Research Article

Raquel P. F. Guiné*, Joana Gonçalves, Sofia G. Florença, Manuela Ferreira, Ana Paula Cardoso, Elena Bartkiene, Ilija Djekić, Monica Tarcea, Ivana Rumbak, Marijana Matek Sarić, Maša Černelič-Bizjak, Kathy Isoldi, Ayman EL-Kenawy, Vanessa Ferreira, Dace Klava, Małgorzata Korzeniowska, Elena Vittadini, Marcela Leal, Maria Papageorgiou, Ofélia Anjos

Healthy motivations for food consumption in 16 countries

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Abstract: There are many factors that can influence people's attitudes towards healthy eating, including personal nature, sociodemographic influences, and lifestyle. This work investigated to what extent the motivations for healthy food consumption are shaped in individuals from different countries. A questionnaire survey was carried out on a sample of 11,919 participants from 16 countries. The results indicated that the strongest motivations for healthy food consumption were related to the perception of consuming healthy food, eating foods rich in vitamins and minerals, allied to food safety and hygiene concerns. Significant differences were found in healthy motivations between countries. Additionally, the sociodemographic variables that had a higher influence on health motivation levels were country, age, and gender. Concerning the anthropometric and lifestyle variables influencing healthy motivation for food consumption, the discriminating variables were: believing in having a healthy diet, physical exercise, and chronic diseases. In conclusion, the work showed important differences in the motivations for a healthy diet in different countries, but other variables also play a role in the motivation for the consumption of foods for health and well-being.

Keywords: healthy motivation, food consumption, county differences, questionnaire survey

1 Introduction

Eating is a basic human need to ensure survival and health [1]. Although the primary purpose of the act of eating is to sustain life, it is conditioned by several individual aspects at the internal (psychological and biological) and external

*** Corresponding author: Raquel P. F. Guiné**, CERNAS-IPV Research Centre, Polytechnic University of Viseu, 3504-510, Viseu, Portugal; Escola Superior Agrária de Viseu, Quinta da Alagoa, Estrada de Nelas, Ranhados, 3500-606, Viseu, Portugal, e-mail: raquelguine@esav.ipv.pt
Joana Gonçalves, Sofia G. Florença: CERNAS-IPV Research Centre, Polytechnic University of Viseu, 3504-510, Viseu, Portugal
Manuela Ferreira: UICISA:E Research Centre, Polytechnic University of Viseu, 3504-510, Viseu, Portugal
Ana Paula Cardoso: CIDEI Research Centre, Polytechnic University of Viseu, 3504-510, Viseu, Portugal
Elena Bartkiene: Department of Food Safety and Quality, Lithuanian University of Health Sciences, 47181, Kaunas, Lithuania
Ilija Djekić: Department of Food Safety and Quality Management, Faculty of Agriculture, University of Belgrade, 11000, Belgrade, Serbia
Monica Tarcea: Department of Community Nutrition and Food Safety, GEP University of Medicine Pharmacy Science and Technology of Targu Mures, 540139, Targu Mures, Romania
Ivana Rumbak: Department of Food Quality Control, Faculty of Food Technology and Biotechnology, University of Zagreb, 10000, Zagreb, Croatia
Marijana Matek Sarić: Department of Health Studies, University of Zadar, 23000, Zadar, Croatia
Maša Černelič-Bizjak: Department of Nutritional Counseling–Dietetics, Faculty of Health Science, University of Primorska, 6320, Izola, Slovenia
Kathy Isoldi: Department of Diagnostic Health Professions, Long Island University, 720 Northern Boulevard, Brookville, New York, 11548-1327, United States of America
Ayman EL-Kenawy: Department of Molecular Biology, Genetic Engineering and Biotechnology Institute, University of Sadat City, 79/22857, Sadat City, Egypt
Vanessa Ferreira: Department of Nutrition, School of Nursing, UFMG University, 30130-100, Belo Horizonte, Minas Gerais, Brazil
Dace Klava: Department of Food Technology, Latvia University of Life Sciences and Technologies, Jelgava, LV, 3001, Latvia
Małgorzata Korzeniowska: Faculty of Food Science, Wroclaw University of Environmental and Life Sciences, 51-630, Wrocław, Poland
Elena Vittadini: School of Biosciences and Veterinary Medicine, University of Camerino, 62032, Camerino, Italy
Marcela Leal: School of Nutrition, Faculty of Health Sciences, Maimonides University, C1405 Buenos Aires, Argentina
Maria Papageorgiou: Department of Food Science and Technology, International Hellenic University, 57001 Thessaloniki, Greece
Ofélia Anjos: CERNAS-IPCB, Research Centre for Natural Resources, Environment and Society, Polytechnic University of Castelo Branco, 6001-909, Castelo Branco, Portugal

(cultural, socioeconomic, and geophysical) levels [1,2]. Food choices are essential in daily life, providing the energy and nutrients for the body's proper functioning [1,3,4]. The energy acquired through food is spent on different daily activities, ranging from physical activity to physiological processes [2]. Therefore, energy needs must be ensured through adequate food intake, in qualitative and quantitative terms, ensuring the supply of specific nutritional components [2]. Additionally, the body's Nutrition must aim at well-being and psychophysical development [2].

At a physiological level, Nutrition depends on many factors, namely smell, vision or food memory, which activate specific regions of the hypothalamus [3]. In mechanistic terms, hunger/satiety are regulated through endocrine signals, mediated essentially by ghrelin (hunger hormone) and leptin (satiety hormone), regulating energy homeostasis, but also impulsive food choices [2,3]. The levels of these hormones vary throughout the day and depend on mealtimes [3]. However, food choices and preferences are conditioned by other factors, including social, cultural, and economic factors [1,5]. Several studies emphasise the influence of social norms on the type and quantity of food eaten [6,7]. These standards include beliefs, opinions, ideas, or knowledge about food, shared by the same group of people, which result in the attribution of connotations associated with food, conditioning food choices, and consumer behaviour [5]. Economic factors (price, quality and convenience) are also an important influence from a social point of view [8].

Additionally, demographic factors such as region or country dictate food choices, as dietary trends and patterns differ across different geographic and cultural environments, with tradition also playing a very important role [9–13]. Traditional diets are known for their health benefits, such as the Mediterranean Diet, recognised by UNESCO as an intangible cultural heritage in 2013 [14]. The rural or urban environment [15,16], along with age and sex [17–19], are key factors influencing food choices and the corresponding practised diet.

Religion and ethnicity play an important role in food choices since, in addition to influencing social customs, they restrict some food choices, dictating preferences, routines, and food purchases [20]. Certain religions have dietary restrictions, such as the exclusion of pork in Judaism and Islam or beef in Hinduism, dictating the dietary choices of their believers [5,21,22]. Other elements such as health, politics, marketing, family preferences, and lifestyle have also been described as influencing eating habits [3,5]. The easy access to fast food, dining out, or lack of time to prepare meals also contributes significantly to food choices [3,5]. Therefore, choosing food is a complex and dynamic process, with each person deciding what to eat on average 220 times a day [23].

Given the factors influencing food choices, it is crucial to establish emotional, environmental, sociodemographic, economic, and social conditions that motivate individuals to adopt a healthy diet [24]. Indeed, less nutritious food choices associated with low adherence to dietary guidelines can lead to adverse health consequences [25]. A balanced diet is associated with better eating habits and consequently good health. However, making appropriate food choices depends on individuals' knowledge about food, limiting motivations and food choices [26]. Thus, governments around the world have implemented interventions to guide a healthier lifestyle, particularly targeting food choices [3].

Most health problems arise from modifiable behaviours, such as smoking, eating unhealthy foods, and sedentary lifestyles [3]. An unhealthy lifestyle is associated with daily fatigue and stress [27,28]. Maintaining a healthy diet also helps prevent the onset of non-communicable diseases, namely diabetes, obesity, cancer, hypertension, or cardiovascular diseases [23,29]. For this reason, consuming healthy foods is essential for maintaining well-being and a good health status [25]. Prioritising the consumption of fruits and vegetables over highly processed foods with high levels of salt, sugar, and fats, especially trans-saturated fat, translates into health benefits and prevention of various diseases [26].

What foods and beverages people choose to consume can significantly influence one's health status and well-being. Diet has a unique relation with physical and health status, and therefore, the motivations that shape people's consumption patterns are of the utmost relevance not only for individual health but also for public health. In this context, the present study focuses on the eating motivations of a wide sample of participants from 16 countries concerning healthy eating. It aims to understand the most relevant motivations for healthy food consumption and compare countries according to the different motivations investigated.

2 Materials and methods

2.1 Questionnaire

The questionnaire was initially validated for a Portuguese sample [30], and then, it was into English and sent to the other 15 countries of the participating partners. The questionnaire was translated into the native languages of all the

participating countries. The translation was validated by a back-translation methodology, and all possible cultural particularities that could influence the interpretation of the questions were considered. The instrument was later validated for the different countries [31].

This study focuses on the ten items used to assess the health motivations (HM) that shape the participants' food choices:

Q1. I am very concerned about the hygiene and safety of the food I eat;

Q2. It is important for me that my diet is low in fat;

Q3. Usually, I follow a healthy and balanced diet;

Q4. It is important for me that my daily diet contains a lot of vitamins and minerals;

Q5. There are some foods that I consume regularly, even if they may raise my cholesterol;

Q6. I try to eat foods that do not contain additives;

Q7. I avoid eating processed foods, because of their lower nutritional quality;

Q8. It is important for me to eat food that keeps me healthy;

Q9. There are some foods that I consume regularly, even if they may raise my blood glycaemia;

Q10. I avoid foods with genetically modified organisms.

For all the items, the participants were asked to express their level of agreement using a 5-point hedonic scale: 1 – strongly disagree, 2 – disagree, 3 – neither agree nor disagree, 4 – agree, and 5 – strongly agree.

2.2 Data collection

The study participants were all adults over the age of 18 who voluntarily completed the questionnaire after providing informed consent. They were free to end the questionnaire at any time and without sending the answers. All data collected was anonymous, and no data were collected or registered that could ever link the answers to a particular individual. All ethical procedures were strictly followed in all phases of the study, including when designing the questionnaire, when collecting data, or when treating or storing the data.

The sample was selected by convenience, recruited through online tools (e-mail and social media), and following a snowball methodology. In the end, 11,919 validated responded questionnaires were obtained through Google Forms.

2.3 Data analysis

To treat the data, standard statistical tools, like frequencies and descriptives such as mean value and standard deviation, were used. Additionally, to compare means was used Analysis of Variance (ANOVA) with the *post-hoc* test Tukey, to identify homogeneous subgroups.

To assess the influence of sociodemographic, anthropometric, and lifestyle variables on the HMs for food consumption, classification trees were used. For this, a variable was computed for each participant as the mean value from the scores to all items. However, because some of the questions included were in reversed mode as to the other items of the scale (Q5 and Q9), the corresponding scores were reversed before computing the mean score, also on a scale from 1 to 5. As such, the higher the global or mean scores, the stronger the HMs for food choice. To this effect, a new variable was created to express the intensity of the HMs on the following scale: mean score $< 3 \Rightarrow$ negative HM; $3 <$ mean score $< 4 \Rightarrow$ positive moderate HM; $4 \leq$ mean score $\leq 5 \Rightarrow$ positive strong HM. Because score 3 of the scale corresponded to neither agree nor disagree, it was not considered the mid-point in assessing the HMs scale. For the tree classification analysis was used a classification and regression trees (CRT) algorithm with cross-validation [32]. The parameters for the CRT were the following: minimum change in improvement = 0.001, minimum number of cases for parent nodes = 100, and minimum number of cases for child nodes = 50.

The software used to treat the data was SPSS version 29, from IBM Inc. (Armonk, New York, USA).

Informed consent: All participants provided informed consent before answering the questionnaire.

Ethical approval: The Ethical Committee of Health School of Polytechnic University of Viseu approved the survey, with reference no. 04/2017, and follows national and international protocols for research carried out with human subjects, such as those of the Declaration of Helsinki.

3 Results

3.1 Sociodemographic characterisation of the sample

The sociodemographic variables collected from the participants were six: country, age, gender, education level, marital status, and area of studies or work.

The participants were from 16 countries situated on three continents (Europe, America, and Africa), and were distributed as indicated in Figure 1, which was produced with the tool MapChart (freely available online at https://www.mapchart.net/index.html).

The sample consisted of participants aged between 18 and 90 years, of which 50.1% were young adults (between 18 and 30 years), 34.1% were adults (between 31 and 50 years), 13.4% were senior adults (between 51 and 65 years), and 2.4% were elderly (aged 66 years or more). Regarding gender distribution, 71.4% were female, and 28.6% were male participants. As for marital status, 46.0% were single, 47.5% were married/living together, 4.6% were divorced or separated, and 1.9% were widowed.

With respect to education, 2.1% had completed primary school, 36.3% had completed secondary school, and 61.6% had a university degree. In what concerns the area of work or studies, 8.7% were related to Nutrition, 10.0% to Food, 3.7% to Agriculture, 5.7% to Sports, 4.5% to Psychology, 19.1% to Health, and 48.3% with none of the previous areas.

3.2 Anthropometric data

The anthropometric data collected were height and weight, after which the Body Mass Index (BMI) was calculated (BMI = weight/height^2). The values of BMI were classified according to the four standard classes from the World Health Organisation, and the data are shown in Table 1 for the global sample and by country. Most of the participants fall into the normal weight category, 61.2% of the global sample, but a high percentage fall into the category of overweight (24.8%). While Serbia registered the highest percentage of underweight participants (7.2%), that percentage was lowest in Egypt, with only 1.5% underweight. As for the obesity values, it was less frequent for Portuguese participants (only 3.2%) and most frequent for Hungarian participants, with 24.0% of obese participants.

3.3 Lifestyle characteristics of the participants

The lifestyle variables used to collect data were five, as follows: (1) being responsible for purchasing their own food, (2) frequency of practising physical exercise, (3) practising a balanced/healthy diet, (4) having chronic diseases, and (5) suffering from food allergies/intolerances.

Most of the participants are responsible for buying their own food (84.0%). Regarding the practice of physical exercise (Figure 2a), 13% never do it, 23% do it sporadically (less than once a week), 22% do it occasionally (on average once per week), 29% do it moderately (between 2 and 3 times per week) and 13% have intense physical activity (more than 3 times per week). Concerning the participants'

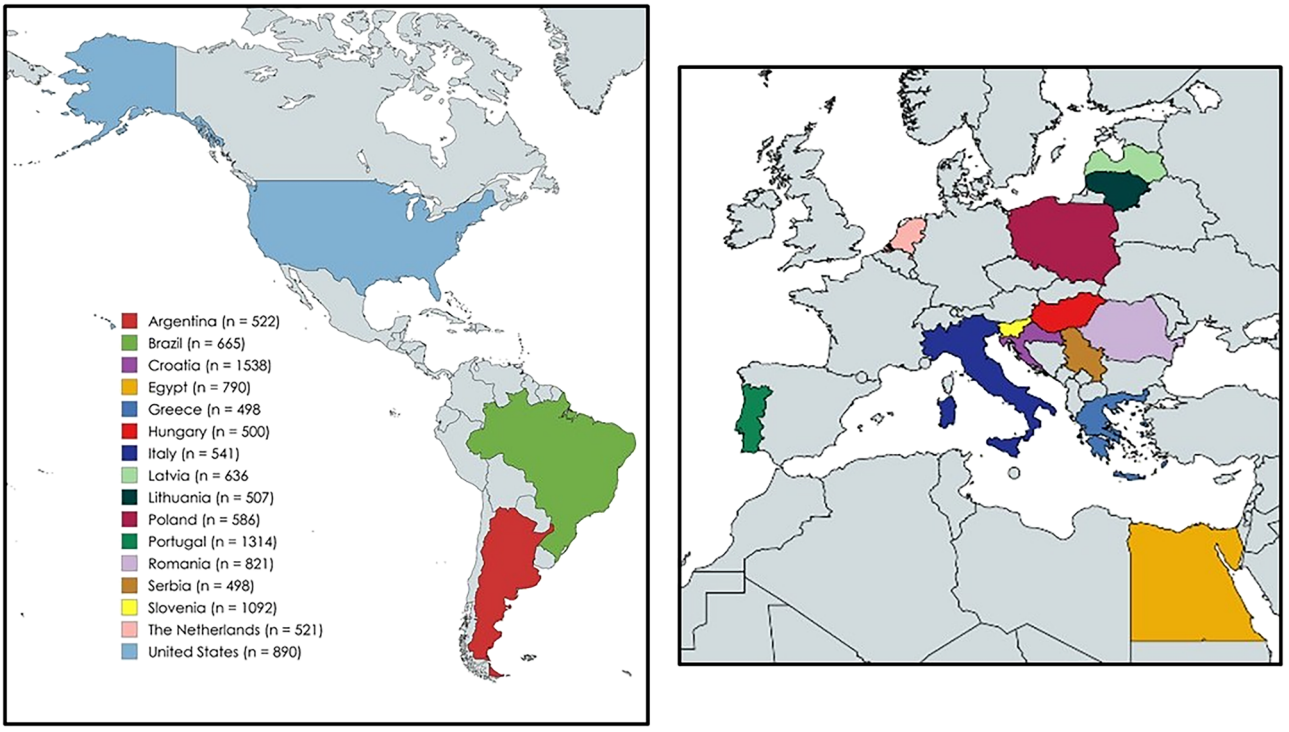

Figure 1: Geographical distribution of countries included in the study and the corresponding number of participants (Total *N* = 11,919 participants) (Original work by Raquel P. F. Guiné).

Table 1: BMI of the participants, according to the four main classes defined by the World Health Organization

Country	N^1	Percentage of participants according to BMI class[2] (%)				Total %[3]
		Underweight	Normal weight	Overweight	Obesity	
Argentina	522	3.5	62.1	24.6	9.8	100.0
Brazil	665	3.8	61.1	23.9	11.2	100.0
Croatia	1538	3.4	59.9	30.1	6.6	100.0
Egypt	790	1.5	49.3	33.7	15.5	100.0
Greece	498	2.8	68.3	23.5	5.4	100.0
Hungary	500	2.6	40.2	33.2	24.0	100.0
Italy	541	5.9	63.2	24.1	6.8	100.0
Latvia	636	2.4	55.8	27.8	14.0	100.0
Lithuania	507	5.3	56.2	28.4	10.1	100.0
Poland	586	4.5	63.6	22.8	9.1	100.0
Portugal	1314	5.5	79.9	11.4	3.2	100.0
Romania	821	5.1	53.8	29.5	11.6	100.0
Serbia	498	7.2	69.1	19.3	4.4	100.0
Slovenia	1092	3.7	60.4	24.7	11.2	100.0
The Netherlands	521	3.6	62.4	21.7	12.3	100.0
United States	890	3.4	58.0	23.0	15.6	100.0
Global sample[4]	**11,919**	**4.0**	**61.2**	**24.8**	**10.0**	**100.0**

[1]N = number of participants in each country and in the global sample.
[2]Underweight (BMI < 18.5 kg/m^2), Normal weight (18.5 kg/m^2 ≤ BMI < 25.0 kg/m^2), Overweight (25.0 ≤ BMI < 30.0 kg/m^2), Obesity (BMI ≥ 30.0 kg/m^2).
[3]Total = sum of percentages in row, i.e., in each country and in the global samples.
[4]Global sample accounts for all the participants from all countries.

opinions about how frequently they believe in having a balanced and healthy diet (Figure 2b), 5% admit to never doing it, and 11% only do it rarely. On the other hand, 40% believe they frequently have a healthy diet, and 10% think they do it all the time.

In terms of the presence of any chronic disease, only 26.3% of the participants have it. These include cardiovascular diseases (n = 315 participants), diabetes (n = 254), high cholesterol (n = 626), hypertension (n = 840), gastric problems (n = 489), intestinal problems (n = 326), and obesity (n = 578).

Regarding food allergies or intolerances, only 12.8% of the participants report such cases. These include intolerance/allergy to lactose (n = 664), casein (n = 87), gluten (n = 193), nuts (n = 174), and shellfish (n = 269).

3.4 HMs for food consumption

Table 2 presents the mean scores calculated for the ten items calculated from the scores attributed to all participants. The items with the highest level of agreement were Q8 – It is important for me to eat food that keeps me healthy (4.04 ± 0.88); Q4 – It is important for me that my daily diet contains a lot of vitamins and minerals (3.82 ± 0.88); and Q1 – I am very concerned about the hygiene and

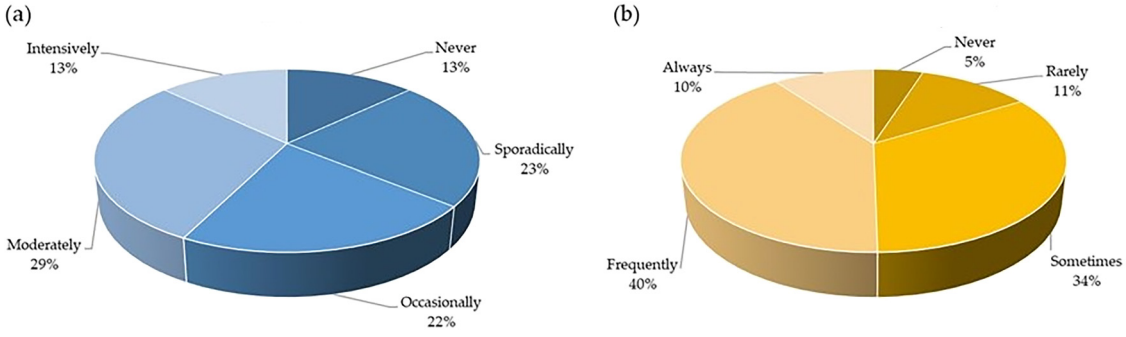

Figure 2: Frequency of practising physical exercise and having a healthy and balanced diet. (a) Physical exercise, (b) balanced/healthy diet.

Table 2: Average scores for the items used to assess the HMs for food consumption

Item	Mean[1] ± SD[2]
Q1. I am very concerned about the hygiene and safety of the food I eat	3.77 ± 1.02
Q2. It is important for me that my diet is low in fat	3.15 ± 1.07
Q3. Usually, I follow a healthy and balanced diet	3.56 ± 0.94
Q4. It is important for me that my daily diet contains a lot of vitamins and minerals	3.82 ± 0.88
Q5. There are some foods that I consume regularly, even if they may raise my cholesterol	3.08 ± 1.12
Q6. I try to eat foods that do not contain additives	3.41 ± 1.01
Q7. I avoid eating processed foods, because of their lower nutritional quality	3.14 ± 1.05
Q8. It is important for me to eat food that keeps me healthy	4.04 ± 0.88
Q9. There are some foods that I consume regularly, even if they may raise my blood glycaemia	3.04 ± 1.13
Q10. I avoid foods with genetically modified organisms	3.35 ± 1.13

[1]Scale from 1 (total disagreement) to 5 (total agreement); [2]SD – Standard deviation.

safety of the food I eat (3.77 ± 1.02). The items with the lowest level of agreement were the two items that implicate consuming certain foods even though knowing they are not healthy: Q5 – There are some foods that I consume regularly, even if they may raise my cholesterol (3.08 ± 1.12) and Q9 – There are some foods that I consume regularly, even if they may raise my blood glycaemia (3.04 ± 1.13).

According to the results in Table 3, there were significant differences between countries for all ten items. Q1, about safety and hygiene, presented the highest mean score for Egypt (4.32 ± 0.92) and lowest for the Netherlands (2.64 ± 1.05). Q2, about low-fat diet, got the highest score for Portuguese participants (3.85 ± 0.96) and lowest for Slovenian (2.28 ± 1.01). Q3, related to following a healthy diet, got the highest score in Romania (3.84 ± 0.91) and lowest in Serbia (3.14 ± 1.05). For Q4, the highest score for a diet containing vitamins and minerals was for Portugal (4.07 ± 0.66) and the lowest for The United States (3.27 ± 1.17). Q5, about consuming foods even knowing they are bad for cholesterol, got the highest mean score for Latvian participants (3.75 ± 1.00) and lowest for Portuguese (2.21 ± 1.19). Q6, about avoiding food additives, got the highest score among Romanian participants (3.77 ± 0.92) and the lowest for participants from the Netherlands (2.95 ± 1.11). Q7, related to avoiding processed foods, got the highest score in Slovenia (3.64 ± 1.01) and lowest in Brazil (2.68 ± 1.02). Q8, about consuming food for health, received the highest score from Portuguese participants (4.39 ± 0.65) and lowest from those of the United States (3.48 ± 1.29). Q9 is about consuming foods that raise blood glycaemia; the highest score was for Argentina (3.46 ± 1.04) and the lowest for Portugal (2.21 ± 1.16). Finally, Q10, about avoiding genetically modified organisms, received the highest score in Romania (3.76 ± 1.19) and Lithuania (3.76 ± 1.24) and lowest in The Netherlands (2.57 ± 1.07).

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3.5 Influence of sociodemographic variables on HMs for food consumption

The variable accounting for the HM was submitted to a classification tree algorithm, considering the six sociodemographic variables (country, age class, gender, education level, marital status, and area of studies/work). The resulting tree (Figure 3) has four levels and 17 nodes, of which nine are terminal. From the six variables considered in the analysis, only three were found to be explicative of HM and included in the tree classification (country, age group, and gender). The risk estimate was 0.370 with a standard error of 0.005 and 0.371 with an error of 0.005, respectively, for resubstitution and cross-validation. The model's overall prediction capacity accounts for a 63.0% probability of correctly predicting the cases according to the class of HM.

The results in Figure 3 show that the first discriminating variable for HM was country, separating Romania, Lithuania, and Portugal from the other countries for having many more participants with strong HM (36.6%). For these three countries, the next discriminating variable was the age group, separating the young adults with lower levels of strong HM (23.3%). For the participants of the other age groups, the following discriminant was again country, with Portugal manifesting high percentages of the strong HM (55.5%). For the other

Table 3: Country differences in the mean scores for the items used to assess the healthy motivations for food consumption

	Mean ± SD[1]									
Country	**Q1**	**Q2**	**Q3**	**Q4**	**Q5**	**Q6**	**Q7**	**Q8**	**Q9**	**Q10**
Argentina	3.51 ± 1.09^{cde}	3.26 ± 1.05^{ef}	3.62 ± 1.01^{def}	3.82 ± 0.91^{def}	3.38 ± 1.11^{e}	3.12 ± 1.14^{ab}	3.20 ± 1.14^{ef}	4.14 ± 0.82^{def}	3.46 ± 1.04^{h}	3.06 ± 1.12^{bcd}
Brazil	3.99 ± 0.82^{gh}	3.28 ± 1.02^{ef}	3.59 ± 0.99^{cde}	3.88 ± 0.86^{efg}	3.33 ± 1.00^{de}	3.48 ± 1.02^{ef}	2.68 ± 1.02^{a}	4.18 ± 0.78^{ef}	3.41 ± 0.98^{gh}	3.00 ± 1.07^{b}
Croatia	3.91 ± 0.90^{g}	3.06 ± 0.94^{d}	3.56 ± 0.89^{cd}	3.76 ± 0.82^{cde}	3.14 ± 1.00^{cd}	3.38 ± 0.98^{cde}	3.15 ± 0.99^{def}	3.96 ± 0.79^{bc}	3.23 ± 1.01^{efg}	3.59 ± 1.12^{ef}
Egypt	4.32 ± 0.92^{i}	3.77 ± 0.97^{g}	3.66 ± 0.96^{def}	3.81 ± 0.92^{def}	3.07 ± 1.13^{c}	3.19 ± 1.07^{bc}	3.24 ± 1.14^{fg}	4.12 ± 0.95^{def}	2.86 ± 1.24^{c}	3.03 ± 1.11^{bc}
Greece	3.39 ± 0.92^{c}	3.12 ± 0.91^{de}	3.37 ± 0.97^{b}	3.63 ± 0.88^{bc}	3.04 ± 1.07^{c}	3.21 ± 1.01^{bcd}	3.15 ± 1.08^{def}	3.93 ± 0.91^{bc}	2.86 ± 1.14^{c}	3.52 ± 1.12^{e}
Hungary	2.88 ± 1.20^{b}	2.85 ± 1.14^{bc}	3.29 ± 0.99^{ab}	3.59 ± 1.05^{b}	3.36 ± 1.07^{e}	3.39 ± 1.13^{de}	2.89 ± 1.09^{bc}	3.57 ± 1.03^{a}	3.36 ± 1.04^{gh}	3.50 ± 1.20^{e}
Italy	3.69 ± 0.89^{f}	3.25 ± 0.88^{ef}	3.62 ± 0.88^{def}	3.77 ± 0.75^{cde}	3.34 ± 0.96^{de}	3.48 ± 0.96^{ef}	3.22 ± 0.99^{ef}	4.01 ± 0.78^{cd}	3.32 ± 0.93^{gh}	3.60 ± 1.11^{ef}
Latvia	3.90 ± 0.93^{g}	3.27 ± 1.00^{ef}	3.42 ± 0.92^{bc}	3.87 ± 0.91^{efg}	3.75 ± 1.00^{f}	3.47 ± 1.09^{ef}	2.93 ± 1.03^{bc}	4.07 ± 0.82^{cde}	3.39 ± 1.13^{gh}	3.24 ± 1.03^{d}
Lithuania	4.12 ± 0.77^{h}	3.43 ± 0.92^{f}	3.70 ± 0.87^{defg}	3.99 ± 0.83^{gh}	2.71 ± 1.15^{b}	3.55 ± 1.02^{ef}	2.98 ± 1.00^{bcd}	3.99 ± 0.87^{cd}	2.55 ± 1.20^{b}	3.76 ± 1.24^{f}
Poland	3.91 ± 0.85^{g}	2.77 ± 0.98^{b}	3.42 ± 0.83^{bc}	3.88 ± 0.78^{efg}	2.75 ± 0.91^{b}	3.52 ± 0.85^{ef}	3.49 ± 0.92^{hi}	4.00 ± 0.76^{cd}	3.00 ± 0.94^{cd}	3.23 ± 1.06^{cd}
Portugal	4.15 ± 0.68^{h}	3.85 ± 0.96^{g}	3.77 ± 0.69^{fg}	4.07 ± 0.66^{h}	2.21 ± 1.19^{a}	3.63 ± 0.78^{fg}	2.98 ± 0.81^{bcd}	4.39 ± 0.65^{g}	2.21 ± 1.16^{a}	3.23 ± 0.84^{cd}
Romania	4.17 ± 0.84^{hi}	3.36 ± 1.07^{f}	3.84 ± 0.91^{g}	4.06 ± 0.88^{h}	3.35 ± 1.15^{e}	3.77 ± 0.92^{g}	3.43 ± 1.06^{gh}	4.26 ± 0.83^{fg}	3.11 ± 1.08^{def}	3.76 ± 1.19^{f}
Serbia	3.58 ± 1.03^{def}	2.70 ± 0.98^{b}	3.14 ± 1.05^{a}	3.67 ± 0.88^{bcd}	3.09 ± 1.05^{c}	3.23 ± 1.04^{bcd}	3.08 ± 1.09^{cdef}	3.80 ± 0.88^{b}	3.29 ± 1.00^{fgh}	3.74 ± 1.10^{f}
Slovenia	3.62 ± 0.92^{ef}	2.28 ± 1.01^{a}	3.73 ± 0.83^{efg}	3.95 ± 0.72^{fgh}	3.05 ± 1.06^{c}	3.63 ± 0.93^{fg}	3.64 ± 1.01^{i}	4.23 ± 0.70^{f}	2.88 ± 1.12^{c}	3.65 ± 1.06^{ef}
The Netherlands	2.64 ± 1.05^{a}	2.74 ± 0.88^{b}	3.60 ± 0.86^{def}	3.96 ± 0.66^{fgh}	3.36 ± 0.89^{e}	2.95 ± 1.11^{a}	2.81 ± 1.06^{ab}	4.05 ± 0.61^{cde}	3.45 ± 0.86^{h}	2.57 ± 1.07^{a}
United States	3.42 ± 1.17^{cd}	3.00 ± 1.02^{cd}	3.18 ± 1.15^{a}	3.27 ± 1.17^{a}	3.21 ± 1.05^{cde}	3.14 ± 1.05^{b}	3.04 ± 1.11^{cde}	3.48 ± 1.29^{a}	3.06 ± 0.98^{cde}	2.96 ± 1.13^{b}
p-value	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001

[1]Mean value ± standard deviation. The mean values were calculated for each of the items as a mean of the scores attributed by all participants in each of the countries. Scoring: The participants scored the items on a 5-point hedonic scale as follows: 1 – strongly disagree, 2 – disagree, 3 – neither agree nor disagree, 4 – agree, and 5 – strongly agree. Values in the same column with different superscript letters are significantly different (ANOVA with Tukey's *post-hoc* test).

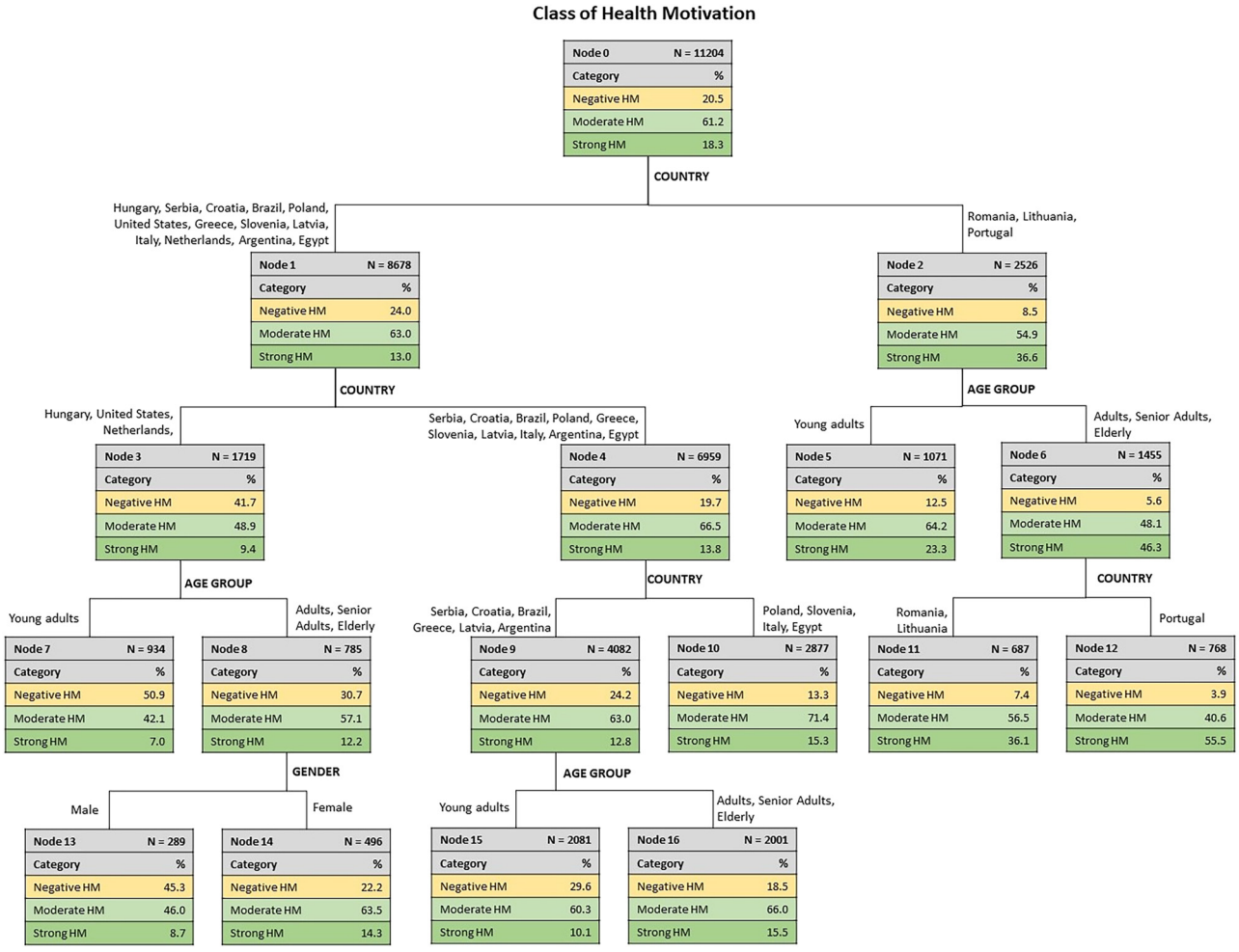

Figure 3: Classification trees for variable HM according to sociodemographic variables.

countries, on the left branch of the tree, the second-level and the third-level discriminants were variable countries again, separating Poland, Slovenia, Italy, and Egypt for having higher percentages of strong HM (15.3%). Age group appeared as a discriminating variable in levels 2, 3, and 4, in all cases separating the young adults from the other age groups, for presenting lower percentages of strong HM. The variable gender appeared only in the fourth level, separating the female participants with a higher percentage of strong HM (14.3%).

3.6 Influence of anthropometric and lifestyle variables on HMs for food consumption

In this case, the classification tree was obtained with six input variables (BMI class, buying one's food, physical exercise, healthy diet, chronic diseases, and food allergies/intolerances). The obtained tree is shown in Figure 4, and it has five levels of depth, with 13 nodes, seven of which are terminal. Of the six independent variables considered, only four were found explicative (healthy diet, physical exercise, chronic diseases, and BMI), which are the variables included in the final tree. The risk estimate/error was 0.386/0.005 and 0.387/0.005, respectively, for resubstitution and cross-validation. The global prediction capacity of the model was found to be 61.4%.

The tree in Figure 4 shows that caring to practice a healthy diet is the most important discriminating variable, separating the participants who do it more frequently by presenting a higher percentage of strong HM (25.3%). From these, the next discriminating variable was physical exercise, with stronger levels of HM (28.8%) for those with more intense physical activity. On the left branch of the tree, the second discriminant was again a healthy diet, separating the participants with less preoccupation with having a healthy diet, showing higher percentages of negative HM

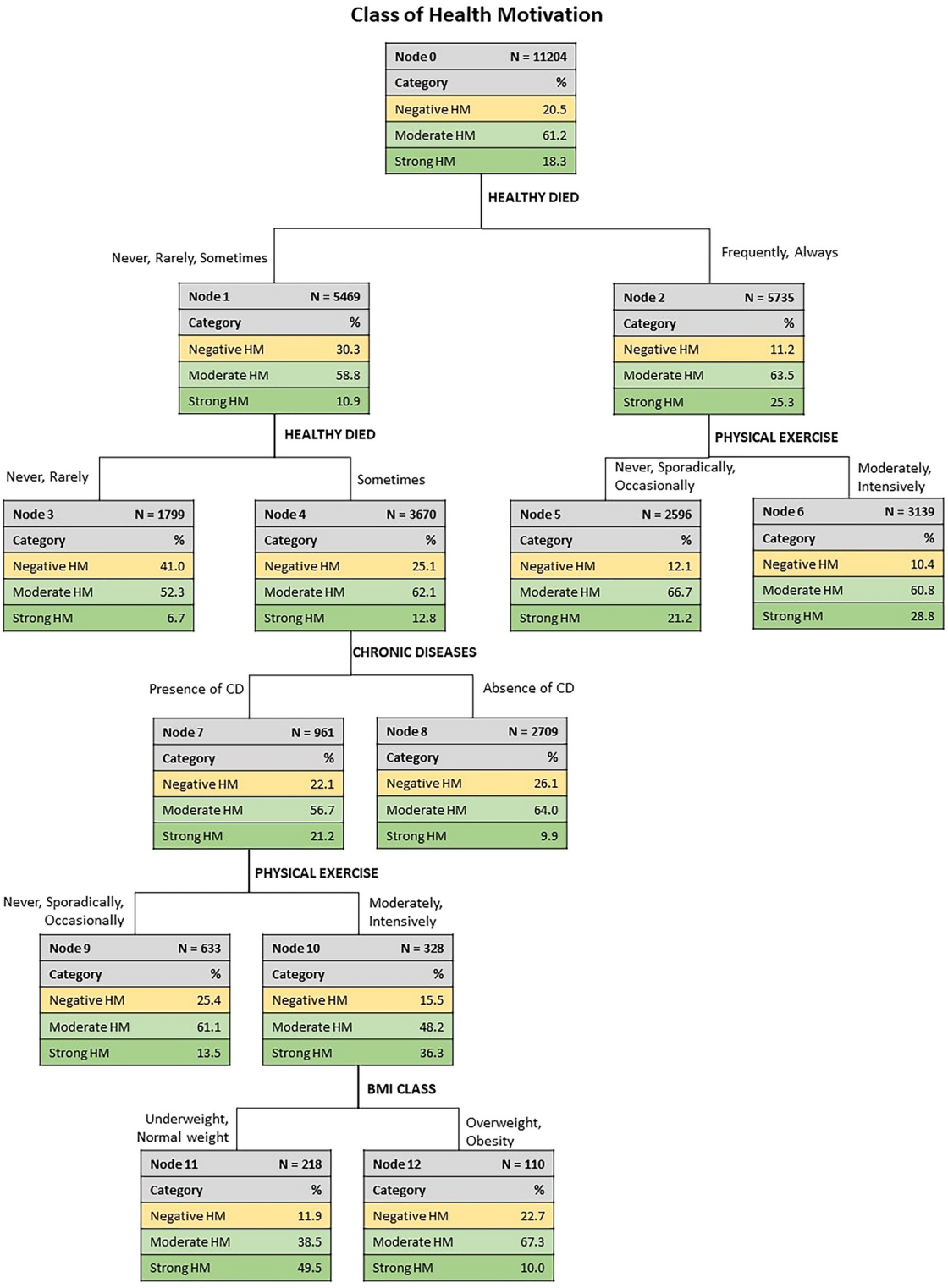

Figure 4: Classification trees for variable HM according to anthropometric and lifestyle variables.

(41.0%). For the participants who sometimes have a healthy diet, the discriminating variable in level three was having chronic diseases, as a factor influencing stronger HM (21.2%). For these, the next discriminant was physical exercise, so those individuals who did it more intensively showed higher percentages of strong HM (36.3%). In the final level of depth, the BMI was the discriminating variable separating those that were over the recommended

body weight for having lower percentages of strong HM (10.0%).

4 Discussion

The results obtained in this study show the motivations for healthy food consumption in individuals of different ages, genders, education levels, marital statuses, and areas of study/work, in a range of sixteen countries. Anthropometric data on weight and height were collected, and BMI was calculated for respondents from all countries. Serbia had the highest percentage of underweight individuals, with a figure of 7.2%. In fact, similar values were obtained in another study carried out on Serbian children, where it was found that 8.1% of respondents were also underweight [33]. While some studies indicate underweight values higher than those obtained here [34–36], others reported the opposite [37–39]. Egypt had the lowest percentage of underweight individuals, with values of 1.5%. Razak et al. [40] described underweight values lower than 0.1%. However, not all studies indicate this trend [41,42]. In terms of obesity figures, Portugal was the country with the lowest percentages. However, some studies describe higher values [43–45]. This discrepancy could stem from methodological differences, such as varying definitions of obesity (e.g., BMI thresholds), sample populations, or data collection periods.

Additionally, a systematic review carried out by Carreira et al. [46] revealed that there has been an increase in the number of obese individuals in Portugal since 2005. This rising trend in obesity aligns with global patterns of increasing obesity due to lifestyle changes, such as decreased physical activity, higher caloric intake, and urbanisation. The apparent contradiction underscores the importance of consistent and harmonised data collection and reporting. Portugal's traditional Mediterranean diet, often considered healthy, might have contributed to historically lower obesity rates. However, shifts towards processed foods and sedentary lifestyles could explain the rising trends. Additionally, the population's demographic profile could affect health outcomes.

Hungary, on the other hand, was the country with the highest percentage of obese individuals, being these results in agreement with the order of magnitude obtained in other studies [47,48]. Nevertheless, other studies indicate higher obesity rates for the Hungarian population [49]. Obesity and other weight-related diseases are a concern of the 21st century. Nowadays, the population has greater access to more processed foods and so-called junk food [3,5]. This type of food is often within reach of people of a younger age, particularly children and teenagers, and in these age groups it is often the meal of choice to have with friends [29]. Thus, the tendency for diseases such as obesity or diabetes to emerge has been increasing [50]. Therefore, the implementation of nutritional education measures is urgent and must be supported [3].

Regarding motivations for healthy food consumption, the results indicated that the factors that most influenced respondents' food choices were related to health and food safety. According to the literature, health benefits determine food acceptance [51]. Similar results were also obtained in other studies [31,52–54]. Regarding individual items, the highest score was obtained for sentence Q8. "It is important for me to eat food that keeps me healthy," with Portugal being the country where this agreement was highest. These results can be justified by Cardoso et al. [55], where Portuguese citizens showed they had a correct perception of a healthy diet. The fact that the Mediterranean Diet is part of the gastronomic culture of this country may justify the healthy habits [56]. However, Portugal was also the country where the highest level of agreement was obtained for items Q2. "It is important for me that my diet is low in fat." and Q4. "It is important for me that my daily diet contains a lot of vitamins and minerals," which may be justified by the importance attributed to fruits and vegetables in the diet and the practice of a balanced and varied diet, as well as the avoidance of foods rich in fat and sugar [55]. Probably for this exact reason, it was in Portugal that the most significant disagreement was obtained in item Q5. "There are some foods that I consume regularly, even if they may raise my cholesterol." and Q9. "There are some foods that I consume regularly, even if they may raise my blood glycaemia." These were simultaneously the items where the lowest level of agreement was obtained at a general level. Sugar and saturated fats can contribute to the development of several diseases, such as obesity, diabetes, and heart disease [57–59].

In contrast, the results presented for Argentina and Latvia demonstrate that these participants regularly consume foods that can increase cholesterol and blood sugar levels. In a study that investigated the influence of some sociodemographic factors on eating motivations in several countries, including Argentina and Latvia, it was possible to verify that economics and availability are the factors that most motivate Latvians to eat [60]. Regarding Argentina, although health is the biggest sociodemographic factor that influences eating motivations, this is on a much smaller scale compared to most of the other countries studied [60]. Additionally, food choices in this country are also influenced by factors such as economic and availability and environmental and political issues [60]. The only countries whose health factors demonstrated less influence on eating motivations were the Netherlands, Hungary, and the United States

[60]. Coincidentally, in the present study, respondents of Dutch nationality were those who showed the lowest agreement with items Q1. "I am very concerned about the hygiene and safety of the food I eat.", Q6. "I try to eat foods that do not contain additives." and Q10. "I avoid foods with genetically modified organisms." The findings suggest that participants from more developed countries, such as the Netherlands, exhibit lower levels of concern regarding food hygiene and safety. This likely reflects the high standards of food production, regulation, and monitoring in these nations, where strict protocols ensure that food is generally safe and hygienic. In such environments, food safety is perceived as a given, reducing the urgency of this factor in motivating healthy eating behaviours. In contrast, participants from less developed or transitioning economies may prioritise food safety and hygiene more prominently in their motivations for healthy eating. This difference underscores the role of infrastructure, regulatory systems, and cultural perceptions in shaping attitudes toward food consumption. In countries where food safety is less reliably ensured, individuals may focus more on these concerns, as they directly influence their health and well-being.

The United States was the country with the lowest score for items Q4. "It is important for me that my daily diet contains a lot of vitamins and minerals." and Q8. "It is important for me to eat food that keeps me healthy," which could be associated to a highly urbanised lifestyle, including the consumption of prepared food as opposed to foods prepared at home environments. The low score for the United States on items Q4 and Q8, which reflects the importance of consuming a healthy diet and one rich in micronutrients, reveals interesting cultural and behavioural trends. The United States is known for its highly industrialised food system, where convenience foods and processed products dominate many people's diets. These foods are often marketed for their taste, affordability, and convenience rather than nutritional quality, potentially influencing perceptions of the importance of vitamins and minerals. In the United States, HMs often align with weight management or fitness goals rather than holistic nutritional well-being. This could lead to a lesser emphasis on daily vitamin and mineral intake as a critical factor. Americans have a strong reliance on dietary supplements. Many people may feel that they can meet their vitamin and mineral needs through pills or fortified products rather than through a natural, nutrient-rich diet.

There is no universal definition of a healthy diet, although global guidelines for what can be considered an unhealthy food are established [55]. Thus, there is openness on the part of countries to define what a healthy and balanced diet should be [55]. Despite this, individuals' perceptions of foods and how they should include them in their diet can be guided by greater nutritional knowledge [55]. Therefore, it is important to promote educational training in this sense [61,62].

In this study, statistically significant associations were found between motivations for consuming healthy foods and the sociodemographic variables of country, age group, and gender. The results show that the first discriminant variable consisted of the country, where respondents from Lithuania, Romania, and Portugal presented a strong HM. In fact, social and cultural factors can significantly influence each individual's food choices and motivations, and, as is known, these factors vary from country to country [63]. Thus, these results highlight the importance and influence of location and nationality in HM for food choice, differing according to gastronomic tradition [1,5,26,55,63]. Additionally, the quantities and types of food consumed vary depending on the cultural context, as de Castro et al. [64] demonstrated. In the study mentioned above, the eating behaviours of German, French, and American students were compared, showing pronounced differences in intake patterns, meal composition, and food quantities [64]. The perception that each country has about healthy eating also differs greatly between them, which can affect food choices [26]. Previous studies have shown that perceptions of healthy eating differ significantly across countries [55].

The results obtained here showed that for the three countries mentioned (Lithuania, Romania, and Portugal), the following discriminant variable was the age group, with young adults presenting lower levels of strong HM. These results are consistent with those described in the literature, which suggest that adults consider HMs to be among the most important [65–67]. It is also described that as older people get older, they tend to view food choices as an inherent process of ageing and, therefore, feel more motivated to practice healthy eating [68,69], showing a higher adherence rate compared to young adults [70]. In a study developed by Quarta et al. [71] it was also demonstrated that increasing age is associated with greater adherence to a healthy diet. Wongprawmas et al. [52] also found that the age of individuals with health-oriented food choices was significantly higher. Looking at the results obtained with tree classification for sociodemographic factors, it is still possible to see that for the remaining age groups, the next discriminant variable was again the country, with Portugal showing a strong HM. These results may be explained by the fact that Portugal is part of the group of European countries located in the Mediterranean Sea region, whose previous studies have shown that they have a higher consumption of foods considered healthy [71,72]. In fact, in Portugal, there is a prevalence of the Mediterranean Diet, which is considered one of the

healthiest [73]. Ljubičić et al. [26] also described that Portuguese citizens were more motivated to adopt health behaviours compared to other European countries, namely Greece, Croatia, and Italy. The same study also described that the Portuguese had a better perception of healthy foods and better motivation for healthy behaviour compared to Slovenian citizens [26]. Cardoso et al. [55] also described in their study that residents in Portugal showed a more correct perception of what a healthy diet should be.

In the other branch of the tree diagram obtained for the influence of sociodemographic variables on HM, the discriminant variable at the second and third levels was again country and then age group. Finally, the gender variable was discriminatory at the fourth level, showing that female respondents presented a strong HM, therefore higher than the percentage obtained for the male gender. Studies suggest that women are more associated with motivation for healthy behaviour [74,75]. Other studies indicate that females have a greater adherence to healthy foods [71,72]. Indeed, it is known that women attach more importance to health and, therefore, are more motivated to follow a healthy diet [75,76].

In the present study, statistically significant associations were also found between motivations for the consumption of healthy foods and the anthropometric and lifestyle variables healthy diet, physical exercise, chronic diseases, and BMI. Results indicate that the first discriminant variable consisted of practising a healthy diet, with respondents who do so frequently or always presenting a strong HM. Similar results have been previously obtained, and it was found that individuals with HMs adopted a healthy diet [52]. Additionally, a healthy diet was perceived as being that suggested by professionals in the field of Nutrition; that is, it should be varied and balanced and include vegetables and fruits [52]. Knowledge about what a healthy diet should be dictates the behaviour and knowledge of individuals [77–80]. However, to maintain this diet, it is necessary to take several factors into account, namely motivations [81–83]. Therefore, it is crucial to educate the population in order to transmit knowledge about the concept of a healthy diet and its benefits/consequences for health [23]. Lack of knowledge in the health area is often associated with unhealthy eating practices [23]. Following the results already mentioned, the next discriminant lifestyle variable was physical exercise, with higher HM being associated with higher levels of physical activity. Indeed, physical exercise is associated with motivation for healthy behaviour, as previously described [74,75]. More intense physical activity is related to a healthier lifestyle, a fact proven in the literature [26,84].

Additionally, physical exercise may be linked to an improved body image, which in turn can contribute to a healthier diet [85]. In a study that assessed differences in health in relation to the reasons for food choices, it was possible to verify that individuals who practised more physical activity had stronger HMs [23]. Another study found moderately active individuals had stronger HM when making food choices [65].

In contrast, in the other branch of the tree diagram for the influence of lifestyle variables on HM, the discriminant variable was again the practice of a healthy diet, and respondents with less concern about adopting a healthy diet presented a negative HM. The concept of healthy eating is sometimes underestimated, especially in healthy individuals [26]. Additionally, people are often attracted by the taste of food and, although they understand the concept of "healthy," they do not prioritise it, especially at younger ages [86–88]. For the same tree classification, it is possible to see that the next discriminant variable, for respondents who sometimes follow a healthy diet, was having chronic diseases; this is associated with a stronger HM. These results are in line with those previously demonstrated, where it was found that individuals with chronic diseases have more motivation to eat healthily [68]. In fact, when diseases appear, there may be an increase in concern for health [26]. However, although people are aware of the benefits of a healthy diet and its influence on the development of diseases, they do not always care about the possible consequences [26]. Despite this, it is known that the most prevalent chronic diseases are associated with lifestyle practices, namely the practice of physical exercise and a balanced diet [26]. On the other hand, individuals without chronic diseases choose foods for economic and availability reasons [65].

The results of the present study also showed that at the last level, BMI was the discriminating variable, with respondents who were overweight presenting higher HM. Contradictory findings were obtained by Warren et al. [89], where it was found that people with a higher BMI did not show motivation to practice physical exercise and eat healthily [89]. On the other hand, according to the literature, a normal BMI is associated with motivation for healthy behaviour [74,75]. The same results were obtained by Guiné et al. [63], where it was found that individuals with normal weight practised and believed that a healthy diet should be varied, complete, and balanced.

5 Conclusions and limitations

The results obtained showed that the participants felt higher motivation for the following issues: Q3. Usually, I follow a healthy and balanced diet; Q4. It is important for

me that my daily diet contains a lot of vitamins and minerals; and Q1. I am very concerned about the hygiene and safety of the food I eat.

The items with the lowest motivation were: Q5. There are some foods that I consume regularly, even if they may raise my cholesterol; and Q9. There are some foods that I consume regularly, even if they may raise my blood glycaemia.

Statistically significant differences were found for all the healthy motivations investigated. The motivations for consumption of healthy foods were further influenced by age, gender, practice of a healthy diet, practice of physical exercise, BMI, or chronic diseases.

These results could be useful in adapting strategies to improve healthy food consumption among people in different sociodemographic and geographic contexts.

This work has some limitations, such as the uneven distributions of the participants by the sociodemographic groups considered; data collection from the online survey; and self-reporting of anthropometric data.

Nevertheless, because the global number of participants was nearly 12 thousand, there is some degree of reliability in the obtained results that make this a relevant approach to the study, which could, in the future, be extended to other countries.

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Conflict of interest: Authors state no conflicts of interest.

Data availability statement: The data generated or analysed during this study are reported in this published article. The raw data are curated by the corresponding author and are protected by the Regulation of Data Protection of the Polytechnic University of Viseu for studies with human subjects, as stipulated by the Ethics committee that approved the study conditioned to the protection of the participant's data.

References

[1] de Queiroz FLN, Raposo A, Han H, Nader M, Ariza-Montes A, Zandonadi RP. Eating competence, food consumption and health outcomes: an overview. Int J Environ Res Public Health. 2022;19:4484. doi: 10.3390/ijerph19084484.

[2] Grzymisławska M, Puch EA, Zawada A, Grzymisławski M. Do nutritional behaviors depend on biological sex and cultural gender? Adv Clin Exp Med. 2020;29:165–72. doi: 10.17219/acem/111817.

[3] Leng G, Adan RAH, Belot M, Brunstrom JM, Graaf K, de Dickson SL, et al. The determinants of food choice. Proc Nutr Soc. 2017;76:316–27. doi: 10.1017/S002966511600286X.

[4] Scaglioni S, De Cosmi V, Ciappolino V, Parazzini F, Brambilla P, Agostoni C. Factors influencing children's eating behaviours. Nutrients. 2018;10:706. doi: 10.3390/nu10060706.

[5] Boustani NM, Guiné RPF. Food determinants and motivation factors impact on consumer behavior in Lebanon. Open Agric. 2023;8(1):20220176. doi: 10.1515/opag-2022-0176.

[6] Pelletier JE, Graham DJ, Laska MN. Social norms and dietary behaviors among young adults. Am J Health Behav. 2014;38:144–52. doi: 10.5993/AJHB.38.1.15.

[7] Higgs S. Social norms and their influence on eating behaviours. Appetite. 2015;86:38–44. doi: 10.1016/j.appet.2014.10.021.

[8] Hinrichs CC. Embeddedness and local food systems: notes on two types of direct agricultural market. J Rural Stud. 2000;16:295–303. doi: 10.1016/S0743-0167(99)00063-7.

[9] Barker ME, McClean SI, Thompson KA, Reid NG. Dietary behaviours and sociocultural demographics in Northern Ireland. Br J Nutr. 1990;64:319–29. doi: 10.1079/BJN19900034.

[10] Jaime PC, Duran AC, Sarti FM, Lock K. Investigating environmental determinants of diet, physical activity, and overweight among adults in Sao Paulo, Brazil. J Urban Health. 2011;88:567–81. doi: 10.1007/s11524-010-9537-2.
[11] Glanz K, Basil M, Maibach E, Goldberg J, Snyder D. Why americans eat what they do: taste, nutrition, cost, convenience, and weight control concerns as influences on food consumption. J Am Diet Assoc. 1998;98:1118–26. doi: 10.1016/S0002-8223(98)00260-0.
[12] Miller LC, Joshi N, Lohani M, Singh R, Bhatta N, Rogers B, et al. Head growth of undernourished children in rural Nepal: association with demographics, health and diet. Paediatr Int Child Health. 2016;2:91–101.
[13] Mengesha ST. Understanding the patterns and trends of food consumption in a developing country context: the case of Amhara Region, Ethiopia. Risk Manage Healthcare Policy. 2021;14:1777–84. doi: 10.2147/RMHP.S299669.
[14] Papageorgiou M, Zinoviadour KG, Guiné RPF. Mediterranean habits and patterns of consumption; interrelation with sustainability aspects. In: Betoret N, Betoret E, editors. Resources, strategies and potentialities for food system sustainability in the Mediterranean area. Valencia, Spain: CEMAS/FAO; 2022, Chap. 8. p. 132–52.
[15] Downs SM, Fraser SN, Storey KE, Forbes LE, Spence JC, Plotnikoff RC, et al. Geography influences dietary intake, physical activity and weight status of adolescents. J Nutr Metab. 2012;2012:816834. doi: 10.1155/2012/816834.
[16] Vadiveloo M, Perraud E, Parker HW, Juul F, Parekh N. Geographic differences in the dietary quality of food purchases among participants in the nationally representative food acquisition and purchase survey (FoodAPS). Nutrients. 2019;11:1233. doi: 10.3390/nu11061233.
[17] Aranceta J, Pérez-Rodrigo C, Ribas L, Serra-Majem L. Sociodemographic and lifestyle determinants of food patterns in Spanish children and adolescents: the enKid study. Eur J Clin Nutr. 2003;57:S40–4. doi: 10.1038/sj.ejcn.1601813.
[18] Mullie P, Guelinckx I, Clarys P, Degrave E, Hulens M, Vansant G. Cultural, socioeconomic and nutritional determinants of functional food consumption patterns. Eur J Clin Nutr. 2009;63:1290–6. doi: 10.1038/ejcn.2009.89.
[19] Kraus A, Annunziata A, Vecchio R. Sociodemographic factors differentiating the consumer and the motivations for functional food consumption. J Am Coll Nutr. 2017;36:116–26. doi: 10.1080/07315724.2016.1228489.
[20] Hoek AC, Luning PA, Weijzen P, Engels W, Kok FJ, de Graaf C. Replacement of meat by meat substitutes. A survey on person- and product-related factors in consumer acceptance. Appetite. 2011;56:662–73. doi: 10.1016/j.appet.2011.02.001.
[21] Topel MF. As leis dietéticas judaicas: um prato cheio para a antropologia. Horiz Antrop. 2003;9:203–22.
[22] de Oliveira KK, de Fátima Padilha MD, Shinohara NK, Correia MJ. As leis dietéticas da culinária judaica. Revista Contextos Da Alimentação SENAC. 2012;1:48–61.
[23] Ilić A, Rumbak I, Dizdarić D, Matek Sarić M, Colić Barić I, Guiné RPF. Motivations associated with food choices among adults from urban setting. Foods. 2023;12:3546. doi: 10.3390/foods12193546.
[24] Ferrão AC, Correia P, Ferreira M, Guiné RPF. Perceptions towards healthy diet of the portuguese according to area of work or studies. Zdr Varst. 2019;58:40–6. doi: 10.2478/sjph-2019-0005.
[25] de Ridder D, Kroese F, Evers C, Adriaanse M, Gillebaart M. Healthy diet: Health impact, prevalence, correlates, and interventions. Psychol Health. 2017;32:907–41. doi: 10.1080/08870446.2017.1316849.
[26] Ljubičić M, Sarić MM, Klarin I, Rumbak I, Barić IC, Ranilović J, et al. Motivation for health behaviour: A predictor of adherence to balanced and healthy food across different coastal Mediterranean countries. J Funct Foods. 2022;91:105018. doi: 10.1016/j.jff.2022.105018.
[27] Finch LE, Cummings JR, Tomiyama AJ. Cookie or clementine? Psychophysiological stress reactivity and recovery after eating healthy and unhealthy comfort foods. Psychoneuroendocrinology. 2019;107:26–36. doi: 10.1016/j.psyneuen.2019.04.022.
[28] Morera LP, Marchiori GN, Medrano LA, Defagó MD. Stress, dietary patterns and cardiovascular disease: a mini-review. Front Neurosci. 2019;13:1226. doi: 10.3389/fnins.2019.01226.
[29] Folkvord F, Naderer B, Coates A, Boyland E. Promoting fruit and vegetable consumption for childhood obesity prevention. Nutrients. 2022;14:157. doi: 10.3390/nu14010157.
[30] Ferrão AC, Guine RPF, Correia PMR, Ferreira M, Lima J. Development of a questionnaire to assess people's food choices determinants. Curr Nutr Food Sci. 2019;15:281–95.
[31] Guiné RPF, Bartkiene E, Szűcs V, Tarcea M, Ljubičić M, Černelič-Bizjak M, et al. Study about food choice determinants according to six types of conditioning motivations in a sample of 11,960 participants. Foods. 2020;9:888. doi: 10.3390/foods9070888.
[32] Guiné RPF, Florença SG, Ferrão AC, Bizjak MČ, Vombergar B, Simoni N, et al. Factors affecting eating habits and knowledge of edible flowers in different countries. Open Agric. 2021;6:67–81. doi: 10.1515/opag-2020-0208.
[33] Bozic P, Djordjic V, Markovic L, Cvejic D, Trajkovic N, Halasi S, et al. Dietary patterns and weight status of primary school children in Serbia. Front Public Health. 2021;9:678346. doi: 10.3389/fpubh.2021.678346.
[34] Stanojević SP, Pešić MM, Milinčić DD, Kostić AŽ, Pešić MB. Nutritional behavior and motives of college students for the choice of traditional food in the Republic of Serbia. Heliyon. 2022;8:e11002. doi: 10.1016/j.heliyon.2022.e11002.
[35] Gazibara T, Tepavcevic DBK, Popovic A, Pekmezovic T. Eating habits and body-weights of students of the university of Belgrade, Serbia: a cross-sectional study. J Health Popul Nutr. 2013;31:330–3.
[36] Djordjic V, Jorga J, Radisavljevic S, Milanovic I, Bozic P, Ostojic SM. Thinness in young schoolchildren in Serbia: another case of the double burden of malnutrition? Public Health Nutr. 2018;21:877–81. doi: 10.1017/S1368980017003457.
[37] Fabiano V, Barcellini L, Sartorio MUA, Pendezza E, Leone A, Meneghin F, et al. Nutritional status of children and adolescents in three Serbian enclaves in Kosovo and Metohija. BMC Public Health. 2021;21:794. doi: 10.1186/s12889-021-10848-z.
[38] Spinelli A, Buoncristiano M, Nardone P, Starc G, Hejgaard T, Júlíusson PB, et al. Thinness, overweight, and obesity in 6- to 9-year-old children from 36 countries: The world health organization european childhood obesity surveillance initiative—COSI 2015–2017. Obes Rev. 2021;22:e13214. doi: 10.1111/obr.13214.
[39] Maksimović MŽ, Rakić JMG, Vlajinac HD, Vasiljević ND, Nikić MI, Marinković JM. Comparison of different anthropometric measures in the adult population in Serbia as indicators of obesity: data from the National Health Survey 2013. Public Health Nutr. 2016;19:2246–55. doi: 10.1017/S1368980016000161.
[40] Razak F, Corsi DJ, Slutsky AS, Kurpad A, Berkman L, Laupacis A, et al. Prevalence of body mass index lower than 16 among women in

low- and middle-income countries. JAMA. 2015;314:2164–71. doi: 10.1001/jama.2015.15666.
[41] Manyanga T, El-Sayed H, Doku DT, Randall JR. The prevalence of underweight, overweight, obesity and associated risk factors among school-going adolescents in seven African countries. BMC Public Health. 2014;14:887. doi: 10.1186/1471-2458-14-887.
[42] Mahfouz NN, Fahmy RF, Nassar MS, Wahba SA. Body weight concern and belief among adolescent egyptian girls. Open Access Maced J Med Sci. 2018;6:582–7. doi: 10.3889/oamjms.2018.145.
[43] Gaio V, Antunes L, Namorado S, Barreto M, Gil A, Kyslaya I, et al. Prevalence of overweight and obesity in Portugal: Results from the First Portuguese Health Examination Survey (INSEF 2015). Obes Res Clin Pract. 2018;12:40–50. doi: 10.1016/j.orcp.2017.08.002.
[44] Alves L, Stringhini S, Barros H, Azevedo A, Marques-Vidal P. Inequalities in obesity in Portugal: regional and gender differences. Eur J Public Health. 2017;27:775–80. doi: 10.1093/eurpub/ckx041.
[45] Henriques A, Azevedo A, Lunet N, Moura-Ferreira P, do Carmo I, Silva S. Obesity-related knowledge and body mass index: a national survey in Portugal. Eat Weight Disord. 2020;25:1437–46. doi: 10.1007/s40519-019-00782-w.
[46] Carreira H, Pereira M, Azevedo A, Lunet N. Trends of BMI and prevalence of overweight and obesity in Portugal (1995–2005): a systematic review. Public Health Nutr. 2012;15:972–81. doi: 10.1017/S1368980012000559.
[47] Nagy É, Cseh V, Barcs I, Ludwig E. The impact of comorbidities and obesity on the severity and outcome of COVID-19 in hospitalized patients—a retrospective study in a hungarian hospital. Int J Environ Res Public Health. 2023;20:1372. doi: 10.3390/ijerph20021372.
[48] Diamantis DV, Karatzi K, Kantaras P, Liatis S, Iotova V, Bazdraska Y, et al. Prevalence and socioeconomic correlates of adult obesity in Europe: The feel 4 diabetes study. Int J Environ Res Public Health. 2022;19:12572. doi: 10.3390/ijerph191912572.
[49] Rurik I, Ungvári T, Szidor J, Torzsa P, Móczár C, Jancsó Z, et al. Elhízó Magyarország. A túlsúly és az elhízás trendje és prevalenciája Magyarországon. 2016;157:1248–55. doi: 10.1556/650.2016.30389.
[50] Dover RVH, Lambert EV. Choice Set for health behavior in choice-constrained settings to frame research and inform policy: examples of food consumption, obesity and food security. Int J Equity Health. 2016;15:48. doi: 10.1186/s12939-016-0336-6.
[51] Topolska K, Florkiewicz A, Filipiak-Florkiewicz A. Functional food—consumer motivations and expectations. Int J Environ Res Public Health. 2021;18:5327. doi: 10.3390/ijerph18105327.
[52] Wongprawmas R, Mora C, Pellegrini N, Guiné RPF, Carini E, Sogari G, et al. Food choice determinants and perceptions of a healthy diet among italian consumers. Foods. 2021;10:318. doi: 10.3390/foods10020318.
[53] Eertmans A, Victoir A, Notelaers G, Vansant G, Van den Bergh O. The food choice questionnaire: factorial invariant over western urban populations? Food Qual Preference. 2006;17:344–52. doi: 10.1016/j.foodqual.2005.03.016.
[54] Corallo A, Latino ME, Menegoli M, Spennato A. A survey to discover current food choice behaviors. Sustainability. 2019;11:5041. doi: 10.3390/su11185041.
[55] Cardoso AP, Ferreira V, Leal M, Ferreira M, Campos S, Guiné RPF. Perceptions about healthy eating and emotional factors conditioning eating behaviour: a study involving Portugal, Brazil and Argentina. Foods. 2020;9:1236. doi: 10.3390/foods9091236.
[56] Teixeira B, Afonso C, Sousa AS, Guerra RS, Santos A, Borges N, et al. Adherence to a mediterranean dietary pattern status and associated factors among Portuguese older adults: Results from the Nutrition UP 65 cross-sectional study. Nutrition. 2019;65:91–6. doi: 10.1016/j.nut.2019.03.005.
[57] Park H, Yu S. Policy review: Implication of tax on sugar-sweetened beverages for reducing obesity and improving heart health. Health Policy Technol. 2019;8:92–5. doi: 10.1016/j.hlpt.2018.12.002.
[58] Carbone S, Lavie CJ, Elagizi A, Arena R, Ventura HO. The impact of obesity in heart failure. Heart Fail Clin. 2020;16:71–80. doi: 10.1016/j.hfc.2019.08.008.
[59] DiNicolantonio JJ, Lucan SC, O'Keefe JH. The evidence for saturated fat and for sugar related to coronary heart disease. Prog Cardiovasc Dis. 2016;58:464–72. doi: 10.1016/j.pcad.2015.11.006.
[60] Guiné RPF, Ferrão AC, Ferreira M, Correia P, Mendes M, Bartkiene E, et al. Influence of sociodemographic factors on eating motivations – modelling through artificial neural networks (ANN). Int J Food Sci Nutr. 2020;71:614–27. doi: 10.1080/09637486.2019.1695758.
[61] Rustad C, Smith C. Nutrition knowledge and associated behavior changes in a holistic, short-term nutrition education intervention with low-income women. J Nutr Educ Behav. 2013;45:490–8. doi: 10.1016/j.jneb.2013.06.009.
[62] Dammann KW, Smith C. Food-related environmental, behavioral, and personal factors associated with body mass index among urban, low-income african-american, american indian, and caucasian women. Am J Health Promot. 2011;25:e1–10. doi: 10.4278/ajhp.091222-QUAN-397.
[63] Guiné RPF, Bartkiene E, Florença SG, Djekić I, Bizjak MČ, Tarcea M, et al. Environmental issues as drivers for food choice: study from a multinational framework. Sustainability. 2021;13:2869. doi: 10.3390/su13052869.
[64] de Castro JM, Bellisle F, Feunekes GIJ, Dalix A-M, De Graaf C. Culture and meal patterns: A comparison of the food intake of free-living American, Dutch, and French students. Nutr Res. 1997;17:807–29. doi: 10.1016/S0271-5317(97)00050-X.
[65] Guiné R, Ferrão AC, Ferreira M, Correia P, Cardoso AP, Duarte J, et al. The motivations that define eating patterns in some Mediterranean countries. Nutr Food Sci. 2019;49:1126–41. doi: 10.1108/NFS-12-2018-0360.
[66] Cunha LM, Cabral D, Moura AP, de Almeida MDV. Application of the food choice questionnaire across cultures: Systematic review of cross-cultural and single country studies. Food Qual Preference. 2018;64:21–36. doi: 10.1016/j.foodqual.2017.10.007.
[67] Trinh HT, Linderhof V, Vuong VT, Esaryk EE, Heller M, Dijkxhoorn Y, et al. Diets, food choices and environmental impacts across an urban-rural interface in Northern Vietnam. Agriculture. 2021;11:137. doi: 10.3390/agriculture11020137.
[68] Dijkstra SC, Neter JE, Brouwer IA, Huisman M, Visser M. Motivations to eat healthily in older Dutch adults - a cross sectional study. Int J Behav Nutr Phys Act. 2014;11:141. doi: 10.1186/s12966-014-0141-9.
[69] Hansen K. Healthy older adults' motivation and knowledge related to food and meals. Qual Rep. 2019;24:2815–31. doi: 10.46743/2160-3715/2019.3414.
[70] Leclercq C, Arcella D, Piccinelli R, Sette S, Donne CL. Group AT on behalf of the I-S 2005–06 S, The italian national food consumption survey INRAN-SCAI 2005–06: main results in terms of food consumption. Public Health Nutr. 2009;12:2504–32. doi: 10.1017/S1368980009005035.
[71] Quarta S, Massaro M, Chervenkov M, Ivanova T, Dimitrova D, Jorge R, et al. Persistent moderate-to-weak mediterranean diet adherence and low scoring for plant-based foods across several

southern european countries: are we overlooking the mediterranean diet recommendations? Nutrients. 2021;13:1432. doi: 10.3390/nu13051432.

[72] Andrade V, Jorge R, García-Conesa M-T, Philippou E, Massaro M, Chervenkov M, et al. Mediterranean diet adherence and subjective well-being in a sample of portuguese adults. Nutrients. 2020;12:3837. doi: 10.3390/nu12123837.

[73] Hidalgo-Mora JJ, García-Vigara A, Sánchez-Sánchez ML, García-Pérez M-Á, Tarín J, Cano A. The mediterranean diet: A historical perspective on food for health. Maturitas. 2020;132:65–9. doi: 10.1016/j.maturitas.2019.12.002.

[74] Lee M, Park S, Lee K-S. Relationship between morbidity and health behavior in chronic diseases. J Clin Med. 2020;9:121. doi: 10.3390/jcm9010121.

[75] Naughton P, McCarthy SN, McCarthy MB. The creation of a healthy eating motivation score and its association with food choice and physical activity in a cross sectional sample of Irish adults. Int J Behav Nutr Phys Act. 2015;12:74. doi: 10.1186/s12966-015-0234-0.

[76] Johansen SB, Næs T, Hersleth M. Motivation for choice and healthiness perception of calorie-reduced dairy products. A cross-cultural study. Appetite. 2011;56:15–24. doi: 10.1016/j.appet.2010.11.137.

[77] Spronk I, Kullen C, Burdon C, O'Connor H. Relationship between nutrition knowledge and dietary intake. Br J Nutr. 2014;111:1713–26. doi: 10.1017/S0007114514000087.

[78] Chung LMY, Chung JWY, Chan APC. Building healthy eating knowledge and behavior: an evaluation of nutrition education in a skill training course for construction apprentices. Int J Environ Res Public Health. 2019;16:4852. doi: 10.3390/ijerph16234852.

[79] Kulik NL, Moore EW, Centeio EE, Garn AC, Martin JJ, Shen B, et al. Knowledge, attitudes, self-efficacy, and healthy eating behavior among children: results from the building healthy communities trial. Health Educ Behav. 2019;46:602–11. doi: 10.1177/1090198119826298.

[80] Melesse MB, van den Berg M. Consumer nutrition knowledge and dietary behavior in urban ethiopia: a comprehensive study. Ecol Food Nutr. 2021;60:244–56. doi: 10.1080/03670244.2020.1835655.

[81] Worsley A. Nutrition knowledge and food consumption: can Nutrition knowledge change food behaviour? Asia Pac J Clin Nutr. 2002;11:S579–85. doi: 10.1046/j.1440-6047.11.supp3.7.x.

[82] Menozzi D, Sogari G, Mora C. Understanding and modelling vegetables consumption among young adults. LWT - Food Sci Technol. 2017;85:327–33. doi: 10.1016/j.lwt.2017.02.002.

[83] Nagy-Pénzes G, Vincze F, Sándor J, Bíró É. Does better health-related knowledge predict favorable health behavior in adolescents? Int J Environ Res Public Health. 2020;17:1680. doi: 10.3390/ijerph17051680.

[84] Maenhout L, Peuters C, Cardon G, Compernolle S, Crombez G, DeSmet A. The association of healthy lifestyle behaviors with mental health indicators among adolescents of different family affluence in Belgium. BMC Public Health. 2020;20:958. doi: 10.1186/s12889-020-09102-9.

[85] Panão I, Carraça EV. Effects of exercise motivations on body image and eating habits/behaviours: A systematic review. Nutr Diet. 2020;77:41–59. doi: 10.1111/1747-0080.12575.

[86] Boustani NM, Guiné RPF. Food choice motivations and perception of a healthy diet in a developing mediterranean country. Open Agric. 2020;5:485–95. doi: 10.1515/opag-2020-0048.

[87] Liu AG, Ford NA, Hu FB, Zelman KM, Mozaffarian D, Kris-Etherton PM. A healthy approach to dietary fats: understanding the science and taking action to reduce consumer confusion. Nutr J. 2017;16:53. doi: 10.1186/s12937-017-0271-4.

[88] Mai R, Hoffmann S. How to combat the unhealthy = tasty intuition: the influencing role of health consciousness. J Public Policy Mark. 2015;34:63–83. doi: 10.1509/jppm.14.006.

[89] Warren JC, Smalley KB, Barefoot KN. Discrepancy in motivation for weight loss and exercise in rural patients. Am J Health Behav. 2017;41:803–9. doi: 10.5993/AJHB.41.6.14.