Preferences for processed tomato products' attributes: an explorative analysis of Italian consumers using a large sample

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Introduction: Price competition in the tomato market may lead Italian processing companies to adopt product differentiation strategies to attract consumers and raise revenues. Exploring consumers' preferences for processed tomato products' attributes can support companies in implementing product differentiation strategies and succeed in the market.

Methods: This study used a convenience sample of 602 Italian consumers to identify consumers' preferences for processed tomato products' attributes selected through a literature review and tested by the Best Worst Scaling (BWS) method. Also, a two-step cluster analysis was used to identify and size consumer groups with common preferences for tested product's attributes.

Results: Overall, our results showed that Italian consumers of processed tomato products strongly preferred attributes such as *Country of origin*, *Organic*, and *Social and economic sustainability labels*. In addition, the analysis shows the existence of three distinct consumer segments such as "traditional," "price-sensitive," and "sustainable" consumers. The largest one was price-sensitive consumers followed by sustainable and traditional ones.

Discussion: Our findings have practical implications for producers and policymakers. Producers may use claims about the product's origin jointly with an organic production logo and ethical label to differentiate their products and raise revenues. Likewise, policymakers should enhance monitoring and control measures to ensure with environmental, social, and economic sustainable standards compliance. This will support building consumer trust for those credence attributes. Overall, this study adds valuable insights to the existing literature on consumer preferences for processed tomato products, providing results with high external validity using a large convenience sample.

KEYWORDS

processed tomato, best-worst scaling (BWS), market segmentation, Italy, differentiation strategies

1 Introduction

Industrial tomato production is a resource-intensive (e.g., labor, water, chemicals) industry whose products, processed tomatoes, are globally traded as commodities (Ronga et al., 2017; Ronga et al., 2019). Processed tomato products encompass a wide variety of products such as whole peeled and unpeeled tomatoes, diced tomatoes, tomato paste, pulp, and puree. These products find extensive application in retail, food processing, and the food service industry (e.g., hotels, restaurants, and fast-food chains) (Samoggia et al., 2021). The global production of processed tomato products is approximately sized at 44.6 million tons (Mt) and Italy is the third-largest producer with 5.4 Mt., following the U.S. (11.4 Mt) and China (8.0 Mt), while Italy is the largest exporter country (ISMEA, 2024). In detail, Italian tomato production and processing stages are concentrated in two distinct geographical districts: the first located in the northern region of Emilia-Romagna and the second in southern regions like Apulia and Campania.[1] The northern district accounts for approximately 3.1 Mt. of annual production and processing, drawing tomatoes from 36,000 hectares cultivated by 2,000 farmers, who supply 20 different processing companies.[2] In contrast, the southern regions produce roughly 2.6 Mt. annually, utilizing 28,000 hectares and involving 24 farmer cooperatives that supply 48 processing companies.[3] Five companies dominate the Italian processed tomato market: Conserve Italia, Mutti, Calasco Società Agricola Inc., La Doria Inc., and Prices Industrie Alimentari (PIA) Co., Ltd.[4]

Worldwide companies are engaged in intense price competition to supply the market and this hinders their profitability (Lombardi et al., 2016; Čechura et al., 2021). In response to this challenge, companies may pursue a cost-reduction strategy by focusing on mergers and acquisitions to expand their production capacity and benefit from economies of scale, thus lowering their prices on the market (De Roest et al., 2018). While this strategy may attract price-sensitive consumers and increase sales volume, it may exacerbate price competition with major global players like U.S. and Chinese processed tomato producers. Also, focusing solely on price competition might neglect to consider consumer preferences for those quality attributes that the existing literature pointed out affecting consumers' preferences for processed tomato products (Latino et al., 2023).

Alternatively, firms may adopt a product differentiation strategy that helps them avoid price competition by offering on the market a product with unique features that appeal to specific consumer segments. The existing marketing literature suggests that multiple extrinsic and intrinsic quality attributes influence consumer preferences for processed tomato products such as taste, tomato variety, brand, country of origin, geographical indications, packaging material, price, and labels (Frez-Muñoz et al., 2016; Hoek et al., 2017; Tisselli et al., 2017; Oenning et al., 2018; Zhu et al., 2018; Boesen et al., 2019).

Specifically, intrinsic attributes refer to the physical characteristics of a product such as taste and tomato variety (Steenkamp, 1989; Malekpour et al., 2022; Giezenaar et al., 2024). Instead, extrinsic attributes include attributes like brand, packaging material, price, and labels that are not related to the physical characteristics of the product but are also able to affect consumer's purchasing decisions (Steenkamp, 1989; Malekpour et al., 2022; Giezenaar et al., 2024). Tomato product taste has been explored in a few studies which found shaping consumer preferences (Frez-Muñoz et al., 2016; Zhu et al., 2018). A cross-country study conducted by Frez-Muñoz et al. (2016) revealed that the taste of processed tomato products is a crucial factor in consumer's purchasing decisions: Danish consumers preferred processed tomato products with a strong taste over those with medium or low taste; Chilean consumers preferred processed tomato products with a medium sweetness level; while Italians recorded higher acceptance rate for processed tomato products with stronger fresh aromatic notes (Zhu et al., 2018). These results are further supported by the general food marketing literature, indicating taste as a fundamental component of the choice criterion (Drewnowski, 1997; Birch, 1999; O'Neill et al., 2014; Saba et al., 2019; Duong et al., 2022; Török et al., 2023). Additionally, evidence suggests that the personal experience with a product already purchased in the past and its taste shape future purchasing decisions. In detail, if a consumer has had a negative previous experience with a product, they may hesitate to buy it again (Ragaert et al., 2004; Enneking et al., 2007). Also, intrinsic attributes such as tomato variety affect consumers' choices toward processed tomato products as each tomato variety has unique sensory properties that influence consumers' expectations regarding taste as pointed out by Spinelli et al. (2019). For instance, datterini tomatoes were the most preferred variety by Italians due to their higher sweetness level (Spinelli et al., 2019).

Consumer preferences for processed tomato products are also shaped by extrinsic attributes such as brand, country of origin, packaging material, price, and labels. Frez-Muñoz et al. (2016) pointed out that the product's brand was one of the most important attributes for Italian consumers when purchasing processed tomato products. In detail, Italians preferred the farmer's brand over a well-known industrial brand likely due to the Italian tradition of buying this product by farmers in large quantities for a whole year. Indeed, according to the general marketing literature, consumers associate local branded products with higher quality and they have greater trust in them since are perceived as safer and easier to trace back compared to industrial branded products (Feldmann and Hamm, 2015). Country of origin is another extrinsic quality attribute that scholars pointed to significantly shaping consumers' preferences for processed tomato products. The cross-country study conducted by Frez-Muñoz et al. (2016) showed that consumers generally prefer processed tomato products from producing countries, such as the Mediterranean ones where field-grown practices are largely spread, contrasting to non-producing countries. Also, consumers preferred products with geographical indications, like protected designations of geographical origin (PDO), over conventional ones since the geographical indications work as an additional guarantee of the products' origin (Frez-Muñoz et al., 2016). Among extrinsic attributes, the packaging

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1 Tomato, Associazione Nazionale Industriali Conserve Alimentari Vegetali (ANICAV), https://anicav.it/i-prodotti/pomodoro/ (Accessed March 16, 2023).

2 OI Industrial Tomato Northern Italy, OI Pomodoro da Industria Nord Italia, https://oipomodoronorditalia.it/chi-siamo/, (Accessed March 16, 2023).

3 Home. OI Pomodoro da Industria Bacino Centro Sud Italia, https://oipomodorocentrosud.it/ (Accessed March 16, 2023).

4 Ognibene, S., Benchmark: the accounts of Conserve Italia, La Doria, Star, Mutti and Casalasco X-rayed, GDO news, last modified September 7, 2022, https://www.gdonews.it/2022/09/07/benchmark-i-conti-di-conserve-italia-la-doria-star-mutti-e-casalasco-ai-raggi-x/.

material was found also to play a significant role in affecting consumers' preferences for processed tomato products although these preferences vary across countries (Frez-Muñoz et al., 2016; Oenning et al., 2018; Boesen et al., 2019). Existing studies pointed out that glass packaging material was preferred by Chilean and Danish consumers as perceived as safer in preserving products, as well as environmentally friendly and reusable (Frez-Muñoz et al., 2016; Boesen et al., 2019). Contrasting findings were found by Frez-Muñoz et al. (2016) and Oenning et al. (2018) which showed that Dutch and Brazilian consumers largely preferred brick cartons and cans over glass containers since are easy to open. Regarding the price, research showed its key role in affecting consumer preferences for processed tomato products. A higher price was associated with a lower willingness to buy processed tomato products (Hoek et al., 2017). Furthermore, in a cross-country study, conducted by Tisselli et al. (2017), price was ranked the second attribute in shaping consumers' preferences among European (EU) and non-EU consumers. These findings are consistent with the general food marketing literature, indicating price as a crucial factor in consumer purchasing decisions. Generally, a high price acts as a purchasing barrier, while a low price encourages purchasing decisions, as suggested by O'Donovan and McCarthy (2002), French (2003), Drewnowski and Darmon (2005), and Drewnowski and Monsivais (2020). Also, researchers suggested a growing consumer interest in organic processed tomato products compared to conventional options. This trend is mostly driven by rising consumer concerns regarding the potential health and environmental impacts associated with the use of pesticides and fertilizers in conventional agriculture (Frez-Muñoz et al., 2016; Riganelli and Marchini, 2017; Tisselli et al., 2017). Finally, rising consumers' concerns about the living and working conditions of workers employed in tomato production, as well as the importance of guaranteeing a fair price to producers was found by Samoggia et al. (2021) who investigated a sample of Italian processed tomato consumers. These findings are consistent with the studies on fresh tomatoes conducted by Meyerding (2016) and Meyerding et al. (2019) which pointed out the importance for German consumers to guarantee that at least 10% of the final price of the product is transferred to the primary producer.

However, researchers have only tested a few selected product attributes jointly to determine consumers' preferences. In detail, they did not provide a comprehensive evaluation of the product features that can influence consumers' choices for processed tomato products, accounting for all the attributes identified in the literature. Furthermore, findings were collected mainly using small and non-representative samples collected across different geographical areas. Therefore, results can be referred only to the sample in which the study was performed and results show large variations which depend on the attributes included in the research design. Also, existing research did not identify, size, and profile the segment of consumers within the processed tomato products market who prioritize extrinsic and intrinsic quality attributes beyond price in their purchasing decisions. Thus, the current study extends the literature on processed tomato products by filling these gaps and informing producers about how to differentiate their products according to consumers' preferences.

To reach this goal, the current research simultaneously accounts for the multiple extrinsic (i.e., brand, country of origin, geographical indications, organic label, price, social and economic sustainability labels, and sustainable packaging) and intrinsic (i.e., previous

experience and tomato variety) that the literature pointed out affecting consumers' preferences for processed tomato products (reported in Table 1 of section Material and Methods) and that may jointly influence consumer purchase decisions. Also, the work identifies and characterizes homogeneous consumer segments based on their preferences for the product attributes tested and using a large convenience sample of Italian processed tomato products consumers.

TABLE 1 Socio-demographic characteristics of respondents (n = 602).

Categorical variables	Sample	
	N.	%
Gender		
Females	303	50.3
Males	299	49.7
Education		
No one education's level	1	0.2
Primary school	2	0.3
Middle school	73	12.1
High school	348	57.8
Bachelor's degree	63	10.5
Master's degree and/or Postgraduate (e.g., PhD, master)	115	19.1
Occupation		
Not employed/housewife	103	17.1
Retired	121	20.1
Student	40	6.6
Part-time employed	90	15.0
Full-time employed	248	41.2
Children in the household (< 12years old)		
Yes	138	22.9
No	464	77.1
Family monthly income		
Under €1,500	143	23,8
€1,501–2,000	167	27.7
€2,001–2,500	115	19.1
€2,501–3,000	87	14.5
Over €3,001	90	15.0
Area of residency		
South and Islands	219	36.4
Centre	110	18.3
North-East	117	19.4
North-West	156	25.9
Inhabitants of the municipality		
Under 20,000 inhabitants	255	42.4
20,000–100,000 inhabitants	199	33.1
Over 100,000 inhabitants	148	24.6

Continuous variables	Mean	SD
Age	47.9	15.9

To rank consumer preferences for various extrinsic and intrinsic quality attributes of processed tomato products, the study employed the Best-Worst Scaling (BWS) method and a two-step cluster analysis to identify and characterize distinct groups of consumers ("segments") based on their shared preferences for the product attributes. Both the BWS and cluster analysis were applied to a convenience sample of 602 Italian consumers who frequently purchase processed tomato products. Italy was specifically chosen as the case study due to its worldwide leadership in processing tomato production, allowing Italian companies to compete in the global market. The Italian market of processed tomato products was selected as Italy is the leading European producer and the largest exporter of processed tomato products (ISMEA, 2024).

2 Materials and methods

2.1 Data collection and description

Data were collected through a web-based survey conducted in 2022 by a professional marketing agency to a convenience sample of the Italian population ($n=602$), stratified by age, gender, and area of residence. The sample was selected through quota sampling, a non-probabilistic technique. Data was managed according to the "Italian Personal Data Protection Code" (Legislative Decree no. 196 of 30 June 2003). Thus, all the subjects who decided to participate in the study gave informed consent, and all the data was collected anonymously. The survey collected information about Italian processed tomato products consumers, aged 18 years old and over, whose socio-demographics and economic characteristics are reported in Table 1.

2.2 Best-worst scaling method

The B-W analysis, developed by Louviere and Woodworth (1990), was performed to identify consumer preferences for processed tomato products' attributes. This methodology was widely used in the food marketing literature to analyze consumer preferences for food products' features (Finn and Louviere, 1992; Lagerkvist, 2013; de-Magistris et al., 2017). It consists of iteratively asking participants to choose the most preferred ("best") and the least preferred ("worst") product features, or items, of a choice set (Louviere et al., 2015). The BWS method, forcing respondents to make trade-offs between items, was found to have greater discrimination rather than rating scales, overcoming the issue of having many attributes with the same importance weights (Jaeger et al., 2008). The current BWS experiment aimed at identifying the consumer preferences for 9 tomato-processed attributes selected from the literature, as shown in Table 2. It had a balanced incomplete block design (12,4,3,1) which means that the 9 items were divided into 12 choice sets, with 3 items each, and every attribute appears 4 times in the choice sets. Finally, the term balanced means that every item appears the same number of times.

The ranking for processed tomato products' attributes was calculated for each respondent, as well as for the entire sample, by assessing +1 every time one item was considered the best and −1 every time it was considered the worst. Furthermore, for each attribute the overall score (B-W score) was calculated by subtracting the number of times the attribute was indicated most important (BEST) by the number of times it was indicated least important (WORST) in determining the purchasing choices of processed tomato products. Finally, for each attribute tested, the average score (B-W average score) was calculated by dividing the B-W score by the sample size.

TABLE 2 The nine processed tomato products' quality attributes used in the survey.

Quality attributes	Description	References
Intrinsic attributes		
Previous experience	Personal experience with a product already purchased in the past determines the development of expectations around its sensory characteristics (e.g., taste)	Frez-Muñoz et al. (2016) and Zhu et al. (2018)
Tomato variety	The variety or varieties of tomatoes indicated on the label (e.g., datterino tomatoes, San Marzano, etc.).	Spinelli et al. (2019)
Extrinsic attributes		
Brand	The producer's name or other identifying logos on the label (e.g., Granoro, Mutti, Coop, Rosso Gargano, etc.).	Frez-Muñoz et al. (2016)
Country of origin	The country or countries where tomatoes were harvested and processed.	Frez-Muñoz et al. (2016)
Geographical indications	Certification and mark guaranteeing that at least one (protected geographical indication, PGI) or all stages (protected designation of origin, PDO) of processed tomato products are placed in a well-defined area (e.g., San Marzano tomato from Agro Sarnese-Nocerino PDO, Pachino tomato PGI).	Frez-Muñoz et al. (2016)
Organic label	Certification with associated logo certifying that all stages of the production process have been carried out using environmentally friendly practices that do not make use of synthetic chemicals.	Frez-Muñoz et al. (2016) and Tisselli et al. (2017)
Price	The unit price (€) paid for the tomato-processed product purchase.	Hoek et al. (2017) and Tisselli et al. (2017)
Social and economic sustainability labels	Labels with associated logos (e.g., SA800, NO CAP) certifying respect for social rights, to improve the living and working conditions of farmers as well as guarantee a price capable of equally repaying all the resources used, including work.	Samoggia et al. (2021)
Sustainable packaging	Use of sustainable packaging materials such as reusable glass containers.	Frez-Muñoz et al. (2016), Oenning et al. (2018), and Boesen et al. (2019)

2.3 Cluster analysis

Cluster analysis is commonly used in marketing research to segment market groups (Kitunen et al., 2022; Ravn, 2023). This methodology allows for dividing observations (in our case the respondents of the survey) into homogeneous groups identified by common characteristics. Therefore, the cluster analysis is aimed at classifying an initial set of n observations in k groups (Halpin, 2016). Then, the two-step cluster analysis was conducted to identify homogeneous groups of consumers. This methodology was considered appropriate for this study because it has been previously used to identify segments from individual B-W scores (Kitunen et al., 2022). Moreover, two-step cluster analysis can handle large sample sizes and the number of cluster solutions is not predetermined by the researcher. Finally, it allows the use of categorical and continuous variables (Kitunen et al., 2022). Hence, cluster solutions were generated using individual B-W scores and socio-demographic variables. The number of clusters was determined by using Bayesian Information Criterion (BIC) and log-likelihood (LL), as a distance measure. The segments were profiled with cross-tabulations and Chi-square tests were conducted on categorical variables to investigate differences between the segments. Furthermore, one-way ANOVA tests were conducted on continuous variables to analyze whether clusters significantly differed in the importance of each attribute, using the individual B-W score as a proxy for attribute-related importance. Subsequently, the paired statistically significant difference among the cluster means was investigated with post-hoc Tukey tests ($p < 0.05$). All analyses were conducted using IBM SPSS Statistics version 28 (IBM Corp, Armonk, N. Y., United States).

3 Results

Results from the average B-W score analysis, reported in Table 3, showed that among the nine attributes tested, *Country of origin*, *Organic label*, and *Social and economic sustainability label* were the most selected attributes from consumers, suggesting the importance of these features in affecting consumer's purchase decisions for processed tomato products.

Specifically, findings indicated that the indication of the *Country of origin* was the most important attribute driving processed tomato products' purchases among consumers, with the highest average B-W score of 1.42. The *Organic label* was the second most important attribute in choosing processed tomato products, with an average B-W score of 0.90. The attribute *Social and economic sustainability label* was ranked third among those tested, with an average B-W score of 0.86. Furthermore, results from the average B-W score analysis showed that the attributes of *Sustainable packaging*, *Geographical indications*, and *Price* were of secondary importance compared to the *Country of origin*, *Organic label*, and *Social and economic sustainability labels*. These attributes recorded an average value of Average B-W score equal to −0.06, −0.07, and −0.18, respectively. Finally, *Previous experience*, *Tomato variety*, and *Brand* were the three least important attributes among the nine tested. For these attributes, the average B-W score was equal to −0.70, −1.08, and −1.08, respectively.

Consumer heterogeneity was explored through the two-step cluster analysis aiming to identify homogeneous groups of consumers with common preferences for processed tomato products' attributes.

TABLE 3 Sample-level best, worst, best-worst (B-W score), and average B-W score.

Attributes	Best	Worst	B-W score	Average B-W score
Country of origin	1,276	421	855	1.42
Organic label	1,154	615	539	0.90
Social and economic sustainability labels	1,084	569	515	0.86
Sustainable packaging	802	841	−39	−0.06
Geographical indications	740	782	−42	−0.07
Price	769	875	−106	−0.18
Previous experience	574	996	−422	−0.70
Tomato variety	367	1,015	−648	−1.08
Brand	458	1,110	−652	−1.08

The individual B-W scores of the total sample and socio-demographic variables were used to identify segments, which is consistent with other segmentation studies (Kitunen et al., 2022). A three-segment solution was obtained by two-step cluster analysis, consisting of 35.4, 42.9, and 21.8% of the respondents in the sample, respectively. The goodness-of-fit of the model was measured by the silhouette measure of cohesion and separation which was equal to 0.2, suggesting a fair outcome (Kitunen et al., 2022). The predictor importance levels of each segmentation variable were higher than 0.0, meaning that every single variable contributed to some variation within the clusters (Kitunen et al., 2022). In detail, results showed that the *Social and economic sustainability label* was the most important variable in cluster formation with a predictor importance score equal to 1.0, followed by *Previous experience* (0.81), *Organic label* (0.78), and occupation (0.72). Instead, inhabitants of the municipality (0.01), *Geographical indications* (0.03), and gender (0.04) were the least important variables. Between-cluster differences were examined using the Pearson Chi-square test and one-way analysis of variance (ANOVA) with the Tukey post-hoc test. Significant differences between the three segments were confirmed for all the variables used to identify the clusters. Table 4 shows the cluster analysis results that were used to determine the segments of individuals with common preferences for processed tomato products' attributes.

A three-cluster solution grouped consumers to maximize homogeneity within clusters, while at the same time maximizing heterogeneity between clusters. This was based on their individual B-W scores and their socio-demographic characteristics.

Cluster 1, called *traditional consumers*, was the smallest group identified in the study including 21.8% of the sample. *Traditional consumers* valued the *Country of origin* of processed tomato products more than did the other groups (2.1), while they also valued other product features such as *Organic label* (1.6), and *Social and economic sustainability label* (1.6). *Traditional consumers* were less interested in tomato variety (−1.8), previous experience (−1.8), and brand (−1.7). *Traditional consumers* were mainly men (51.9%), with an average age of 63 years old. *Traditional consumers* mostly had a household size of two components (42.7%); most of them had a high school education level (56.5%), were retired (58.8%), with a family monthly income below €1,500 (41.2%). Finally, *traditional consumers* were mainly located in municipalities with less than 20,000 inhabitants (41.2%).

TABLE 4 Cluster analysis results.

Segmentation variables	Traditional consumers 21.8% *n* = 131	Price-sensitive consumers 42.9% *n* = 258	Sustainable consumers 35.4% *n* = 213		
B-W scores	M (SD)	M(SD)	M(SD)	F	*p*-value
Brand*	−1.7 (1.8)[a]	0.0 (2.0)[b]	−2.0 (1.4)[a]	87,096	0.000
Country of origin*	2.1 (1.8)[c]	1.0 (2.3)[a]	1.4 (2.0)[a]	11,828	0.000
Geographical indications**	0.0 (1.5)[ac]	−0.3 (1.8)[bc]	0.1 (1.5)[a]	4,465	0.012
Organic label*	1.6 (2.0)[c]	−0.6 (2.0)[b]	2.3 (1.7)[a]	149,370	0.000
Previous experience*	−1.8 (2.0)[a]	0.8 (2.1)[b]	−1.9 (1.5)[a]	157,397	0.000
Price*	−0.4 (2.6)[c]	1.3 (2.3)[b]	−1.8 (2.0)[a]	107,466	0.000
Social and economic sustainability labels*	1.6 (1.6)[c]	−0.7 (1.8)[b]	2.3 (1.3)[a]	203,895	0.000
Sustainable packaging*	0.4 (2.0)[c]	−1.2 (2.0)[b]	1.1 (1.8)[a]	87,179	0.000
Tomato variety*	−1.8 (1.4)[a]	−0.3 (1.9)[b]	−1.5 (1.4)[a]	50,613	0.000
Socio-demographic variables					
Age (numeric)*	63 (11)[c]	46 (15)[b]	41 (13)[a]	108.012	0.000
	Frequency %	Frequency %	Frequency %	F	*p*-Value
Gender**				13.326	0.001
Male	51,9%	56,6%	39.9%		
Female	48,1%	43,4%	60.1%		
Household size*				67.518	0.000
1	22.1%	12.0%	7.0%		
2	42.7%	27.5%	19.2%		
3	23.7%	29.1%	30.5%		
4	11.5%	24.0%	31.9%		
5	0.0%	6.6%	8.0%		
>5	0.0%	0.8%	3.4%		
Education*				38.012	0.000
No one education's level	0.8%	0,0%	0.0%		
Primary school	0.8%	0.0%	0.5%		
Middle school	20.6%	14.0%	4.7%		
High school	56.5%	58.5%	57.7%		
Bachelor's degree	2.3%	11.6%	14.1%		

(Continued)

TABLE 4 (Continued)

Segmentation variables	Traditional consumers 21.8% *n* = 131	Price-sensitive consumers 42.9% *n* = 258	Sustainable consumers 35.4% *n* = 213		
B-W scores	M (SD)	M(SD)	M(SD)	F	*p*-value
Master's degree and/or Postgraduate (e.g., PhD, master)	19.1%	15.9%	23.0%		
Education					
Occupation*				273.000	0.000
Not employed	16.8%	6.6%	4.7%		
Housewife	19.1%	9.3%	2.3%		
Retired	58.8%	14.3%	3.3%		
Student	0.0%	5.8%	11.7%		
Part-time employed	4.6%	16.7%	19.2%		
Full-time employed	0.8%	47.3%	58.7%		
Inhabitants of the municipality**				13.118	0.011
Under 20,000 inhabitants	41.2%	48.8%	35.2%		
20,000–100,000 inhabitants	30.5%	27.5%	41.3%		
Over 100,000 inhabitants	28.2%	23.6%	23.5%		
Family monthly income*				41.978	0.000
Under €1,500	41.2%	22.1%	15.0%		
€1,501–2,000	26.0%	28.7%	27.7%		
€2,001–2,500	17.6%	19.0%	20.2%		
€2,501–3,000	4.6%	14.0%	21.1%		
Over €3,001	10.7%	16.3%	16.0%		

*$p < 0.001$; **$p < 0.05$; ᵃ⁻ᶜ segments with the same superscript letter are not significantly different. Pearson Chi-square and ANOVA, with Tukey *post-hoc* test, were used.

Cluster 2, called *price-sensitive consumers*, represented the largest group and included 42.9% of the sample. Specifically, *Price* as the motive of tomato-processed products' choices was ranked highly (1.3). Moreover, the *price-sensitive consumers*' group valued the *Price* more than the other groups, suggesting the importance of this attribute in affecting processed tomato products' purchasing decisions. Instead, *price-sensitive consumers* were less interested in those segmentation variables related to sustainability like *Sustainable packaging* (−1.2), and *Social and economic sustainability label* (−0.7). *Price-sensitive consumers* were mainly men (56.6%), with an average age of 46 years old. Most of the *price-sensitive consumers* had a household size of three components (29.1%); most of them had a high school education's level (57.5%), were full-time employed (47.3%), with a family monthly income between €1,501 and 2,000 (28.7%). Finally, *price-sensitive consumers* were mainly located in municipalities with less than 20,000 inhabitants (48.8%).

Cluster 3, named *sustainable consumers*, consisted of 35.4% of the respondents in the total sample. *Sustainable consumers* recorded the highest score for *Organic label* (2.3), *Social and economic sustainability label* (2.3), and *Sustainable packaging* (1.1), while they were less interested in the *Brand* (−2.0), *Previous experience* (−1.92), and *Price* (−1.76). *Sustainable consumers* were mainly women (60.1%), with an average age of 41 years old. Most of the sustainable consumers had a household size of four components (31.9%) and most of them had a high school education level (57.7%). However, sustainable consumers had, more than other groups, the highest level of education (23.0%), such as a master's degree and/or postgraduate (Ph.D., master's) education. Furthermore, *sustainable consumers* were full-time employed (58.7%), and with a family monthly income between €1,501 and 2,000 (27.7%). However, *sustainable consumers* showed, more than those in the other groups, to have the highest family monthly income, such as between €2,001 and 3,000 (41.3%). Finally, *sustainable consumers* were mainly located in municipalities with the number of inhabitants between 20,000 and 100,000 (41.3%).

4 Discussion

The current study investigated consumers' preferences for processed tomato products' attributes through the BWS method. Findings pointed out that Italian consumers largely preferred product attributes such as *Country of origin*, *Organic label,* and *Social and economic sustainability label* associated with processed tomato products. The *Country of origin* received the highest value of BWS (1.42) and this result was consistent with that obtained by Frez-Muñoz et al. (2016) who analyzed preferences for processed tomato products through a small sample of Italian consumers ($n=80$). The Italian preference for domestic products over foreign ones was also consistent with extensive literature from agri-food markets such as that of milk (Mauracher et al., 2013), extra-virgin olive oil (De Gennaro et al., 2021), fish (Bimbo et al., 2022), and fresh fruit and vegetables (Migliore et al., 2015; Török et al., 2023). National food products were preferred by consumers over foreign ones as they perceived having an overall enhanced quality as well as they believed that buying national foods would help their economy and support local farmers (Chambers et al., 2007; Mauracher et al., 2013). Further consumers' motivation in preferring domestic processed tomato products may be related to the

consumers' opposition to long-distance food systems due to their negative environmental impacts (Costanigro et al., 2015).

The second most important attribute associated with processed tomato products was the *Organic label* which received a value of BWS equal to 0.90. This result was in line with the study carried out by Frez-Muñoz et al. (2016) showing that organic processed tomato products were preferred over conventional ones by Italians. Also, this finding was consistent with the existing evidence suggesting that consumers overall preferred organic agri-food products over conventional ones. The relative importance of organic features over others can be due to some complementary or simultaneous motivations. First, organic products were largely preferred by consumers due to the increasing concerns about the negative impacts of conventional agricultural practices on the environment (Tobler et al., 2011; Meyerding, 2016). Additionally, consumers mostly preferred organic products as perceived as having an overall higher quality, "original" taste, and lower impact on human health thanks to the lower use of synthetic chemicals for their production (Zanoli and Naspetti, 2002; Ness et al., 2010; Boncinelli et al., 2017; Hoek et al., 2017).

The third and last product's attribute able to drive consumers' preferences for processed tomato products was *Social and economic sustainability label* that received a value of BWS equal to 0.86. Despite the lack of evidence from the literature about the product tested, research on fresh tomatoes highlighted a growing consumer interest in ethical aspects related to its primary production. For instance, Meyerding (2016) investigating German consumers pointed out that the Fairtrade logo was one of the highest relevant attributes in driving consumer interest in fresh tomatoes to guarantee fair revenue for farmers and avoid labor exploitation. Also, the Italians' interest in ethical accreditations likely reflects the growing concerns about labor exploitation in the Italian tomato production sector. The latter has been widely documented in Southern Italian production areas by mass media[5] and academics over the past 10 years raising Italians' awareness about this issue (Howard and Forin, 2019; Melossi, 2021).

Overall results confirmed the growing consumers' interest in sustainable-related attributes of processed tomato products: Italians mostly preferred processing tomatoes produced according to organic standards, without labor exploitation, and able to guarantee fair revenues for local producers. However, Italians placed marginal interest in sustainable product features associated with the packaging. This result may be justified by the fact that most processed tomato products are usually sold in glass containers which consumers usually consider as already environmentally-friendly packaging solutions as reusable (Tobler et al., 2011).

Findings from the BWS method allowed us to rank the nine attributes related to processed tomato products available in the market and that the existing literature reported affecting consumers' choices.

Then, the following two-step cluster analysis allowed us to detect three segments of consumers (i.e., traditional, price-sensitive, and sustainable) having common preferences for processed tomato products' attributes and provides a more granular picture of the Italian market for the product tested.

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5   The terrible truth about your tin of Italian tomatoes, The Guardian, https://www.theguardian.com/global-development/2017/oct/24/the-terrible-truth-about-your-tin-of-italian-tomatoes [Accessed on 5 June, 2024].

The group of *traditional consumers*, encompassing approximately 21.8% of the sample, assigned the highest score to *Country of origin* (2.1) than that assigned by other groups. The existence of *traditional consumers* in the processed tomato products market is in line with previous studies from the general marketing literature which identified the traditional consumer as an aged male showing a strong interest in the origin of the raw material (Grunert and Aachmann, 2016; De Gennaro et al., 2021). Also, in the current study *traditional consumers* placed interest in whether the product was organically produced, without labor exploitation, and packaged in sustainable material. However, *traditional consumers*' interest in sustainable-related attributes was lower than that assigned by consumers in the *sustainable consumers* group. Therefore, this group of consumers preferred local tomato products produced according to traditional methods of cultivation such as the organic one which lowered the use of pesticides and fertilizers preserving the health of the agroecosystem. Also, *traditional consumers* cared about economic fairness across the food supply chain actors: in detail, farmers receive a fair revenue for their work preserving them from labor exploitation. Surprisingly, *traditional consumers* were marginally interested in geographical indications associated with processed tomato products. This result was likely since geographical indications in the Italian market of processed tomato products are only few and are related to specific tomato varieties (e.g., Piennolo tomato from Vesuvio PDO, San Marzano tomato from Agro Sarnese-Nocerino PDO, Pachino tomato PGI)[6] instead, hundreds of geographical indications are available in other food markets such as in the extra virgin olive oil and wine markets (Belletti et al., 2017). Thus, consumers may have litter awareness and thus limited knowledge related to the availability of geographical indications in the processed tomato products market justifying the lower consumer's interest for this related attribute.

The *price-sensitive consumers* group was the largest one detected from the two-step cluster analysis, encompassing 42.9% of the total sample and grouping middle-aged males with a medium level of education and income. Price-sensitive consumers group was previously detected in other agrifood markets such as the fresh tomato (Jürkenbeck et al., 2020) and the extra-virgin olive oil (De Gennaro et al., 2021) although the size of the price-sensitive consumers' group in the processed tomato products' market is greater than that detected in other food markets. *Price-sensitive consumers* selected the product by a mix of attributes such as previous experience, taste, and price while their products' choices were not affected by sustainable-related attributes, confirming findings from existing studies. Additionally, *price-sensitive consumers* valued the product's brand in their decision process. The brand can be an additional guarantee of a specific price range and organoleptic characteristics (Sahin et al., 2011) of processed tomato products which are considered important attributes by *price-sensitive consumers*. Furthermore, the high frequency of consumption of tomato-processed products by Italians has increased their routine shopping habits leading *price-sensitive consumers* to choose the usual product, of a known brand, with a specific taste and a good value for money.

Finally, the *sustainable consumers*' group was found to be 35.4% of the total sample corresponding to the second most important segment in terms of dimension after the *price-sensitive* one. The existing marketing literature on processed tomato products failed to detect the existence of *sustainable consumers* which in the current study were profiled as middle-aged females, with a high level of education and income. These findings were consistent with previous studies on other agri-food products such as fresh tomatoes (Jürkenbeck et al., 2020), extra-virgin olive oil (De Gennaro et al., 2021), and fish (Bimbo et al., 2022) which identified highly educated and wealthy females as those consumers strongly interested in sustainable-related features of food products. In detail, *sustainable consumers* found in the processed tomato products market were interested that products were organically produced, avoiding labor exploitation at the farm level, and later packaged in sustainable materials. Also, the country of origin of processed tomato products was found to be important for *sustainable consumers* although in a secondary way than that of *traditional consumers*. This result may be likely since the consumption of national foods is generally perceived by *sustainable consumers* as environmentally friendly thanks to the reduction of transportation distances that allows for mitigating greenhouse gas emissions, contributing to improving the carbon footprint (Reich et al., 2018).

These findings have practical implications for tomato-processing companies and policymakers. On one hand, Italian companies willing to differentiate their products, alongside the legal obligation to indicate on the label the place of cultivation and processing of tomatoes,[7] may want to further highlight the origin of tomatoes in their products, through the use of claims (e.g., 100% Italian), as consumers prioritize place of origin information on labels and prefer domestic processed tomato products over foreign ones. Also, tomato-processing companies can differentiate their products by investing in sustainable attributes that guarantee consumers the respect of the environment and workers' rights in producing tomatoes. The current study documented for the first time the consumers' growing interest in the ethical aspects of processed tomato products' production, such as the safety, health, and welfare of workers. This trend presents an opportunity for tomato-processing companies to differentiate their products and raise their revenue. Finally, to avoid consumer information overload due to the coexistence of several labels on the pack, tomato-processing companies may further communicate sustainable-related attributes to consumers through digital innovations, like smart labels (e.g., QR codes), by complementing that information already available on the label.

On the other hand, policymakers aiming to promote sustainable food consumption patterns and support the global transition to a fair, healthy, and environmentally friendly food system as advocated by the Farm to Fork Strategy, should educate consumers about the various sustainability labels available on the processed tomato market. By increasing consumers' knowledge of these labels and promoting informed choices, public informational campaigns can encourage their adoption and contribute to a more sustainable future. Also, since sustainable-related attributes like organic and NO CAP labels are defined as credence attributes considering that consumers can not verify the truthfulness even after consumption (Janssen and Hamm, 2012), policymakers should strengthen monitoring and control measures. This

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6   Control and tariff plans for PDO and PGI products. Ministry of Agriculture, Food Sovereignty and Forestry, accessed August 4, 2024, https://www.politicheagricole.it/flex/cm/pages/ServeBLOB.php/L/IT/IDPagina/7722.

7   DECREE 16 November 2017. Indication of the origin on the label of the tomato. (18A01366) (OJ General Series n.47 of 26-02-2018), https://www.gazzettaufficiale.it/eli/id/2018/02/26/18A01366/sg.

will help to increase consumers' trust in the multiple sustainability attributes available. Thirdly, to prevent consumer confusion resulting from several independent ethical certifications such as Global GAP with GRASP assessment, SA8000,[8] and NO CAP certification,[9] policymakers should promote standardized ethical accreditation.

Finally, the current study also comes with some limitations and future research directions. First, although our convenience sample reflects the characteristics of the whole Italian population, the sampling method is not probabilistic. Therefore, future research may focus on a representative sample using probabilistic method. Second, as our analysis is only limited to one country, our findings might not be generalizable to other geographical areas. However, considering that in 2023, the Italian processed tomato products industry had the best trade balance between imports and exports, with 4.1 million tons of exports valued at 2.8 billion Euros (ISMEA, 2024), it would be beneficial to further investigate consumer preferences for processed tomato products' attributes in different markets to support companies in developing their export strategies. Then, future research may focus on different geographical areas. Third, other sustainable-related attributes of processed tomato products like carbon and water footprint were not considered among those able to affect consumers' preferences. Therefore, future research may focus on other sustainable-related attributes to further study the multidimensional nature of sustainability.

Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

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8 Branthôme F.-X., Princes: QR codes as proactive approach to illegal labour, TOMATO NEWS SAS, last modified October 10, 2020, https://www.tomatonews.com/en/princes-qr-codes-as-proactive-approach-to-illegal-labour_2_1161.html.

9 The Stamp No Cap, No Cap Association, https://www.associazionenocap.it/il-bollino-nocap (Accessed October 4, 2023).

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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