

Food Waste Behaviour: A Cross-country Study

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RESEARCH ARTICLE

Abstract

Food choices are influenced by personal, cultural, and religious factors influence food choices. Within the EATMOT project, a questionnaire survey was conducted with 11919 voluntary adult participants residing in 16 countries to investigate how people relate to food waste, their attitudes, and how these vary across socio-demographic groups. The questionnaire was translated into local languages, and non-probabilistic methods selected the sample. Descriptive statistics tools were used to at the 5% significance level. The decision tree method (Classification and Regression Trees) identified the best predictors, which split the samples into clusters. Statistically significant differences were found between groups for all socio-demographic variables related to avoiding food waste when cooking at home. Similar differences emerged for choosing local foods and preferring restaurants that promote strategies to minimize food waste. The tree classification analysis revealed that, for all three items studied, the variable country, characterized by different cultures, was the most important discriminating factor. This work highlighted that people from different countries and socio-demographic groups as defined by established cut-offs for each characteristic.

Keywords: Food culture; food surplus; consumer behaviour; cooking; local food preferences; eating out.

INTRODUCTION

Food waste is a worldwide concern that has received increasing attention over the last few years (Pandey et al., 2023; Ramírez-Pulido et al., 2021). According to Urugo et al. (2024), approximately 1.3 billion tons of food produced annually for human consumption are lost or wasted across the entire food value chain. At the same time, 828 million people suffer from undernourishment globally (Nyhan et al., 2023). Wasting food intensifies food insecurity: while some discard safe, edible food, others remain without access to food, perpetuating inequality (Cattaneo et al., 2021). Thus, this global problem constitutes a challenge, with economic, environmental, social, food security and inequality impacts (Widayat et al., 2025). Additionally, food waste Earth's resources, such as water and energy, contributes to greenhouse gas emissions and climate change

(Melini et al., 2020), and contributes to significant loss of Earth's resources, such as water and energy. In this way, a coordinated intervention is important to develop and implement strategies to reduce food waste, promoting more sustainable food systems (Ramírez-Pulido et al., 2021).

To achieve a fair, equitable, sustainable future for all people around the world, as well as to promote prosperity and protect the environment, the United Nations (2015) proposed the Sustainable Development Goals (SDGs) within the 2030 Agenda for Sustainable Development (Chang et al., 2024a). Food waste reduction is one of these goals, integrated with SDG 12 – Responsible Consumption and Production, that intends to reduce food waste per capita by half, on the retail and consumer levels, as well as to reduce losses throughout production and supply chains (Sagar et al., 2024; Melini et al., 2020). Additionally, food waste mitigation is related to other goals, such as SDG 2 – Zero Hunger, SDG 13 – Climate Action, and SDG 15 – Life on land (Huang et al., 2024; Nyhan et al., 2023).

Consumer behaviour is responsible for approximately 30-40 % of all food waste (Ahmed et al., 2021). So, consumers' food choices have an important influence on the food waste problem (Llagas et al., 2025). Food choices can be influenced by complex factors and others (Boustani & Guiné, 2023). Additionally, attitudes towards food waste -differ among individuals due to socio-demographic and geographic characteristics, such as age, gender, education level, professional context, country, and living environment (Bacărea et al., 2023).

In this context, the objective of the present study was to investigate the attitudes of people from different countries towards food waste and evaluate possible differences according to several socio-demographic factors, such as age, gender, level of education, marital status, professional status, and area of work or studies, and geographic variables, namely country and living environment. This research aims to contribute to a deeper understanding of the determinants of sustainable food behaviour and to support the identification of food waste behaviour patterns, thereby enabling the outline of effective interventions, such as education strategies and public policies aligned with Agenda 2030, to help reduce food waste. This study is integrated in the EATMOT project, which is a cross-country project developed between 2018 and 2020, in which 16 countries were included (Argentina, Brazil, Croatia, Egypt, Greece, Hungary, Italy, Latvia, Lithuania, the Netherlands, Poland, Portugal, Romania, Serbia, Slovenia, and the United States of America). This study contributes novel cross-country evidence on how socio-demographic and geographic variables shape attitudes towards food waste, filling an important gap in understanding cultural and structural determinants of sustainable food behaviour.

MATERIALS AND METHODS

This was a cross-sectional study, carried out via an online questionnaire survey, in the ambit of the EATMOT project. The instrument used for the survey underlying this study was validated (Ferrão et al., 2019) and translated into the native languages of the sixteen countries that constituted the consortium for this project, using a double-sided translation-checking methodology. In this particular study, the problem of food waste was investigated, and for that, three items were selected from the questionnaire for evaluation of the participants' attitudes and values towards food waste:

Q1. When I cook, I have in mind the quantities to avoid food waste;

Q2. It is important to me that the food I eat comes from my own country;

Q3. I avoid going to restaurants that do not have a recovery policy of food surplus.

The participants were asked to manifest their level of agreement towards the questions above using a 5-point Likert scale, as follows: 1 = totally disagree, 2 = disagree, 3 = neither agree nor disagree, 4 = agree, and 5 = totally agree.

Additionally, some socio-demographic variables were collected to characterise participants by age, gender, education level, country, living environment, marital status, professional activity, and area of study or work.

Data collection

The study was conducted through a survey administered to a sample of nearly 12,000 participants (n = 11919) residing in 16 countries from different parts of the globe, with higher expression across Europe than in America or Africa. The countries involved in the study were: Argentina, Brazil, Croatia, Egypt, Greece, Hungary, Italy, Latvia, Lithuania, the Netherlands, Poland, Portugal, Romania, Serbia, Slovenia, and the United States of America.

The sample was defined by combining convenience, volunteer, and snowball non-probabilistic methods, to increase representativeness. Firstly, participants in the study volunteered, and they had to be adults aged 18 years or over. No upper limit was imposed on participation in the study. Secondly, the questionnaire was distributed online -via Google Forms, following invitations via e-mail and social networks, and using a snowball sampling method to reach a larger number of participants. Finally, the recruited sample was, therefore, a convenience sample. All answers were kept strictly anonymous, and no personal data were collected that could

possibly relate to the answers, to fully protect participants' anonymity. All ethical principles were upheld from the beginning to the end of the study, including the design of the questionnaire, data collection, data treatment, and data repository. The research was approved by the Ethics Committee at the Polytechnic University of Viseu (Reference N.º 04/2017) before the study was carried out. The data were collected between September 2017 and June 2018.

Sample characterization

The distribution of the participants by country was the following: 4.4% from Argentina (n = 522), 5.6% from Brazil (n = 665), 12.9% from Croatia (n = 1538), 6.6% from Egypt (n = 790), 4.2% from Greece (n = 498), 4.2% from Hungary (n = 500), 4.5% from Italy (n = 541), 5.3% from Latvia (n = 53), 4.3% from Lithuania (n = 507), 4.4% from The Netherlands (521), 4.9% from Poland (n = 586), 11.0% from Portugal (n = 1314), 6.9% from Romania (n = 821), 4.2% from Serbia (n = 498), 9.2% from Slovenia (n = 1092) and 7.5% from the United States of America (n = 890).

The age of the participants age was grouped into the following categories: young adults (between 18 and 30 years) accounting for 50.1% of the participants (n = 5972), adults (between 31 and 50 years) accounting for 34.1% (n = 4061), senior adults (between 51 and 65 years) accounting for 13.5% (n = 1605) and the remaining 2.4% (n = 281) were elderly (aged 66 or over).

The majority of participants were women (71.4%, n = 8505). Most of the participants had a high level of education (61.6% had completed a university degree, n = 7345). In comparison, 36.3% had completed secondary school (n = 4321) and only 2.1% (n = 253) had the lowest level of education (primary school). Regarding marital status, 46.0% were single (n = 5483), 47.5% were married (n = 5656), 4.7% (n = 556) were divorced, and 1.9% (n = 224) were widowed.

Most of the participants lived in urban environments (66.9%; n = 7971), while 16.3% (n = 1941) lived in rural areas and 16.8% (n = 2007) resided in suburban areas, i.e., the periphery of a city. As for professional activity, a great majority of the participants were employed (54.3%, n = 6469) or students (27.8%, n = 3319), while some were working and studying at the same time (7.7%, n = 917), some were unemployed (5.7%, n = 682). Some were retired (4.5%, n = 532). With respect to the area of studies of work, the distribution was as follows: health (19.1%, n = 2280), food (10.0%, n = 1195), nutrition (8.7%, n = 1039), sports (5.7%, n = 678), psychology (4.5%, n = 537), agriculture (3.7%, n = 437), others (48.3%, n = 5753).

Statistical analysis

For analysing the data, basic descriptive statistics such as frequency, mean, and standard deviation were used for an exploratory evaluation of the data. Additionally, to explore the associations between food waste variables and socio-demographic characteristics, statistical tests were used.

Parametric tests were used since they are more powerful than their non-parametric counterparts. In the present sample, the high number of cases resulted in distributions that met the normality assumption, according to the Kolmogorov–Smirnov test (Marôco, 2018), thus allowing the use of parametric tests. To compare means between two groups, the t-test for independent samples was used, while to compare means between three or more groups, the analysis of Variance (ANOVA) was used, complemented with a post hoc test of Tukey to identify the location of differences. The test identifies where the difference between two mean values exceeds the standard error, as expected (Brochard et al., 2021; Guiné et al., 2022).

The multivariate analysis procedure-, the decision tree, using the Classification and Regression Trees (CRT) algorithm, was used to investigate the relative importance of the geographical and socio-demographic variables in consumers' behaviour towards food waste. This is a stepwise method that evaluates the influence of the independent variables on the model and assesses the significance of their contributions. The aim was to decompose the dependent variables (Questions Q1, Q2, and Q3) to obtain the most likely determinants (among the independent variables). The independent variables used to construct the decision tree were: gender, age, education, marital status, Professional status, area of work or studies, living environment, and country of residence.

The analysis used the Classification and Regression Trees (CART) algorithm with cross-validation and the Gini index as the splitting criterion. The minimum number of cases considered for parent and child nodes was 100 and 50, respectively. The minimum change in improvement considered was 0.001.

SPSS from IBM Inc. (licensed version 29) was used for all data analysis, with a 5% level of significance ($p < 0.05$).

RESULTS AND DISCUSSIONS

Consumers' attitudes towards food waste

The indices obtained for the three variables related to food waste investigated are shown in Figure 1. The indices correspond to the sums of the scores given by all participants to each question. Considering that there were 11919 participants and that each participant's score ranged from 1 to 5, the range of values for the indices is from 11919 (if all participants scored the lowest value) to 59595 (if all participants scored the highest value). The results indicate that globally, participants scored highest on question Q1, about avoiding food waste when cooking at home, followed by question Q2, about choosing foods from their own country, and then question Q3, about preferring restaurants that have a policy to recover food surplus.

The results for Q1 suggest that sustainable behaviour regarding food waste is evident among participants in the 16 countries included in the study. In this context, there is a major control over meal planning and available foods to cook, which makes it easier to adopt conscientious practices, such as using leftovers and planning food purchases (Dos Santos et al., 2022). Furthermore, consumers demonstrate more accurate knowledge of the quantities of food needed to feed all household members, allowing them to adjust meal planning to avoid or even anticipate leftovers (Schanes et al., 2018). According to Evans (2012), this finding is consistent with previous studies, which highlight a greater concern about food waste at home, particularly when consumers are responsible for preparing their own meals.

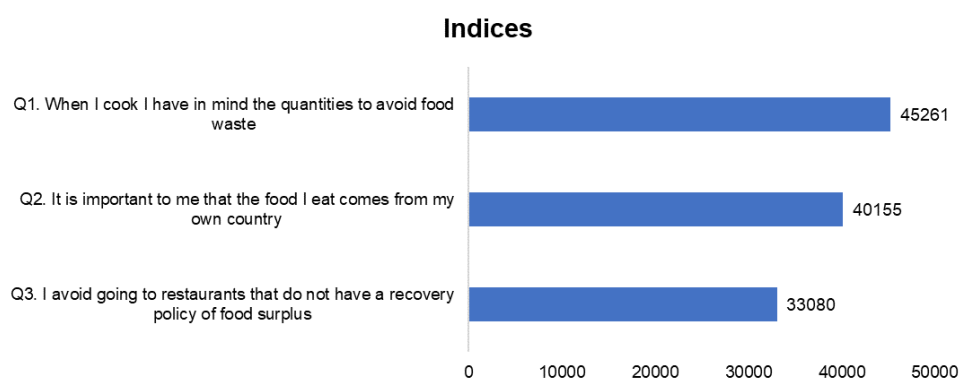


Figure 1. Indices for the three variables investigated, related to food waste.

In the case of Q2 results, which rank second-highest, it is possible to infer that this behaviour may be related to environmental and sustainability factors, such as reducing ecological footprint (Amahnui et al., 2025). Additionally, these results can be related to other aspects, such as cultural identity, preferences for local products, and trust in product origin (Carvalho et al., 2025; Feldmann & Hamm, 2015). According to Bayraktar et al. (2023), the valorisation and preference for local products are not always understood as a food waste reduction measure, which may explain the intermediate value in this question.

The Q3, related to the choice of restaurants that promote recovery policies for surplus, was the question with the lowest score. These results can be related to reduced levels of available information to consumers about the food waste practices carried on by commercial establishments (Filimonau et al., 2020). Furthermore, consumers lack control over the cooking process and restaurant waste management, which reduces the perceived impact of their choices (Coşkun & Yetkin Özbük, 2020). The findings corroborate other research that identifies the restaurant sector as one of the most challenging sectors to implement waste-fighting practices, both from an operational and consumer behaviour perspective (Fajriah et al., 2025; Filimonau et al., 2020). Additionally, consumers do not consider recovery policy an important criterion for choosing a restaurant, prioritising other factors such as price, food quality, service quality, and convenience (Ribeiro et al., 2024). This result highlights the need to reinforce awareness campaigns and labelling mechanisms on sustainable practices in this sector.

The mean scores for the three variables related to food waste, calculated as the mean score for each question across all participants in each group, were calculated as the mean score for each question across all participants in each group. These scores are shown in Table 1. Based on ANOVA with Tukey's post hoc test, the results indicate that participants' geographic location has a strong influence on attitudes towards food waste, with significant differences across all three questions by country and living environment. The findings suggest that the residence country is the major influential factor on three study variables, which corroborate previous results that highlight cultural factors as determinants of behaviour (Srijuntrapun et al., 2025; Lima et al., 2024).

Table 1. Consumers' behaviour towards food waste across the global sample and by geographic variables

Variables/ Groups	Q1 (When I cook, I have in mind the quantities to avoid food waste)	Q2 (It is important to me that the food I eat comes from my own country)	Q3 (I avoid going to restaurants that do not have a recovery policy for food surplus)
	Mean $\pm$ SD [†]	Mean $\pm$ SD [†]	Mean $\pm$ SD [†]
Global sample	3.80 $\pm$ 1.00	3.37 $\pm$ 1.09	2.78 $\pm$ 0.98
Country [‡]	F = 80.295; p < 0.001	F = 100.240; p < 0.001	F = 75.767; p < 0.001
Argentina	3.72 $\pm$ 1.02 ^d	2.75 $\pm$ 1.05 ^a	2.75 $\pm$ 0.99 ^{cde}
Brazil	4.03 $\pm$ 0.85 ^g	3.02 $\pm$ 1.01 ^b	2.80 $\pm$ 0.90 ^{ef}
Croatia	3.82 $\pm$ 0.92 ^{def}	3.58 $\pm$ 1.02 ^{ef}	2.57 $\pm$ 0.94 ^{acb}
Egypt	3.75 $\pm$ 1.00 ^d	3.41 $\pm$ 0.97 ^{cde}	3.25 $\pm$ 1.13 ^g
Greece	3.71 $\pm$ 1.04 ^d	3.49 $\pm$ 1.18 ^{def}	2.85 $\pm$ 0.99 ^{ef}
Hungary	3.75 $\pm$ 1.09 ^d	3.36 $\pm$ 1.23 ^{cd}	2.61 $\pm$ 1.24 ^{bcd}
Italy	3.99 $\pm$ 0.80 ^{fg}	3.54 $\pm$ 1.04 ^{def}	2.95 $\pm$ 0.84 ^f
Latvia	3.80 $\pm$ 1.02 ^{de}	3.62 $\pm$ 1.11 ^f	2.40 $\pm$ 1.07 ^a
Lithuania	3.51 $\pm$ 1.15 ^c	2.98 $\pm$ 1.10 ^b	2.68 $\pm$ 0.90 ^{cde}
Netherlands	3.97 $\pm$ 0.81 ^{efg}	2.63 $\pm$ 0.93 ^a	2.42 $\pm$ 0.83 ^a
Poland	3.30 $\pm$ 1.02 ^{ab}	3.42 $\pm$ 0.98 ^{cde}	2.69 $\pm$ 0.64 ^{cde}
Portugal	4.29 $\pm$ 0.70 ^h	3.88 $\pm$ 0.92 ^g	3.36 $\pm$ 0.75 ^g
Romania	3.87 $\pm$ 0.99 ^{defg}	3.65 $\pm$ 0.97 ^f	2.80 $\pm$ 0.85 ^{ef}
Serbia	3.13 $\pm$ 0.99 ^a	3.26 $\pm$ 1.13 ^c	2.76 $\pm$ 0.89 ^{de}
Slovenia	4.04 $\pm$ 0.84 ^g	3.53 $\pm$ 0.99 ^{def}	2.44 $\pm$ 0.90 ^{ab}
United States	3.31 $\pm$ 1.17 ^b	2.72 $\pm$ 1.06 ^a	2.77 $\pm$ 0.94 ^{def}
Living environment [‡]	F = 24.767; p < 0.001	F = 40.877; p < 0.001	F = 17.699; p < 0.001
Urban	3.83 $\pm$ 0.99 ^b	3.38 $\pm$ 1.10 ^b	2.79 $\pm$ 0.98 ^b
Sub-urban	3.65 $\pm$ 1.03 ^a	3.20 $\pm$ 1.09 ^a	2.67 $\pm$ 0.93 ^a
Rural	3.83 $\pm$ 0.97 ^b	3.51 $\pm$ 1.04 ^c	2.84 $\pm$ 1.04 ^b

Note: [†] Mean value and standard deviation (Scale from 1 = strongly disagree to 5 = strongly agree). [‡] value of F-statistic from one-way ANOVA with Tukey post-hoc test. Different superscript letters in the same column indicate mean values that are significantly different (p<0.05).

Additionally, the results showed that rural area residents have more positive attitudes in all evaluated dimensions, which can be related to rural consumers' greater proximity to the origins of food production, as well as a more realistic perception of the value of food and the impacts of waste (Diaz-Ruiz et al., 2018). Consumers in rural areas tend to , engage in greater self-production, and maintain a greater level of practice. They are also more closely linked to the seasons and the circularity of food (Schanes et al., 2018). Regarding question Q1, participants who showed more positive attitudes towards avoiding food waste at home were from Portugal and from rural or urban areas. As for question Q2, participants who chose more foods from their country were those living in Portugal and rural areas. Finally, for question Q3, participants who were more in favour of restaurants with a policy to recover food surplus were from rural areas and resided in Portugal. Thus, Portugal was the country with the most positive attitudes towards food waste, which can be explained by growing public awareness of sustainability and the fight against waste, driven by educational campaigns, public policies, and civil society initiatives (Simões et al., 2023). Additionally, Portugal has a culinary tradition associated with food surplus and the reuse of leftovers, as well as promoting local food valorisation, which can reinforce sustainable practices (Gonçalves et al., 2023).

The mean scores for the three variables under study, grouped by geographical region, are presented in Table 2. The results indicate that for question Q1 on household food waste, significant differences were found

across all socio-demographic variables considered. Higher mean scores were obtained for this variable among elderly, widowed, female participants with the lowest level of education and who were employed. These findings align with recent studies that highlight that older people tend to be more aware of food waste, driven by life experiences, traditional values, and economic practices learned in the past (Llagas et al., 2025; Widayat et al., 2025). Furthermore, a study by Dos Santos et al. (2022) found that women are more aware of food waste issues, as they are traditionally more involved in household food management. According to Bacârea et al. (2023), low education and higher awareness are often found together which may reflect a greater appreciation of resources and a lower level of impulsive consumption.

For question Q2, about choosing primarily foods from their country, higher mean scores were obtained for participants with a profile similar to that in the previous question in terms of gender, age, and education, but differing in occupation, specifically retired from the agricultural sector. These results suggest that local product valorisation can be strongly associated with proximity practices, cultural identity, and food security (Carvalho et al., 2025; Bayraktar et al., 2023). Environmental awareness, ecological footprint, and food waste concerns can be related to that attitude type (Amahnui et al., 2025).

Finally, for question 3, about avoiding restaurants that do not have a policy to recover food surplus, the highest scores were obtained from male participants, senior adults, and widowed individuals who completed secondary school in the area of sport but were already retired. According to the findings, these participants appear to have greater availability or sensitivity to ethical and social aspects, or more time and attention to evaluate the sustainability policies of establishments (Fajriah et al., 2025). Even so, the lack of clear information about restaurant practices remains one of the biggest obstacles to adopting sustainable behaviours outside the home (Filimonau et al., 2020).

Table 2. Consumers' behaviour regarding food waste by socio-demographic variables

Variables/ Groups	Q1	Q2	Q3
	(When I cook, I have in mind the quantities to avoid food waste)	(It is important to me that the food I eat comes from my own country)	(I avoid going to restaurants that do not have a recovery policy for food surplus)
	Mean ± SD [†]	Mean ± SD [†]	Mean ± SD [†]
Gender[‡]	T = 11.436; p < 0.001	T = 1.221; p = 0.111	T = -1.284; p = 0.100
Female	3.87 ± 0.96	3.38 ± 1.08	2.77 ± 0.97
Male	3.63 ± 1.07	3.35 ± 1.12	2.79 ± 1.02
Age[*]	F = 102.081; p < 0.001	F = 180.582; p < 0.001	F = 28.982; p < 0.001
Young adults	3.64 ± 1.04 ^a	3.15 ± 1.08 ^a	2.71 ± 0.97 ^a
Middle aged adults	3.92 ± 0.93 ^b	3.52 ± 1.07 ^b	2.79 ± 0.98 ^a
Senior adults	4.00 ± 0.91 ^b	3.71 ± 1.02 ^c	2.96 ± 0.99 ^b
Elderly	4.13 ± 0.93 ^c	3.82 ± 1.03 ^c	2.91 ± 0.98 ^b
Education[*]	F = 11.669; p < 0.001	F = 19.564; p < 0.001	F = 0.611; p = 0.543
Primary school	3.89 ± 1.07 ^b	3.43 ± 1.13 ^b	2.76 ± 1.06 ^a
Secondary school	3.74 ± 1.02 ^a	3.29 ± 1.10 ^a	2.79 ± 1.01 ^a
University	3.83 ± 0.98 ^a	3.42 ± 1.09 ^a	2.77 ± 0.97 ^a
Marital status[*]	F = 66.183; p < 0.001	F = 130.437; p < 0.001	F = 10.332; p < 0.001
Single	3.66 ± 1.03 ^a	3.16 ± 1.09 ^a	2.74 ± 0.98 ^a
Married	3.90 ± 0.96 ^b	3.53 ± 1.07 ^b	2.79 ± 0.98 ^a
Divorced	3.96 ± 0.91 ^{bc}	3.53 ± 1.07 ^b	2.86 ± 1.04 ^a
Widowed	4.09 ± 0.93 ^c	3.88 ± 0.93 ^c	3.05 ± 1.02 ^b
Professional status[*]	F = 31.372; p < 0.001	F = 92.841; p < 0.001	F = 8.698; p < 0.001
Employed	3.88 ± 0.97 ^c	3.50 ± 1.07 ^c	2.77 ± 0.98 ^a
Unemployed	3.80 ± 1.00 ^{bc}	2.26 ± 1.14 ^b	2.77 ± 1.03 ^a
Student	3.65 ± 1.02 ^a	3.15 ± 1.08 ^{ab}	2.77 ± 0.99 ^a

Retired	3.84 ± 1.09 ^{bc}	3.74 ± 1.04 ^d	3.00 ± 0.98 ^a
Working student	3.72 ± 1.04 ^{ab}	3.08 ± 1.08 ^a	2.69 ± 0.97 ^b
Area of work/Studies*	F = 11.795; p < 0.001	F = 10.807; p < 0.001	F = 12.296; p < 0.001
Nutrition	3.77 ± 1.03 ^{bc}	3.31 ± 1.06 ^b	2.71 ± 0.92 ^{ab}
Food	3.73 ± 1.01 ^{bc}	3.36 ± 1.10 ^b	2.65 ± 0.93 ^a
Agriculture	3.68 ± 1.00 ^{ab}	3.55 ± 1.12 ^c	2.82 ± 1.01 ^b
Sport	3.68 ± 1.02 ^{ab}	3.26 ± 1.02 ^b	3.03 ± 1.10 ^c
Psychology	3.57 ± 1.10 ^a	3.10 ± 1.12 ^a	2.78 ± 1.01 ^{ab}
Health	3.80 ± 0.99 ^{bc}	3.35 ± 1.05 ^b	2.74 ± 0.97 ^{ab}
Others	3.86 ± 0.98 ^c	3.41 ± 1.11 ^{bc}	2.79 ± 0.99 ^b

Note: † Mean value and standard deviation (Scale from 1 = strongly disagree to 5 = strongly agree). ‡ T-test for independent sample (p < 0.05). *value of F-statistic from one-way ANOVA with Tukey post-hoc test. Different superscript letters in the same column indicate mean values that are significantly different (p<0.05).

Predictors for food waste based on decision tree results

The decision tree for variable "Q1. When I cook, I have in mind the quantities to avoid food waste", for which the explanatory variables were only two (country and marital status) from the eight socio-demographic variables considered, is shown in Figure 2. The tree consisted of 13 nodes, of which seven were terminal, and included four levels of depth. Variable Q1 constitutes the root, or node zero, and the box shows that, among the 11919 participants, the highest percentages were 46.7% for option 'Agree' and 24.0% for option 'Strongly Agree'. The first depth level of the tree was variable best predicts the dependent variable Q1; i.e., country is the strongest influential variable.

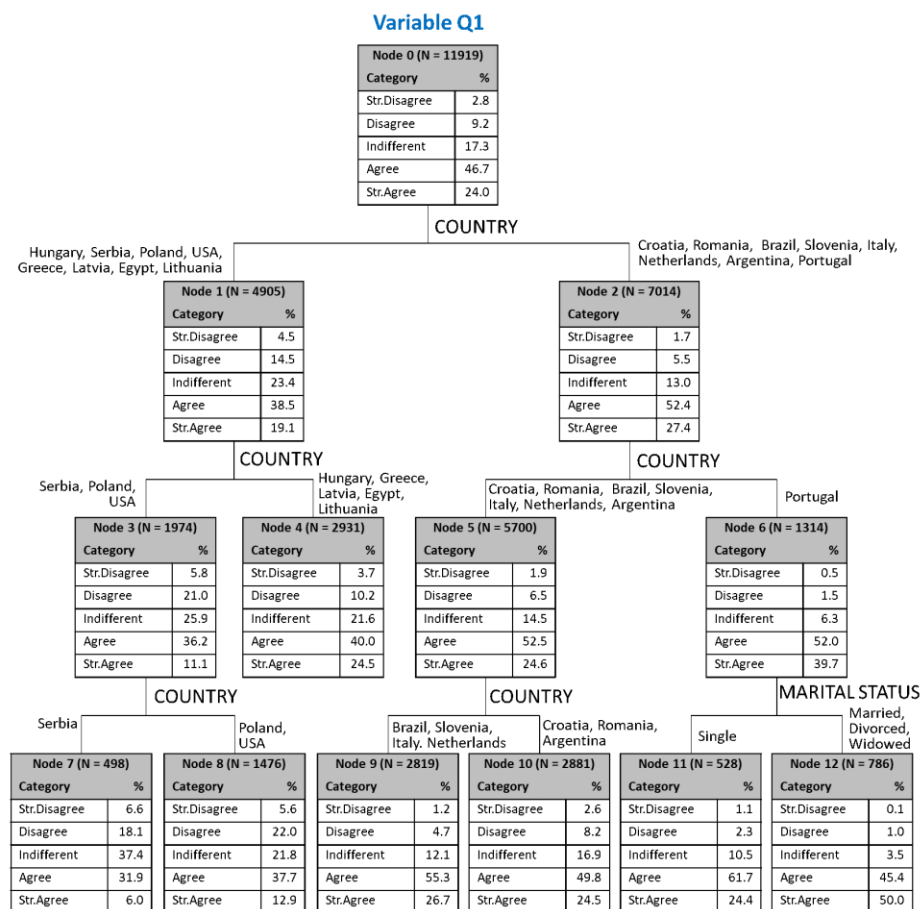


Figure 2. Tree classification for variable "Q1. When I cook, I have in mind the quantities to avoid food waste". (Str – Strongly).

The sample was segmented into two distinct groups of countries, with the set constituted by Croatia, Romania, Brazil, Slovenia, Italy, Netherlands, Argentina, Portugal, presenting a higher level of agreement towards Q1, 52.4% and 27.4%, respectively, for options 'Agree' and 'Strongly Agree'. For these countries, the next-best predictor was again country, separating Portugal from the others, due to the highest percentage of the 'Strongly Agree' option. The next level, depth 3, indicated that, for the Portuguese, the next discriminating variable was marital status, separating single participants, with higher percentages of 'Agree' and lower percentages of 'Strongly Agree' (61.7% and 24.4%, respectively). In all other cases, the discriminating variable was country, traversing all levels of depth and the entire tree. Thus, the decision tree for variable Q1 shows that country is the factor with the greatest predictive capacity for avoiding food waste when cooking, confirming the central role of cultural and structural variables in modulating consumer behaviour (Srijuntrapun et al., 2025; Lima et al., 2024). Although methodological factors, such as the quality of questionnaire completion, cannot be entirely excluded, the statistical analysis provides evidence supporting the interpretation that cultural and structural determinants are the primary drivers of the observed differences. Portugal had the highest percentage of responses to "Totally agree", which can reflect institutional and cultural efforts to counter food waste, including governmental campaigns, school programs, and cultural practices such as the reuse of leftovers (Gonçalves et al., 2023; Simões et al., 2023). Furthermore, marital status emerges as a relevant factor in Portugal, indicating that married and widowed individuals exhibit more sustainable attitudes, which may be related to greater experience and responsibility in food management and the adoption of food security practices, similarly to what was observed by Amaich et al. (2024) in a study conducted in collective catering in Morocco. The decision tree obtained for variable "Q2. It is important to me that the food I eat comes from my own country" is presented in Figure 3.

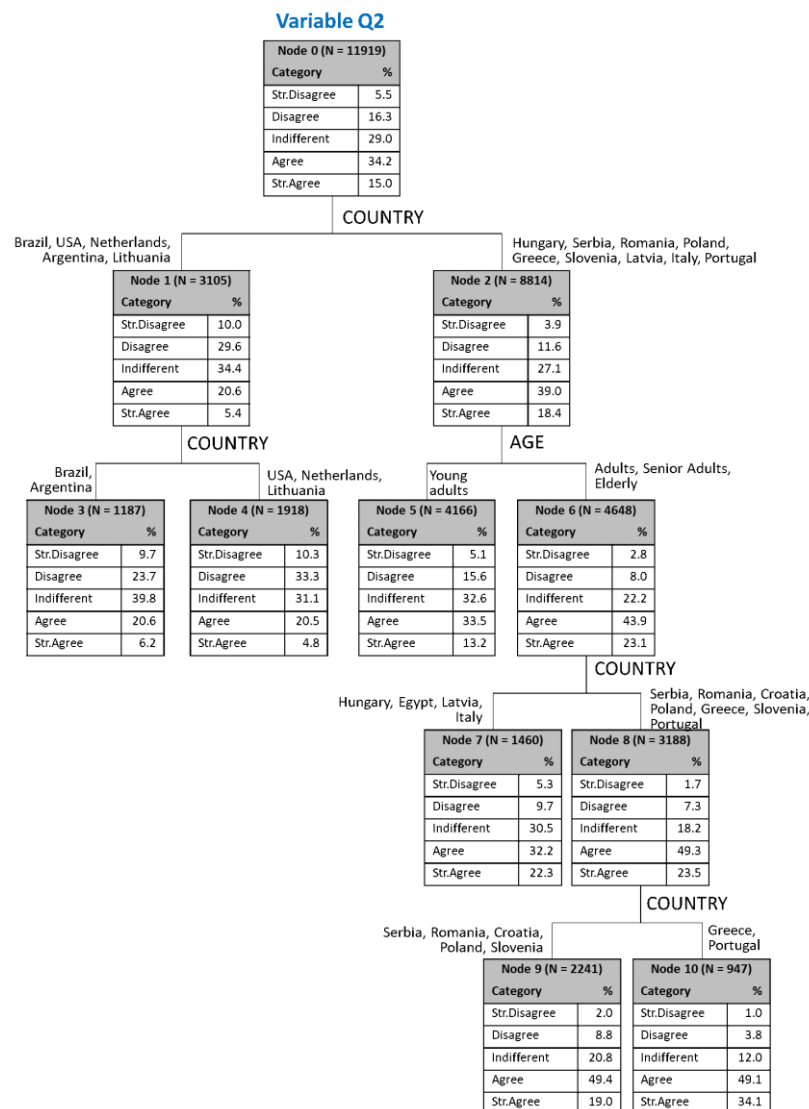


Figure 3. Tree classification for variable "Q2. It is important to me that the food I eat comes from my own country". (Str – Strongly).

In this case, the explanatory variables were country and age, of the eight considered. In this case, the tree had 11 nodes, and six of them were terminal, for a tree with four levels of depth. In this case, : 34.2% and 15.0% for 'Agree' and 'Strongly Agree', respectively. Also in this case, the first discriminant was country. It was the discriminant in practically all branches of the tree, except one: age, for the participants in the group Hungary, Serbia, Romania, Poland, Greece, Slovenia, Latvia, Italy, Portugal, who were separated according to age into young adults and all others. These young adult participants showed the lowest percentages of agreement with question Q2 among the rest, at 33.5% and 13.2%, respectively.

Findings suggest that young adults show less concordance in the importance of eating food from their own country, which may be related to global consumption trends and a greater concern with product origin (Chang et al., 2024b; Boustani & Guiné, 2023). On the other hand, older age groups continue to prefer local products, which may be related to cultural identity, trust values, and the freshness of food (Bayraktar et al., 2023; Feldmann & Hamm, 2015). This result reinforces the idea that sensitization strategies to food local importance may be adapted to different age groups and cultural values, as well as to the characteristics of each region (Pugra et al., 2025; Kovács et al., 2022).

Lastly, for variable "Q3. I avoid going to restaurants that do not have a recovery policy of food surplus", the decision tree is shown in Figure 4. In this case, of the eight variables considered, four were considered explanatory (country, area of work or studies, age, and marital status). This suggests that the decision to avoid a restaurant without sustainable policies implemented is diffuse and multifactorial. In this case, the tree had only 17 nodes, of which 9 were terminal, at 4 levels of depth. Node zero reveals that, for Q3, participants showed a comparatively lower level of agreement, with 13.9% 'Agree' and 4.8% 'Strongly Agree'.

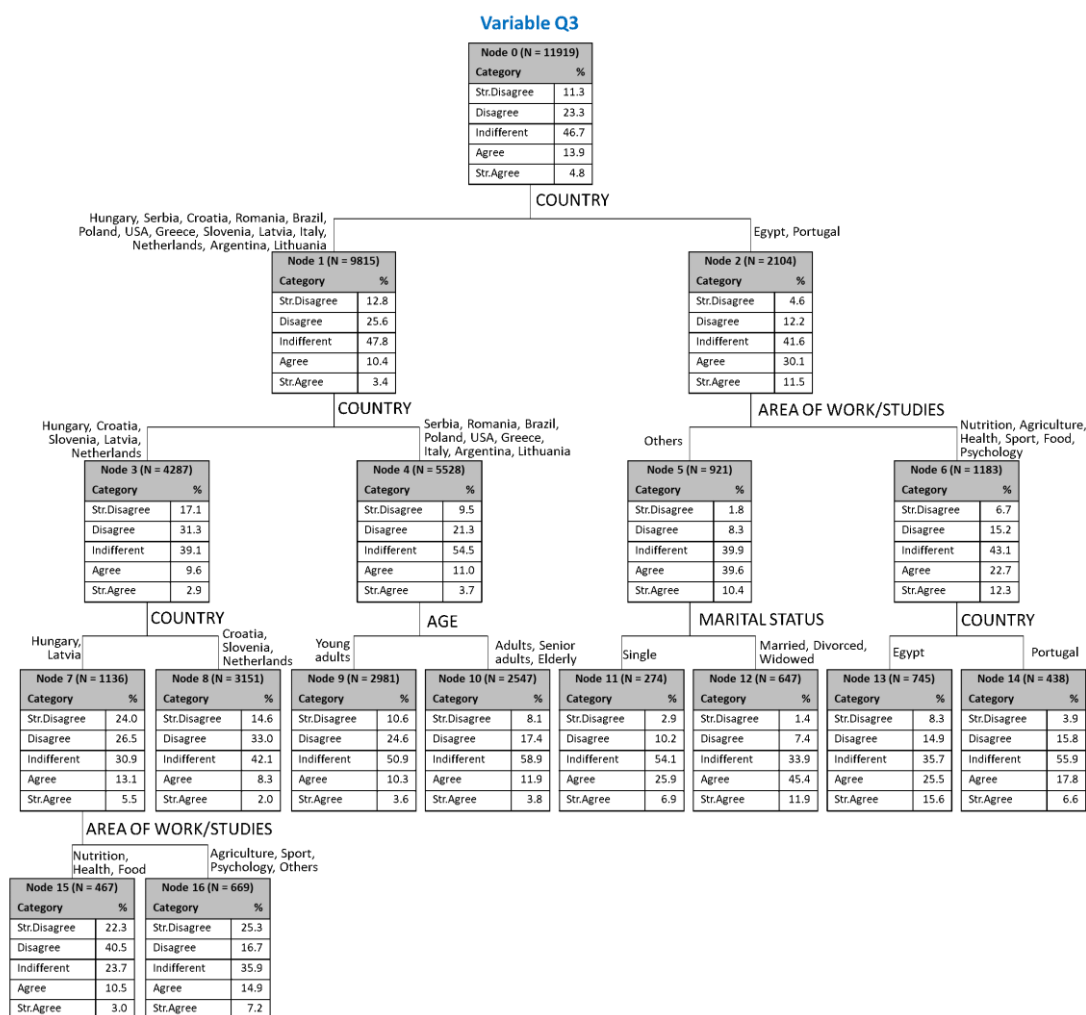


Figure 4. Tree classification for variable "Q3. I avoid going to restaurants that do not have a recovery policy of food surplus". (Str – Strongly).

The first discriminant is once more a variable country, separating a group of participants from Egypt and Portugal from all other countries, due to higher levels of agreement (30.1% and 11.5% of 'Agree' and 'Strongly

Agree', respectively). Thus, these countries stand out from the others in their strong sensitivity to frequent restaurants that implement a recovery policy for food surplus, which can reflect a greater exposure of Portuguese and Egyptian citizens to educational campaigns or public policies (Simões et al., 2023). For participants from these countries, the discriminating variable at the second level of depth was area of work or studies, which was also a discriminating variable at the fourth level of depth for participants from Hungary and Latvia. This discriminating variable is highlighted by the sport, health, and agriculture areas, fields can promote more conscious attitudes (Huang et al., 2024).

Age and marital status were both discriminating variables appearing in the third level of the tree. In these two cases, the participants who were single and young adults showed the lowest agreement towards Q3, meaning that these participants do not influence their choice of a restaurant as much based on a food surplus policy, which underlines the lowest priority given to food sustainability by younger populations (Widayat et al., 2025; Urugo et al., 2024).

CONCLUSIONS

This work revealed that the participants' attitudes towards food waste are highly variable according to geographical and socio-demographic factors. Participants in Portugal living in rural areas tend to show a more positive attitude toward managing quantities when cooking at home to avoid food waste, to choose national food, and to avoid restaurants that do not promote an active policy of recovering food surplus. More positive attitudes were found, in general, for older participants, widowed females, who had the lowest levels of education. Tree classification confirmed that country was the most influential factor in determining consumers' attitudes towards food waste, but, to a lesser extent, variables such as age, marital status, and area of work or studies also showed some discriminating capacity. On the other hand, variables such as gender, education, professional status, or living environment were not found to be explanatory of consumers' attitudes towards food waste in the present study. The results point to the need for differentiated educational strategies and public policies, adapted to the cultural and socio-demographic specificities of each population group, reinforcing the role of education for responsible consumption as a pillar for compliance with the 2030 Agenda. Thus, the study highlights the need for culturally tailored educational campaigns and national policies to reduce food waste. Future research should further explore how cultural dimensions interact with demographic and behavioural determinants.

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Conflicts of Interest

The authors declare no conflict of interest.

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