belonging to the ultra-processed group. Loaf bread was the ultra-processed food with the lowest percentage of correct answers (15.9%).

DISCUSSION

The results of the study and the knowledge of the outgoing students suggest that they had encountered the NOVA classification at some point during the course. However, it is not possible to say that this contact happened in specific subjects because neither the program nor the content of the subjects of this course were analyzed. The students were not asked if they were given the opportunity to learn about this subject at any time during the course.

This knowledge may have been acquired through classes but also through courses, lectures, and even through the social media of official agencies, entities, and scientific associations, which released the content of the NOVA classification after the publication of the Food Guide for the Brazilian Population by the Ministry of Health.

It is likely that the students acquired this knowledge outside the classes, since the outgoing students were performing supervised curricular internship (started in June 2015) outside the university during the study period (June2016), and the NOVA classification had been presented to the Brazilian population through the Food Guide less than a year before. This discussion is important for showing that the students' knowledge can come from various sources, not being restricted to the classroom.

Previous studies that compared the knowledge of incoming and outgoing students in health courses show that the knowledge of outgoing students is greater than that of incoming students when the subject is correlated to health.[18-21] It is clear that the more specific the issues in question, the greater the differences in knowledge among incoming and outgoing students.

Despite the better performance of the outgoing students, their low score deserves attention. Therefore, the classifications of some foods made by students are discussed below.

In the group of unprocessed or minimally processed foods, most errors were related to classifying these foods as processed foods. Thus, pasteurized milk, pasta made of flour and eggs, and dried fruit were classified by 58%, 56.5%, and 55.1% of total students as processed foods, respectively .Such classifications could be justified by the processes to which these foods are subjected (e.g., milk goes through pasteurization, dried fruit and pasta go through drying, and all of them go through the packaging process). However, these foods do not contain large quantities of salt, sugar, fat, oil, or any other preservatives (characteristics of processed foods), thus justifying their classification as minimally processed foods.[3]

In the processed food group, the food that obtained the highest percentage of correct answers was canned corn. Of the total number of students, 62% got it correct according to the NOVA classification. This result can be justified by the fact that the term canned refers to products packaged uncooked or pre-cooked in a saline solution. However, most processed foods were wrongly classified as unprocessed or ultra-processed. Cheese was wrongly classified by the students as belonging to the unprocessed or minimally processed group (43.5%), while fruit in syrup was erroneously classified as belonging to the ultra-processed food group (27.5%). As the manufacturing method included the addition of salt, cheese could not be classified as unprocessed or minimally processed. In the case of fruits in syrup, although they carry added sugar in high quantities, they generally present no food additives nor undergo exclusively industrial processing that would consider them ultra-processed.[3]

Most students got most of the ultra-processed foods on the list right. The classification of chicken nuggets was correct by 100%, soft drink by 97.1%, frozen lasagna by 91.3%, powdered drink mix by 88.4%, and stuffed cookie by 87% of all students. This result shows that, although new, the term ultra-processed seems to be the best known by the study participants among the other terms that make up the NOVA classification.

A study commissioned by the government of Uruguay conducted by Ares et al.[22] reviewed the country's food guide, followed the Brazilian steps, and ultimately decided to include the NOVA classification in the recent edition of the Uruguay food guide. First they analyzed how consumers conceptualized the term "ultra-processed food," since this was not a familiar term to them, although it was mentioned a few times in the media.[22] The results showed that most participants described ultra-processed foods as highly processed products containing additives and other artificial ingredients, having low nutritional quality, and are not generally considered to be healthy.

Similarly, a study conducted with 181 young Ecuadorian and Argentinean consumers showed that they understand ultra-processed foods as highly processed foods containing a lot of artificial ingredients. The unnatural and harmful dimension also was emphasized by the participants.[23]

A practical way to identify ultra-processed food is to check if the list of ingredients contains at least one item characteristic of ultra-processed foods according to the NOVA guidelines, i.e., food substances never or rarely used in kitchens (such as corn syrup and hydrogenated or interesterified oils) or classes of food additives (such as flavorings, sweeteners, thickeners, preservatives, among others).[24]

Although most foods were correctly classified as a part of this group, granola bars and loaf bread were correctly sorted by only 65.2% and 15.9% of students, respectively. Confusion in the classification of granola bars may occur owing to the presence of fiber in its formulation, a nutritional information massively used by the food industry to add value to the product. This may lead consumers to use this nutritional information alone to judge the overall healthiness of the food.[25,26] As for the loaf bread, confusion may occur because this product is originally made from a few ingredients like wheat flour, salt, and/or sugar. However, the loaves available to consumers on supermarket shelves have a substantial use of food additives, which place such products in the ultra-processed category.[27]

In the processed culinary ingredient group, brown sugar and white sugar were wrongly classified by 79.7% and 87% of all students, respectively. In the case of brown sugar, 42% of all students classified it as unprocessed or minimally processed, with white sugar being classified as processed food by 53.6% of this total. This may have occurred owing to the different types of processing these foods go through, generating classification doubts. According to Fellows,[28] brown sugar does not undergo the refining process and addition

of additives, preserving their nutritional characteristics; white sugar goes through the extraction and refining process, with the use of additives such as clarifiers, anti-humectants, and preservatives.

According to the NOVA classification, salt, sugars, oils, and fats are classified as processed culinary ingredients because they are ingredients obtained through food extraction, undergoing refining and purification, among other food processes characteristic of this group, to be used for seasoning, cooking, and creating culinary preparations.[4]

Finally, butter and oil were also wrongly classified as processed foods by 47.8% and 50.7% of the students, respectively. In contrast, salt was classified correctly by 58% of all students.

A qualitative study conducted by Menegassi et al.[29] analyzed how a sample of Brazilian adults classified a set of 24 food and beverages. These authors observed that the participants classified butter and oil included in one group while sugar, salt, and brown sugar were classified in another one; these foods were considered in different groups, when in fact they are all from the group of processed culinary ingredients. This study shows that when freely classifying the foods given by researchers, aspects related to the nutrients and food pyramid groups were taken into account.[29] This shows that, in the perception of the participants of the study conducted by these authors, such foods have characteristics that do not justify them belonging to the same group.

Of the four NOVA groups, processed culinary ingredients obtained the lowest score in both groups of participants, showing that the knowledge of all the participants about this group was limited.

The questionnaire used in this study was prepared especially for the purpose of this research. This represents a study limitation that may require adjustments and validations to better meet this purpose in future studies.

CONCLUSION

The study contributed with information that shows the knowledge of university students about the four NOVA groups.

Incoming and outgoing students presented significant differences in knowledge, with outgoing students exhibiting greater knowledge compared with incoming students. However, both groups presented unsatisfactory knowledge about the NOVA classification. The ultra-processed food group obtained the highest percentage of correct answers by the students, but there was an expressive number of errors in the classification of unprocessed or minimally processed food, processed food, and culinary ingredients.

Therefore, it is important to evaluate the learning of the Nutrition students regarding the NOVA classification so that they can correctly utilize it not only in educational and nutritional activities in the present but also as part of their professional practice in the future.

It should be noted that the Brazilian Guidelines for the Brazilian Population is for all Brazilians. Therefore, its content, which includes the NOVA classification of food, needs to be understood by everyone so that its recommendations are efficient, starting with the Nutrition students as future health professionals.

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Contributors

BM conceived the initial idea of the study and worked on manuscript writing and approval of the final version; CMLC worked on data collection, analysis and interpretation, and manuscript writing; FRL worked on data analysis and interpretation and manuscript writing; CCM and VGL worked on the final review and manuscript approval for submission.

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