



The meat paradox and health-related aspects: A cluster analysis among red meat consumers

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ABSTRACT

Many consumers in Western countries enjoy eating meat as they consider it a key component in their diets, despite increasing awareness of the negative effects of meat overconsumption. The inner conflict that arises from the discrepancy between consumers' attitudes and actual behaviour can be named the "meat paradox." Thus, meat eaters adopt *rationalization* as a coping strategy to solve this discrepancy by means of four meat-eating justifications, known as the 4Ns: eating meat is natural, normal, necessary, and nice. However, how these meat-eating justifications vary among consumers and to what extent health-related aspects influence rationalization is unclear. This is the first study that identified specific red meat consumer segments according to the 4Ns, shedding light on the influence of health-related aspects. To achieve this, a two-step cluster analysis was performed on a stratified, representative sample of 1179 Italian red meat consumers. As a result, three red meat consumer segments (flexitarians, potential flexitarians, and meat lovers) were identified according to their meat-eating justifications. In addition, they were characterized by different health-related aspects as well as consumption habits, social norms, and sociodemographic characteristics. Our findings provide theoretical implications and practical knowledge to policymakers and non-profit organizations devising interventions to reduce excessive meat consumption and shift toward more sustainable diets.

1. Introduction

Red meat consumption is a heavily debated topic, not only for environmental and ethical reasons (Migliore et al., 2015; Parlasca & Qaim, 2022; Roozen & Raedts, 2023), but also because of its health-related aspects (González et al., 2020; Parlasca & Qaim, 2022). Meat is recognized as an essential food in the human diet because of its high nutritional content (e.g., vitamins, proteins, and minerals) that helps prevent nutritional deficiencies (Godfray et al., 2018; Headey et al., 2018). However, a meat-based diet is considered deleterious to health because it increases the risks of several non-communicable diseases, such as type 2 diabetes, and cardiovascular diseases (Hu et al., 2019; Willett et al., 2019). Thus, the World Health Organization (WHO) recommends eating less than 500 g of meat per week (about three servings) (WHO, 2023). Nevertheless, in the last years Western populations have lowered their meat consumption quite moderately and at a slow pace

(Dagevos, 2021; Verain et al., 2022). For instance, most European meat eaters still exceed the WHO recommended intake not only in Northern and Central Europe but also in Mediterranean countries like Italy (Caso et al., 2023).

Many consumers enjoy eating meat and consider it a key component of their diets, despite the increasing awareness of its negative environmental, ethical, and health-related consequences (Piazza et al., 2015; Roozen & Raedts, 2023). Therefore, an inner conflict arises in which there is a discrepancy between the consumer's attitude and actual behaviour; this is called the "meat paradox" (Loughnan et al., 2010; Oleschuk et al., 2019; Roozen & Raedts, 2023).

Previous research has shown that consumers can adopt different coping strategies to resolve this inner conflict and maintain this discrepancy. For instance, denying the emotions and suffering of animals, or considering living animals different from meat (Buttlar & Walther, 2018; Oleschuk et al., 2019).

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Another coping strategy consumers adopt to maintain meat-based diets is defined in the literature as *rationalization*. Piazza et al. (2015) reported that meat eaters justify their consumption using four rationalizations (or justifications) that allow them to avoid feeling guilty about their choices. Thus, consumers defend their points of view, not caring about the possible negative consequences of their choices but defending why they continue to eat meat (Oleschuk et al., 2019). Piazza et al. (2015) argued that one of the reasons why people continue to eat meat is that it is perceived as *natural* food because human beings have been biologically omnivorous since the beginning of their evolutionary history and, thus, have a genetic predisposition toward animal-based proteins.

Another rationalization is that meat is considered *necessary* for health because of its nutrients, which humans need to stay fit and build muscles throughout life. In addition, people think that meat is a *normal* food because it is socially accepted by most people, being part of many cultures and traditional dishes around the world.

Finally, individuals tend to justify their meat consumption for the pleasure derived from its taste, considering it as a *nice* food. Therefore, Piazza et al. (2015) developed the Natural, Necessary, Normal, and Nice (4Ns) scale to measure the meat paradox, identifying omnivores, partial vegetarians, full vegetarians, and vegans. Following Piazza et al. (2015), other studies have adopted this scale to better understand how omnivores and vegetarians—considering adults (Hopwood et al., 2021; Hopwood & Bleidorn, 2019; Oleschuk et al., 2019) and adolescents (Latimer et al., 2022)—or meat eaters (Verain et al., 2022) rationalize meat consumption differently. For instance, Verain et al. (2022), in a study on Dutch consumers, found that who eats more meat is more likely to justify their meat consumption as natural, necessary, normal, and nice. This justification tends to decrease among segments that consume less meat. Similarly, a recent study by Roozen and Raedts (2023) demonstrated that the higher the scores for the four meat-eating justifications, the higher the consumer's meat attachment and, the less likely for them to reduce their meat consumption. However, no research has identified the presence of heterogeneity within meat eaters, considering the 4Ns as segmentation variables. In other words, it is still not clear how consumers are characterized according with their meat-eating justifications.

Furthermore, although a positive correlation between consumers who consider meat a necessary food and health motivations has been highlighted (Latimer et al., 2022; Piazza et al., 2015), the role of health-related aspects among individuals who present different meat-eating justifications is still unexplored. For instance, Oleschuk et al. (2019) highlighted that many consumers consider red meat both a healthy and unhealthy food because of its essential protein content and the risks associated with its overconsumption.

However, despite health could be one of the main reasons influencing dietary change (Kwasny et al., 2022; Verain et al., 2022), it is not clear whether and to what extent different levels of meat justification are also characterized by variations in consumers' health-related aspects. A more holistic knowledge of health-related aspects may contribute to understanding the role of these aspects in the meat paradox and their influence on consumers' eating habits (Dagevos, 2021; Escriba-Perez et al., 2017; Godfray et al., 2018). This could clarify how consumers face with the meat paradox, choosing to maintain or reduce meat-based diets (Hopwood & Bleidorn, 2019; Piazza et al., 2015).

2. Research goals

Understanding how consumers formulate their justifications for eating meat and their relationship with health-related aspects could provide policymakers and non-profit organizations with practical information for designing interventions to reduce excessive meat consumption and shift toward more sustainable diets.

Therefore, to fill these knowledge gaps this paper aims to explore a) the role of rationalization in the meat paradox among red meat

consumers; b) to what extent health-related aspects differ among red meat consumers. In particular, the novel contribution of this study lies in identifying segments of red meat consumers according to their meat-eating justifications, shedding light on their health-related characteristics. To achieve these goals, a two-step cluster analysis was carried out on a stratified, representative sample of Italian red meat consumers. First, consumer clusters were distinguished according to the 4Ns scale. Then, in order to better understand potential differences between meat eaters in terms of health-related aspects, each segment was profiled considering consumers' health attitudes, perceptions of health status perception and risk propensity. Furthermore, as the literature has shown that healthier eating habits are associated with the consumption of white meat, plant-based meat alternatives (PBMA) and organic foods (MacDonald et al., 2023; Milford & Muiruri, 2024; Rizzo et al., 2023), the frequency of consumption of these foods was also taken into account to profile each segment. Additionally, to better understand the heterogeneity of consumers, intersegmental differences in the impact of social norms and socio-demographic characteristics were also explained.

According to the literature, social norms are defined as the collective beliefs and values that prevail within a society or a particular group, influencing perceptions of what is considered acceptable or desirable in food-related decisions (Herman et al., 2003; Higgs & Thomas, 2016). In the context of consumers' meat preferences, however, conflicting findings have emerged. Some studies suggest that social norms exert a stronger influence on individuals with a meat-rich diet (Caso et al., 2023; Wolfswinkel et al., 2024), whereas other research emphasizes that such norms predominantly affect individuals with lower meat consumption (Strässner & Wirth, 2024; Verain et al., 2022). Additionally, sociodemographic have long been recognized as a crucial factor in consumer segmentation, as demonstrated in several previous studies (e.g., Escriba-Perez et al., 2017; Strässner & Wirth, 2024; Verain et al., 2022; Wolfswinkel et al., 2024).

However, the extent to which these variables are associated with the level of rationalization remains unclear. Given that both social norms and sociodemographic factors vary across different segments and cultural contexts (Strässner & Wirth, 2024; Wolfswinkel et al., 2024), examining their influence on meat consumption could aid clarify their role in the meat paradox among Italian consumers. This study contributes to enrich the existing literature on the role that meat justifications/rationalization can play in resolving the meat paradox among consumers.

Findings should also provide useful insights to tailor private and public interventions in Western countries aimed at reducing excessive meat consumption and shifting toward more sustainable diets.

3. Materials and methods

3.1. Measures

To segment Italian red meat consumers according to their meat-eating justifications, specific psychographic, dietary, and socio-demographic variables (Table 1) were collected using a questionnaire divided into three sections. Specifically, the first section dealt with food consumption habits. In line with previous research, consumption of red meat, white meat, plant-based meat alternatives (PBMA), as well as organic food have been investigated (MacDonald et al., 2023; Milford & Muiruri, 2024; Rizzo et al., 2023; Verain et al., 2022).

The second section of the questionnaire included several psychographic variables, reported in detail in the Appendix. Specifically, the 4Ns scale (Piazza et al., 2015), consisting of 16 items, divided into four subcategories (Natural, Necessary, Normal, and Nice), were treated as factors. According to this scale, consumers with high rationalization scores are more likely to agree that red meat is nice, normal, necessary, and natural as they try to defend their meat-eating behaviour and not change it (Piazza et al., 2015). The outcome factors of this scale were then used as segmentation variables for cluster analysis, enabling the

Table 1
Description of collected variables.

Variables	Type	Coding
Sex at birth	Dummy variable	0 = Female; 1 = Male
Generations	Categorical variable	1 = Generation Z (<28 years old) 2 = Millennials (28–43 years old) 3 = Generation X (44–59 years old) 4 = Baby Boomers (60–78 years old)
Education	Dummy variable	0 = Lower-middle level (Up to high school diploma); 1 = Higher level (From bachelor's degree onwards)
Income	Categorical variable	1 = Low income; 2 = Lower-middle income; 3 = Upper-middle income; 4 = High income
Geographical area of residence	Categorical variable	1 = Northwest Italy; 2 = Northeast Italy; 3 = Central Italy; 4 = Southern Italy and Islands
Number of children (<12 years old) in the household	Categorical variable	1 = No children; 2 = One child under the age of 12; 3 = Two children under the age of 12; 4 = Three children under the age of 12; 5 = More than three children under the age of 12
Red meat consumption frequency	Categorical variable	1 = Less than once every 15 days; 2 = Once every 15 days; 3 = Once a week; 4 = 2–3 times a week; 5 = 4–5 times a week; 6 = Every day
White meat consumption frequency	Categorical variable	1 = Never; 2 = Less than once every 15 days; 3 = Once every 15 days; 4 = Once a week; 5 = 2–3 times a week; 6 = 4–5 times a week; 7 = Every day
PBMA consumption frequency	Categorical variable	1 = Never; 2 = Less than once every 15 days; 3 = Once every 15 days; 4 = Once a week; 5 = 2–3 times a week; 6 = 4–5 times a week; 7 = Every day
Percentage of organic products on total food expenditure	Categorical variable	1 = 0 %; 2 = Less than 20 %; 3 = Between 20 and 50 %; 4 = Between 50 and 75 %; 5 = More than 75 %
4Ns	Continuous variable	1–7 (from 'totally disagree' to 'totally agree')
GHI	Continuous variable	1–7 (from 'totally disagree' to 'totally agree')
Social norms	Continuous variable	1–7 (from 'not at all' to 'very much')
Risk propensity	Continuous variable	1–7 (from 'not at all willing' to 'completely willing')
Personal health perception	Continuous variable	1–7 (from 'very bad' to 'very good')

categorization of individuals into distinct groups based on their meat-eating justifications.

For the General Health Interest (GHI) scale (Roininen et al., 1999), consisting of eight items, Cronbach's coefficient was calculated, and then the mean was obtained to better understand individuals' motivations and attitudes toward health and well-being (i.e., their health consciousness). The same procedure was applied to social norms (Berndsen & Van der Pligt, 2004), which were investigated by asking respondents if the people they consider important believe they should eat meat and how much they desire to conform to these beliefs. Furthermore, the risk propensity (Caso et al., 2023) and the health status perception (Cordts et al., 2014), each consisting of a single item, were also collected in this section of the questionnaire. Finally, participants were queried about their perception of own health status and their propensity to take risks in their daily lives.

In the last section, the sociodemographic characteristics were collected (generation, sex at birth, income, educational level, and number of children under 12 years old in the household). The age ranges used to define the generations were based on Laird et al. (2024).

3.2. Data collection and respondents

Data were collected by a professional marketing agency, via an online survey in September 2023. The agency manages a private panel of individuals who voluntarily participate in similar studies. Respondents filled out a form with their personal information and were subsequently contacted by the agency if they matched the screening criteria.

The research procedure was approved by the Bioethics Committee of the University of Palermo (approval certificate no. 151/2023) and all data were collected in accordance with the Declaration of Helsinki and the Italian Personal Data Protection Code (Law Decree no. 196/2003). The selection criteria required participants to be aged 18 years or older, be at least partially responsible for household food shopping, and be consumers of red meat (at least once in the last six months). The target population was divided into distinct and homogeneous strata, considering some participants' characteristics as stratification variables, such as age and area of residence.

Subsequently, a sample was randomly selected from each stratum in proportion to the size of the stratum relative to the total population. This approach ensured that everyone had a known and non-zero probability of being selected, thereby guaranteeing the representativeness of the sample for each reference group.

The final sample consisted of 1179 Italian individuals. Table 2 reports sample characteristics and the relative Italian population quotas (ISTAT, 2024). The participants were aged between 18 and 67 years, with an average age of 44 years (SD ± 12), with a slight majority of females. Although sex at birth was not used as a stratification variable, the sample shows a distribution very similar to that of the general Italian population, also in terms of education levels.

Most of the participants had a lower-middle education level and an upper-middle income level. Geographical distribution exhibited balanced territorial coverage. Regarding family composition, it is evident that the majority of families comprised a single child under the age of 12, while those with more than two children represented less than 10 % of the sample.

3.3. Statistical analysis

All psychographic scales were validated through an analysis of internal consistency (Cronbach's alpha >0.70). An exploratory factor analysis was conducted on the 4Ns scale, revealing a single significant factor for each group of variables analysed. Factor loadings for each item exceeded the acceptable threshold of 0.40 (ranging from 0.672 to 0.908), indicating strong alignment with the respective latent variables. The total variance explained by the factors was 74.66 %, suggesting a good representation of the underlying constructs. The Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy was 0.84, exceeding the recommended value of 0.60, confirming the suitability of the data for factor analysis. Bartlett's test of sphericity was significant ($\chi^2 = 2638.84$, $p < .001$), indicating that the correlation matrix was not an identity matrix and supporting the use of factor analysis to assess construct validity.

Then, the obtained factors were normalized to render the clustering analysis results more reliable and interpretable, ensuring that all variables had a balanced influence on the results. The normalization was performed using a linear transformation that scales the values of each factor within the range [−1,1]. This approach was chosen to ensure that the factors have the same weight and scale during the clustering analysis, preventing variables with larger scales from dominating the result. Specifically, the normalization was carried out using the following formula:

$$X_{norm} = -1 + 2 * \frac{X - X_{min}}{X_{max} - X_{min}}$$

Where X is the original factor value, Xmin and Xmax are the minimum

Table 2
Respondents' characteristics.

	Description	Sample (N = 1179)	Italian population
Sex at birth	Female	614 (52.1 %)	51.1 %
	Male	565 (47.9 %)	48.9 %
Education	Lower-middle level	756 (64.1 %)	66.9 %
	Higher level	423 (35.9 %)	33.1 %
Generations	Generation Z	128 (10.9 %)	12.6 %
	Millennials	403 (34.2 %)	32.1 %
	Generation X	507 (43.0 %)	41.9 %
	Baby Boomers	141 (11.9 %)	13.4 %
Geographical area of residence	Northwest	314 (26.6 %)	26.9 %
	Northeast	221 (18.7 %)	19.6 %
	Central	239 (20.3 %)	19.9 %
	South and Islands	405 (34.4 %)	33.6 %
Income	Low income	118 (36.6 %)	
	Lower-middle income	431 (32.2 %)	na
	Upper-middle income	524 (44.4 %)	
	High income	106 (8.9 %)	
Number of children (<12 years old) in the household	No children	107 (9.1 %)	
	One child under the age of 12	797 (67.6 %)	
	Two children under the age of 12	160 (13.6 %)	na
	Three children under the age of 12	99 (8.4 %)	
	More than three children under the age of 12	16 (1.3 %)	

and maximum observed values for that factor, respectively, and Xnorm is the normalized value, resulting in the range $[-1, 1]$. This normalization technique preserves the relative distribution of the data while reducing scale differences between variables.

After the EFA, a two-step cluster analysis (Honkanen & Frewer, 2009; Panico et al., 2014) was performed to obtain segments based on meat-eating justifications, applying the 4Ns scale. The two-step cluster analysis combines sequential and hierarchical approaches (e.g., Honkanen & Frewer, 2009), starting with a pre-clustering phase followed by a sub-clustering phase. Hierarchical clustering was chosen because of the exploratory nature of this analysis and the absence of any prior assumptions regarding the number or structure of consumer segments. This approach helps to observe the distribution of diverse justifications for meat consumption among consumers, facilitating the identification of more precise and detailed segments. Indeed, the dendrogram provides the opportunity to ascertain the optimal number of clusters during the analysis, obviating the necessity for defining it in advance (Giordani

et al., 2020). Reducing the risk of creating arbitrary divisions that may not reflect the real patterns in the data.

Subsequently, a K-mean cluster analysis was performed using the optimal number of clusters (Lerro et al., 2018; Yue et al., 2024). After obtaining the clusters, using the 4Ns, comparisons were made among subgroups (Hellstern et al., 2024).

Then, psychographic variables concerning health-related aspects and social norms, consumption habits, and sociodemographic variables were used to profile the segments, using an ANOVA and Duncan's post-hoc test (with Bonferroni corrections) for continuous and ordinal categorical variables. Duncan's post-hoc test was chosen for its greater sensitivity in detecting significant differences between averages, making it particularly suitable for exploratory studies. Indeed, Duncan's test is likely to detect even small differences between segments (Agbangba et al., 2024; Sridhar & Charles, 2021). This approach is particularly useful when analysing nuanced behaviours and attitudes, such as the justifications behind meat consumption (4Ns), which can vary subtly but significantly between consumer groups. The trade-off between sensitivity and error risk control was managed with the application of the Bonferroni correction, ensuring that the approach was rigorous without sacrificing the ability to identify relevant patterns. Finally, Pairwise Pearson Chi-square tests were used for nominal categorical variables (Sameshima & Akamatsu, 2023).

4. Results

4.1. Pre-clustering phase

An EFA on the 4Ns scale revealed a single significant factor for each group of variables analysed, with factorial loadings supporting consistent results (Table 3).

We used a dendrogram to visualize and determine the optimal cluster numerosity as the dendrogram graphically represented the hierarchical structure of the data (Higuchi & Maehara, 2021; Panico et al., 2014). The dendrogram (Fig. 1) suggested the adoption of three clusters.

Based on respondents' meat-eating justifications (Table 4), the three clusters were labelled as "flexitarians" (22.9 % of the total sample), "potential flexitarians" (45.6 %), and "meat lovers" (31.5 %).

The one-way ANOVA showed significant differences for all four factors across the three clusters. Additionally, Duncan's post-hoc test indicated that all pairs of clusters differed significantly from each other, suggesting that the perceptions and evaluations measured by the factors varied greatly among the three subgroups.

In particular, meat lovers tended to evaluate meat more positively and justify its consumption as natural, necessary, normal, and nice compared to potential flexitarians and, even more sharply, flexitarians. The latter group showed an overall lack of motivation to eat meat, whereas potential flexitarians tended to rationalize meat consumption as necessary and nice.

4.2. Cluster characterization

Statistical analyses were conducted to identify potential differences among the three clusters in terms of socio-demographic characteristics, psychographic profiles, and consumption habits. Table 5 shows that only two socio-demographic variables differed among the clusters: generation, and presence of children in the family.

Table 3
Descriptive Statistics of 4Ns factors.

Variable	Obs.	Mean	Std. Dev.	Min	Max
Nature norm. Factor	1179	0.25	0.432	-1	1
Necessary norm. Factor	1179	0.247	0.479	-1	1
Normal norm. Factor	1179	-0.041	0.42	-1	1
Nice norm. Factor	1179	0.171	0.432	-1	1

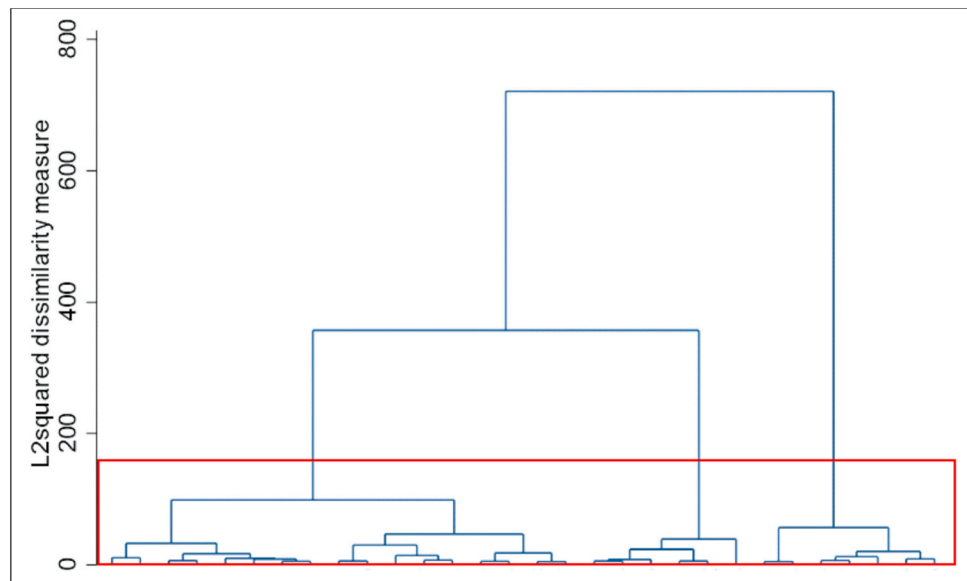


Fig. 1. Dendrogram of cluster analysis applying the 4Ns factors as segmentation variables.

Table 4
4N normalized factor scores of clusters (means \pm S.D.)

Factors	Flexitarians (n = 270)	Potential flexitarians (n = 537)	Meat Lovers (n = 372)	F Test	p- value
Natural	-0.288 ^a (± 0.291)	-0.211 ^b (± 0.228)	0.695 ^c (± 0.21)	1337.61	0.000
Necessary	-0.373 ^a (± 0.341)	0.239 ^b (± 0.272)	0.708 ^c (± 0.212)	1227.40	0.000
Normal	-0.52 ^a (± 0.246)	-0.078 ^b (± 0.248)	0.36 ^c (± 0.311)	847.48	0.000
Nice	-0.291 ^a (± 0.334)	0.128 ^b (± 0.283)	0.57 ^c (± 0.278)	681.13	0.000

Note: different superscripts indicate significantly different means according to post ANOVA Duncan multiple comparison tests with Bonferroni correction.

Flexitarians included a higher proportion of younger and older consumers, as this group had the highest percentage of Generation Z and Baby Boomers compared to potential flexitarians and meat lovers. Additionally, potential flexitarians lived in households with fewer members, whereas meat lovers lived in larger households compared with the other two clusters. However, this may be due to the younger age of flexitarians.

Food consumption habits were also analysed to further explore potential differences among the subgroups (Table 6). The comparison among the three groups revealed significant differences in the patterns of red meat, white meat, PBMA, and organic food consumption, with potential flexitarians showing an intermediate level of consumption of these items.

Flexitarians showed the lowest frequency of red meat consumption (once a week), whereas meat lovers exhibited the highest (more than three times a week), followed by potential flexitarians (2–3 times a week). Similarly, albeit to a lesser extent, flexitarians demonstrated a higher frequency of white meat consumption than the other two clusters. Flexitarians also consumed PBMA more frequently than the other two groups and had a higher propensity to buy organic products, with a higher percentage of consumers spending between 20 % and 75 % of their food budget on organic products.

Concerning psychographic variables, potential flexitarians did not differ from flexitarians regarding how they perceived their health status or health consciousness, while flexitarians revealed lower levels of risk propensity ($M = 2.86$) and were less affected by social norms concerning

red meat consumption ($M = 2.68$) (Table 7).

By contrast, meat lovers were most influenced by other people ($M = 4.65$) and were the most willing to take risks ($M = 3.45$). Although their perception of general health interest was lower than that of flexitarians, they viewed their health status more positively. On the other hand, potential flexitarians showed a lower risk propensity ($M = 3.02$) and perception of others' opinions ($M = 3.68$) compared to meat lovers.

5. Discussion

Our findings reveal that Italian red meat consumers can be grouped into three main clusters, representing a continuum from strong to moderate meat-eating justifications: meat lovers, potential flexitarians, and flexitarians. The three subgroups differ in health-related aspects, consumption habits, perception of others' opinions, and sociodemographic variables. This result proves that consumers employ a cognitive strategy to continue (or reduce) their meat consumption according to their different rationalization levels (Hopwood & Bleidorn, 2019; Latimer et al., 2022; Piazza et al., 2015; Roozen & Raedts, 2023).

Similarly, health-related aspects influence consumers, playing a key role in maintaining an unchanged red meat intake or shifting toward more sustainable diets (Buttlar & Walther, 2018; Verain et al., 2022).

Finally, the influence of social norms and sociodemographic characteristics varies across consumer groups (Strässner & Wirth, 2024; Wolfswinkel et al., 2024), playing a significant role in the meat paradox. However, among the sociodemographic variables, only age and household size are found to impact meat consumption, while factors such as sex at birth, education level, income, and geographical area do not exhibit significant variation across consumer groups. This can be attributed to the widespread presence of red meat in Italy's culinary culture and its availability at affordable prices across the country (Roozen & Raedts, 2023; Strässner & Wirth, 2024).

5.1. Meat lovers

Findings have revealed that meat lovers account for about one-third of red meat consumers as in other European countries (Verain et al., 2022). However, compared to previous findings, in the current study this segment of Italian consumers highlights a meat consumption frequency lower compared to Northern European consumers.

Furthermore, this group of Italian consumers represents the segment in which the meat paradox is evident as these consumers strongly justify

Table 5
Cluster profiles (number and percentages).

	Description	Flexitarians (n = 270)	Potential flexitarians (n = 537)	Meat Lovers (n = 372)	Test	p-value
Sex at birth	<i>Female</i>	151 (55.93 %)	283 (52.70 %)	180 (48.39 %)	$\chi^2 = 3.7157$	0.156
	<i>Male</i>	119 (44.07 %)	254 (47.30 %)	192 (51.61 %)		
Generations	<i>Generation Z</i>	41 (15.19 %)	53 (9.87 %)	34 (9.14 %)	$\chi^2 = 14.2130$	0.027
	<i>Millennials</i>	80 (29.63 %)	192 (35.75 %)	131 (35.22 %)		
	<i>Generation X</i>	108 (40 %)	227 (42.27 %)	172 (46.24 %)		
	<i>Baby Boomers</i>	41 (15.19 %)	65 (12.10 %)	35 (9.41 %)		
Education	<i>Lower-middle level</i>	164 (60.74 %)	330 (61.45 %)	262 (70.43 %)	$\chi^2 = 9.4396$	0.112
	<i>Higher level</i>	106 (39.26 %)	207 (38.55 %)	110 (29.57 %)		
Income	<i>Low income</i>	23 (8.52 %)	49 (9.12 %)	46 (12.37 %)	$\chi^2 = 7.6398$	0.266
	<i>Lower-middle income</i>	87 (32.22 %)	204 (37.99 %)	140 (37.63 %)		
	<i>Upper-middle income</i>	133 (49.26 %)	238 (44.32 %)	153 (41.13 %)		
	<i>High income</i>	27 (10.00 %)	46 (8.57 %)	33 (8.87 %)		
Area of residence	<i>Northwest Italy</i>	71 (26.30 %)	126 (23.46 %)	117 (31.45 %)	$\chi^2 = 11.6523$	0.170
	<i>Northeast Italy</i>	57 (21.11 %)	110 (20.48 %)	54 (14.52 %)		
	<i>Central Italy</i>	57 (21.11 %)	110 (20.48 %)	72 (19.35 %)		
	<i>Southern Italy and Islands</i>	85 (31.48 %)	191 (35.57 %)	129 (34.68 %)		
Presence of children (<12 years old) in the family	<i>No children</i>	31 (11.48 %)	45 (8.38 %)	31 (8.33 %)	$\chi^2 = 29.4335$	0.001
	<i>One child</i>	202 (74.81 %)	359 (66.85 %)	236 (63.44 %)		
	<i>Two children</i>	26 (9.63 %)	69 (12.85 %)	65 (17.47 %)		
	<i>Three children</i>	7 (2.59 %)	58 (10.80 %)	34 (9.14 %)		
	<i>More than three children</i>	4 (1.48 %)	6 (1.12 %)	6 (1.61 %)		

Table 6
Food consumption habits of clusters (mean scores \pm S.D.).

	Flexitarians (n = 270)	Potential flexitarians (n = 537)	Meat Lovers (n = 372)	Test	p-value	
Red meat consumption frequency	2.85 ^a (± 0.97)	3.95 ^b (± 0.88)	4.51 ^c (± 0.98)	39.34	0.000	
White meat consumption frequency	3.61 ^a (± 1.02)	3.49 ^b (± 0.82)	3.39 ^c (± 0.85)	4.67	0.009	
PBMA consumption frequency	3.09 ^a (± 1.47)	2.71 ^b (± 1.43)	2.62 ^b (± 1.50)	10.37	0.000	
% of organic products on total food expenditure	<i>0 %</i>	17 (6.30 %)	37 (6.89 %)	36 (9.68 %)	13.72	0.089
	<i>Less than 20 %</i>	125 (46.30 %)	287 (53.45 %)	196 (52.69 %)		
	<i>Between 20 and 50 %</i>	97 (35.93 %)	174 (32.40 %)	120 (32.26 %)		
	<i>Between 50 and 75 %</i>	29 (10.74 %)	36 (6.70 %)	19 (5.11 %)		
	<i>More than 75 %</i>	2 (0.74 %)	3 (0.56 %)	1 (0.27 %)		

Note: different superscripts indicate significantly different means according to post ANOVA Duncan multiple comparison tests with Bonferroni correction.

the presence of meat in their diets, ignoring the negative consequences of its overconsumption and production (Buttlar & Walther, 2018; Hopwood et al., 2021; Roozen & Raedts, 2023).

Meat lovers consider themselves omnivores, perceiving red meat as a natural food that has been part of the diet since the dawn of humanity (Latimer et al., 2022; Roozen & Raedts, 2023). Eating red meat is normal

Table 7
Psychographic variables of clusters (mean scores \pm S.D.).

Variables	Flexitarians (n = 270)	Potential flexitarians (n = 537)	Meat Lovers (n = 372)	F Test	p- value
GHI	4.92 ^a (± 0.99)	4.65 ^a (± 0.92)	3.60 ^b ($\pm 0.1.03$)	8.18	0.000
Social Norms	2.68 ^a ($\pm 0.1.31$)	3.68 ^b ($\pm 0.1.25$)	4.65 ^c (± 1.59)	161.58	0.000
Risk propensity	2.86 ^a (± 1.35)	3.02 ^b (± 1.39)	3.45 ^c (± 1.64)	15.54	0.000
Personal health perception	1.97 ^a (± 1.24)	2.1 ^a (± 1.20)	2.25 ^b (± 1.51)	3.67	0.026

Note: different superscripts indicate significantly different means according to post ANOVA Duncan multiple comparison tests.

for this segment of the population because it is socially acceptable in the cultural context in which they live (Oleschuk et al., 2019; Piazza et al., 2015). Red meat is commonly eaten by people who are important in their lives (i.e., their family, peers, and friends); thus, they have no moral concerns or doubts about its consumption (Randers et al., 2021).

Therefore, meat lovers are strongly affected by social norms because they do not have a well-defined personal perception of what is right or wrong (Randers et al., 2021), but their choices are encouraged by the social context (Caso et al., 2023). In particular, a recent study by Wolfswinkel et al. (2024) shows that they are more affected by others' opinions aimed at favouring meat consumption rather than meat avoidance. This contrasts with the findings of Verain et al. (2022) who, in the Dutch context, showed that social norms have a minimal effect on individuals with a strong preference for meat, as they are less likely to be influenced by a supportive social environment. Conversely, they think meat is just a nice meal that affords pleasure because of its taste and sensorial characteristics (Hopwood & Bleidorn, 2019).

Furthermore, they consider that red meat is necessary for their health as it is rich in essential nutrients (Hopwood et al., 2021; Piazza et al., 2015) and believe that including red meat in the diet is necessary to avoid nutritional deficiencies (Parlasca & Qaim, 2022). This viewpoint is due to their low health consciousness, which allows them to ignore the risks associated with red meat overconsumption (Godfray et al., 2018; Greene-Finestone et al., 2005). As suggested by previous studies, low interest in one's health does not help the transition toward healthier diets (Cliceri et al., 2018; Malek & Umberger, 2021). However, although a recent study by Caso et al. (2023) has shown that neither personal health perception nor a propensity to take risks seem not to be a driver for meat overconsumption, the current findings reveal that meat lovers have a high perception of their health status and a tendency to take risks daily. This highlights that these consumers are willing to challenge the negative consequences of a meat-based diet, as their highest level of rationalization does not make them worry about meat consumption, overestimating their personal health status (Randers et al., 2021).

Hence, meat lovers not only have a low perception of the positive health effects of reducing their meat intake (Hopwood & Bleidorn, 2019; Latimer et al., 2022; Verain et al., 2022), but they think that a diet with little meat is unhealthy (Strässner & Wirth, 2024). Therefore, meat lovers are unlikely to reduce their meat consumption (Roozen & Raedts, 2023), even though it exceeds the weekly intake recommended by the WHO (WHO, 2023). These consumers, in fact, show the lowest consumption of white meat, PBMA, and organic food (Milford & Muiruri, 2024; Strässner & Wirth, 2024; Verain et al., 2022). This is due to their rationalization and stubbornness regarding their consumption habits, which are difficult to change (Graça et al., 2015; Oleschuk et al., 2019).

Interestingly, contrary to previous research suggesting that meat lovers tend to be younger than flexitarians (Wolfswinkel et al., 2024), and similar to findings from Northern European countries (Verain et al., 2022), our results confirm that meat lovers are generally middle-aged consumers. Additionally, meat lovers are more likely to have children,

suggesting that a larger household size may make it more challenging to reduce meat consumption (Caso et al., 2023; Verain et al., 2022). This is because meat lovers often view meat as an essential component of their children's diet and may also prefer to avoid healthier food options due to constraints such as limited culinary skills and time (Caso et al., 2023; Piazza et al., 2015). Furthermore, while existing literature indicates that in Northern European countries, males tend to exhibit stronger justifications for meat consumption, with less concern for diet or nutritional aspects (Milford & Muiruri, 2024; Verain et al., 2022), no significant differences by sex at birth were observed in our study.

Finally, although some studies suggest that meat lovers are typically characterized by lower education levels (Wolfswinkel et al., 2024) and income (Levasseur et al., 2024), the current findings for Italian consumers indicate that these sociodemographic characteristics do not significantly influence meat-eating justifications (Roozen & Raedts, 2023). This aligns with other research showing that meat consumption is not notably affected by education level (Verain et al., 2022) or income (Wolfswinkel et al., 2024).

5.2. Flexitarians

By contrast, flexitarians do not justify their meat consumption (Piazza et al., 2015). In other words, they have consciously reduced their meat intake, showing the lowest cognitive conflict about meat (Randers et al., 2021). They still represent the smallest segment of red meat consumers, confirming the deep-rooted meat-centred food culture of Western countries (Dagevos, 2021; MacDonald et al., 2023). However, contrary to previous studies (Verain et al., 2022; Wolfswinkel et al., 2024), our findings indicate that the proportion of flexitarians in Mediterranean countries is higher than in Northern and Central European countries.

Moreover, these consumers exhibit a lower frequency of meat consumption compared to their counterparts in other European regions (Verain et al., 2022; Wolfswinkel et al., 2024). This indicates that consumers in Mediterranean countries are more willing to reduce their meat intake (De Boer & Aiking, 2018). This is because people in Southern European countries primarily follow the Mediterranean diet, a universally recognized healthy and sustainable food model characterized by a higher intake of whole grains, fruits, vegetables, seafood, beans, and nuts, compared to other European countries (Annunziata et al., 2019; De Boer & Aiking, 2018).

Thus, flexitarians do not consider meat an essential dietary component in human evolutionary history (Oleschuk et al., 2019; Verain et al., 2022). Instead, they are more likely to think that humans do not need a meat-rich diet because they recognize the negative environmental and ethical effects of meat production (Strässner & Wirth, 2024). Given that flexitarians are more aware of the ethical implications of eating meat, they do not consider red meat a normal component of their diets and are less affected by others' ideas (Oleschuk et al., 2019).

Therefore, although previous research has shown that whenever social norms are aimed at reducing meat consumption are more effective for flexitarians than for meat lovers (Strässner & Wirth, 2024), the current findings highlight that the opinions of others appear to be a less important factor in shifting to a more sustainable diet. This is probably because the adherence to the Mediterranean diet on which the food culture is based, could lead Italian consumers to adopt a low-meat diet more easily than other Europeans (Annunziata et al., 2019). Thus, although the transition to low-meat diet is a complex process that takes time (Dagevos, 2021; Kwasny et al., 2022), the findings suggest that it could be achieved in Mediterranean countries in less time than Northern countries, where social norms appear to be a key factor in reducing the high meat intake (Eker et al., 2019; Strässner & Wirth, 2024; Verain et al., 2022).

Their conviction of having made the right choice leads flexitarians to consider red meat an unpleasant food because these consumers experience a sort of "alternative hedonism", for which they prefer the morality

of alternative foods to the taste of meat (Randers et al., 2021). Therefore, flexitarians think meat is unnecessary in their diets as its overconsumption has negative consequences (Verain et al., 2022). In other words, they are aware that a meat-rich diet could increase the risk of cancer, type 2 diabetes, and cardiovascular diseases (Strässner & Wirth, 2024). Thus, they are more likely to reduce their meat consumption and choose healthier diets (Dagevos, 2021; MacDonald et al., 2023; Peschel & Grebitus, 2023).

Flexitarians are more health-conscious than meat lovers, so they are more willing to replace meat with plant-based or sustainable foods (Milford & Muiruri, 2024; Nevalainen et al., 2023; Rizzo et al., 2023; Strässner & Wirth, 2024). In general, health-conscious consumers believe that lowering their meat consumption will translate into health benefits (Malek & Umberger, 2021; Rizzo et al., 2023). Moreover, flexitarians have a low perception of their health status and low risk propensity; thus, they tend not to eat red meat to avoid the risk of developing chronic diseases (Caso et al., 2023). However, they are aware that a completely meat-free diet may result in nutritional deficiencies, so they choose to reduce their meat intake instead of following a vegetarian or vegan diet (Dagevos, 2021; Strässner & Wirth, 2024).

Moreover, in contrast to previous studies where age did not differ significantly among meat consumers (Caso et al., 2023; Escriba-Perez et al., 2017; Roozen & Raedts, 2023), our findings indicate that flexitarians comprise a higher proportion of both younger and older individuals compared to other consumer segments, as observed by Milford and Muiruri (2024). This suggests that younger generations may primarily modify their diets for environmental and ethical reasons, while older individuals are more likely to do so due to health concerns (Latimer et al., 2022).

Additionally, similar to studies conducted in Northern European contexts, flexitarians tend to live alone or in smaller households (Verain et al., 2022; Wolfswinkel et al., 2024).

However, although women are generally more likely to reduce their red meat consumption, as they are less attached to meat and more inclined to replace it with healthier alternatives (Latimer et al., 2022; Roozen & Raedts, 2023), our findings suggest that gender does not significantly influence the flexitarian segment. This contrasts with previous research indicating that flexitarians are predominantly women (Escriba-Perez et al., 2017; MacDonald et al., 2023; Milford & Muiruri, 2024; Verain et al., 2022).

Finally, unlike previous studies, Italian flexitarians do not exhibit a higher level of education (Wolfswinkel et al., 2024) or income (Levasseur et al., 2024).

5.3. Potential flexitarians

Potential flexitarians are in an intermediate position between these two segments, confirming that a clear definition of a flexitarian diet does not exist (Strässner & Wirth, 2024). Potential flexitarians represent a broad group, differing in their frequency of meat consumption, food preferences, and attitudes (Peschel & Grebitus, 2023; Hellstern et al., 2024). Potential flexitarians can be defined as people who are undertaking a transitional path toward healthier diets in the medium-long run; thus, it is difficult to classify them as either meat lovers or strict flexitarians (MacDonald et al., 2023; Verain et al., 2022).

In line with previous studies (Strässner & Wirth, 2024; Wolfswinkel et al., 2024), potential flexitarians represent the majority of respondents, confirming that consumers in Western countries tend to reduce their meat consumption slightly and slowly (Dagevos, 2021; Peschel & Grebitus, 2023; Verain et al., 2022).

Overall, these consumers justify their meat eating more strongly than flexitarians but important differences can be detected. Contrary to a recent study by Verain et al. (2022), potential flexitarians agree with flexitarians that red meat is not a natural or normal food, confirming that Italian consumers are more likely to adopt a low-meat diet because

of their sustainable food culture (Annunziata et al., 2019).

However, because they show fewer moral concerns about meat production and consumption, they are more affected by social pressure (Randers et al., 2021; Wolfswinkel et al., 2024). On the other hand, although to a lesser extent than meat lovers, potential flexitarians tend to justify their meat consumption as they consider meat a nice and necessary part of their diets. This is in line with Hopwood et al. (2021), who showed that the “nice and necessary” dimensions are the most common justifications among red meat consumers. Indeed, taste and sensorial characteristics represent one of the most important determinants affecting consumers (de Araújo et al., 2022; Santos et al., 2021). Furthermore, in Western countries, red meat is still traditionally considered an essential food to avoid nutritional diseases (Strässner & Wirth, 2024).

Therefore, potential flexitarians experience a greater internal conflict than other segments because they are aware that meat consumption should be reduced but continue to eat meat for its nutritional value (Oleschuk et al., 2019). Thus, potential flexitarians could shift to more sustainable diets as well as return to meat-rich diets, becoming flexitarians or meat lovers (Strässner & Wirth, 2024). The inner dilemma of this group is confirmed by the fact that they tend to consume healthier and more sustainable foods than meat lovers (MacDonald et al., 2023; Strässner & Wirth, 2024).

By contrast, the higher risk propensity compared to flexitarians allows potential flexitarians to consume more red meat because they do not care as much about its health risks (Randers et al., 2021). However, while previous research has indicated that low-meat diets are typically associated with a higher perceived health benefit of reducing meat consumption (Kwasny et al., 2022; Latimer et al., 2022; Verain et al., 2022), potential flexitarians do not appear to differ from flexitarians in terms of health consciousness or personal health perceptions. This suggests that potential flexitarians are more likely to reduce overall meat consumption, supporting the notion that in Mediterranean countries, the shift toward more sustainable diets may occur more rapidly than in Northern countries.

Finally, as potential flexitarians represent a transitional group between meat lovers and flexitarians, both age and household size exhibit intermediate, yet unclear, characteristics in defining this consumer segment (Wolfswinkel et al., 2024).

5.4. Theoretical and practical implications

The findings of the current study could provide both theoretical and practical implications.

From a theoretical point of view, this is the first study aimed at understanding the heterogeneity of red meat consumers according to their meat-eating justifications, shedding light on individual health-related aspects. Furthermore, a segmentation analysis of the large, representative sample confirms that consumers in Western countries are a broad and complex group in which different opinions and perceptions coexist, influencing their diets and lifestyles.

Thus, although red meat is recognized as one of the most controversial foods because of its negative environmental, ethical, and health aspects, each individual faces their own inner conflict to justify its consumption, leading to the so-called meat paradox. This study finds that meat-eating justifications are a relevant coping strategy to solve the meat paradox, and consumers’ dietary choices depend on their different levels of rationalization. Specifically, meat consumers in Italy are distributed along a continuum, varying from high to low levels of justification for meat consumption. Examining how psychological conflicts and contradictory behaviours related to meat intake differ across segments could offer valuable insights for researchers seeking to design targeted behavioural interventions (e.g., nudging strategies) aimed at promoting a reduction in red meat consumption.

Again, different levels of rationalization are characterized by variations in health-related aspects, confirming that the level of health

awareness is crucial for maintaining one's red meat intake or shifting toward more sustainable diets. On one hand, the findings suggest that consumers with high meat consumption (meat lovers) view meat as an essential food for maintaining health and preventing nutritional deficiencies, leading them to possess strong justifications for meat consumption. On the other hand, consumers with low-meat diets (flexitarians) recognize the negative health effects of excessive meat consumption and generally exhibit lower levels of rationalization, considering red meat as unnecessary for their diet.

Furthermore, the results indicate that as sustainable consumption habits increase, the strength of the association with meat-eating justifications decreases, suggesting that consumers with higher rationalization are less likely to substitute meat with more sustainable alternatives. Additionally, while perceptions of others' opinions and sociodemographic factors influence the meat paradox, their effects vary across segments, underscoring the complexity of meat consumption behaviours. Specifically, the influence of social norms grows with increasing levels of rationalization, while only age and household size significantly differentiate consumer groups in Italy, with low-meat diets being more common among both younger and older individuals who tend to live alone.

Finally, some differences can be found with other European countries. In fact, given that potential flexitarians do not consider meat to be a natural or normal food, and that they do not differ from flexitarians in terms of health awareness and personal health perception, the current study suggest that the transition to a more sustainable diets may take less time in Mediterranean countries than in Northern countries. This is likely due to the influence of the Mediterranean diet, which forms the foundation of Italy's food culture, making it easier for Italian consumers to adopt a low-meat diet compared to other Europeans. For this reason, the share of flexitarians is higher than in other European countries, being more likely to adopt a low-meat diet for more personal reasons without the need to be affected by others' opinions.

Furthermore, the current outcomes provide useful practical knowledge to tailor public and private interventions aimed at reducing excessive meat consumption or shifting toward more sustainable diets, while meeting consumers' needs and preferences.

In terms of policy implications, the current findings could inform the development of targeted nutrition education campaigns aimed at consumer groups for whom reducing meat consumption is essential for public health purposes. For example, given that meat lovers do not have a well-defined self-identity but are affected by social pressure, public campaigns could use celebrities or influencers to promote healthier diets in meat lovers' social context. Public figures involved in educational campaigns should prioritize middle-aged consumers, emphasizing that reducing red meat intake should not be perceived solely as a negative aspect of household health. Nutrition education programs should therefore highlight the positive benefits of incorporating red meat substitutes (e.g., white meat, plant-based meat alternatives) into daily diets, rather than focusing exclusively on the negative health effects of excessive meat consumption. For these consumers, red meat is often viewed as an easy-to-prepare, familiar food that is essential for preventing nutritional deficiencies, particularly for their own health and for their children's development.

In contrast, for both flexitarians and potential flexitarians –who exhibit higher health consciousness– it is more appropriate to focus on the health risks associated with excessive meat consumption. These groups are less attached to meat and are more open to adopting healthier food choices. While educational campaigns targeting potential flexitarians should primarily emphasize the health benefits of reducing red meat intake.

Furthermore, while the opinions of others appear to influence potential flexitarians, campaigns targeting flexitarians may not require the involvement of public figures. In these cases, text-based, vocal, and visual messages reinforcing the health-related aspects of red meat consumption would likely be the most effective. According to the current

findings, these messages should be specifically tailored to younger or older individuals living alone or in smaller households.

Finally, considering that both meat lovers and potential flexitarians consider meat a nice product, food manufacturers should strive to develop tasty meat alternatives and devise marketing strategies aimed at promoting these products' taste and benefits. Advertising strategies could specifically feature renowned chefs preparing dishes with meat substitutes, highlighting not only their taste but also the ease of preparation in terms of time and culinary skill required. In contrast, marketing strategies should avoid focusing on demographic factors such as gender, education level, income, and geographical location, as red meat is a prevalent component of the culinary culture in Western countries, where it is readily available at affordable prices to consumers.

6. Limitations

As with all research, this study faces several important limitations. First, the research was performed only among Italian consumers, thus, to better understand the heterogeneity among red meat consumers, replications should be conducted in other Western countries to identify potential cross-cultural differences.

Furthermore, this study is based on self-reported meat consumption frequency; therefore, respondents might have under(over) stated consumption or presented weaker justifications for their meat-eating behaviour because they are likely aware of the negative effects of meat overconsumption (due to potential social desirability).

Therefore, further research should employ incentive compatible methods, such as experimental auctions, to better simulate real-market conditions and provide more accurate insights into meat-eating justifications, thereby minimizing biases associated with the gap between intentions and actual behaviour.

Additionally, prospective studies should consider additional issues driving red meat consumption, such as inflation, cooking capabilities and time constraints. Similarly, future research should explore additional individual traits (e.g. personality, animal welfare and environmental concerns) that could foster or hamper the transition toward more sustainable diets.

7. Conclusions

Segmentation analysis identified three segments of Italian red meat consumers according to their meat-eating justifications: flexitarians, potential flexitarians, and meat lovers. These groups are also characterized by different health-related aspects, consumption habits, perception of others' opinions, and sociodemographic characteristics.

Flexitarians generally do not rationalize meat eating; for them, health-related aspects play a key role in reducing their meat consumption in favour of healthier diets and are weakly affected by social norms. This cluster represents the smallest share of red meat consumers (22.9 %). By contrast, meat lovers account for almost one-third of the participants. These consumers exceed the WHO weekly recommended intake of red meat; they justify their meat overconsumption, driven by the lowest health consciousness and the highest risk propensity and personal health perception.

However, most participants (45.5 %) can be considered potential flexitarians, showing that in Western countries, the transition toward more sustainable diets is slowly taking place. Potential flexitarians experience the greatest interior dilemma about meat intake because, despite being aware that meat is not natural or normal food, they consider it nice and necessary. Therefore, they present stronger meat-eating justifications than flexitarians but tend to consume healthier and more sustainable foods than meat lovers thanks to their lower risk propensity, while health concerns (general and personal) are similar to those of flexitarians.

CRedit authorship contribution statement

Riccardo Testa: Writing – original draft, Conceptualization. **Giuseppina Rizzo:** Writing – original draft, Data curation. **Riccardo Vecchio:** Writing – review & editing, Methodology, Data curation, Conceptualization. **Francesco Vella:** Investigation. **Giorgio Schifani:** Investigation. **Giuseppina Migliore:** Writing – review & editing, Supervision, Project administration, Methodology, Conceptualization.

Ethical statement

The current research has received formal ethical approval from the Bioethics Committee of the University of Palermo (approval certificate no. 151/2023).

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Appendix A. Appendix

Table A1
Psychographic scales.

Scale	Items	
4Ns (Piazza et al., 2015)	Natural	It is only natural to eat meat. It is unnatural to eat an all plant-based diet. Our human ancestors ate meat all the time. Human beings naturally crave meat.
	Necessary	It is necessary to eat meat in order to be healthy You cannot get all the protein, vitamins, and mineral you need on an all plant-based diet Human beings need to eat meat.
	Normal	A healthy diet requires at least some meat. Not eating meat is socially unacceptable It is abnormal for humans not to eat meat. Most people I know eat meat. It is normal to eat meat Meat is delicious.
	Nice	Meat adds so much flavor to a meal it does not make sense to leave it out. The best tasting food is normally a meat-based dish Meals without meat would just be bland and boring.
General Health Interest (Roininen et al., 1999)	The healthiness of food has little impact on my food choices. I am very particular about the healthiness of food I eat. I eat what I like and I do not worry much about the healthiness of food. It is important for me that my diet is slow in fat. I always follow a healthy and balanced diet. It is important for me that my daily diet contains a lot of vitamins and minerals. The healthiness of snacks makes no difference to me. I do not avoid foods, even if they may raise my cholesterol.	
Social Norms (Berndsen & Van der Pligt, 2004)	People important to me think I should eat meat. How much do you want to do what these important people think you should do?	
Risk propensity (Caso et al., 2023)	Indicate what your tendency is to take risks in everyday life	
Health status perception (Cordts et al., 2014)	Your general health status is...	

Data availability

Data will be made available on request.

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Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

References

Agbangba, C. E., Aide, E. S., Honfo, H., & Kakai, R. G. (2024). On the use of post-hoc tests in environmental and biological sciences: A critical review. *Heliyon*, 10(3), Article e25131. <https://doi.org/10.1016/j.heliyon.2024.e25131>

- Annunziata, A., Agovino, M., & Mariani, A. (2019). Sustainability of Italian families' food practices: Mediterranean diet adherence combined with organic and local food consumption. *Journal of Cleaner Production*, 206, 86–96. <https://doi.org/10.1016/j.jclepro.2018.09.155>
- de Araújo, P. D., Araújo, W. M. C., Patarata, L., & Fraqueza, M. J. (2022). Understanding the main factors that influence consumer quality perception and attitude towards meat and processed meat products. *Meat Science*, 193, Article 108952. <https://doi.org/10.1016/j.meatsci.2022.108952>
- Berndsen, M., & Van der Pligt, J. (2004). Ambivalence towards meat. *Appetite*, 42(1), 71–78. [https://doi.org/10.1016/S0195-6663\(03\)00119-3](https://doi.org/10.1016/S0195-6663(03)00119-3)
- Buttler, B., & Walther, E. (2018). Measuring the meat paradox: How ambivalence towards meat influences moral disengagement. *Appetite*, 128, 152–158. <https://doi.org/10.1016/j.appet.2018.06.011>
- Caso, G., Rizzo, G., Migliore, G., & Vecchio, R. (2023). Loss framing effect on reducing excessive red and processed meat consumption: Evidence from Italy. *Meat Science*, 199, Article 109135. <https://doi.org/10.1016/j.meatsci.2023.109135>
- Cliceri, D., Spinelli, S., Dinnella, C., Prescott, J., & Monteleone, E. (2018). The influence of psychological traits, beliefs and taste responsiveness on implicit attitudes toward plant- and animal-based dishes among vegetarians, flexitarians and omnivores. *Food Quality and Preference*, 68, 276–291. <https://doi.org/10.1016/j.foodqual.2018.03.020>
- Cordts, A., Nitzko, S., & Spiller, A. (2014). Consumer response to negative information on meat consumption in Germany. *International Food and Agribusiness Management Review*, 17, 83–106. <https://doi.org/10.22004/ag.econ.164599>, 1030-2016-82984.
- Dagevos, H. (2021). Finding flexitarians: Current studies on meat eaters and meat reducers. *Trends in Food Science & Technology*, 114, 530–539. <https://doi.org/10.1016/j.tifs.2021.06.021>
- De Boer, J., & Aiking, H. (2018). Prospects for pro-environmental protein consumption in Europe: Cultural, culinary, economic and psychological factors. *Appetite*, 121, 29–40. <https://doi.org/10.1016/j.appet.2017.10.042>
- Eker, S., Reese, G., & Obersteiner, M. (2019). Modelling the drivers of a widespread shift to sustainable diets. *Nature Sustainability*, 2(8), 725–735. <https://doi.org/10.1038/s41893-019-0331-1>
- Escriba-Perez, C., Baviera-Puig, A., Buitrago-Vera, J., & Montero-Vicente, L. (2017). Consumer profile analysis for different types of meat in Spain. *Meat Science*, 129, 120–126. <https://doi.org/10.1016/j.meatsci.2017.02.015>
- Giordani, P., Ferraro, M. B., & Martella, F. (2020). Hierarchical clustering. In *Vol. 1. An introduction to clustering with R. Behaviormetrics: Quantitative approaches to human behavior*. Singapore: Springer. https://doi.org/10.1007/978-981-13-0553-5_2
- Godfray, H. C. J., Aveyard, P., Garnett, T., Hall, J. W., Key, T. J., Lorimer, J., ... Jebb, S. A. (2018). Meat consumption, health, and the environment. *Science*, 361(6399), Article eam5324. <https://doi.org/10.1126/science.aam53>
- González, N., Marqués, M., Nadal, M., & Domingo, J. L. (2020). Meat consumption: Which are the current global risks? A review of recent (2010–2020) evidences. *Food Research International*, 137, Article 109341. <https://doi.org/10.1016/j.foodres.2020.109341>
- Graça, J., Calheiros, M. M., & Oliveira, A. (2015). Attached to meat? (un) willingness and intentions to adopt a more plant-based diet. *Appetite*, 95, 113–125. <https://doi.org/10.1016/j.appet.2015.06.024>
- Greene-Finestone, L. S., Campbell, M. K., Gutmanis, I. A., & Evers, S. E. (2005). Dietary intake among young adolescents in Ontario: Associations with vegetarian status and attitude toward health. *Preventive Medicine*, 40(1), 105–111. <https://doi.org/10.1016/j.ypmed.2004.05.009>
- Headey, D., Hirvonen, K., & Hoddinott, J. (2018). Animal sourced foods and child stunting. *American Journal of Agricultural Economics*, 100, 1302–1319. <https://doi.org/10.1093/ajae/aay053>
- Hellstern, L., Gebhardt, B., & Nachtsheim, R. (2024). Who are the flexitarians? Improved segmentation of plant-based meat consumers in Germany. In *Plant-based food consumption* (pp. 179–201). Woodhead Publishing. <https://doi.org/10.1016/B978-0-323-98828-5.00005-X>
- Herman, C. P., Roth, D. A., & Polivy, J. (2003). Effects of the presence of others on food intake: A normative interpretation. *Psychological Bulletin*, 129(6), 873. <https://psycnet.apa.org/doi/10.1037/0033-2909.129.6.873>
- Higgs, S., & Thomas, J. (2016). Social influences on eating. *Current Opinion in Behavioral Sciences*, 9, 1–6. <https://doi.org/10.1016/j.cobeha.2015.10.005>
- Higuchi, A., & Maehara, R. (2021). A factor-cluster analysis profile of consumers. *Journal of Business Research*, 123, 70–78. <https://doi.org/10.1016/j.jbusres.2020.09.030>
- Honkanen, P., & Frewer, L. (2009). Russian consumers' motives for food choice. *Appetite*, 52(2), 363–371. <https://doi.org/10.1016/j.appet.2008.11.009>
- Hopwood, C. J., & Bleidorn, W. (2019). Psychological profiles of people who justify eating meat as natural, necessary, normal, or nice. *Food Quality and Preference*, 75, 10–14. <https://doi.org/10.1016/j.foodqual.2019.02.004>
- Hopwood, C. J., Piazza, J., Chen, S., & Bleidorn, W. (2021). Development and validation of the motivations to eat meat inventory. *Appetite*, 163, Article 105210. <https://doi.org/10.1016/j.appet.2021.105210>
- Hu, F. B., Otis, B. O., & McCarthy, G. (2019). Can plant-based meat alternatives be part of a healthy and sustainable diet? *JAMA*, 322(16), 1547–1548. <https://doi.org/10.1001/jama.2019.13187>
- ISTAT. (2024). *Principali caratteristiche strutturali della popolazione*. Retrieved from <https://demo.istat.it/#sezione1>. Retrieved online on January 10th, 2025.
- Kwasny, T., Dohernig, K., & Riefler, P. (2022). Towards reduced meat consumption: A systematic literature review of intervention effectiveness, 2001–2019. *Appetite*, 168, Article 105739. <https://doi.org/10.1016/j.appet.2021.105739>
- Laird, H. L., Miller, R. K., Kerth, C. R., Berto, M. C., & Adhikari, K. (2024). USA millennial and non-millennial beef consumers perception of beef, pork, and chicken. *Meat Science*, 214, Article 109516. <https://doi.org/10.1016/j.meatsci.2024.109516>
- Latimer, K. R., Peddie, M. C., Scott, T., & Haszard, J. J. (2022). Rationalisation of meat consumption in New Zealand adolescents. *Public Health Nutrition*, 25(4), 904–912. <https://doi.org/10.1017/S13688980021003244>
- Lerro, M., Vecchio, R., Caracciolo, F., Pascucci, S., & Cembalo, L. (2018). Consumers' heterogeneous preferences for corporate social responsibility in the food industry. *Corporate Social Responsibility and Environmental Management*, 25(6), 1050–1061. <https://doi.org/10.1002/csr.1519>
- Levasseur, P., Mariotti, F., Denis, I., & Davidenko, O. (2024). Potential unexpected effects of meat reduction in diet: Could educational attainment influence meat substitution strategies? *Agricultural and Food Economics*, 12(1), 4. <https://doi.org/10.1186/s40100-024-00298-7>
- Loughnan, S., Haslam, N., & Bastian, B. (2010). The role of meat consumption in the denial of moral status and mind to meat animals. *Appetite*, 55(1), 156–159. <https://doi.org/10.1016/j.appet.2010.05.043>
- MacDonald, J., Brauer, P., & Yi, S. (2023). Meat reduction among post-secondary students: Exploration of motives, barriers, diets and preferences for meals with partial and full meat substitution. *Appetite*, 188, Article 106977. <https://doi.org/10.1016/j.appet.2023.106977>
- Malek, L., & Umberger, W. J. (2021). Distinguishing meat reducers from unrestricted omnivores, vegetarians and vegans: A comprehensive comparison of Australian consumers. *Food Quality and Preference*, 88, Article 104081. <https://doi.org/10.1016/j.foodqual.2020.104081>
- Migliore, G., Di Gesaro, M., Borsellino, V., Ascuto, A., & Schimmenti, E. (2015). Understanding consumer demand for sustainable beef production in rural communities. *Quality - Access to Success*, 16(147), 75–79.
- Milford, A. B., & Muiruri, S. W. (2024). The impact of consumers' preferences for domestic food on dietary sustainability. *Appetite*, 195, Article 107206. <https://doi.org/10.1016/j.appet.2024.107206>
- Nevalainen, E., Niva, M., & Vainio, A. (2023). A transition towards plant-based diets on its way? Consumers' substitutions of meat in their diets in Finland. *Food Quality and Preference*, 104, Article 104754. <https://doi.org/10.1016/j.foodqual.2022.104754>
- Oleschuk, M., Johnston, J., & Baumann, S. (2019). Maintaining meat: Cultural repertoires and the meat paradox in a diverse sociocultural context. *Sociological Forum*, 34(2), 337–360. <https://doi.org/10.1111/sof.12500>
- Panico, T., Del Giudice, T., & Caracciolo, F. (2014). Quality dimensions and consumer preferences: A choice experiment in the Italian extra-virgin olive oil market. *Agricultural Economics Review*, 15(2), 100–112. <https://doi.org/10.22004/ag.econ.253685>
- Parlasca, M. C., & Qaim, M. (2022). Meat consumption and sustainability. *Annual Review of Resource Economics*, 14(1), 17–41.
- Peschel, A. O., & Grebitus, C. (2023). Flexitarians' and meat eaters' heterogeneous preferences for beef: Gourmets and value seekers. *Food Quality and Preference*, 104, Article 104756. <https://doi.org/10.1016/j.foodqual.2022.104756>
- Piazza, J., Ruby, M. B., Loughnan, S., Luong, M., Kulik, J., Watkins, H. M., & Seigerman, M. (2015). Rationalizing meat consumption. The 4Ns. *Appetite*, 91, 114–128. <https://doi.org/10.1016/j.appet.2015.04.011>
- Randers, L., Grønhoj, A., & Thøgersen, J. (2021). Coping with multiple identities related to meat consumption. *Psychology & Marketing*, 38(1), 159–182. <https://doi.org/10.1002/mar.21432>
- Rizzo, G., Testa, R., Dudinskaya, E. C., Mandolesi, S., Solfanelli, F., Zanoli, R., ... Migliore, G. (2023). Understanding the consumption of plant-based meat alternatives and the role of health-related aspects. A study of the Italian market. *International Journal of Gastronomy and Food Science*, 32, Article 100690. <https://doi.org/10.1016/j.ijgfs.2023.100690>
- Roininen, K., Lähteenmäki, L., & Tuorila, H. (1999). Quantification of consumer attitudes to health and hedonic characteristics of foods. *Appetite*, 33(1), 71–88. <https://doi.org/10.1006/appe.1999.0232>
- Roosen, I., & Raedts, M. (2023). What determines omnivores' meat consumption and their willingness to reduce the amount of meat they eat? *Nutrition and Health*, 29(2), 347–355. <https://doi.org/10.1177/0260106021080255>
- Sameshima, N., & Akamatsu, R. (2023). A cluster analysis of Japanese consumer perceptions concerning information about the safety of food products. *Food Control*, 149, Article 109723. <https://doi.org/10.1016/j.foodcont.2023.109723>
- Santos, D., Monteiro, M. J., Voss, H. P., Komora, N., Teixeira, P., & Pintado, M. (2021). The most important attributes of beef sensory quality and production variables that can affect it: A review. *Livestock Science*, 250, Article 104573. <https://doi.org/10.1016/j.livsci.2021.104573>
- Sridhar, K., & Charles, A. L. (2021). Multivariate analysis of variance: An advanced chemometric approach to differentiate dose-dependent antioxidant activities of grape (*Vitis labruscana*) skin extracts. *Journal of Food Processing and Preservation*, 45(5), Article e15447. <https://doi.org/10.1111/jfpp.15447>
- Strässner, A. M., & Wirth, W. (2024). Shades and shifts in flexitarian and meat-oriented consumer profiles in a German panel study. *Appetite*, 197, Article 107298. <https://doi.org/10.1016/j.appet.2024.107298>
- Verain, M. C., Dagevos, H., & Jaspers, P. (2022). Flexitarianism in the Netherlands in the 2010 decade: Shifts, consumer segments and motives. *Food Quality and Preference*, 96, Article 104445. <https://doi.org/10.1016/j.foodqual.2021.104445>
- WHO. (2023). *Red and processed meat in the context of health and the environment: many shades of red and green: information brief*. Retrieved from <https://www.who.int/publications/i/item/9789240074828>. Accessed May 10, 2024.
- Willett, W., Rockström, J., Loken, B., Springmann, M., Lang, T., Vermeulen, S., ... Murray, C. J. (2019). Food in the anthropocene: The EAT–Lancet Commission on

- healthy diets from sustainable food systems. *The Lancet*, 393(10170), 447–492. [https://doi.org/10.1016/S0140-6736\(18\)31788-4](https://doi.org/10.1016/S0140-6736(18)31788-4)
- Wolfswinkel, S., Raghoobar, S., Dagevos, H., de Vet, E., & Poelman, M. P. (2024). How perceptions of meat consumption norms differ across contexts and meat consumer groups. *Appetite*, 195, Article 107227. <https://doi.org/10.1016/j.appet.2024.107227>
- Yue, M., Jin, S., Tindale, S., Vicario-Modroño, V., Sánchez-Zamora, P., Gallardo-Cobos, R., ... Frewer, L. J. (2024). Segmenting consumers of meat and dairy products from five European countries: Implications for promoting sustainable food choices. *Sustainable Production and Consumption*, 47, 47–58. <https://doi.org/10.1016/j.spc.2024.03.034>