Agricultural and Food Economics

RESEARCH Open Access

Consumers' preferences for processed meat: a best–worst scaling approach in three European countries

Áron Török[1*], Ching-Hua Yeh[2], Davide Menozzi[3], Péter Balogh[4,5] and Péter Czine[4]

*Correspondence:
aron.torok@uni-corvinus.hu

[1] Department of Agricultural Economics, Corvinus University of Budapest, Budapest 1093, Hungary
[2] Institute for Food and Resource Economics, University of Bonn, 53115 Bonn, Germany
[3] Department of Food and Drug, University of Parma, 43124 Parma, Italy
[4] Department of Statistics and Methodology, University of Debrecen, Debrecen 4032, Hungary
[5] ELKH-DE High-Tech Technologies for Sustainable Management Research Group, University of Debrecen, Debrecen 4032, Hungary

Abstract

Processed meat products are a staple part of the typical European diet. Product packaging can include a considerable amount of information and, with other intrinsic and extrinsic attributes, substantially influence consumers' preferences and purchasing decisions. This study investigates 14 product attributes of processed meat products using a cross-country analysis. Based on an online survey conducted in Hungary ($n=410$), Italy ($n=268$), and Serbia ($n=402$), an object-case best–worst scaling approach was applied. Results reveal both international and country-specific characteristics of preferences. Best-Worst scores reveal that taste and best-before date are among the most significant considerations in all three countries, while brand is among the attributes considered least important. Comparisons indicate significant differences according to country and socioeconomic characteristics. The study provides managerial implications.

Keywords: Processed meat, Best-worst scaling, Hungary, Italy, Serbia

Introduction

The consumption of animal-based proteins became more prominent in the twentieth century in developed countries (Bazoche et al. 2023). In many cultures, meat and meat products are an important part of the human diet (Sares-Jaske et al. 2022). Recent studies on consumers' preferences for processed meat products have identified a wide set of product attributes that might influence consumers (among others, Boncinelli et al. 2021; Hong et al. 2023; Török et al. 2022; Yeh and Hartmann 2021), indicating the complexity of attitudes toward this food product category.

As suggested by Mata et al. (2023), in Europe, there are great differences between consumers in terms of their consumption of processed meat. In our study, we analyzed patterns in consumers' attitudes toward processed meat products in a multinational context, including individuals with different European dietary backgrounds (from the Balkan, Eastern European, and Mediterranean regions).

For consumers, food quality is a multi-dimensional construct (Acebron and Dopico 2000); as such, it is hard to measure (Grunert et al. 1995). Like foods in general, processed

meats have extrinsic and intrinsic product attributes that may influence their perceived quality level, and consumers often have difficulty evaluating the latter (Grunert et al. 2004). Extrinsic product attributes are related to the product (e.g., price level or brand). However, they are not a part of it in a physical sense, while intrinsic attributes are very specific and inseparable core characteristics (e.g., taste and nutritional value) (Brecic et al. 2017; Grunert et al. 2004; Malekpour et al. 2022). In our study, we investigate the stated importance of fourteen different product attributes – both extrinsic and intrinsic – that might influence consumers' attitudes toward processed meat products. The choice of all these attributes is supported by the literature and is introduced in the theoretical background chapter.

Consequently, this study aims to investigate consumers' perceptions of and preferences for processed meat products using the object case best–worst scaling (BWS) approach in three European countries. This methodology has often been used in recent food-related consumer studies (e.g., Carins et al. 2022; Chrysochou et al. 2022; Lerro et al. 2020; Rolfe et al. 2023; Thomson and Coates 2021); however, to the best of our knowledge, BWS studies have not investigated consumers' preferences for processed meat products in a multi-European-country context. Therefore, the contribution of our study to the literature is threefold. First, investigating consumers' preferences for processed meat, one of the most important protein sources in developed countries, is of utmost importance. We have included fourteen product attributes relevant to meat consumers in our survey, providing an opportunity for a broad assessment of their relevance. Second, our investigation of processed-meat-related preferences in a multi-national context is novel, providing comparable results for the three European countries with different dietary backgrounds. Previous studies mainly involved non-European and single-country approaches. Third, we applied BWS methodology in a new empirical context, enlarging the scope of this widely accepted and applied methodological approach. Our multi-dimensional segmentation of selected European countries and their consumer groups might serve as a reasonable basis for shaping the agenda of industry and policy stakeholders. The paper is structured as follows. After the literature review and validation of the selection of the attributes involved in the research, Sect. "Methodology" describes the dataset that was constructed and the methodology that was applied for the BWS survey. Sect. "Results" provides the results for all three countries; afterward, differences among countries and specific consumer groups are highlighted. The final section discusses the results in relation to prior literature and concludes.

Theoretical background

Previous studies have discovered that information concerning the *country of origin* should be taken into account during the assessment of the purchasing process of many traditional processed meat products, given that it plays an important role (Balogh et al. 2016; Resano et al. 2007). This claim is particularly valid for Europe, where the European Union system of geographical indications (GIs) clearly distinguishes between products of a distinct quality or reputation due to their origin (Bellassen et al. 2022). Although among countries and sociodemographic groups consumers' awareness of these GIs is quite heterogeneous (Verbeke et al. 2012), their role is increasingly relevant within the European economy as they account for an estimated 7% of the total sales value of

the European food and drink sector (European Commission 2021) and processed meat products are a distinct product group of European GIs (Török and Moir 2018). Moreover, among the GI foods on the EU register, meat products are present in the second largest proportion (after cheeses) and are associated with one of the highest price premiums (Jantyik and Török 2020; Török et al. 2020).

Visual appearance (the color of the meat and the packaging, in particular) plays an important role for consumers in their selection of processed meat products since it influences perceptions of the product by defining "expectations, as they represent the first contact between an individual and a product" (de Almeida et al. 2017, p. 390). Consumers' preferences for colors of meat are often similar for specific products (e.g., cherry-red for beef); however, different packaging methods may influence consumers' acceptance (Grebitus et al. 2013).

For meat products, *brand* might be an obvious tool for differentiation and signaling superior quality (Grunert et al. 2004). Besides product differentiation, the producers' brand might be associated with a price premium, particularly for processed meat products; however, the growing share of retailers' private label brands might erode such premiums, putting additional pressure on manufacturers' brands (Ahmad and Anders 2012).

For food products, consumers often associate freshness with the *best-before date* (Samotyja and Sielicka-Różyńska 2020). Consequently, consumers' correct interpretation of this label impacts food waste and is relevant from a marketing perspective (Thompson et al. 2018). Compared to fresh meat, processed meat products have a longer shelf life (Schumann and Schmid 2018), and the food innovation of processed meat products involves significant emphasis on extending this (Hygreeva and Pandey 2016).

The *price* of processed meat products is a particularly important product characteristic, as food consumers are generally considered price-sensitive (Ackerman and Tellis 2001; Dhar and Hoch 1997). Price can therefore be considered one of the most important product attributes that is investigated in processed-meat-related studies (among others, see Ahmad and Anders 2012; Baba et al. 2016; de Araujo et al. 2022; Di Vita et al. 2019, 2022; Hung and Verbeke 2018; Hussein and Fraser 2018; Loginova and Irek 2022).

With increasing consumer awareness about nutritional content and interest in obtaining more information about the health benefits of food products, one of the challenges for the food industry is producing products with high *nutritional value* that also have desirable sensory properties and appearance (Amani et al. 2017). Nowadays, consumers are highly demanding regarding the health benefits of food and other products (Badar et al. 2021). The demand for high-quality meat products has increased, and to attract these consumers, the processed meat sector is intensely focused on developing low-fat and healthy meat products (Badar et al. 2021). Several adverse health-related features of processed meat products may be overcome through production reformulation – e.g., the reduction of unhealthy constituents, such as saturated fats, salt, and nitrites (Hung et al. 2016; Wolfer et al. 2018). The addition of natural antioxidants, strengthened with functional and health-promoting bioactive ingredients such as dietary fiber (Ranucci et al. 2018) are a current trend in the food industry and the subject of several scientific studies (Karre et al. 2013; Martínez et al. 2011). Consumer concerns about the health characteristics of processed meats have increased in recent years (Shan et al. 2017; Tobin et al. 2014). Concerning food products, it has also been reported that the use of health-positive framing elicits

more robust responses from consumers than the use of health-loss-avoiding frames (Dolgopolova et al. 2022). In connection with this, consumers and the meat industry have become more aware and knowledgeable regarding the benefits of healthier diets (Mora-Gallego et al. 2016) partly due to advances in comprehending the relationship between diet and health (López-López et al. 2010).

In addition to the attributes listed above, we included *traditional methods used in the production/processing of the product* because, in the context of a changing food consumption culture, the interest of consumers in traditional foods has increased, particularly in European countries (Di Monaco and Cavella 2015). Traditionally processed foods constitute an important element of European culture, identity, and heritage, contributing to the development and sustainability of rural areas, involving substantial product differentiation opportunities for producers, and increasing the diversity of food choices for consumers (Guerrero et al. 2009; Iaccarino et al. 2006). Traditionally processed food is defined as food (products) produced or processed in a non-industrial environment that is traditional or unique, characterized by specific production methods with a limited degree of mechanization (Kupiec and Revell 1998); these can also be referred to as specific place and producer/production-related factors (Kuznesof et al. 1997). This description implies that traditional food involves wide diversity and a strong identity (Rason et al. 2007). However, studies that have explored consumer perceptions of reformulated processed meat products have produced contradictory results: some have concluded that consumers have positive perceptions of reformulated meat products (e.g., Hung et al. 2016; Schnettler et al. 2018), whereas others have concluded the opposite (Shan et al. 2017; Żakowska-Biemans et al. 2016). Additionally, as far as traditional food is concerned, innovation associated with this food category is greater for those products that have visible and relevant benefits, such as improving nutritional values (Grunert et al. 2011).

At the same time, increasing concerns for farm-animal welfare and the citizens' rising awareness of production methods have led some companies to invest in a new concept of sustainable meat production that includes *animal-friendly production* practices. For example, in the pork supply chain, this trend has affected several aspects of pig farming, including substituting traditional methods of castrating male pigs (used to prevent boar taint in meat) with other methods such as immunocastration (Mancini et al. 2017).

The increase in the demand for foods produced using organic methods includes greater demand for organic processed meat products (Sindelar et al. 2007). In this area, being defined as organic means avoiding the use of the chemicals traditionally used for preservation (Haugaard et al. 2014; Sullivan et al. 2012). However, consumer studies often reveal that the share of meat in the diets of typical organic consumers is smaller (Kesse-Guyot et al. 2013).

We also included the attribute *GMO free,* as recent public concerns about GMO foods have resulted in the promotion of the GMO-free product characteristic (Robinson and Leonhardt 2018). Although European and US GMO regulations are contested, and even among European consumers there is no positive or negative consensus about the desirability of GMO foods (Popek and Halagarda 2017).

Because meat contains large amounts of bio-compounds, consumers have a great passion for its *taste* (Amani et al. 2017). Consumer demand for convenience and good tasting food has ensured that processed meat remains a dietary staple (Grunert 2006). Concerning the sensory attributes of processed meat, the prominent role of taste in consumers' food choices is well-established and considered the most important

sensory attribute (de Almeida et al. 2017; Shan et al. 2017). Sensory analyses of cured and processed meats have been carried out in relative depth and several approaches have been used to evaluate the quality parameters of the latter (Di Vita et al. 2017; Resurreccion 2004). Font-I-Furnols and Guerrero (2014), focusing on the sensory analysis of meat products, highlighted the importance of flavor intensity and saltiness.

One response of the food sector to the lower level of trust in food due to food-related scandals in recent decades might be the shortening of food supply chains. Relatedly, (personal) *knowledge of the producer* might increase confidence through face-to-face interactions (Renting et al. 2003). However, consumer attitudes toward artisan-type, locally produced meat products are yet to be covered in the literature. In addition, food consumers do not appear to value the various implications of farmer's ownership of food brands, so farmer-owned labels might not be an effective means of increasing trust (Grashuis and Su 2023).

The concept of *fair trade* is usually applied to commodity-like food products (like cocoa or coffee) produced by small-scale farmers. However, in the case of meat products, fair trade has been investigated in the context of game meat authenticity (Fajardo et al. 2010) and (the identification of) meat product adulteration (Jawla et al. 2021).

In addition to the country of origin, in our study, the *product's region of origin* refers to a closer relationship between the consumer and the product in terms of physical distance and cultural embeddedness. Previous research reported that meat products are one of the predominant product categories involved in local food activities (Ilbery et al. 2006), and consumers often consider meat processed by local small-scale operators safer (Telligman et al. 2017).

Methodology

An online cross-country questionnaire using the BWS method was developed to explore consumers' preferences associated with processed meat products. First and foremost, the aim was to elicit the relative importance that participants award to items/attributes when purchasing processed meat. BWS is an attribute-based method that has attracted research attention in the agricultural and health economics literature in recent decades (Erdem et al. 2012; Louviere and Flynn 2010; Merlino et al. 2018). In the present study, fourteen processed-meat-related attributes of particular relevance to consumers' processed-meat purchase decisions were defined and included based on a review of the relevant literature and intensive discussion with the academic researchers on the project team. Table 1 provides an overview of these attributes.

Regarding the experimental design of the BWS questions, 240 BWS choice scenarios were generated for this study. An orthogonal frequency balanced design was developed to maximize BWS design efficiency. To prevent respondent fatigue, the choice scenarios were divided into 40 blocks, with the respondents being required to complete six BWS choice sets displaying five attributes for each version per block.

Figure 1 shows an example of the BWS questions that were used in the online survey. Respondents were randomly assigned one of 40 versions of the questionnaire to complete and asked to select the processed meat attribute that they found the most and least important when purchasing processed meat. All BWS block variations consisted of the same content, but the questions contained different combinations of product attributes. All country-specific questionnaires were initially designed in English but translated by

Table 1 Attributes examined in the object-case BWS questions

No	Attributes
1	Product's country of origin
2	Visual appearance of the product
3	Brand
4	Best-before date
5	Price
6	Nutritional value of product
7	Traditional methods used in production/ processing of product
8	Animal-friendly production
9	Organic production
10	GMO-free
11	Taste of product
12	My [respondent's] knowledge of producer
13	Fair trade
14	Product's region of origin

3. How important are the following criteria for you when buying ***processed meat***?

From the following five criteria please indicate which one is the Most Important and which one is the Least Importantfor you?
(1 of 6)

Least important	Criteria	Most important
◯	Specific variety of the product	◯
◯	Production methods	◯
◯	Price	◯
◯	Nutritional value of the product	◯
◯	Fair trade	◯

Fig. 1 Example of a BWS question (English-language version of survey deployed in Italian)

the participating researchers into their local languages using the back-translation procedure to ensure linguistic equivalence. The content of the survey and the translations were discussed and reflected on by the researchers in the respective countries.

Data collection

An online survey was conducted in the autumn of 2017 after pretesting using a nationwide online survey administered in three countries (Hungary, Italy, and Serbia) by a third-party contractor (Lightspeed Research Ltd.) using its consumer panel database. To generate a more comprehensive overview, these countries were selected based on their heterogeneous food cultures (Central-European, Mediterranean, and Western-Balkan, respectively), with diets favoring processed meat products. A total of 1,488 individuals (HU = 505; IT = 488; RS = 495) participated in the study. We excluded from the survey those individuals who did not consume meat.

Data analysis

Our research applied a stated preference methodology using the BWS approach. This method investigates individual preferences in a hypothetical context by asking respondents to evaluate and choose the 'best' and the 'worst' options in multiple-choice situations, allowing the 'importances' of the attributes to be measured (Cohen 2003; Louviere et al. 2015).

According to the structure of the decision set and the level of complexity, three types of BWS can be distinguished: Case 1 (object case), Case 2 (profile case), and Case 3 (alternative case) (Flynn 2010). Our approach involved implementing Case 1 BWS, often called maximum difference scaling (although this name is misleading and not entirely accurate; see Marley and Louviere (2005)), which can be linked to the authors Finn and Louviere (1992). The initial step when employing Case 1 BWS is allocating attributes into decision sets, whose number should be defined according to the cognitive capacity of the respondents. Respondents are then asked to choose the attributes they consider the best and the worst of the options. This step is followed by data collection and assessing responses. The last step involves analyzing the dataset by calculating several statistical indicators (the 'counting approach') or modeling (Aizaki and Fogarty 2023). We used the so-called counting approach in our analyses, which is detailed below.

The survey dataset can be analyzed using statistical indicators both on an individual and aggregate level. First, the best–worst values for the individual (Eq. 1) and aggregate (Eq. 2) levels are calculated, where n is the individual and k is the examined attribute.

$$\mathrm{B-W}_{\mathrm{Score_{n,k}}} = B_{n,k} - W_{n,k} \tag{1}$$

$$\mathrm{B-W}_{\mathrm{Score_{k}}} = B_{k} - W_{k} \tag{2}$$

The standardized form of these values is calculated using Eqs. 3 and 4.

$$\mathrm{StandardizedB-W}_{\mathrm{Score_{n,k}}} = \frac{B - W_{Score_{n,k}}}{f} \tag{3}$$

where f denotes the frequency of attribute k that appears in the decision sets.

$$\mathrm{StandardizedB-W}_{\mathrm{Score_{k}}} = \frac{B - W_{Score_{k}}}{Nf} \tag{4}$$

where N is the number of respondents (Aizaki and Fogarty 2023; Goodman et al. 2005).

Results

In this section, our sample is first described, then the B-W scores are presented for the selected countries (Hungary, Italy, and Serbia). Following this, the B-W differences are analyzed among the selected countries. Finally, we describe our analysis of the B-W differences according to several sociodemographic aspects.

Description of the sample

After excluding incomplete questionnaires, a final sample of 1,080 meat consumers remained for analysis (see details in Table 2). In the samples, females and males participated equally, with an average age of 41–43 years. Non-rural respondents are the majority in all three samples who have completed at least upper secondary school. The main sample characteristics are reported in Table 2.

Table 2 Sample characteristics

	Hungary Sample (*n* = 410)	**Italy Sample (*n* = 268)**	**Serbia Sample (*n* = 402)**	**Total sample (*n* = 1080)**
Gender (%)				
Female	50.0	50.4	49.0	49.7
Male	50.0	49.6	51.0	50.3
Average age	43.0	41.0	41.5	41.9
Age category (%)				
< 30	18.5	23.5	21.2	20.8
30–39	22.9	23.9	24.6	23.8
40–49	22.5	23.9	23.6	23.2
49 <	36.1	28.7	30.6	32.2
Living area (%)				
Rural area (< 5000)	21.7	13.4	11.4	15.8
Urban medium town (5000–100,000)	36.6	41.1	43.3	40.2
City (> 100,000)	41.7	45.5	45.3	44.0
Highest level of education (%)				
Lower secondary/primary school education or below	3.2	8.6	0.3	3.4
Upper secondary school education	12.4	37.3	35.8	27.3
University or college entrance qualification	45.6	13.0	18.9	27.6
Bachelor's degree or equivalent level	27.6	19.8	36.3	28.9
Master, postgraduate or doctoral degree	11.2	21.3	8.7	12.8
*Household monthly net income (%)**				
Cat. 1	16.4	6.7	6.0	10.1
Cat. 2	15.6	15.7	23.9	18.7
Cat. 3	12.4	32.8	24.6	22.0
Cat. 4	26.6	21.6	20.4	23.1
Cat. 5	14.4	6.7	7.7	10.0
Cat. 6	1.7	1.9	2.0	1.8
Prefer not to answer	12.9	14.6	15.4	14.3
Householdsize	2.9	3.0	3.4	3.1

*Detailed income categories according to selected countries are presented in the appendix (Table 5)

Best–Worst scores in the selected countries

The frequency of best and worst scores for the attributes is shown in Table 3. In addition, the standardized B-W scores are presented and interpreted using a country-level breakdown in Fig. 2.

Table 3 reports the sum of the most important (column "total best"), the sum of the least important (column "total worst"), and the difference between the most and least important for each processed meat attribute (column "best–worst score") in the three countries. The most-least difference for each attribute is then ranked (column "rank").

Table 3 Best–Worst scores in the selected countries

Attribute name	Number	Total Best			Total Worst			Best-Worst score			Rank*		
		Hungary	Italy	Serbia	Hungary	Italy	Serbia	Hungary	Italy	Serbia	Hungary	Italy	Serbia
Product's country of origin	1	141	154	95	187	73	263	-46	81	-168	9	4	11
Visual appearance of product	2	157	117	93	127	84	212	30	33	-119	5	6	9
Brand	3	85	41	62	322	259	370	-237	-218	-308	13	14	14
Best-before date	4	409	171	295	38	70	45	371	101	250	2	3	3
Price	5	297	98	177	95	137	163	202	-39	14	3	11	6
Nutritional value of product	6	144	86	94	132	117	201	12	-31	-107	7	10	8
Traditional methods used in production/processing of product	7	188	137	221	148	109	107	40	28	114	4	7	5
Animal welfare-friendly production	8	115	166	53	111	55	173	4	111	-120	8	2	10
Organic production	9	69	85	198	264	104	65	-195	-19	133	12	9	4
GMO free	10	185	147	470	170	91	68	15	56	402	6	5	1
Taste of product	11	435	179	409	14	30	13	421	149	396	1	1	2
My [respondent's] knowledge of producer	12	38	66	158	530	182	191	-492	-116	-33	14	12	7
Fair trade	13	87	36	27	141	190	298	-54	-154	-271	10	13	13
Product's region of origin	14	110	125	60	181	107	243	-71	18	-183	11	8	12

*Darker background color refers to higher rank according to Best–Worst scores

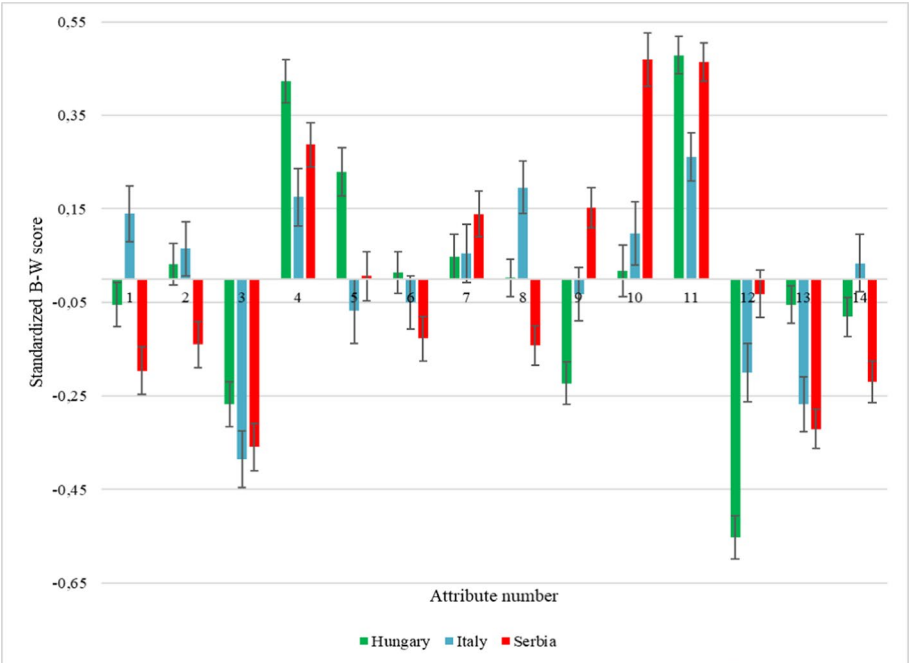

Fig. 2 Standardized B-W scores in the selected countries. *Note:* (1) Product's country of origin (2) Visual appearance of product (3) Brand (4) Best-before date (5) Price (6) Nutritional value of product (7) Traditional methods used in the production/processing of the product (8) Animal-friendly production (9) Organic production (10) GMO free (11) Taste of product (12) My [respondent's] knowledge of the producer (13) Fair trade (14) Product's region of origin

The results indicate that the taste of processed meat products is among the attributes most highly ranked in all three countries, placed first in Hungary and Italy and second in Serbia. In contrast, best-before date is ranked second in Hungary and third in Italy and Serbia. For the Hungarians, product price is also an attribute of fundamental importance (rank 3). Simultaneously, GMO-free and animal welfare-friendly production methods play an important role for consumers in Serbia and Italy, respectively. Among the attributes considered least important is the brand in all three samples, together with the respondent's knowledge of the producer (in Hungary) and fair trade (in Italy and Serbia). In contrast to the other two countries, organic production methods are considered less important in Hungary, while product region of origin is rated lowest in importance in Serbia.

Standardized B-W scores were also calculated (Fig. 2). On the x-axis, we can see the attributes according to the countries under study, while the y-axis shows the standardized B-W scores for each country and attribute. It is important to note that the standardized Best–Worst scores range between −1 and 1.

Although the results underline that the taste of the product and best-before date play a relevant role everywhere for processed meat products, country-specific differences exist; therefore, pairwise comparisons were calculated and are described in the following section.

Differences between countries

Several country-specific differences are evident in Fig. 2, showing how the importance of the selected attributes differs among the studied countries. The differences regarding the evaluation of the attributes between the three selected countries were tested and are presented in Table 4. The nonparametric Kruskal–Wallis test indicates significant national-level differences for all fourteen attributes. The product's country and region of origin are more important for Italian consumers than in Serbia and Hungary. Furthermore, the best-before date and price attributes are evaluated more highly in Hungary, while GMO-free and organic in Serbia. On the other hand, the respondent's knowledge of the producer is considered more important in Italy and Serbia than in Hungary.

Differences among consumer groups

In the last step of our analysis, we also applied the Kruskal–Wallis test to identify if sociodemographic characteristics (gender, age, residence, level of education, and income) significantly affected the evaluation of the importance of the attributes. All results are presented in the Appendix (Table 6).

Significant differences between consumer groups were also identified. Gender plays a significant role in all three selected countries, as females consider best-before date (Hungary and Serbia), animal-welfare-friendly production (Hungary and Italy), GMO-free production (Hungary), and country/region of origin (Serbia) more important than male consumers. On the other hand, for men, price (Hungary and Serbia), together with brand, taste, and fair trade (Serbia), seem to be more important. In addition, age was found to be a relevant characteristic in all three countries, as Hungarians younger than 30 consider fair trade to be important. However, older consumers evaluate animal-welfare-friendly production methods as more important, and middle-aged consumers (age 40–49) rank the product's visual appearance highly (both in Italy). Traditional methods

Table 4 Differences between selected countries

Attributes	Test statistics	Pairwise comparisons		Effect size (η^2)
		Test statistics	Pairs (mean ranks)	
Product's country of origin	68.06**	118.06**	Hungary–**Italy** (539.90–657.96)	0.06
		77.11**	**Hungary**–Serbia (539.90–462.80)	
		195.16**	**Italy**–Serbia (657.96–462.80)	
Visual appearance of product	33.79**	102.50**	**Hungary**–Serbia (575.80–473.30)	0.03
		113.99**	**Italy**–Serbia (587.29–473.30)	
Brand	9.62**	68.09*	**Hungary**–Italy (575.80–507.72)	0.01
Best-before date	40.62**	145.72**	**Hungary**–Italy (608.43–462.70)	0.04
		85.34**	**Hungary**–Serbia (608.43–523.09)	
		60.39*	Italy–**Serbia** (462.70–523.09)	
Price	57.50**	164.43**	**Hungary**–Italy (626.13–461.71)	0.05
		120.45**	**Hungary**–Serbia (626.13–505.69)	
Nutritional value of product	16.74**	83.83**	**Hungary**–Serbia (583.52–499.69)	0.01
Traditional methods used in production/processing of product	8.77*	59.61*	Hungary–**Serbia** (515.29–574.90)	0.01
Animal welfare-friendly production	89.05**	125.17**	Hungary–**Italy** (540.89–666.07)	0.08
		84.50**	**Hungary**–Serbia (540.89–456.39)	
		209.68**	**Italy**–Serbia (666.07–456.39)	
Organic production	130.12**	112.88**	Hungary–**Italy** (424.83–537.71)	0.12
		235.50**	Hungary–**Serbia** (424.83–660.33)	
		122.61**	Italy–**Serbia** (537.71–660.33)	
GMO free	132.67**	231.70**	Hungary–**Serbia** (444.25–675.95)	0.12
		191.37**	Italy–**Serbia** (484.58–675.95)	
Taste of product	46.03**	148.31**	**Hungary**–Italy (581.87–433.56)	0.04
		136.04**	Italy–**Serbia** (433.56–569.60)	
My [respondent's] knowledge of the producer	194.69**	203.02**	Hungary–**Italy** (381.76–584.78)	0.18
		291.13**	Hungary–**Serbia** (381.76–672.88)	
		88.11**	Italy–**Serbia** (584.78–672.88)	
Fair trade	79.12**	136.41**	**Hungary**–Italy (638.90–502.50)	0.07
		173.44**	**Hungary**–Serbia (638.90–465.47)	
Product's region of origin	41.28**	64.04*	Hungary–**Italy** (555.41–619.45)	0.04
		82.76**	**Hungary**–Serbia (555.41–472.66)	
		146.79**	**Italy**–Serbia (619.45–472.66)	

*Significant at a 5% level. **Significant at a 1% level. Bold indicates the country where the attribute was considered more important in the pairwise comparisons

used in the production/processing of the product are more important for older Serbian consumers.

In Hungary and Serbia, income status is also determinative. In Hungary, knowledge of the producer is more important for consumers with a mid-level income than those with a higher income, while in Serbia, the best-before date is valued more by less affluent consumers.

In Hungary, educational level significantly influences the attitude to fair trade, as this is considered important for consumers with a secondary and lower education level. Finally, place of residence was found to be relevant only in Italy: products' nutritional value was evaluated as more important for consumers living in urban settings.

Discussion

In developed countries, animal-based proteins in diets are of significant importance. However, the role of the daily consumption of meat products has come under scrutiny in recent years, mainly due to health and environmental concerns (Willett et al. 2019). Processed meat products are directly associated with unfavorable health and environmental impacts (Sares-Jaske et al. 2022). In 2015, the World Health Organization declared the excessive consumption of processed meat products "carcinogenic to humans" (WHO 2015), and from an environmental perspective, livestock production greatly contributes to greenhouse gas emissions and has other harmful effects on ecosystems (Clare et al. 2022).

Despite these recent trends, processed meat products are still an important part of the European diet (Cocking et al. 2020), and it is estimated that the demand for animal-based proteins will continue to increase globally (Willett et al. 2019). In response to health and sustainability concerns, plant-based proteins might represent a solution; however, consumer acceptance of these is still relatively low (Bazoche et al. 2023). In addition, cultured meat products are expected to become a substitute for traditional meat; however, several hurdles must be overcome before marketable products will be available (Broucke et al. 2023). Therefore, in the short term, the role of traditional processed meat products remains unquestioned.

This research explores the importance of product attributes associated with processed meat products in three European countries. The survey results of this research indicate that some general patterns are valid in all three countries. First, taste matters most for consumers everywhere in the purchase of processed meat products. Numerous pieces of earlier research reported similar conclusions. Among others, de Almeida et al. (2017) and Shan et al. (2017) for Brazilian and Irish meat consumers, respectively, while Malone and Lusk (2017), for a US sample, found that for meat product consumers, taste is of prominent importance.

Similarly to taste, best-before date also played an important role everywhere, first of all in Hungary. The role of best-before dates has recently been investigated in a food-waste-related context (e.g., Li et al. 2020; Samotyja and Sielicka-Różyńska 2020); however, as a product attribute, this might also significantly influence consumer preferences (Aday and Yener 2014; Secondi 2019). Meat and processed meat products are usually

considered perishable food (Genigeorgis 1986; Umaraw et al. 2020) with a limited shelf life; therefore, the freshness of these products is a crucial cue for consumers regarding their safety (Van Rijswijk et al. 2008). Our results also proved that the best-before date among Hungarian and Serbian consumers was significantly more important for females than males. Other studies have also found that females are much more liable than men to reject consuming expired processed meat products (e.g., Van Boxstael et al. (2014) in Belgium), and they check best-before dates more frequently, too (e.g., Achón et al. (2017) in Spain).

For processed meat products, brand might be an indicator of quality and a guarantee of authenticity and traceability (Bredahl 2004; Grunert et al. 2004), and eye-tracking experiments have proven that brand logos on packaged meat products are very attractive to consumers (Lombard et al. 2020). However, our results showed that brand was among the least important product characteristics, as noted by Rolfe et al. (2023). This also indicates that the level of brand loyalty was low in the selected three countries, as has been found for other countries (e.g., in Sweden—Lagerkvist 2013). It should be noted that for processed cured meat, geographical indications, such as Parma ham from Italy, are relevant attributes in terms of shaping product reputation; in such cases, a collective brand (e.g., the Consortium brand) is considered more important than a private/company one (Arfini and Mancini 2015).

In parallel to the general patterns, we also identified national characteristics. Generally, price is the extrinsic attribute considered most important in relation to meat products (Davidson et al. 2003) and is often considered highly important (Lagerkvist 2013). This finding is particularly valid for Hungary: results indicate that Hungarian consumers are significantly more price-sensitive than those in Italy and Serbia. This finding aligns with previous national-level results showing that price is the main attribute Hungarian consumers evaluate when purchasing food (Szakály et al. 2014). Gender also determines attitude to price, as males usually pay more attention to prices than female consumers.

For Italians, animal welfare-friendly production methods were found to be more important than for consumers in other countries; females usually cared more about this characteristic. For Italian meat consumers, similar results were previously obtained (e.g., Napolitano et al. (2007) and Merlino et al. (2018) – both for beef meat), indicating that consumers consider animal welfare issues a great deal in Italy; this attribute is considered of similar importance to price. Our results also validated that animal welfare certification is more important for female Italian consumers than males (as in Hungary) (Blanc et al. 2020). Also, origin played a more dominant role for Italians, as both a product's country and its region of origin were considered of significantly greater importance. As noted before, the strong awareness of Italian consumers of geographical indications in general (Verbeke et al. 2012), as well as the relevance of regional and local GIs for processed meat purchase decisions in Italy, has been identified by several scholars (e.g., Arfini and Mancini 2015).

For Serbians, purchasing processed meat products that are GMO free and knowing the producer were significant characteristics, reflecting the latter's solid anti-GMO attitudes (Zdjelar et al. 2013) and the dominant position of small private farms in the meat product supply chain of the country (Zaric et al. 2011).

Our contribution to the literature is threefold. First, our research validates wider claims about a range of previously investigated processed meat attributes in a multi-country European environment. Similar investigations mainly focused on non-European countries (particularly the USA), following a single-country approach. Second, we applied BWS methodology, which has not been applied to this research topic, to highlight similarities and differences in the selected countries, allowing us to draw broader conclusions. Third, our multi-dimensional segmentation of consumers in selected European countries might serve as a reasonable basis for shaping the agenda of both industry and policy stakeholders. The attributes identified and analyzed herein are relevant in marketing the traditional processed meat products broadly available in European markets. Further, greater understanding of the relevance of these attributes might help comprehend consumers' attitudes toward processed meat products derived from alternative protein sources, which are currently subject to debate in Europe.

From an economic point of view, this study also has several implications. First, the importance to consumers of taste is unquestionable; therefore, meeting consumers' taste expectations is one of the keys to success. However, tastiness is an experience quality that varies not only between consumer segments but also between types of products. This puts significant pressure on producers and processors as product development in the food industry is complex and risky, with a substantial failure rate (Grunert et al. 2004). Second, highly valued best-before dates indicate that consumers also appreciate the extended shelf-life of processed meat products. Therefore, focusing on advanced packaging might have benefits in terms of profitability and food-waste-reduction (Soro et al. 2021). Third, the minimal importance of company brands suggests that a private labeling marketing approach to processed meats may be relevant, with all the associated benefits (larger retail margins and store loyalty, particularly (Riboldazzi et al. 2021)). Finally, consumers' national and socioeconomic characteristics (in all three countries) revealed that a uniform marketing approach should not be applied to consumers; focusing on a specific set of extrinsic attributes is required for developing and promoting meat products tailored to consumers (Bernues et al. 2003).

While the research has led to several robust findings, it also has some limitations. First, the survey was conducted in three European countries; therefore, no overall conclusions about European tendencies can be made. Another limitation is related to the structure of the samples. Due to the online data collection process, the samples are biased toward more educated, urban, and upper-middle-income respondents; however, the survey aimed at collecting data about meat consumers, about which population we need more information. Finally, the hypothetical nature of the experiment is another limitation of the research, as stated preferences were investigated in our approach. Introducing cheap talk at the beginning of the said preference exercise should have minimized hypothetical bias (Penn and Hu 2018).

The best–worst scaling methodology proved useful for investigating consumers' preferences for processed meat products in a cross-country analysis of three European countries. Results clearly identified dominant product attributes in all locations (taste and best-before date, in particular) and minor important characteristics (e.g., brand). Additional econometric tests identified significant differences among countries and several socioeconomic characteristics associated with processed meat product attributes.

These limitations might also serve as a basis for further investigations. Future research might expand the spatial scope (e.g., to involve countries from the Nordic, the Baltic, or Western-European states) or include other product attributes which shape consumers' attitudes toward processed meat products (such as alternative protein sources, in particular).

Conclusions

To the best of our knowledge, this study is the first to investigate consumer preferences toward processed meat products' attributes using the best-worse scaling approach in three European countries. Our study identifies general and country-specific characteristics, and thus might be useful from a managerial and policy perspective. Our research reveals new insights into this research field and contributes to studies on consumer preferences for processed meat products (de Almeida et al. 2017; Shan et al. 2017). In general, taste and best-before date were ranked as the most important attributes in all three countries, while brand was among those considered least important. The country-level comparisons revealed that Hungarians are very price-sensitive; Italians care about the product's country and region of origin and animal welfare-friendly production methods, while Serbians value GMO-free products and knowledge of the producer. The results also identified significant differences in socioeconomic characteristics: in general, for female consumers, best-before date and animal welfare are more important attributes, while for males, price matters more.

Appendix

See Tables 5 and 6.

Table 5 Household net income categories

	Hungary	Italy	Serbia
Cat. 1	< 150,000 HUF		< 25,000 din
	< €486	< €900	*< €204*
Cat. 2	150,000–205,000 HUF		25,000–55,000 din
	€486-€664	€900-€1,500	*€204-€448*
Cat. 3	205,000–235,000 HUF		55,000–85,000 din
	€664-€761	€1,500-€2,500	*€448-€693*
Cat. 4	235,000–380,000 HUF		85,000–125,000 din
	€761-€1,231	€2,500-€3,500	*€693-€1,019*
Cat. 5	380,000–835,000 HUF		125,000–185,000 din
	€1,231-€2,705	€3,500-€4,500	*€1,019-€1,508*
Cat. 6	≥ 835,000 HUF		≥ 185,000 din
	≥ €2,705	≥ €4,500	*≥ €1,508*

National currencies of Hungary and Serbia are converted to euros at the exchange rate relevant to the time of the start of the survey

Table 6 Differences between consumer groups in Hungary, Italy and Serbia (Kruskal–Wallis tests)

Attributes	Hungary				Italy				Serbia			
	Test statistics	Pairwise comparisons		Effect size (η^2)	Test statistics	Pairwise comparisons		Effect size (η^2)	Test statistics	Pairwise comparisons		Effect size (η^2)
		Test statistics	Pairs (Mean ranks)			Test statistics	Pairs (Mean ranks)			Test statistics	Pairs (Mean ranks)	
Product's country of origin	n.s.d				n.s.d				4.32*	4.32*	**Female**–Male (213.33–190.13)	0.01
Visual appearance of product	n.s.d				11.16*	39.27**	**40–49–**50 < (152.55–113.29)	0.03	n.s.d			
Brand	n.s.d				n.s.d				4.75*	4.75*	Female–**Male** (189.03–213.48)	0.01
Best-before date	4.95*	4.95*	**Female**–Male (218.02–192.98)	0.01	n.s.d				7.00**	7.00**	**Female**–Male (216.31–187.27)	0.02
									20.47**	68.95*	**inc. 1**–inc. 3 (237.60–168.66)	0.04
										72.90*	**inc. 1**– inc. 4 (237.60–164.71)	
										112.65**	**inc. 1**– inc. 5 (237.60–124.95)	
									8.11*	42.58*	**30–39**–40–49 (218.65–176.06)	0.01

Table 6 (continued)

Attributes	Hungary				Italy				Serbia			
	Test statistics	Pairwise comparisons		Effect size (η^2)	Test statistics	Pairwise comparisons		Effect size (η^2)	Test statistics	Pairwise comparisons		Effect size (η^2)
		Test statistics	Pairs (Mean ranks)			Test statistics	Pairs (Mean ranks)			Test statistics	Pairs (Mean ranks)	
Price	16.71**	16.71**	Female–**Male** (182.46–228.54)	0.04	n.s.d				5.78*	5.78*	Female–**Male** (187.93–214.54)	0.01
									10.96*	49.88*	**<30**–30–39 (231.81–181.93)	0.02
Nutritional value of product	n.s.d				8.18*	39.54*	Rural area–**Urban** (103.54–143.08)	0.02	n.s.d			
Traditional methods used in production/processing of product	n.s.d				n.s.d				21.69**	56.24**	<30–**30–39** (153.35–209.60)	0.05
										72.10**	<30–**40–49** (153.35–225.44)	
										56.41**	<30–**50**< (153.35–209.76)	
Animal-welfare-friendly production	8.67**	8.67**	**Female**–Male (220.77–190.23)	0.02	10.24**	10.24**	**Female**–Male (148.71–120.07)	0.04	n.s.d			

Table 6 (continued)

Attributes	Hungary				Italy				Serbia			
	Test statistics	Pairwise comparisons		Effect size (η^2)	Test statistics	Pairwise comparisons		Effect size (η^2)	Test statistics	Pairwise comparisons		Effect size (η^2)
		Test statistics	Pairs (Mean ranks)			Test statistics	Pairs (Mean ranks)			Test statistics	Pairs (Mean ranks)	
					12.33**	37.80*	40–49–**50 <** (114.02–151.82)	0.04				
Organic production	n.s.d				n.s.d				n.s.d			
GMO free	6.78**	6.78**	**Female**–Male (219.99–191.01)	0.01	n.s.d				11.86**	52.19**	< 30–**40–49** (173.33–225.52)	0.02
Taste of product	n.s.d				n.s.d				4.16*	4.16*	Female–**Male** (189.94–212.60)	0.01
My [respondent's] knowledge of producer	14.64*	54.92*	inc. 3–inc. 4 (**218.87**–163.95)	0.02	n.s.d				n.s.d			
		59.65*	inc. 3–inc. 5 (**218.87**–159.22)									
Fair trade	19.00**	65.95*	**Secondary**–Postgraduate (240.46–174.51)	0.04	n.s.d				14.19**	14.19**	Female–**Male** (180.48–221.70)	0.03

Table 6 (continued)

Attributes	Hungary				Italy				Serbia			
	Test statistics	Pairwise comparisons		Effect size (η^2)	Test statistics	Pairwise comparisons		Effect size (η^2)	Test statistics	Pairwise comparisons		Effect size (η^2)
		Test statistics	Pairs (Mean ranks)			Test statistics	Pairs (Mean ranks)			Test statistics	Pairs (Mean ranks)	
		115.03**	**Lower secondary**–Postgraduate (289.54–174.51)									
		93.41*	**Lower secondary**–Bachelor's (289.54–196.13)									
		86.13*	**Lower secondary**–Below a degree (289.54–203.41)									
	8.09*	42.99*	**<30**–30–39 (226.72–183.73)	0.01								
Product's region of origin	n.s.d				n.s.d				4.94*	4.94*	**Female**–Male (213.92–189.56)	0.01

*Significant at 5% level. **Significant at 1% level. n.s.d.: no significant difference

Abbreviations

B-W	Best-worst
BWS	Best-worst scaling
EU	European Union
GI	Geographical indication
GMO	Genetically modified organisms
US	United States

Acknowledgements
Not applicable.

Author contributions
Conceptualization: AT, CHY, DM, PB. Formal analysis: AT, PC. Funding acquisition: AT, CHY, DM. Methodology: CHY, PB, PC. Writing—original draft: AT, CHY, MD, BP, PC. Writing—review & editing: AT, CHY, DM, PB, PC.

Funding
Open access funding provided by Corvinus University of Budapest. This research received funding from the European Union's Horizon 2020 research and innovation program under grant agreement no. 678024, entitled: "Strength2Food: Strengthening European Food Chain Sustainability by Quality and Procurement Policy".

Availability of data and materials
The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

Declarations

Competing interests
The authors declare no competing interests.

Received: 15 February 2023 Revised: 7 August 2023 Accepted: 21 August 2023
Published online: 31 August 2023

References

Acebron LB, Dopico DC (2000) The importance of intrinsic and extrinsic cues to expected and experienced quality: an empirical application for beef. Food Qual Prefer 11(3):229–238. https://doi.org/10.1016/S0950-3293(99)00059-2
Achón M, Serrano M, García-González Á, Alonso-Aperte E, Varela-Moreiras G (2017) Present food shopping habits in the Spanish adult population: a cross-sectional study. Nutrients 9(5):508. https://doi.org/10.3390/nu9050508
Ackerman D, Tellis G (2001) Can culture affect prices? A cross-cultural study of shopping and retail prices. J Retail 77(1):57–82. https://doi.org/10.1016/s0022-4359(00)00046-4
Aday MS, Yener U (2014) Understanding the buying behaviour of young consumers regarding packaging attributes and labels. Int J Consum Stud 38(4):385–393. https://doi.org/10.1111/ijcs.12105
Ahmad W, Anders S (2012) The value of brand and convenience attributes in highly processed food products. Can J Agric Econ 60(1):113–133. https://doi.org/10.1111/j.1744-7976.2011.01234.x
Aizaki H, Fogarty J (2023) R packages and tutorial for case 1 best–worst scaling. J Choice Modell 46:100394. https://doi.org/10.1016/j.jocm.2022.100394
Amani H, Rigi S, Shahrokhisahne B (2017) Processed meat products: health issues and attempts toward healthier food. Int J Agric Sci Vet Med 5:1–9
Arfini F, Mancini MC (2015) The effect of information and co-branding strategies on consumers willingness to pay (WTP) for protected designation of origin (PDO) products: the case of pre-sliced Parma Ham. Prog Nutr 17(1):15–22
Baba Y, Kallas Z, Costa-Font M, Gil JM, Realini CE (2016) Impact of hedonic evaluation on consumers' preferences for beef attributes including its enrichment with n-3 and CLA fatty acids. Meat Sci 111:9–17. https://doi.org/10.1016/j.meatsci.2015.08.005
Badar IH, Liu HT, Chen Q, Xia XF, Kong BH (2021) Future trends of processed meat products concerning perceived healthiness: a review. Comprehensive Rev Food Sci Food Saf 20(5):4739–4778. https://doi.org/10.1111/1541-4337.12813
Balogh P, Bekesi D, Gorton M, Popp J, Lengyel P (2016) Consumer willingness to pay for traditional food products. Food Policy 61:176–184. https://doi.org/10.1016/j.foodpol.2016.03.005
Bazoche P, Guinet N, Poret S, Teyssier S (2023) Does the provision of information increase the substitution of animal proteins with plant-based proteins? An experimental investigation into consumer choices. Food Policy 116:12. https://doi.org/10.1016/j.foodpol.2023.102426
Bellassen V, Drut M, Hilal M, Bodini A, Donati M, de Labarre MD, Filipović J, Gauvrit L, Gil JM, Hoang V, Malak-Rawlikowska A, Mattas K, Monier-Dilhan S, Muller P, Napasintuwong O, Peerlings J, Poméon T, Tomić Maksan M, Török Á, Arfini F (2022) The economic, environmental and social performance of European certified food. Ecol Econ 191:107244. https://doi.org/10.1016/j.ecolecon.2021.107244
Bernues A, Olaizola A, Corcoran K (2003) Extrinsic attributes of red meat as indicators of quality in Europe: an application for market segmentation. Food Qual Preference 14(4):265–276. https://doi.org/10.1016/s0950-3293(02)00085-x
Blanc S, Massaglia S, Borra D, Mosso A, Merlino VM (2020) Animal welfare and gender: a nexus in awareness and preference when choosing fresh beef meat? Ital J Anim Sci 19(1):410–420. https://doi.org/10.1080/1828051x.2020.1747952

Boncinelli F, Piracci G, Casini L (2021) Understanding the role of information and taste heterogeneity in consumer preferences for functional beef: The case of the omega-3 enriched burger. Meat Sci 181:11. https://doi.org/10.1016/j.meatsci.2021.108614
Brecic R, Mesic Z, Cerjak M (2017) Importance of intrinsic and extrinsic quality food characteristics by different consumer segments. British Food J 119(4):845–862. https://doi.org/10.1108/Bfj-06-2016-0284
Bredahl L (2004) Cue utilisation and quality perception with regard to branded beef. Food Qual Prefer 15(1):65–75. https://doi.org/10.1016/S0950-3293(03)00024-7
Broucke K, Van Pamel E, Van Coillie E, Herman L, Van Royen G (2023) Cultured meat and challenges ahead: a review on nutritional, technofunctional and sensorial properties, safety and legislation. Meat Sci 195:12. https://doi.org/10.1016/j.meatsci.2022.109006
Carins JE, De Diana JM, Kitunen AK (2022) Beyond a question of liking: examining military foods using the Best-Worst Scaling technique. Food Qual Preference 97:9. https://doi.org/10.1016/j.foodqual.2021.104462
Chrysochou P, Tiganis A, Trigui IT, Grunert KG (2022) A cross-cultural study on consumer preferences for olive oil. Food Qual Preference 97:8. https://doi.org/10.1016/j.foodqual.2021.104460
Clare K, Maani N, Milner J (2022) Meat, money and messaging: How the environmental and health harms of red and processed meat consumption are framed by the meat industry. Food Policy 109:12. https://doi.org/10.1016/j.foodpol.2022.102234
Cocking C, Walton J, Kehoe L, Cashman KD, Flynn A (2020) The role of meat in the European diet: current state of knowledge on dietary recommendations, intakes and contribution to energy and nutrient intakes and status. Nutr Res Rev 33(2):181–189. https://doi.org/10.1017/S0954422419000295
Cohen S (2003) Maximum difference scaling: improved measures of importance and preference for segmentation. In: Sawtooth software conference proceedings
Davidson A, Schröder MJ, Bower JA (2003) The importance of origin as a quality attribute for beef: results from a Scottish consumer survey. Int J Consum Stud 27(2):91–98
de Almeida MA, Montes Villanueva ND, Saldaña E, da Silva Pinto JS, Contreras-Castillo CJ (2017) Are sensory attributes and acceptance influenced by nutritional and health claims of low-sodium salami? Preliminary study with Brazilian consumers. Scientia Agropecuaria 8(4):389–399
de Araujo PD, Araujo WMC, Patarata L, Fraqueza MJ (2022) Understanding the main factors that influence consumer quality perception and attitude towards meat and processed meat products. Meat Sci 193:12. https://doi.org/10.1016/j.meatsci.2022.108952
Dhar SK, Hoch SJ (1997) Why store brand penetration varies by retailer. Mark Sci 16(3):208–227. https://doi.org/10.1287/mksc.16.3.208
Di Monaco R, Cavella S (2015) Differences in liking of traditional salami: the effect of local consumer familiarity and relation with the manufacturing process. Br Food J. https://doi.org/10.1108/BFJ-05-2014-0168
Di Vita G, Blanc S, Mancuso T, Massaglia S, La Via G, D'Amico M (2019) Harmful compounds and willingness to buy for reduced-additives salami. An Outlook on Italian Consumers. Int J Environ Res Public Health 16(14):9. https://doi.org/10.3390/ijerph16142605
Di Vita G, Bracco S, D'Amico M (2017) Mapping the Italian cured meats' attributes: a qualitative approach. Quality-Access to Success, 18
DiVita G, Zanchini R, Spina D, Maesano G, LaVia G, D'Amico M (2022) Exploring purchasing determinants for a low fat content salami: are consumers willing to pay for an additional premium? Front Sustainable Food Syst 6:13. https://doi.org/10.3389/fsufs.2022.794533
Dolgopolova I, Li B, Pirhonen H, Roosen J (2022) The effect of attribute framing on consumers' attitudes and intentions toward food: a meta-analysis. Bio-Based Appl Econ 10(4):253
Erdem S, Rigby D, Wossink A (2012) Using best-worst scaling to explore perceptions of relative responsibility for ensuring food safety. Food Policy 37(6):661–670. https://doi.org/10.1016/j.foodpol.2012.07.010
European Commission (2021) Study on economic value of EU quality schemes, geographical indications (GIs) and traditional specialities guaranteed (TSGs): leaflet. Publications Office. https://doi.org/10.2762/792424
Fajardo V, Gonzalez I, Rojas M, Garcia T, Martin R (2010) A review of current PCR-based methodologies for the authentication of meats from game animal species. Trends Food Sci Technol 21(8):408–421. https://doi.org/10.1016/j.tifs.2010.06.002
Finn A, Louviere JJ (1992) Determining the appropriate response to evidence of public concern - the case of food safety. J Public Policy Mark 11(2):12–25. https://doi.org/10.1177/074391569201100202
Flynn TN (2010) Valuing citizen and patient preferences in health: recent developments in three types of best-worst scaling. Exp Rev Pharmacoecon Outcomes Res 10(3):259–267. https://doi.org/10.1586/Erp.10.29
Font-I-Furnols M, Guerrero L (2014) Consumer preference, behavior and perception about meat and meat products: an overview. Meat Sci 98(3):361–371. https://doi.org/10.1016/j.meatsci.2014.06.025
Genigeorgis C (1986) Problems associated with perishable processed meats. Food Technol 40(4):140–154
Goodman S, Lockshin L, Cohen E (2005) Best-worst scaling: a simple method to determine drinks and wine style preferences
Grashuis J, Su Y (2023) Farmer-owned brand purchases: The importance of label comprehension and price fairness perception. Stud Agric Econ. https://doi.org/10.7896/j.2390
Grebitus C, Jensen HH, Roosen J (2013) US and German consumer preferences for ground beef packaged under a modified atmosphere – Different regulations, different behaviour? Food Policy 40:109–118. https://doi.org/10.1016/j.foodpol.2013.02.005
Grunert KG (2006) Future trends and consumer lifestyles with regard to meat consumption. Meat Sci 74(1):149–160. https://doi.org/10.1016/j.meatsci.2006.04.016
Grunert KG, Bredahl L, Brunso K (2004) Consumer perception of meat quality and implications for product development in the meat sector - a review. Meat Sci 66(2):259–272. https://doi.org/10.1016/S0309-1740(03)00130-X
Grunert KG, Verbeke W, Kugler JO, Saeed F, Scholderer J (2011) Use of consumer insight in the new product development process in the meat sector. Meat Sci 89(3):251–258. https://doi.org/10.1016/j.meatsci.2011.04.024

Grunert KG, Larsen HH, Madsen TK, Baadsgaard A (1995) Market orientation in food and agriculture. Springer Science & Business Media.
Guerrero L, Guardia MD, Xicola J, Verbeke W, Vanhonacker F, Zakowska-Biemans S, Sajdakowska M, Sulmont-Rosse C, Issanchou S, Contel M, Scalvedi ML, Granli BS, Hersleth M (2009) Consumer-driven definition of traditional food products and innovation in traditional foods. A Qualitative Cross-Cultural Study. Appetite 52(2):345–354. https://doi.org/10.1016/j.appet.2008.11.008
Haugaard P, Hansen F, Jensen M, Grunert KG (2014) Consumer attitudes toward new technique for preserving organic meat using herbs and berries. Meat Sci 96(1):126–135. https://doi.org/10.1016/j.meatsci.2013.06.010
Hong XY, Li CG, Wang LM, Wang MS, Grasso S, Monahan FJ (2023) Consumer preferences for processed meat reformulation strategies: a prototype for sensory evaluation combined with a choice-based conjoint experiment. Agric Basel 13(2):15. https://doi.org/10.3390/agriculture13020234
Hung Y, Verbeke W (2018) Sensory attributes shaping consumers' willingness-to-pay for newly developed processed meat products with natural compounds and a reduced level of nitrite. Food Qual Prefer 70:21–31. https://doi.org/10.1016/j.foodqual.2017.02.017
Hung Y, de Kok TM, Verbeke W (2016) Consumer attitude and purchase intention towards processed meat products with natural compounds and a reduced level of nitrite. Meat Sci 121:119–126. https://doi.org/10.1016/j.meatsci.2016.06.002
Hussein M, Fraser I (2018) Hedonic analysis of consumers' valuation of country of origin of meat in the United Kingdom. J Agric Econ 69(1):182–198. https://doi.org/10.1111/1477-9552.12232
Hygreeva D, Pandey MC (2016) Novel approaches in improving the quality and safety aspects of processed meat products through high pressure processing technology - a review. Trends Food Sci Technol 54:175–185. https://doi.org/10.1016/j.tifs.2016.06.002
Iaccarino T, Di Monaco R, Mincione A, Cavella S, Masi P (2006) Influence of information on origin and technology on the consumer response: the case of soppressata salami. Food Qual Prefer 17(1–2):76–84. https://doi.org/10.1016/j.foodqual.2005.08.005
Ilbery B, Watts D, Simpson S, Gilg A, Little J (2006) Mapping local foods: evidence from two English regions. Br Food J. https://doi.org/10.1108/00070700610651034
Jantyik L, Török Á (2020) Estimating the market share and price premium of GI foods-the case of the Hungarian food discounters. Sustainability 12(3):1094. https://doi.org/10.3390/su12031094
Jawla J, Kumar RR, Mendiratta SK, Agarwal RK, Singh P, Saxena V, Kumari S, Boby N, Kumar D, Rana P (2021) On-site paper-based loop-mediated isothermal amplification coupled lateral flow assay for pig tissue identification targeting mitochondrial CO I gene. J Food Composit Anal 102:11. https://doi.org/10.1016/j.jfca.2021.104036
Karre L, Lopez K, Getty KJK (2013) Natural antioxidants in meat and poultry products. Meat Sci 94(2):220–227. https://doi.org/10.1016/j.meatsci.2013.01.007
Kesse-Guyot E, Peneau S, Mejean C, de Edelenyi FS, Galan P, Hercberg S, Lairon D (2013) Profiles of organic food consumers in a large sample of French adults: results from the nutrinet-sante cohort study. Plos One 8(10):13. https://doi.org/10.1371/journal.pone.0076998
Kupiec B, Revell B (1998) Speciality and artisanal cheeses today: the product and the consumer. Br Food J 100(5):236–243. https://doi.org/10.1108/00070709810221454
Kuznesof S, Tregear A, Moxey A (1997) Regional foods: a consumer perspective. Br Food J 99(6):199–206
Lagerkvist CJ (2013) Consumer preferences for food labelling attributes: Comparing direct ranking and best-worst scaling for measurement of attribute importance, preference intensity and attribute dominance. Food Qual Prefer 29(2):77–88. https://doi.org/10.1016/j.foodqual.2013.02.005
Lerro M, Marotta G, Nazzaro C (2020) Measuring consumers' preferences for craft beer attributes through Best-Worst Scaling. Agric Food Econ 8(1):13. https://doi.org/10.1186/s40100-019-0138-4
Li B, Maclaren V, Soma T (2020) Urban household food waste: drivers and practices in Toronto. Can Br Food J 123(5):1793–1809. https://doi.org/10.1108/bfj-06-2020-0497
Loginova D, Irek J (2022) Russian meat price transmission and policy interventions in 2014. Agric Food Econ 10(1):28. https://doi.org/10.1186/s40100-021-00208-1
Lombard WA, Van Zyl JH, Beelders TR (2020) Eye-tracking consumers' awareness of beef brands. Agrekon 59(2):156–168. https://doi.org/10.1080/03031853.2020.1715807
López-López I, Cofrades S, Yakan A, Solas MT, Jiménez-Colmenero F (2010) Frozen storage characteristics of low-salt and low-fat beef patties as affected by Wakame addition and replacing pork backfat with olive oil-in-water emulsion. Food Res Int 43(5):1244–1254. https://doi.org/10.1016/j.foodres.2010.03.005
Louviere JJ, Flynn TN (2010) Using best-worst scaling choice experiments to measure public perceptions and preferences for healthcare reform in Australia. Patient-Patient Centered Outcomes Res 3(4):275–283. https://doi.org/10.2165/11539660-000000000-00000
Louviere JJ, Flynn TN, Marley AAJ (2015) Best-worst scaling: theory, methods and applications. Cambridge University Press
Malekpour M, Yazdani M, Rezvani H (2022) Investigating the relationship between intrinsic and extrinsic product attributes with customer satisfaction: implications for food products. Br Food J 124(13):578–598. https://doi.org/10.1108/Bfj-02-2022-0097
Malone T, Lusk JL (2017) Taste trumps health and safety: incorporating consumer perceptions into a discrete choice experiment for meat. J Agric Appl Econ 49(1):139–157. https://doi.org/10.1017/aae.2016.33
Mancini MC, Menozzi D, Arfini F (2017) Immunocastration: Economic implications for the pork supply chain and consumer perception. An assessment of existing research. Livest Sci 203:10–20. https://doi.org/10.1016/j.livsci.2017.06.012
Marley AA, Louviere JJ (2005) Some probabilistic models of best, worst, and best–worst choices. J Math Psychol 49(6):464–480

Martínez B, Miranda JM, Franco CM, Cepeda A, Vázquez M (2011) Evaluation of transglutaminase and caseinate for a novel formulation of beef patties enriched in healthier lipid and dietary fiber. LWT-Food Sci Technol 44(4):949–956. https://doi.org/10.1016/j.lwt.2010.11.026
Mata J, Kadel P, Frank R, Schüz B (2023) Education- and income-related differences in processed meat consumption across Europe: The role of food-related attitudes. Appetite 182:106417. https://doi.org/10.1016/j.appet.2022.106417
Merlino VM, Borra D, Girgenti V, Vecchio AD, Massaglia S (2018) Beef meat preferences of consumers from Northwest Italy: analysis of choice attributes. Meat Sci 143:119–128. https://doi.org/10.1016/j.meatsci.2018.04.023
Mora-Gallego H, Guardia MD, Serra X, Gou P, Arnau J (2016) Sensory characterisation and consumer acceptability of potassium chloride and sunflower oil addition in small-caliber non-acid fermented sausages with a reduced content of sodium chloride and fat. Meat Sci 112:9–15. https://doi.org/10.1016/j.meatsci.2015.10.008
Napolitano F, Caporale G, Carlucci A, Monteleone E (2007) Effect of information about animal welfare and product nutritional properties on acceptability of meat from Podolian cattle. Food Qual Prefer 18(2):305–312. https://doi.org/10.1016/j.foodqual.2006.02.002
Penn JM, Hu W (2018) Understanding hypothetical bias: an enhanced meta-analysis. Am J Agr Econ 100(4):1186–1206. https://doi.org/10.1093/ajae/aay021
Popek S, Halagarda M (2017) Genetically modified foods: consumer awareness, opinions and attitudes in selected EU countries. Int J Consum Stud 41(3):325–332. https://doi.org/10.1111/ijcs.12345
Ranucci D, Miraglia D, Branciari R, Morganti G, Roila R, Zhou K, Jiang HY, Braconi P (2018) Frankfurters made with pork meat, emmer wheat (Triticum dicoccum Schubler) and almonds nut (Prunus dulcis Mill.): evaluation during storage of a novel food from an ancient recipe. Meat Sci 145:440–446. https://doi.org/10.1016/j.meatsci.2018.07.028
Rason J, Martin JF, Dufour E, Lebecque A (2007) Diversity of the sensory characteristics of traditional dry sausages from the centre of France: Relation with regional manufacturing practice. Food Qual Prefer 18(3):517–530. https://doi.org/10.1016/j.foodqual.2006.07.002
Renting H, Marsden TK, Banks J (2003) Understanding alternative food networks: exploring the role of short food supply chains in rural development. Environ Plan A 35(3):393–411. https://doi.org/10.1068/a3510
Resano H, Sanjuan AI, Albisu LM (2007) Consumers' acceptability of cured ham in Spain and the influence of information. Food Qual Prefer 18(8):1064–1076. https://doi.org/10.1016/j.foodqual.2007.05.002
Resurreccion AVA (2004) Sensory aspects of consumer choices for meat and meat products. Meat Sci 66(1):11–20. https://doi.org/10.1016/S0309-1740(03)00021-4
Riboldazzi S, Capriello A, Martin D (2021) Private-label consumer studies: a review and future research agenda. Int J Consum Stud 45(4):844–866. https://doi.org/10.1111/ijcs.12675
Robinson C, Leonhardt JM (2018) Consumer innovativeness and loyalty to non-GMO foods: the role of cognitive and affective beliefs. J Food Prod Mark 24(1):39–55. https://doi.org/10.1080/10454446.2017.1244789
Rolfe J, Rajapaksa D, De Valck J, Star M (2023) Will greenhouse concerns impact meat consumption? Best-worst scaling analysis of Australian consumers. Food Qual Preference 104:9. https://doi.org/10.1016/j.foodqual.2022.104755
Samotyja U, Sielicka-Różyńska M (2020) How date type, freshness labelling and food category influence consumer rejection. Int J Consum Stud 45(3):441–455. https://doi.org/10.1111/ijcs.12634
Sares-Jaske L, Valsta L, Haario P, Martelin T (2022) Population group differences in subjective importance of meat in diet and red and processed meat consumption. Appetite 169:12. https://doi.org/10.1016/j.appet.2021.105836
Schnettler B, Sepulveda N, Bravo S, Grunert KG, Hueche C (2018) Consumer acceptance of a functional processed meat product made with different meat sources. Br Food J 120(2):424–440. https://doi.org/10.1108/Bfj-04-2017-0211
Schumann B, Schmid M (2018) Packaging concepts for fresh and processed meat - recent progresses. Innov Food Sci Emerg Technol 47:88–100. https://doi.org/10.1016/j.ifset.2018.02.005
Secondi L (2019) Expiry dates, consumer behavior, and food waste: how would Italian consumers react if there were no longer "best before" labels? Sustainability 11(23):15. https://doi.org/10.3390/su11236821
Shan LC, Regan A, Monahan FJ, Li CG, Lalor F, Murrin C, Wall PG, McConnon A (2017) Consumer preferences towards healthier reformulation of a range of processed meat products. A qualitative exploratory study. Br Food J 119(9):2013–2026. https://doi.org/10.1108/Bfj-11-2016-0557
Sindelar JJ, Cordray JC, Olson DG, Sebranek JG, Love JA (2007) Investigating quality attributes and consumer acceptance of uncured, no-nitrate/nitrite-added commercial hams, bacons, and frankfurters. J Food Sci 72(8):S551–S559. https://doi.org/10.1111/j.1750-3841.2007.00486.x
Soro AB, Noore S, Hannon S, Whyte P, Bolton DJ, O'Donnell C, Tiwari BK (2021) Current sustainable solutions for extending the shelf life of meat and marine products in the packaging process. Food Pack Shelf Life 29:100722. https://doi.org/10.1016/j.fpsl.2021.100722
Sullivan GA, Jackson-Davis AL, Schrader KD, Xi Y, Kulchaiyawat C, Sebranek JG, Dickson JS (2012) Survey of naturally and conventionally cured commercial frankfurters, ham, and bacon for physio-chemical characteristics that affect bacterial growth. Meat Sci 92(4):808–815. https://doi.org/10.1016/j.meatsci.2012.07.005
Szakály Z, Horvát A, Soós M, Pető K, Szente V (2014) A minőségre és származásra utaló jelölések szerepe a fogyasztói döntéshozatalban. Élelmiszer, Táplálkozás És Marketing 10(1):3–10
Telligman AL, Worosz MR, Bratcher CL (2017) A qualitative study of Southern US consumers' top of the mind beliefs about the safety of local beef. Appetite 109:1–10
Thompson B, Toma L, Barnes AP, Revoredo-Giha C (2018) The effect of date labels on willingness to consume dairy products: Implications for food waste reduction. Waste Manage 78:124–134. https://doi.org/10.1016/j.wasman.2018.05.021
Thomson DMH, Coates T (2021) Are unconscious emotions important in product assessment? How can we access them? Food Qual Preference 92:8. https://doi.org/10.1016/j.foodqual.2020.104123
Tobin BD, O'Sullivan MG, Hamill R, Kerry JP (2014) European consumer attitudes on the associated health benefits of neutraceutical-containing processed meats using Co-enzyme Q10 as a sample functional ingredient. Meat Sci 97(2):207–213. https://doi.org/10.1016/j.meatsci.2014.01.010

Török Á, Moir HVJ (2018) The market size for GI food products – evidence from the empirical economic literature. Stud Agric Econ 120(3):134–142. https://doi.org/10.7896/j.1816
Török Á, Jantyik L, Maró ZM, Moir HVJ (2020) Understanding the real-world impact of geographical indications: a critical review of the empirical economic literature. Sustainability 12(22):9434. https://doi.org/10.3390/su12229434
Török Á, Gorton M, Yeh CH, Czine P, Balogh P (2022) Understanding consumers' preferences for protected geographical indications: a choice experiment with Hungarian Sausage consumers. Foods 11(7):19. https://doi.org/10.3390/foods11070997
Umaraw P, Munekata PES, Verma AK, Barba FJ, Singh VP, Kumar P, Lorenzo JM (2020) Edible films/coating with tailored properties for active packaging of meat, fish and derived products. Trends Food Sci Technol 98:10–24. https://doi.org/10.1016/j.tifs.2020.01.032
Van Boxstael S, Devlieghere F, Berkvens D, Vermeulen A, Uyttendaele M (2014) Understanding and attitude regarding the shelf life labels and dates on pre-packed food products by Belgian consumers. Food Control 37:85–92. https://doi.org/10.1016/j.foodcont.2013.08.043
Van Rijswijk W, Frewer LJ, Menozzi D, Faioli G (2008) Consumer perceptions of traceability: a cross-national comparison of the associated benefits. Food Qual Prefer 19(5):452–464. https://doi.org/10.1016/j.foodqual.2008.02.001
Verbeke W, Pieniak Z, Guerrero L, Hersleth M (2012) Consumers' awareness and attitudinal determinants of European Union quality label use on traditional foods. Bio-Based Appl Econ 1(2):213–229
WHO (2015) Q&A on the carcinogenicity of the consumption of red meat and processed meat. In: WHO
Willett W, Rockstrom J, Loken B, Springmann M, Lang T, Vermeulen S, Garnett T, Tilman D, DeClerck F, Wood A, Jonell M, Clark M, Gordon LJ, Fanzo J, Hawkes C, Zurayk R, Rivera JA, De Vries W, Majele Sibanda L, Murray CJL (2019) Food in the anthropocene: the EAT-lancet commission on healthy diets from sustainable food systems. Lancet 393(10170):447–492. https://doi.org/10.1016/S0140-6736(18)31788-4
Wolfer TL, Acevedo NC, Prusa KJ, Sebranek JG, Tarte R (2018) Replacement of pork fat in frankfurter-type sausages by soybean oil oleogels structured with rice bran wax. Meat Sci 145:352–362. https://doi.org/10.1016/j.meatsci.2018.07.012
Yeh CH, Hartmann M (2021) To purchase or not to purchase? Drivers of consumers' preferences for animal welfare in their meat choice. Sustainability 13(16):24. https://doi.org/10.3390/su13169100
Żakowska-Biemans S, Sajdakowska M, Issanchou S (2016) Impact of innovation on consumers liking and willingness to pay for traditional sausages. Pol J Food Nutr Sci 66:119–127
Zaric V, Vasiljevic Z, Petkovic D (2011) General characteristics of vertical chain in the trade of meat and the meat products in serbia and its impact on rural economy. Ekonomika Poljoprivreda-Econ Agric 58:88–95
Zdjelar G, Nikolic Z, Vasiljevic I, Bajic B, Jovicic D, Ignjatov M, Milosevic D (2013) Detection of genetically modified soya, maize, and rice in vegetarian and healthy food products in Serbia. Czech J Food Sci 31(1):43–48

Publisher's Note