DEMETRA
Alimentação, Nutrição & Saúde

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Nutritional Knowledge of Residents of the City of Caxias do Sul-RS, Brazil

Conhecimento Nutricional de Adultos e Idosos do Município de Caxias do Sul-RS

Abstract

Introduction: Nutritional knowledge is the understanding of the concepts and processes of nutrition and health, including combinations of knowledge about diet and health, diet and diseases, nutritional sources, and dietary recommendations. *Objective*: To assess the nutritional knowledge of the population from Caxias do Sul and investigate their associations with sociodemographic and anthropometric data. *Methods*: Cross-sectional study including residents of Caxias do Sul, between 18 and 80 years old. Through an online questionnaire, sociodemographic and anthropometric data were collected. To evaluate the nutritional knowledge, sections 2 and 4 from GNKQ (General Nutrition Knowledge Questionnaire for adults) were used. The 26 questions had several items and each item marked correctly received 1 point, totaling 57 possible points. The nutritional knowledge was classified as low (up to 19 points), medium (between 20 and 38 points) and high (above 39 points). *Results*: The sample nutritional knowledge was 39.9 ± 6.1 points. Most of the participants were classified as high nutritional knowledge (n=184; 61.1%, average 43.8 ± 3.6 points). There was a statistical difference between gender (p<0.001), income (p=0.009), schooling (p=0.015) and nutrition students or dietitians (p<0.001). Women, people with higher income and schooling, as well as nutrition students or dietitians demonstrated higher nutritional knowledge. *Conclusions*: The sample of adults and older people from Caxias do Sul-RS has considerable nutritional knowledge, with a higher score between female participants, higher income, higher level of education, and nutrition students or dietitians.

Keywords: Nutrition. Knowledge. Nutritional information. Demographic factors. Socioeconomic factors.

Resumo

Introdução: Conhecimento nutricional é a noção de conceitos e processos relacionados à nutrição e saúde, incluindo associações de conhecimentos sobre dieta e saúde, dieta e doenças, fontes de nutrientes e recomendações dietéticas. *Objetivo*: Avaliar o conhecimento nutricional da população de Caxias do Sul e investigar suas associações com variáveis sociodemográficas e dados antropométricos. *Métodos*: Estudo transversal incluindo moradores do município de Caxias do Sul, entre 18 e 80 anos. Através de questionário *on-line*, foram coletados dados sociodemográficos e antropométricos dos participantes. Para avaliar o conhecimento nutricional, foram utilizadas as seções 2 e 4 do questionário GNKQ *(General NutritionKnowledgeQuestionnaire for Adults)*. As 26 questões possuíam diversos itens e cada item assinalado corretamente recebeu 1 ponto, totalizando 57 pontos possíveis. O conhecimento nutricional foi classificado em baixo (até 19 pontos), médio (entre 20 e 38 pontos) e alto (acima de 39 pontos). *Resultados*: O conhecimento nutricional médio da amostra foi 39,9 ± 6,1 pontos. A maioria dos participantes foi classificada como detentores de alto conhecimento nutricional (n=184;

61,1%, média 43,8 ± 3,6 pontos). Houve diferença estatística entre gêneros (p<0,001), renda (p=0,009), escolaridade (p=0,015) e profissionais e estudantes de Nutrição (p<0,001). Mulheres, pessoas com renda mais elevada e grau de escolaridade maior, bem como estudantes e profissionais de Nutrição apresentaram maior conhecimento nutricional. *Conclusão*: A amostra de adultos e idosos de Caxias do Sul-RS possui um bom conhecimento nutricional, com maiores pontuações entre as participantes do sexo feminino, maior renda, maior escolaridade e profissionais ou estudantes de Nutrição.

Palavras-chave: Nutrição. Conhecimento. Informação nutricional. Fatores demográficos. Fatores socioeconômicos.

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INTRODUCTION

The nutrition knowledge refers to the notion of concepts and processes related to nutrition and health, including associations with knowledge about diet and health, diet and diseases, foods as nutrients sources and dietary recommendations.[1] The question about how much the nutrition knowledge can interfere in nutrition choices and if the level of knowledge has associations with sociodemographic and anthropometric variables has been increasingly discussed.

There are divergences about the impact of nutrition knowledge in habit change. The literature shows both a positive relation between nutrition knowledge and adequate eating habits and a neutral relation, with only nutrition knowledge not being sufficient to encourage good habits, demanding behavioral and motivation factors to be involved.[2,3]

Even using different methods for nutrition evaluation, studies show correlations with sociodemographic and anthropometric variables, showing that women exhibit better nutritional knowledge when compared to men. When associated with socioeconomic and level of education variables, the relation with nutrition knowledge is directly proportional.[4-8]

Understanding the importance of nutrition knowledge as a compass for better choices and to increase the health of the population as a whole, nutrition education programs become important tools in the promotion of healthy dietary habits and in the reduction of chronic illnesses incidence.[9] Besides these changes, the programs lead to an improvement of nutrition knowledge levels.[10]

In view of the above, this work aims to evaluate the nutrition level of the population of the city of Caxias do Sul and investigate the associations between knowledge level with sociodemographic variables and anthropometric data.

METHODS

Study design and sample

This is a cross-section study in which the population living in the city of Caxias do Sul - RS was invited to participate. The study excluded from the sample people younger than 18 years and older than 80 years old, since at this age dementia and cognitive decline are more prevalent.[11] People without access to the electronic form and who provided incomplete questionnaires were also excluded.

The research project was designed in consonance with the Guidelines and Regulations for Research Involving Human Beings, approved by the National Health Board, Resolution n. 466/2012. This study was submitted to the Ethics in Research Committee of University of Caxias do Sul and approved through the Presentation and Ethical Appreciation Certificate 52983621.4.0000.5341. All participants received information about the research and agreed to participate through a Free and Clarified Consent Term (FCCT), available in the Google Formsonline questionnaire.

Sociodemographic and anthropometric data

The whole study was performed on-line. The data was collected through an online questionnaire (https://forms.gle/jiQpWTZRbN1HiEVAA) accessed by a link sent through social media (WhatsApp, Instagram, Facebook) and e-mail. The invitation to participate in the research was sent by the researchers to the

participants, explaining that the FCCT was to be acknowledged and signed before any answering of the questionnaire itself.

Through Google Forms, data was obtained in order to characterize the sample, such as age, ethnicity, gender, marital status, family composition and children number, education (specific as to Nutrition), level of education, income, neighborhood of residence, weight and height and the presence of chronic illnesses such as obesity, diabetes, hypertension and cancer.

Weight and height were used in order to calculate body mass index (BMI). This value was used to indicate the nutrition status of adults, who were then classified in categories: lower than 18.5 kg/m²: underweight; between 18.5 kg/m² and 24.9 kg/m²: normal weight; between 25 kg/m² and 29.9 kg/m²: overweight; and over 30 kg/m²: obesity.[12]

Nutrition Knowledge

The nutrition knowledge about food groups, nutrients, health problems or illnesses related to eating and weight control are in the sections 2 and 4 of the *General Nutrition Knowledge Questionnaire for Adults* (GNKQ) questionnaire developed by Parmenter and Wardle[13] and reviewed by Kliemann et al.[14] From these questions the research instrument of this study was developed, with 26 questions adapted and translated to Brazilian Portuguese.[15]

The nutrition knowledge of the participants was evaluated through 10 questions specifically related to food groups and the nutrients they contain (section 2), and 16 questions about health problems associated with eating (section 4). In the section about foods there are questions with food lists and alternatives to point low or high sugar contents, salt, fibers and calcium, calories, carbohydrates, protein source quality and fats types (trans, saturated, unsaturated or polyunsaturated). In the section about health problems or illnesses related to eating habits and weight loss, the questions related health problems with the consumption of fibers, sugar, salt, red meat, trans fat, refined foods, animal fat, white bread and proteins. Besides that, the section deals with adequate habits for a healthy weight, BMI classification and the relation of abdominal circumference and cardiovascular diseases.

Various items composed each question of the questionnaire. Each item correctly checked received 1 point. The items wrongly marked or marked as "don't know" received zero points. The scores were computed section by section and consider all right answers. Section 2 has a top score of 36 points, while section 4 has a top score of 21 points, totalizing 57 possible points, and higher scores show higher nutrition knowledge. Question 4 of section 4 asks about cancer and recommendations for reducing the risk of its development. As presented in the questionnaire, the option "eat less red meat" is considered correct, but one of the available options was "avoid foods with additives". It is known today that food additives such as nitrates and nitrites are related to cancer.[16] To avoid confusion and interference with the nutrition knowledge analysis and keep the right answer, the "avoid additives" option was replaced with "eating more eggs". Modified versions of the GNKQ are known to be valid measurements of nutrition knowledge.[17]

The scoring about nutrition knowledge was divided in low, medium and high, considering the total of questions in the questionnaire. Scorings up to 19 were classified as "low" nutrition knowledge. Scorings between 20 and 38 were classified as "medium" knowledge, and 39 or over as "high" knowledge.

Statistical analysis

The sample was obtained by convenience. According to the Instituto Brasileiro de Geografia e Estatística (Brazilian Institute of Geography and Statistics) (IBGE), the estimated population of Caxias do Sul is 523,716 habitants.[18] Considering an error margin of 5% and a confidence level of 90%, with an heterogeneous distribution, a sample of 271 participants was estimated.[19]

The data was analyzed through the Statistical Package for Social Sciences software, version 20.0 (SPSS Inc, Chicago, IL). Continuous variables were tested for normality through the Shapiro Wilk test. Variables of normal distribution were presented as mean ± standard deviation, and non-parametric distribution variables as a median (interquartile range). Categorical variables were presented as absolute and percentile numbers. In order to compare the scoring in the questionnaire about nutrition knowledge and sociodemographic and clinical variables, Student *t* tests were applied for variables with two categories and variance analysis (ANOVA) was applied for variables with more than two categories, considering that the questionnaire scoring exhibited a normal distribution. Significance level adopted was $p < 0.05$.

RESULTS

Since the research disclosure, 311 individual answers were received. From these, nine were excluded for being under 18 years old respondents and one for not agreeing to take part in the research, leaving 301 individuals included in the study. All participants were under 80 years old. Mean age was 39.6 ± 13.6 years, with most people being women (n=206, 68.33%). Mean BMI of the sample was 25.4 ± 4.7 Kg/m². The other characteristics of the sample are described in Table 1.

Table 1. Profile of the individuals who participate in the research about nutrition knowledge among habitants of Caxias do Sul-RS and comparing of scores between groups, 2021.

	Total sample (n=301, 100%) Profile	Comparison between groups scorings	
Characteristics	N (%)	Scoring according to groups	P value*
Age			0.253#
From 18 to 29.9 years	71 (23.7)	39.7 ± 5.5	
From 30 to 44.5 years	132 (44.0)	40.1 ± 6.0	
From 45 to 59.9 years	64 (21.3)	40.6 ± 5.9	
Over 60 years	33 (11.0)	38.1 ± 7.6	
Gender			<0.001&
Woman	206 (68.4)	40.8 ± 5.9	
Man	95 (31.6)	37.8 ± 6.0	
Nutritional Status			0.090#
Undernutrition	3 (1.0)	37.7 ± 7.8	
Normal weight	161 (53.5)	40.6 ± 5.6	
Overweight	95 (31.6)	39.6 ± 6.0	
Obesity	42 (14.0)	38.1 ± 7.4	

Table 1. Profile of the individuals who participate in the research about nutrition knowledge among habitants of Caxias do Sul-RS and comparing of scores between groups, 2021. Continues.

Characteristics	Total sample (n=301, 100%) Profile N (%)	Comparison between groups scorings Scoring according to groups	P value*
Level of education			0.015#
Incomplete University Education or inferior	52 (17.3)	38.8 ± 6.1a	
Complete University Education	126 (41.9)	39.2 ± 6.3a	
Postgraduate,Master's Degree or PhD's Degree in progress	39 (13.0)	42.3 ± 5.2b	
Complete Postgraduate. Master's Degree or PhD's Degree.	84 (27.9)	40.5 ± 5.8ab	
Income			0.009#
Up to 2 minimum wages	13 (4.3)	35.8 ± 5.3a	
2 to 4 minimum wages	47 (15.6)	39.7 ± 6.7ab	
4 to 10 minimum wages	113 (37.5)	39.1 ± 5.7ab	
10 to 20 minimum wages	86 (28.6)	40.8 ± 5.0b	
Over 20 minimum wages	42 (14.0)	41.6 ± 7.5b	
Ethnicity			0.550#
Caucasian	286 (95.0)	40.0 ± 6.1	
Black	3 (1.0)	41.0 ± 3.6	
Brown	12 (4.0)	38.1 ± 5.7	
Nutritionist/Nutrition Student			<0.001&
Yes	31 (10.3)	44.2 ± 8.3	
No	270 (89.7)	39.4 ± 5.6	
Disease			0.517#
None	236 (78.4)	39.8 ± 6.1	
Diabetes mellitus	2 (0.7)	33.0 ± 5.7	
Hypertension	26 (8.6)	39.2 ± 5.8	
Obesity	11 (3.7)	42.5 ± 5.4	
Cancer	2 (0.7)	42.5 ± 0.7	
Dyslipidemia	4 (1.3)	38.8 ± 7.5	
Thyroid conditions	7 (2.3)	40.3 ± 3.5	
Other	13 (4.3)	41.3 ± 6.7	

* P value for the comparison of scorings (continuous variable) between groups.
&Student t tests comparing the scorings between two groups.
ANOVA comparing the scorings between three or more groups. Different letters indicate a statistical difference between subgroups.
Source: the autors.

The general knowledge of the participants was determined through the answers to the questionnaire, considering the max number of right answers. Table 2 shows the total scoring and the scoring for each section of the questionnaire. The mean right answer score was 39.9 ± 6.1 points (Table 2). Most participants were classified as of high nutrition knowledge (n=184; 61.1%, mean 43.8 ± 3.6 points), followed by participants with average nutrition knowledge (n=184; 61.1%, mean 43.8 ± 3.6 points) and participants with low nutrition knowledge (n=1; 0.3%, 15 right answers).

Table 2. Total scoring and scoring by section of the questionnaire used to evaluate the nutrition knowledge of the population of Caxias do Sul-RS, 2021.

Correct answers	Total (57 questions)	Section 1 Nutrients (36 questions)	Section 2 Diseases (21 questions)
Mean ± standard deviation, scoring	39.9 ± 6.1	24.1 ± 4.3	15.8 ± 2.5
Minimum scoring / Participants n (%)	15 / 1 (0.3)	6 / 1 (0.3)	7 / 1 (0.3)
Max score / Participants n (%)	53 / 2 (0.7)	33 / 4 (1.3)	21 / 4 (1.3)

Source: theautors

The complete questionnaire with the percentage of each alternative answering is presented in the supplementary material (Supplementary Table 1). It can be observed that most participants have a mistaken understanding about the amount of salt in morning cereals and about the amount of sugar in diet sodas. As for fat types in foods, the "not sure" option was the most chosen in all questions. However, a large portion of the participants answered correctly about choices to keep a healthy weight, such as don't cut fats from one's diet and neither keep a high protein diet. As to label reading, most answered that this is a habit that helps to maintain a healthy lifestyle (Supplementary table 1).

Supplementary Table 1. Questions and answers with number and percentage of choice. Caxias do Sul-RS, 2021.

Questions	Answers n (%)
Do you think diet sodas have high or low amounts of added sugar?	
High added sugar	141 (46.8)
Low added sugar*	139 (46.2)
Notsure	21 (7.0)
Do you think natural yogurt has high or low amounts of added sugar?	
High added sugar	20 (6.6)
Low added sugar*	253 (84.1)
Notsure	28 (9.3)
Do you think ice cream has high or low amounts of added sugar?	
High added sugar*	295 (98.0)
Low added sugar	5 (1.7)
Notsure	1 (0.3)
Do you think ketchup has high or low amounts of added sugar?	
High added sugar*	235 (78.1)
Low added sugar	43 (14.3)
Notsure	23 (7.6)
Do you think melons have high or low amounts of added sugar?	
High added sugar	60 (19.9)
Low added sugar*	197 (65.4)
Notsure	44 (14.6)
Do you think morning cereals have high or low amounts of added salt?	
High added salt*	81 (26.9)
Low added salt	180 (59.8)
Notsure	40 (13.3)
Do you think frozen legumes and vegetables have high or low amounts of added salt?	
High addedsalt	36 (12.0)
Lowaddedsalt*	244 (81.1)
Notsure	21 (7.0)

Supplementary Table 1. Questions and answers with number and percentage of choice. Caxias do Sul-RS, 2021. Continues.

Questions	Answers n (%)
Do you think industrialized bread has high or low amounts of added salt?	
High added salt*	263 (87.4)
Low added salt	32 (10.6)
Notsure	6 (2.0)
Do you think canned peas have high or low amounts of added salt?	
High added salt*	232 (77.1)
Low added salt	54 (17.9)
Notsure	15 (5.0)
Do you think red meats have high or low amounts of added salt?	
High addedsalt	55 (18.3)
Lowaddedsalt*	223 (74.1)
Notsure	23 (7.6)
Do you think packaged soup has high or low added salt?	
High added salt*	295 (98)
Low added salt	3 (1.0)
Notsure	3 (1.0)
Do you think oat has high or low amounts of added fiber?	
High added fiber*	280 (93)
Low added fiber	14 (4.7)
Notsure	7 (2.3)
Do you think bananas have high or low amounts of added fiber?	
High added fiber*	190 (63.1)
Low added fiber	92 (30.6)
Notsure	19 (6.3)
Do you think white rice has high or low amounts of added fiber?	
High added fiber	55 (18.3)
Low added fiber*	219 (72.8)
Notsure	27 (9.0)
Do you think eggs have high or low amounts of added fiber?	
High added fiber	43 (14.3)
Low added fiber*	218 (72.4)
Notsure	40 (13.3)
Do you think unpeeled potatoes have high or low amounts of added fiber?	
High added fiber*	174 (57.8)
Low added fiber	90 (29.9)
Notsure	37 (12.3)
Do you think pasta has high or low amounts of added fiber?	
High added fiber	23 (7.6)
Low added fiber*	248 (82.4)
Notsure	30 (10.0)
Do you think bird meat is a good protein source?	
Good protein source*	287 (95.3)
Not a good protein source	7 (2.3)
Notsure	7 (2.3)
Do you think cheese is a good protein source?	
Good protein source*	167 (55.5)
Not a good protein source	115 (38.2)
Notsure	19 (6.3)
Do you think fruits are a good protein source?	
Good protein source	59 (19.6)
Not a good protein source*	212 (70.4)
Notsure	30 (10.0)

Supplementary Table 1. Questions and answers with number and percentage of choice. Caxias do Sul-RS, 2021. Continues.

Questions	Answers n (%)
Do you think cooked beans are a good protein source?	
Good protein source*	202 (67.1)
Not a good protein source	79 (26.2)
Notsure	20 (6.6)
Do you think butter is a good protein source?	
Good protein source	37 (12.3)
Not a good protein source*	230 (76.4)
Notsure	34 (11.3)
Do you think nuts are a good protein source?	
Good protein source*	178 (59.1)
Not a good protein source	92 (30.6)
Notsure	31 (10.3)
Do professionals consider cheese a carbohydrate rich food?	
It is a carbohydrate rich food	44(14.6)
It is not a carbohydrate rich food*	222 (73.8)
Notsure	35 (11.6)
Do professionalsconsider pasta a carbohydraterich food?	
It is a carbohydrate rich food*	286 (95.0)
It is not a carbohydrate rich food	10 (3.3)
Notsure	5 (1.7)
Do professionals consider potatoes a carbohydrate rich food?	
It is a carbohydrate rich food*	284 (94.4)
It is not a carbohydrate rich food	12 (4.0)
Notsure	5 (1.7)
Do professionals consider nuts a carbohydrate rich food?	
It is a carbohydrate rich food	70 (23.3)
It is not a carbohydrate rich food*	192 (63.8)
Notsure	39 (13.0)
Do professionals consider plantain a carbohydrate rich food?	
It is a carbohydrate rich food*	148 (49.2)
It is not a carbohydrate rich food	109 (36.2)
Notsure	44 (14.6)
What is the main type of fat found in olive oil?	
Polyunsaturated fat	82 (27.2)
Monounsaturatedfat*	103 (34.2)
Saturatedfat	22 (7.3)
Cholesterol	3 (1.0)
Notsure	91 (30.2)
What is the main type of fat found in butter?	
Polyunsaturatedfat	54 (17.9)
Monounsaturatedfat	49 (16.3)
Saturatedfat*	93 (30.9)
Cholesterol	27 (9.0)
Notsure	78 (25.9)
What is the main type of fat present in sunflower oil?	
Polyunsaturatedfat*	69 (22.9)
Monounsaturatedfat	71 (23.6)
Saturatedfat	62 (20.6)
Cholesterol	15 (5.0)
Notsure	84 (27.9)

Supplementary Table 1. Questions and answers with number and percentage of choice. Caxias do Sul-RS, 2021. Continues.

Questions	Answers n (%)
What is the main type of fat found in eggs?	
Polyunsaturatedfat	69 (22.9)
Monounsaturatedfat	62 (20.6)
Saturatedfat	32 (10.6)
Cholesterol*	38 (12.6)
Notsure	100 (33.2)
Which of these foods has the most trans fat?	
Cookies, cakesand pies*	255 (84.7)
Fishes	4 (1.3)
Canolaoil	27 (9.0)
Eggs	0 (0.0)
Notsure	26 (5.0)
The amount of calcium in a glass of whole milk compared to a glass of skimmed milk is:	
Approximatelythesame*	172 (57.1)
Much higher	52 (17.3)
Much lesser	22 (7.3)
Notsure	55 (18.3)
Which of the following nutrients has the most calories for the same food weight?	
Sugar	90 (29.9)
Carbohydrate	54 (17.9)
Fibers	15 (5.0)
Fat*	81 (26.9)
Notsure	61 (20.3)
Compared to minimally processed foods, ultra-processed foods have:	
More calories*	236 (78.4)
More fibers	12 (4.0)
Lesssalt	14 (4.7)
Notsure	39 (13.0)
SECTION 2	
Which of these conditions is related to a low fiber consumption?	
Intestinal disorders*	274 (91.0)
Anemia	15 (5.0)
Dental cavities	1 (0.3)
Notsure	11 (3.7)
Which of these conditions is related to the amount of sugar a person ingests?	
High bloodpressure	30 (10.0)
Dental cavities*	255 (84.7)
Anemia	4 (1.3)
Notsure	12 (4.0)
Which of these conditions is related to the amount of salt (sodium) a person ingests?	
Hypothyroidism	9 (3.0)
Diabetes	3 (1.0)
High bloodpressure*	282 (93.7)
Notsure	7 (2.3)
Which of these habits professionals recommend as a way of reducing the risk of cancer?	
Drinkingalcoholregularly	17 (5.6)
Eatlessredmeat*	226 (75.1)
Eat more eggs	22 (7.3)
Notsure	36 (12.0)

Supplementary Table 1. Questions and answers with number and percentage of choice. Caxias do Sul-RS, 2021. Continues.

Questions	Answers n (%)
SECTION 2	
Which of these habits professionals recommend as a way to prevent heart problems?	
Take nutritionalsupplements	1 (0.3)
Eatlessfatfishes	2 (0.7)
Eatless trans fat*	289 (96.0)
Notsure	9 (3.0)
Which of these habits professionals recommend for diabetes prevention?	
Eatlessrefinedfoods*	270 (89.7)
Tomar mais suco de frutas	16 (5.3)
Eat more processed meats, like sausages	1 (0.3)
Notsure	14 (4.7)
Which of these foods has the highest chance of raising blood cholesterol?	
Eggs	8 (2.7)
Vegetable oils	79 (26.2)
Animal fat*	197 (65.4)
Notsure	17 (5.6)
Which of these foods is classified as of high sugar levels?	
Whole cereals	9 (3.0)
White bread*	267 (88.7)
Fruits, legumes andvegetables	9 (3.03)
Notsure	16 (5.3)
In order to keep a healthy weight, people should eliminate fats from their diet.	
I agree	32 (10.6)
I disagree*	253 (84.1)
Notsure	16 (5.3)
In order to keep a healthy weight, people should have a high protein diet.	
I agree	196 (65.1)
I disagree*	83 (27.6)
Notsure	22 (7.3)
Eating bread always leads to weight gain.	
I agree	108 (35.9)
I disagree*	181 (60.1)
Notsure	12 (4.0)
Fibers can reduce the chance of weight gain.	
I agree*	212 (70.4)
I disagree	49 (16.3)
Notsure	40 (13.3)
Avoiding eating while watching TV helps a person to maintain a healthy lifestyle.	
Yes*	233 (77.4)
No	59 (19.6)
Notsure	9 (3.0)
Reading food labels helps to maintain a healthy lifestyle.	
Yes*	280 (93.0)
No	15 (5.0)
Notsure	6 (2.0)
Taking nutritional supplements helps people to maintain a healthy lifestyle.	
Yes	111 (36.9)
No*	139 (46.2)
Notsure	51 (16.9)
Monitoring one's diet helps to maintain a healthy lifestyle.	
Yes*	298 (99.0)
No	3 (1.0)
Notsure	0 (0.0)

Supplementary Table 1. Questions and answers with number and percentage of choice. Caxias do Sul-RS, 2021. Continues.

Questions	Answers n (%)
SECTION 2	
Monitorar o peso ajuda as pessoas a manter uma vida saudável.	
Sim*	256 (85.0)
Não	37 (12.3)
Notsure	8 (2.7)
Snacking throughout the day helps to maintain a healthy lifestyle.	
Yes	30 (10.0)
No*	259 (86.0)
Notsure	12 (4.0)
Snacking throughout the day helps to maintain a healthy lifestyle.	
Lowweight	12 (4.0)
Normal weight*	138 (45.8)
Overweight	48 (15.9)
Obese	2 (0.7)
Notsure	101 (33.6)
If someone has a body mass index (BMI) of 31 kg/m², how is their weight classified?	
Lowweight	2 (0.7)
Normal weight	4 (1.3)
Overweight	88 (29.2)
Obese*	112 (37.2)
Notsure	95 (31.6)
Which of these body shapes points to an increase in the risk of cardiovascular disease (general term to describe any heart or blood vessels related disease, such as angina, heart attack, cardiac insufficiency, congenital heart disease and stroke)?	
Apple shape*	263 (87.4)
Pear shape	17 (5.6)
Notsure	21 (7.0)

* Correctanswer

The nutrition knowledge obtained through the number of right answers on the questionnaire was then related to sociodemographic and anthropometric data from the participants. The results divided by categories are described in Table 1. There was a statistical difference among genders (p<0.001), income (p=0.009), level of education (p=0.015) and Nutrition professionals and students (p<0.001). Women, people of higher income and higher levels of educations, as well as Nutrition professionals and students, exhibited higher nutrition knowledge (Table 1).

DISCUSSION

In this study, satisfactory results were obtained as to participants' scores, with most exhibiting good nutrition knowledge. For other populations, results vary. Literature shows a study among Brazilian professional triathlon athletes which obtained high marks on their research.[20] The GNKQ was used also in a study with adults who suffered spinal cord injuries and had a satisfactory result when compared to previous studies.[21] When compared to the GNKQ questionnaire application, also adapted to another population, the nutrition knowledge analysis of a group of people with diabetes mellitus type 2 showed a moderate knowledge from the participants.[22]

Even though high scores were observed, the results to some questions are noteworthy. About the amount of sugar in diet soda, most participants believe the added sugar content to be high (46.8%). From all

participants, 59.8% think that morning cereals have low amounts of added salt and 38% don't consider cheese to be a good protein source. The "not sure" option for the answer that deals with the kind of fat in each food was the most answered in all questions. The question about the number of calories in each macronutrient had a similar amount of answers between fat (26.9%) and sugar (29.9%). It was also possible to perceive that there is still a tendency for people to think that in order to lose weight one has to increase protein consumption (65.1%). The high number of wrong answers in the questions related to the composition and source of foods can be justified by advertisements and marketing actions backed by the food industry.[23]

On macronutrients, the inadequate knowledge can be a reflex of the information sources people use nowadays. The internet allows easy access to wrong information, frequently dispersed by health professionals themselves, who end up creating simplistic or incorrect concepts on some nutrients. The search for information on the internet can benefit people, increasing their knowledge, but it demands attention. This tool can be a platform for non-scientific information, and, due to the lack of technical knowledge, people can end up in a vulnerable position, incapable of critical evaluation and ending up wrongly interpreting information and concepts.[24]

As positive highlights we can look at the number of right answers on the question about the need to cut fat from one's diet in order to lose weight, with 84.1% of participants disagreeing with the question, and the right answers on the question about the importance of label reading (93.1%). In order to lose weight, the recommendation is a balanced diet, containing all food groups, focusing on a calorie deficit and not in the restriction or elimination of a macronutrient from the diet.[25] About label reading, the result obtained corroborates a study also performed among the population of Caxias do Sul, in which the habit of label reading was present in order to provide a healthier diet, even with participants considering their nutrition knowledge insufficient. The habit of label reading is most common among women of higher incomes and higher education levels, corroborating the results found in this work.[26]

Analyzed data shows a significant nutrition knowledge difference among genders. Women exhibited higher nutrition knowledge when compared to men. It is possible to compare this result with a Brazilian study that evaluated the nutrition knowledge of people who frequented an open market in Minas Gerais, in which women also showed a higher score than men.[27] Corroborating this result, literature shows that females exhibit a higher nutrition knowledge when the GNKQ is applied in Australian elite athletes.[2] A hypothesis to explain these findings is the fact that women look for medical and nutritional care more than men.

A report from the National Health Program, published in 2019, showed that women see their doctors more frequently than men do, and this proportion grows as family income increases.[28] Even with the growing effort toward gender equality, many women are still responsible for making meals and shopping in their homes. In this case, showing a higher nutrition knowledge can have a positive impact, leading to a consumption of a healthier diet by the whole family.

Higher education levels show better nutrition knowledge, which is also found in previous studies.[21] Better educated people tend to seek diverse knowledge, which can have an impact in nutrition knowledge and, maybe, result in better food choices and nutrition conditions. The ability to understand is also better in groups with higher education levels when compared to those of inferior education.[29]

Another relation that can be observed is the one between level of education and nutritional status. Most participants in this study showed high levels of education and havenormal weight. This same scenario is reproduced nationwide, with the prevalence of obesity found in people who have up to eight years of study.[30]

Concerning the income variable, higher incomes result in higher scorings in the questionnaire. This shows an important and influencing aspect of the nutrition knowledge, in which socioeconomic conditions interfere in eating and health practices and care.[31] This is a reason that could lead to high scores. The sample obtained here has a high-income profile when compared to the mean income of the people who live in this city. Most participants have an income of four or more minimum wages, while the mean monthly wage of people living in Caxias do Sul is 2.9 minimum wages.[18]

Students from the Nutrition course and Nutrition professionals had better scores when compared to students and professionals of other areas. This result shows the importance of education in Nutrition and the importance of Nutrition professionals. The nutrition education activities must be part of the activities of the Nutrition professional, expanded to the various fields of work to spread the knowledge to more people.[32]

Anthropometric variables did not show relation with nutrition knowledge, which suggests that nutrition knowledge needs to interact with the real world. When we talk about the adult population, established literature already affirms that motivational and behavioral factors are needed in order for the knowledge to become action.[2] With adequate nutrition knowledge, participants can have better success in identifying and eating foods considered good for their health, such as fruits and vegetables, although this doesn't define an effective habit change since the consumption of other foods, considered unhealthy, persists.[33] This situation allow us to think about the importance that psychological factors have in the improvement of dietary habits and general health.

The present study has limitations. Existing studies used different questionnaires or adapted GNKQ in accordance with their different populations, limiting the possibility of comparisons between results. There are few studies performed in the Brazilian population.[22,34] The questionnaire used can be another limiting factor, since it would be adequate to have a questionnaire developed and validated specifically to the Brazilian general population, which considered the current recommendations from the Food Guide for the Brazilian Population. However, this questionnaire was the current best alternative for this study, considering the topics and the way the questions were elaborated, easing the understanding by the participants and enabling online data collection. The sample of this study was also a limiting factor, since it doesn't reflect the broader characteristics of the population of Caxias do Sul, both as to income and to education level. Besides that, the number of participants that study or have studied Nutrition may have raised the score mean.

Even if it is not representative, the sample size allows one to verify with accuracy the purpose of this research and draw the relation between the knowledge and the sociodemographic and anthropometric categories. By using the GNKQ questionnaire, we apply a tool that is known, validated and already applied to various population groups. The obtained results are important to direct nutrition education actions to the population groups that need knowledge the most, bringing to light topics less understood. As to Nutrition professionals, this study can help them understand that it is necessary to go beyond only theoretical explanations in consultations, and some topics need to be deepened to better propagate nutrition knowledge.

CONCLUSION

The sample of this study from the city of Caxias do Sul - RS showed a good level of nutrition knowledge, with higher scoring among females and professionals or students of Nutrition. As to sociodemographic variables, higher knowledge is directly related to higher income and higher education levels. Future studies can investigate the impact of the nutrition knowledge in people's food consumption, allowing the understanding of how theory and practice relate in food choices. By associating other strategies beyond food

and nutrition education, such as multidisciplinary approaches that involve psychological and motivational aspects, for example, professionals can contribute to a better understanding and better capacity of relating nutrition knowledge to behavior change and eating habits.

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