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Native Italian poultry products: the factors influencing consumer perceptions

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ABSTRACT

Utilisation and conservation of native chickens are fundamental for sustainable poultry production. This study aimed to predict the key factors influencing consumer perceptions of the quality traits of products from native poultry breeds and their willingness to pay for them. In addition, consumer preferences for native chicken meat and eggs were compared with those from commercial lines. A generalised linear mixed model was used to analyse responses from 1488 Italian consumers. Age, willingness to pay, the perceived productivity of native breeds, and chicken meat and egg preferences in terms of the rearing system were the main predicting factors influencing the importance consumers placed on the geographical proximity and the perceived quality traits of poultry products from native breeds. Younger people and price-sensitive consumers appeared to be more concerned about the food safety aspects of eggs from local breeds. Those perceiving Italian native breeds as more productive than commercial lines placed greater importance on the geographical proximity and perceived native breed chicken meat to be of superior nutritional composition. Price-sensitive consumers also associated chicken meat from local breeds with a higher cholesterol content. Our findings suggest that the quality traits investigated in the present study correlated positively with each other and positively influenced willingness to pay a higher price for native poultry products. These results demonstrate the importance of consumer education to encourage informed choices in favour of sustainable poultry farming, thereby fostering economic development, environmental sustainability, cultural preservation and consumer satisfaction.

HIGHLIGHTS

- Intrinsic and extrinsic factors strongly affect consumer perceptions about the quality traits of products from native chicken breed.
- The creation of niche markets that promote native chicken breeds could help safeguard poultry biodiversity.
- Italian consumers exhibited a fair degree of interest towards meat and eggs obtained from native chicken breeds.

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Introduction

The rapid shift towards intensive animal farming processes has led to a decline in poultry biodiversity, with many local breeds facing extinction (Cendron et al. 2020). This loss in biodiversity is of great concern, with important implications not only in terms of cultural heritage but also in agricultural sustainability and food safety. The greater robustness of local breeds

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with respect to commercial lines in terms of housing and nutritional requirements further support the importance of their conservation. In fact, local breeds are mostly reared using small-scale, extensive farming systems that prioritise animal welfare (Castillo et al. 2021). Products derived from autochthonous chickens are gaining popularity among consumers, more efforts are being made to promote the rearing and diffusion of these birds at the farming level (Franzoni et al. 2021).

Despite the many efforts being made to limit the loss of poultry biodiversity, the industrialisation of livestock farming has favoured a limited number of highly productive animals (Soglia et al. 2021). The Italian poultry was known for its rich biodiversity, vaunting 53 breeds (Castillo et al. 2021), including but not limited to widely reared Polverara, Padovana and Livorno. Out of these 53 breeds, 67% are extinct (Foggiana Cucula, Grossa di Bologna and Crottone) and 21% are currently at risk of extinction (Valdarno, Pepoi and Millefiori Piemontese) (FAO 2020). Most Italian breeds are dual-purpose: males are reared for their delicacy meat and females for egg production. As autochthonous breeds are not subjected to intense selection and adapt easily to the specific environmental conditions of their area of origin, they are more likely to exhibit resilience to diseases and climate variations (Perini et al. 2020). As the threat of climate change rises, so does the need for sustainable food production, making the use of native breeds ever the more relevant since these breeds are best suited to extensive, sustainable farming ecosystems.

Over the past decade, consumers have become more aware of animal welfare issues and concerned about the quality of animal products, and both factors are of essential importance for the conservation and valorisation of local chicken breeds (Arno et al. 2023). However important issues must also be addressed, such as understanding how consumers view products from local chicken breeds, whether they are likely to accept them and what factors influence consumer perceptions and their acceptance of such products.

Poultry meat consumption has significantly risen over the past few decades, in both developed and low-income countries, mainly due to the ease of production and the lower cost compared to other meats (OECD-FAO 2021). Several demographic and personal characteristics (such as, gender and age) influence consumer purchasing behaviours and preferences towards poultry products (Piazza et al. 2015; Knaapila et al. 2022). The existing literature reports that women, especially younger women, tend to eat less meat products than men (Piazza et al. 2015) and are more selective in their food choices, being open to limiting the consumption of animal-based foods to preserve animal welfare (Knaapila et al. 2022). The global consumption of eggs has increased over the last few decades, as has meat consumption, especially in North and South America and Europe (FAO 2023). This is mainly because of their relatively accessible cost and their high nutritional profile (Conrad et al. 2017). In light of their unique qualities, meat and eggs derived from local breeds are an integral part of the Italian gastronomic identity (Bongiorno et al. 2022). Thus, the significant loss of poultry biodiversity poses a threatens to both culinary traditions and Italian cultural identities since specific breeds play a fundamental role in traditional dishes. Moreover, the questionnaire evaluated in the present study is part of the TuBAvI project, a national conservation program aimed at safeguarding and valorising Italian poultry biodiversity (Stoppani et al. 2024; Tutela della Biodiversità nelle Razze Avicole Italiane TuBAVi https://www.pollitaliani.it/en/). The results of this study will help inform policy decisions made by governments to foster the development of diversified farming systems within the poultry sector as well as support the development of educational campaigns for consumers, poultry farmers and corporations. The present survey focused on data provided by Italian citizens reporting to regularly consume chicken meat and/or eggs to investigate the factors driving their perceptions about the quality traits of chicken meat and eggs from local breeds and their willingness to try (WTT) and willingness to pay (WTP) for these products versus those obtained from commercial lines.

Materials and methods

Data collection occurred from January to December 2023 in Italy by means of Computer Assisted Web Interviewing (CAWI). The questionnaire was drawn up in Italian and pre-tested by consumer research professionals. After its approval, the survey was pre-tested by a minimum of three subjects, with no connections to the project, were then asked to identify any problems related to the phrasing of the questions, omissions, or other difficulties that respondents might encounter with the survey (Mitchell et al. 2012; Rodrigues et al. 2024). The feedback obtained from these pre-tests was then used by the researchers to make the necessary adjustments to the questionnaire. The online survey was anonymous, and respondents electronically signed an informed consent form before

participating in the survey after having read a disclosure sheet that described the project and survey aims. This study followed the ethical standards defined by the Declaration of Helsinki and was approved by the Ethical Committee of the Department of Veterinary Sciences of the University of Turin (approval n. 380576 – November 2022).

Participants

A total of 1499 respondents were surveyed using a convenience sampling. Authors were requested to disseminate the survey link to gather data quickly and efficiently (response rate = 95.3%). The inclusion criteria of the participants were individuals claiming to be regular consumers of eggs and chicken meat and none of the participants received any remuneration for their participation. Surveys completed by individuals over 75 years (0.73% of total respondents) were excluded, as well as those that lacked consent for data usage and those completed by individuals claiming not to consume meat and/or eggs. Any surveys not fulfilling quality checks (straight lining) or with missing information were also removed from the final sample. The final analysis included data from 1488 surveys.

Questionnaire

The full questionnaire used in this study is reported in Supplementary Table 1. The survey was based on those reported by Prencipe et al. (2010) and Yeh et al. (2020) regarding meat and egg consumption.

The first section of the survey was designed to profile the population sample. The demographic variables were age, gender, geographical area of origin, education and occupation. The second section was designed to profile consumer preferences: respondents were asked to indicate their dietary regime and their preference regarding the origin of poultry products. In the third section, respondents were asked to express their opinion about the importance of the geographic distance between producers and retailers using a 5–point Likert scale. In addition, consumers were asked to choose the statement (A–D) they most agreed with when comparing commercial chickens and hens with native breeds: (A) Italian native breeds are more productive than commercial lines; B) The productivity of Italian native breeds is similar to that of commercial lines; C) Italian native breeds are less productive than commercial lines; D) I do not know. The fourth and fifth sections were designed to profile consumer preferences regarding poultry products from native breeds and their WTP for these products. Consumers were asked to express details about their meat and egg consumption habits, including the preferred origin, farming systems and consumption frequency, using multiple choice questions (Supplementary Table 1). In addition, respondents expressed their perceptions about meat and eggs derived from local breeds compared with conventional products from commercial lines in relation to nutritional value, risk of food poisoning and organoleptic properties. Responses were provided using a 4–point Likert scale. Finally, respondents were asked to express their WTT poultry products from native breeds through use of a dummy question (yes/no) and their WTP for these products in comparison with products from commercial lines, using a 4–point Likert scale.

Statistical analysis

Statistical analyses were carried out using generalised linear mixed-effect models (GLMM), The *p*-values were adjusted using Bonferroni's method and the least significant difference test applied when the mixed model revealed significant differences ($p < 0.05$). Mixed models were built and evaluated according to Crawley (2012) using R software version 4.4.2 (2024) (Crawley, 2012). Using the 'pwr' function (power = 1), the power analysis of the sample size was performed to ensure a significance level = 0.05 and F-values = 0.4. Correspondence analysis (CA) was performed using the *R* packages *FactoMineR* and *Factoextra* (for data plotting). A Spearman's rank correlation coefficient was done using the 'psych' function and plotted through the 'corrplot' package in *R*.

Results

Table 1 reports the socio-demographic and personal characteristics of the respondents ($n = 1488$ adult consumers of chicken meat and eggs); 59% were women, 37% were adults aged 18 to 35 years, and 62.3% lived in urban areas. Most participants (91.9%) consumed both meat and eggs. Investigating the general knowledge of Italian consumers, 47.7% of the population perceived native chicken breeds to be less productive than commercial lines (Table 1). Age, WTP, perceptions about the productivity of native breeds and preferences for specific types of eggs and chicken meat (differentiated according to rearing system) were the main factors influencing perceptions about the importance of geographical proximity of poultry product and

Table 1. Socio-demographic and personal characteristics of the sample (adult consumers of poultry products).

Characteristics	n° and % of valid responses	Eggs from local breeds	Meat from local breeds
Gender	$n = 1488$		
I don't want to answer	0.40		
Men	40.19		
Other	0.47		
Women	58.94		
Age	$n = 1488$		
18–35 years	37.10		
36–55 years	39.11		
56–75 years	23.05		
> 75 years	0.74		
Area	$n = 1488$		
Rural	37.57		
Urban	62.43		
Educational level	$n = 1488$		
Primary school	0.13		
Lower secondary education	3.56		
Upper secondary education	35.35		
Degree / Master's / Doctorate	60.82		
No education	0.13		
Occupation	$n = 1488$		
Homemaker	2.62		
Retired	7.53		
Student	16.33		
Unemployed	1.89		
Worker	71.64		
Type of consumer	$n = 1488$		
Chicken meat consumer	0.87		
Egg and chicken meat consumer	91.94		
Egg consumer	7.19		
Type of Diet	$n = 1488$		
Carnivore	0.14		
Flexitarian	8.20		
Omnivore	87.34		
Vegan	0.07		
Vegetarian	4.04		
Other	0.21		
Perception towards native breed production	$n = 1475$		
Native breeds are .... compared with commercial lines			
I do not know	39.19		
Similarly productive	6.71		
Less productive	47.73		
More productive	6.37		
Preference towards poultry origin	$n = 1428$		
National	24.16		
Local	49.37		
Regional	26.47		
Willing to try		$n = 1463$	$n = 1365$
Indifferent		12.17 %	8.79 %
No		0.75 %	1.25 %
Yes		87.08 %	89.96 %
Willing to pay		$n = 1469$	$n = 1369$
I do not know		9.67 %	8.18 %
Higher price than conventional poultry products		54.66 %	62.53 %
Lower price than conventional poultry products		1.16 %	1.39 %
Same price as conventional poultry products		34.51 %	27.90 %

perceptions about the quality of poultry meat products from native breeds versus commercial lines.

Consumption of chicken meat and eggs

The results obtained from the present study show that 40.2% of the population preferred commercial chicken meat and the preferred chicken meat colour appeared to be yellow (45.3% of the respondents), as reported in Table 2. The most frequent types of eggs consumed by the population were barn, free-range and organic. Regardless, 67.7% of the population had no preference for eggshell colour (Table 2).

Figure 1 depicts consumer preferences for different types of chicken meat and eggs and perceptions about poultry products from native breeds. The CA of the chicken meat and eggs consumed explained 93.7 and 92.8% of the total variance, respectively, and illustrated that preference for meat and eggs from different types of rearing system, area of origin of the poultry product, type of diet and perceptions about the productivity of native chicken breeds versus

Table 2. Chicken meat and egg consumption habits and perceptions about native chicken breeds.

Preferred rearing system for chicken meat ($n = 1374$)	%	Preferred chicken meat colour ($n = 1374$)	%
No preference	12.52	I do not know	29.26
Commercial chicken	40.17	White chicken meat	25.47
Organic chicken	19.00	Yellow chicken meat	45.27
Free-range chicken	28.31		

Preferred rearing systems for eggs ($n = 1472$)	%	Preferred egg colour ($n = 1473$)	%
No preference	10.05	No preference	67.68
Organic	25.20	White	7.40
Free-range	30.16	Brown	24.92
Battery-cage	2.17		
Barn	32.40		

commercial lines were closely related to consumer gender as a key influencing factor. Neither age nor gender was found to have a significance influence on preference for egg characteristics (Figure 1(B)). In contrast, the chicken meat preferences of male respondents differed from those of women (r-value = 0.479, p-value= 0.047). Men tended to consume yellow chicken meat from commercial lines of national origin, and these tendencies corresponded with the perception that native breeds were less productive than commercial lines. Specifically, older men (56–75 years old) preferred yellow chicken, while younger men (18–55 years old) reported no preferences regarding the meat colour, although they were characterised by a preference for commercial lines of national origin and perceived native breeds to be less productive than commercial lines (Figure 1(A)). Older women (56–75 years old) were characterised by a preference for free-range and organic chickens of local origin and the perception that native chickens are more productive than commercial lines, while younger women (18–55 years old) were characterised by a preference for white chicken meat and the perception that native and commercial chickens were similarly productive (Figure 1(A)). Regardless, older women did not report any preference in terms of chicken meat colour.

The preference for free-range, barn, and brown eggs was closely related to men; however, younger men (18–35 years old) perceived native breeds as less productive than commercial lines (Figure 1). By contrast, middle aged men (36–55 years old) were characterised by the perception that the productivity of native breeds was similar to that of commercial lines, while the preference for regional poultry products was closely related to being an older woman (56–75 years old). In addition, older women perceived native chicken breeds as more productive than commercial chickens (Figure 1(B)).

Age, WTP and the perceived productivity of native chicken breeds on consumers' perceived importance of the geographical proximity and the perceived quality traits of poultry products from native breeds

Overall, most of the respondents remained neutral regarding the importance of the geographical proximity. Concerning the product characteristics of native breeds, consumers perceived these products to have better organoleptic and textural properties than those from commercial lines but the same nutritional composition and a lower cholesterol content (Table 3). The importance consumers placed on geographical proximity and the perceived quality traits of poultry products from native breeds compared with commercial lines diverged across the age groups ($p < 0.05$). Younger adults (18–35 years old) perceived eggs from local breeds to be associated with a higher risk of contamination than those from commercial lines ($p < 0.05$), while respondents aged 56–75 years old showed greater interest in the geographical proximity and perceived eggs from local breeds to have a superior nutritional composition, egg dimension and organoleptic properties than those from commercial lines ($p < 0.05$).

Table 4 shows that consumer WTP a higher price for native breed products was characterised by higher scores for perceptions about the nutritional composition and organoleptic properties of eggs from native chickens ($p < 0.05$). Consumer WTP a lower price for native breeds products was characterised by higher scores for perceptions about the risk of contamination

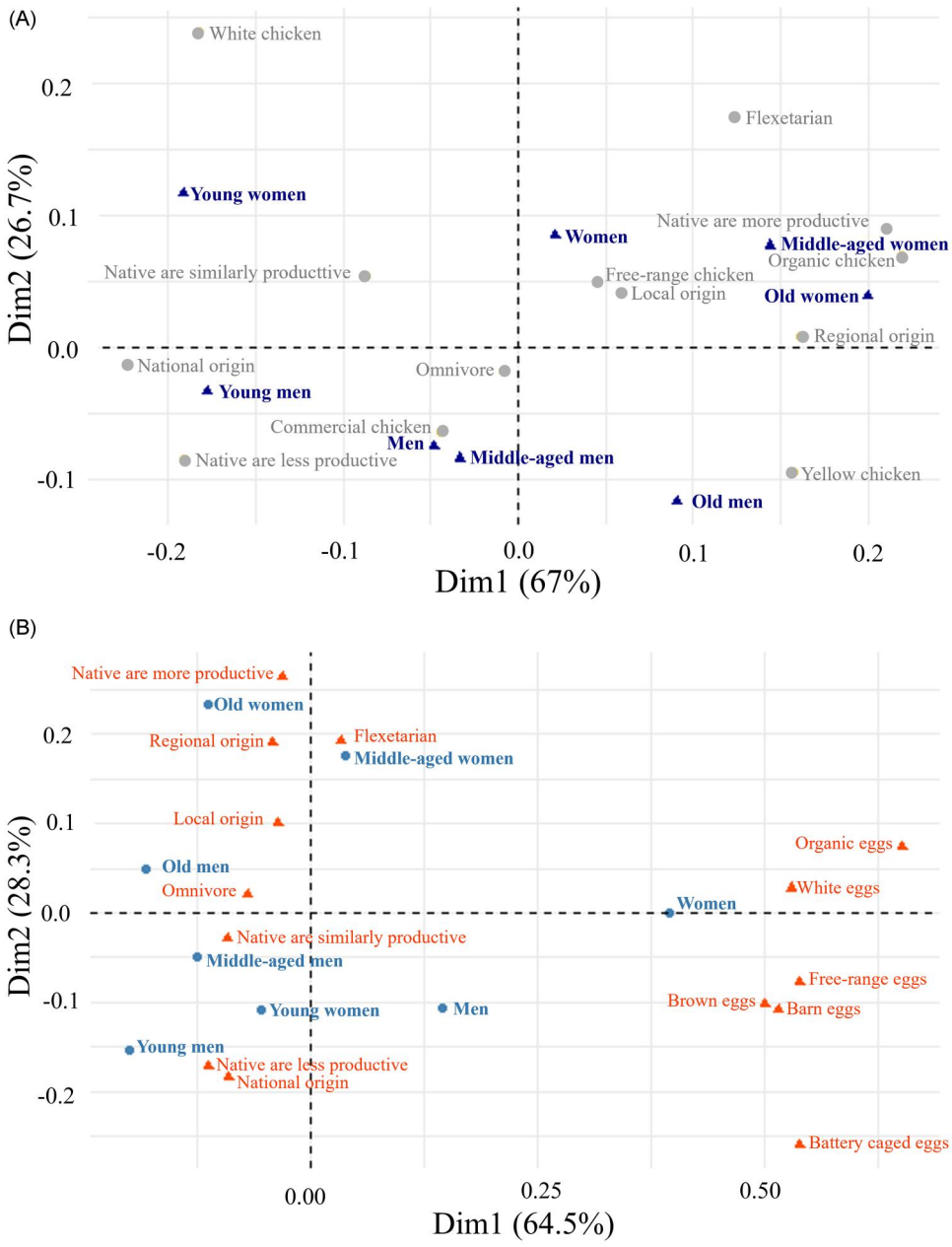

Figure 1. (A) Correspondence analysis of the chicken preferences of Italian consumers and their perceptions of native chicken breeds. (B) Correspondence analysis of the egg preferences of Italian consumers and their perceptions of native chicken breeds. The dimensional space illustrates the similarities and dissimilarities between Italian consumers regarding the different types of chicken consumed, statement of origin, type of diet and perceptions about the productivity of native breeds versus commercial lines.

of eggs and the cholesterol content of meat from native chicken breeds compared with commercial lines ($p < 0.05$).

Consumers who perceived Italian native breeds as more productive than commercial lines also showed higher scores for the importance of geographical proximity of producers to retailers and perceived the eggs and chicken meat from native breeds to be better in terms of nutritional composition compared with those from commercial lines. In addition, these consumers also perceived eggs from native breeds to be characterised by better organoleptic properties than eggs from commercial lines (Table 5, $p < 0.05$).

Effect of meat and egg preference on how important consumers rate the geographical proximity of producers to retailers and perceptions about the quality of poultry products from native breeds

Consumers who frequently consume free-range chicken meat placed more importance of the

Table 3. Association between age and how consumers rated the importance of geographical proximity of producers to retailers and the perceived quality traits of poultry products from native breeds (mean and standard error, $n = 1428$).

	18–35 years old			36–55 years old			56–75 years old				
	Mean	SE		Mean	SE		Mean	SE		F-value	P-value
Geographical proximity	3.28	0.15	b	3.49	0.15	a	3.52	0.16	a	19.91	<.0001
Egg characteristics											
Nutritional composition	3.01	0.15	ab	2.98	0.15	b	3.17	0.16	a	3.411	0.033
Cholesterol content	2.58	0.13		2.55	0.13		2.64	0.14		0.756	0.470
Egg dimension	2.46	0.13	ab	2.39	0.13	b	2.59	0.14	a	4.849	0.008
Risk of food contamination	2.93	0.14	a	2.83	0.14	ab	2.76	0.14	b	4.517	0.011
Organoleptic properties	3.19	0.14	b	3.26	0.14	ab	3.37	0.15	a	4.093	0.017
Chicken meat characteristics											
Nutritional composition	3.03	0.21		3.06	0.22		3.14	0.22		1.270	0.281
Cholesterol content	2.26	0.14		2.26	0.14		2.30	0.15		0.148	0.862
Risk of food contamination	2.39	0.14		2.40	0.14		2.48	0.15		0.898	0.408
Organoleptic properties	3.76	0.14		3.64	0.14		3.71	0.15		1.748	0.174
Texture	3.66	0.15		3.51	0.16		3.58	0.16		2.000	0.136

Geographical proximity scale: 5 = very important, 4 = slightly important, 3 = neutral, 2 = slightly unimportant, 1 = not important at all.
Product characteristics scale: 4 = higher than commercial lines, 3 = the same as commercial lines, 2 = lower than commercial lines, 1 = I do not know.
Abbreviations. **SE** = standard error. Different letters (a, b, ab) indicate a statistical difference related to age using the least significant difference test ($p < 0.05$). p-values were adjusted using Bonferroni's method.

geographical proximity and perceived egg dimensions from native breeds to be greater than those of commercial lines (Table 6, $p < 0.05$).

In contrast, consumers who frequently consume organic eggs placed greater importance on the geographical proximity, while consumers consuming battery-cage and free-range eggs perceived eggs from native breeds as having a better nutritional composition and organoleptic properties compared with those from commercial lines (Table 7, $p < 0.05$).

The influence of the perceived quality of native chicken breed products and the importance of geographical proximity between producers and retails on WTT and WTP a higher price

Spearman's correlation test showed a significant correlation ($p < 0.05$, Figure 2) between consumers' WTT and WTP a higher price for native poultry products and their perceptions about the quality characteristics of native poultry products. The finding suggests that all the quality traits investigated in this study are positively correlated with each other and positively influence consumers' WTT and WTP a higher price for native poultry products (Figure 2, the rho and *p*-values are reported in Supplementary Table 2). In detail, consumers' quality perceptions of the nutritional composition of meat and eggs from native breeds positively influences their perceptions of the importance of the geographical proximity and their WTT this type of poultry product. Consumers' perceptions about the texture of native chicken meat were also positively associated with the perceived importance of geographical proximity.

Discussion

The aim of the present study was to explore the key factors influencing consumer perceptions of poultry products from Italian native chicken breeds, as well as their WTP for and WTT these items. Overall, the findings obtained from the present study suggest several factors that influence Italian consumers' preferences and perceptions of native breed poultry products compared with those from commercial lines.

Chicken consumption is changing towards more sustainable choices, which includes choosing to buy local breeds (Del Bosque et al. 2021). Existing literature suggests that women are more likely to buy local foods (meat, eggs, milk, etc.), as reported by Feldmann and Hamm (2015), a behaviour (be it conscious or not) which favours the safeguarding of biodiversity. This is in line with our findings which showed older women to prefer organic or free-range chicken meat of local origin in contrast with older men who were more likely to opt for chicken meat from commercial lines farmed at the national level. Moreover, the perception of chicken production was also influenced by gender, as younger men perceived local breeds less productive than commercial lines, younger women perceived the production of native chicken breeds and commercial lines with similar production, and lastly older women considered local breeds as the highest yielding. The present findings suggest that women are more likely to care about animal welfare, since they reported a preference for less intensive rearing systems. As reported in other studies, the perception of animal welfare is linked to the rearing system used (Heise and Theuvsen, 2017; Riggio et al. 2023). In general, consumers tend to believe that extensive farming systems ensure higher animal

Table 4. Association between willingness to pay (WTP) and perceived importance of geographical proximity between producers and retailers and perceived quality traits of poultry products from native breeds (mean and standard error, $n = 1428$).

	WTP higher price for native poultry products			WTP the same price for native poultry products			WTP a lower price for native poultry products			Uncertain				
	Mean	SE		Mean	SE		Mean	SE		Mean	SE		F-value	P-value
Geographical proximity	3.49	0.14	ab	3.34	0.14	ab	3.54	0.28	a	3.24	0.17	b	7.479	<.0001
Egg characteristics														
Nutritional composition	3.30	0.14	a	3.07	0.14	b	2.64	0.29	ab	3.11	0.17	ab	5.346	0.000
Cholesterol content	2.65	0.12		2.60	0.12		2.78	0.26		2.46	0.15		2.058	0.084
Egg dimension	2.56	0.12		2.52	0.13		2.56	0.26		2.36	0.15		1.441	0.218
Risk of food contamination	2.96	0.13	ab	2.78	0.13	b	3.03	0.27	a	2.61	0.16	b	5.221	0.000
Organoleptic properties	3.57	0.14	a	3.18	0.14	b	2.88	0.29	ab	3.24	0.17	b	12.58	<.0001
Chicken meat characteristics														
Nutritional composition	3.54	0.14	a	3.11	0.15	b	2.83	0.29	ab	2.84	0.17	b	19.91	<.0001
Cholesterol content	2.11	0.13	b	2.05	0.13	b	2.81	0.26	a	2.14	0.16	ab	2.938	0.020
Risk of food contamination	2.42	0.13		2.34	0.13		2.57	0.26		2.34	0.16		0.703	0.590
Organoleptic properties	3.66	0.13		3.59	0.14		3.93	0.27		3.50	0.17		2.142	0.073
Texture	3.52	0.15		3.44	0.15		3.90	0.29		3.42	0.18		1.527	0.192

Geographical proximity scale: 5 = very important, 4 = slightly important, 3 = neutral, 2 = slightly unimportant, 1= not important at all.
Product characteristics scale: 4 = higher if compared than commercial lines, 3 = the same as commercial lines, 2 = lower than commercial lines, 1 = I do not know.
Abbreviations. **SE** = standard error. Different letters (a, b, ab) indicate a statistical difference related to WTP using the least significant difference test ($p < 0.05$). *p*-values were adjusted using Bonferroni's method.

Table 5. Effect of perceived chicken production on the level of importance of geographical proximity, and perceived quality of poultry products from native breeds (mean and standard error, $n = 1428$).

	Native chicken breeds are more productive than commercial lines			Native chicken breeds are as productive as commercial lines			Native chicken breeds are less productive than commercial lines			Uncertain				
	Mean	SE		Mean	SE		Mean	SE		Mean	SE		F-value	P-value
Geographical proximity	4.07	0.25	a	3.76	0.25	b	4.07	0.37	ab	3.95	0.25	ab	19.52	<.0001
Egg characteristics														
Nutritional composition	3.55	0.24	a	3.30	0.24	b	2.85	0.37	ab	3.41	0.24	ab	1.730	0.125
Cholesterol content	2.25	0.20		2.21	0.21		2.27	0.31		2.14	0.21		1.684	0.135
Egg dimension	2.61	0.21		2.55	0.21		2.74	0.31		2.44	0.21		0.877	0.496
Risk of food contamination	3.15	0.22	ab	3.04	0.22	ab	3.51	0.32	a	2.98	0.22	b	2.478	0.030
Organoleptic properties	3.18	0.23	a	2.88	0.23	b	2.52	0.33	ab	2.90	0.23	b	3.391	0.005
Chicken meat characteristics														
Nutritional composition	3.02	0.28	a	2.75	0.29	b	2.72	0.40	ab	2.48	0.29	b	3.848	0.002
Cholesterol content	2.12	0.21		2.05	0.21		2.58	0.32		2.21	0.22		1.151	0.331
Risk of food contamination	2.91	0.21		2.83	0.21		2.88	0.32		2.78	0.22		0.704	0.620
Organoleptic properties	3.72	0.22		3.69	0.22		3.95	0.33		3.58	0.22		0.468	0.800
Texture	3.20	0.23		3.18	0.24		3.50	0.36		3.16	0.24		0.724	0.606

Geographical proximity scale: 5 = very important, 4 = slightly important, 3 = neutral, 2 = slightly unimportant, 1 = not important at all.
Product characteristics scale: 4 = higher if compared with commercial lines, 3 = the same if compared with commercial lines, 2 = lower if compared with commercial lines, 1 = I do not know.
Abbreviations. **SE** = standard error. Different letters (a, b, ab) indicate a statistical difference related to perceived chicken productivity using the least significant difference test ($p < 0.05$). *p*-values were adjusted using Bonferroni's method.

Table 6. Effect of the type of chicken meat most frequently consumed on how important consumers rated the geographical proximity of produces to retailers and the perceived quality of poultry products from native breeds (mean and standard error, $n = 1428$).

	Organic chicken			Free range chicken			Commercial chicken			No preference				
	Mean	SE		Mean	SE		Mean	SE		Mean	SE		F-value	P-value
Geographical proximity	4.18	0.27	a	4.13	0.26	a	3.79	0.26	b	3.98	0.27	ab	7.827	<.0001
Eggs characteristics														
Nutritional composition	3.39	0.29		3.46	0.29		3.36	0.28		3.22	0.29		1.850	0.117
Cholesterol content	2.23	0.25	a	2.28	0.25	a	2.28	0.25	a	2.06	0.25	b	3.307	0.010
Egg dimension	2.59	0.25	ab	2.74	0.25	a	2.64	0.25	ab	2.44	0.25	b	3.858	0.004
Risk of food contamination	3.07	0.26	ab	3.14	0.26	a	3.11	0.26	a	2.81	0.26	b	3.265	0.011
Organoleptic properties	3.11	0.28	a	3.17	0.28	a	3.09	0.27	a	2.75	0.28	b	6.352	<.0001
Chicken meat characteristics														
Nutritional composition	2.95	0.26		3.01	0.26		2.97	0.26		2.78	0.26		1.984	0.095
Cholesterol content	2.25	0.23		2.28	0.23		2.22	0.22		2.27	0.23		0.460	0.765
Risk of food contamination	2.85	0.23		2.91	0.23		2.89	0.22		2.97	0.23		0.508	0.730
Organoleptic properties	3.75	0.24		3.77	0.23		3.76	0.23		3.95	0.24		1.533	0.190
Texture	3.30	0.25		3.38	0.25		3.31	0.25		3.54	0.25		1.600	0.172

Geographical proximity scale: 5 = very important, 4 = slightly important, 3 = neutral, 2 = slightly unimportant, 1= not important at all.
Product characteristics scale: 4 = higher than commercial lines, 3 = the same as commercial lines, 2 = lower than commercial lines, 1 = I do not know.
Abbreviations. **SE** = standard error. Different letters (a, b, ab) indicate a statistical difference related to type of chicken meat frequently consumed using the least significant difference test ($p < 0.05$). *p*-values were adjusted using Bonferroni's method.

Table 7. Effect of type of eggs frequently consumed on how consumers rated the importance of geographical proximity of producers to retailers, and the perceived quality of poultry products from native breeds (mean and standard error, $n = 1428$).

	Battery-cage eggs			Organic eggs			Free range eggs			Barn eggs			I do not know				
	Mean	SE		Mean	SE		Mean	SE		Mean	SE		Mean	SE		F-value	P-value
Geographical proximity	4.30	0.32	ab	4.23	0.26	a	4.17	0.26	ab	3.95	0.26	b	3.41	0.26	c	14.25	<.0001
Egg characteristics																	
Nutritional composition	3.27	0.30	a	3.22	0.25	ab	3.28	0.25	a	3.24	0.25	ab	3.06	0.25	b	7.227	<.0001
Cholesterol content	2.39	0.26		2.08	0.21		2.15	0.21		2.12	0.21		2.01	0.22		0.713	0.583
Egg dimension	2.65	0.26		2.45	0.22		2.53	0.21		2.52	0.21		2.48	0.22		1.629	0.164
Risk of food contamination	3.35	0.27	a	2.90	0.23	c	3.05	0.22	b	2.98	0.22	b	2.93	0.23	c	2.512	0.040
Organoleptic properties	3.10	0.29	a	2.90	0.24	ab	3.05	0.24	a	2.89	0.24	ab	2.81	0.24	b	12.25	<.0001
Chicken meat characteristics																	
Nutritional composition	2.91	0.34	ab	2.86	0.29	ab	2.92	0.28	a	2.83	0.28	ab	2.55	0.28	b	13.70	<.0001
Cholesterol content	2.41	0.27		2.17	0.22		2.08	0.22		2.19	0.22		2.09	0.22		1.752	0.136
Risk of food contamination	3.03	0.27		2.79	0.22		2.84	0.22		2.82	0.22		2.91	0.22		0.420	0.794
Organoleptic properties	3.87	0.28		3.74	0.23		3.71	0.22		3.72	0.22		3.59	0.23		1.027	0.392
Texture	3.45	0.30		3.25	0.24		3.26	0.24		3.17	0.24		3.14	0.25		0.403	0.807

Geographical proximity scale: 5 = very important, 4 = slightly important, 3 = neutral, 2 = slightly unimportant, 1 = not important at all.
Product characteristics scale: 4 = higher than commercial lines, 3 = the same as commercial lines, 2 = lower than commercial lines, 1 = I do not know.
Abbreviations. **SE** = standard error. Different letters (a, b, ab, c) indicate a statistical difference related to type of eggs frequently consumed using the least significant difference test ($p < 0.05$). *p*-values were adjusted using Bonferroni's method.

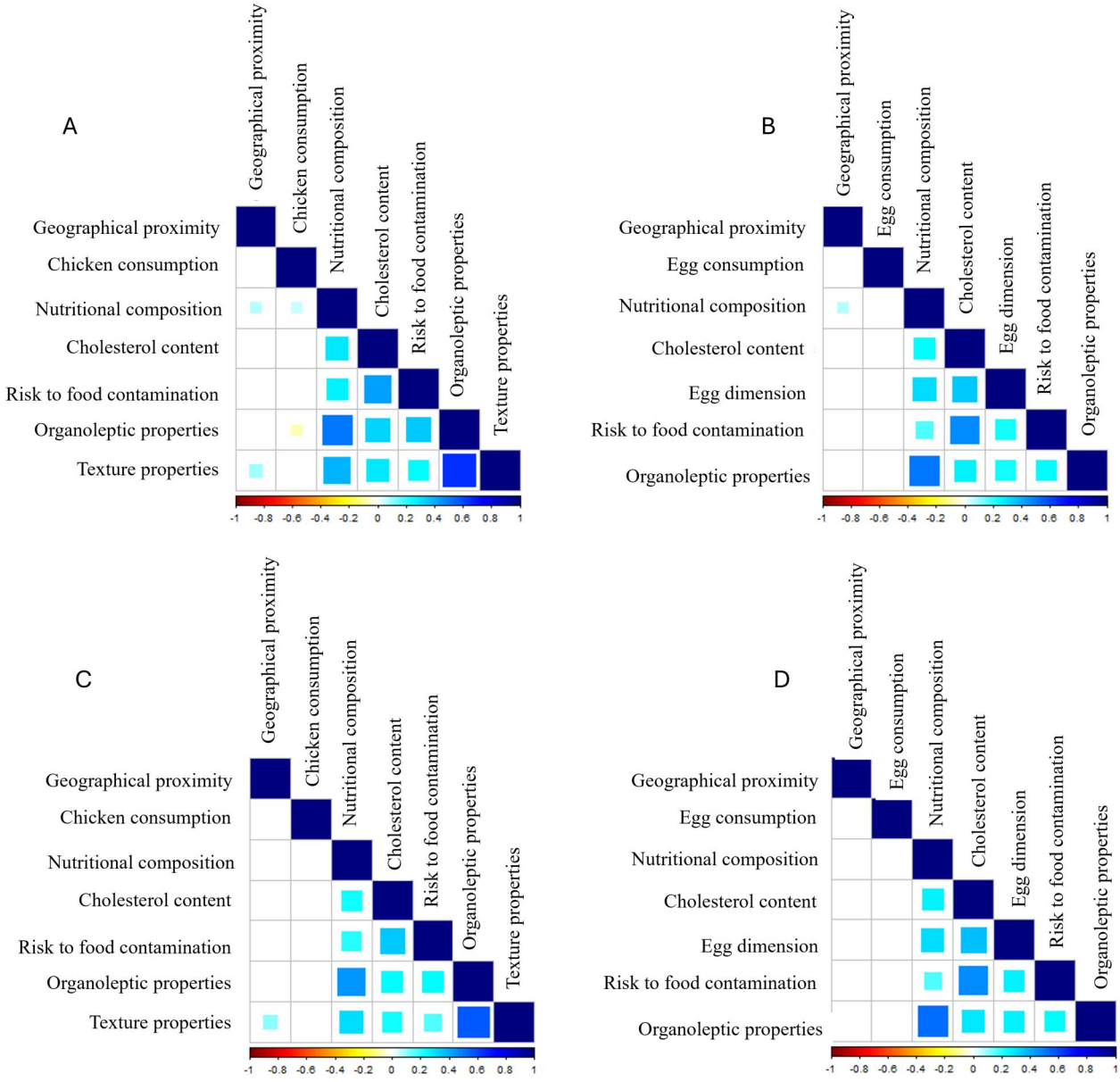

Figure 2. Plot showing Spearman's correlations between the frequency of chicken meat consumption, the importance of geographical proximity and perceived quality traits of poultry products from native compared with commercial lines. Figures are labelled according to (A) willingness to tray (WTT) meat from native breeds, (B) WTT eggs from native breeds, (C) willingness to pay (WTP) a higher price for meat from native breeds and (D) WTP a higher price for eggs from native breeds. Only significant associations between perceptions are shown ($p < 0.05$). P-values were adjusted using Bonferroni's method. The intensity of the colours represents the degree of correlation between the perceptions, as measured by Spearman's correlations. Blue colours represent a positive degree of correlation, whereas yellow and red colours indicate a negative correlation between perceptions.

welfare standards, while intensive ones are believed to be characterised by lower welfare standards (Alonso et al. 2020). Given the growing pressure to reduce the environmental impact of animal production, future research should aim to predict current consumer behaviour more accurately, focusing on consumer purchasing in real-market settings.

Consumer preference is a known discriminant, capable of influencing the purchasing of local food products (Feldmann and Hamm 2015). Indeed, it is known that perceptions about the taste of meat is influenced by consumer expectations (Napolitano et al. 2013). According to Castellini et al. (2002) chicken breasts from medium- and slow-growing genotypes (reared in an organic system) were preferred over commercial and fast-growing chickens by trained panellists. This could explain why Italian consumers believed that meat obtained from local breeds present better organoleptic properties and a lower cholesterol content than commercial meat. However, a recent study

showed no significant differences between the sensory evaluation of commercial fast-growing chickens, two local breeds and slow-growing genotypes as assessed by the trained panellists, except with regard to the toughness and how fibrous the meat was, while Italian consumers still preferred the meat obtained from commercial lines, mainly for the perceived organoleptic properties (Pellattiero et al. 2020). The average consumer has adapted to the choices offered by large-scale distribution systems. In fact, it is well documented that consumers tend to prefer poultry meat that is lighter in colour, a typical feature of commercial lines (Fletcher 2002; Wideman et al. 2016). Indeed, the organoleptic characteristics of chicken meat obtained from autochthonous breeds is quite different to those of commercial lines. In general, the latter present paler and softer meats, while the breast meat of local breeds appears yellower and firmer, and thighs present a greater degree of red pigmentation (Tasoniero et al. 2018; Bongiorno et al. 2022).

Availability, price, complexity and inconvenience were shown to be the key barriers preventing consumers from purchasing local foods (Feldmann and Hamm 2015). Consumers with lower incomes tend to present food neophobia (Coderoni and Perito, 2020) and, therefore, their WTT and WTP are low with respect to foods they are unfamiliar with. In addition, economic factors play an important role in buying decisions and could lead to scepticism in price sensitive consumers towards products from local breeds as most of the meat and eggs offered by larger retailers are less expensive and derived from commercial lines. This could explain why price sensitive Italian consumers had misconceptions about the cholesterol content of chicken meat from local breeds (which they considered to be higher compared with commercial lines), as found in this study. Sensory analysis of poultry products from local breeds in the future could provide a more realistic assessment of consumer acceptance and WTP for this type of food to better meet consumer requirements and overcome survey bias and social-desirability bias in the present study.

When referring to egg preferences, the British population prefers free-range eggs and perceives them to have better organoleptic properties compared with eggs that are not free-range, resulting in British consumers being more willing to pay for this type of egg (Pettersson et al. 2016). Castillo et al. (2024) reported a rapid, worldwide shift in preference towards organic eggs, despite their higher price. This aligns with our findings which show that Italian consumers mostly consume eggs from intensive barn systems, free-range systems and organic systems and prefer local eggs. Consumer preference towards eggshell colour had been related to familiarity with the most common eggs found in local markets (Pelletier 2017). Moreover, in developed countries, diversity in people's preferences for eggshell colour was observed, where most consumers prefer brown eggshells (Rondoni et al. 2020). The results obtained from the present study showed a similar outcome, as men preferred brown eggs coming from intensive barn or free-range farming systems. The physical characteristics of eggs (egg weight, component percentages and eggshell colour) are affected by bird genetics, whereas the colour and nutritional properties of the yolk are affected by the birds' diet (Suk and Park 2001; Silversides and Budgell 2004; Zita et al. 2009; Küçükyılaz et al. 2012; Lordelo et al. 2017; Lordelo et al. 2020). A recent study showed that Portuguese consumers perceived eggs from local breeds to have a better nutritional composition (Lordelo et al. 2020). This is in line with the results of the present study, which showed that more sustainability-conscious consumers (those claiming to frequently consume free-range eggs) associated eggs from local breeds with having a better nutritional composition and organoleptic properties compared with commercial lines, and older men considered eggs obtained from native breeds to be superior in terms of their nutritional value and organoleptic properties. However, more research is needed to evaluate whether consumers are capable of distinguishing the organoleptic properties of eggs from local versus commercial lines.

The main concern about egg consumption regards food poisoning from *Salmonella* spp., one of the main causes of foodborne diseases worldwide (Whiley and Ross 2015). In the United States, after the 2010 *Salmonella* outbreak that occurred in battery-cage rearing systems, most consumers rapidly shifted their preference to organic eggs, presuming this system to be safer (Li et al. 2017). However, some studies suggest that free-range and organic systems might present higher risks of contamination, as eggs remain in contact with the hens for a longer period, while eggs in intensive barn systems are immediately separated from the hens (Hannah et al. 2011; Parisi et al. 2015). This could explain why younger people and price sensitive Italian consumers appeared to be more concerned about the safety of eggs from local breeds, with younger people perceiving eggs from local breeds as associated with a higher risk of food poisoning compared with eggs from commercial lines. However, these beliefs are not supported by scientific

evidence, as earlier studies reported lower incidences of pathogens in free-range eggs than in battery-cage systems (Wales et al. 2007; Namata et al. 2008; Jones et al. 2012). On the other hand, De Vylder et al. (2009) suggest that the lower densities and better animal welfare provided by alternative rearing systems might decrease the incidence of pathogens in eggs, supporting the consumer belief observed in this study that the safety and organoleptic properties of eggs are better from birds raised in systems that ensure better welfare.

Some limitations of the present study must also be mentioned which might influence the generalisability of the study to the Italian population of poultry product consumers. First, older people were under-represented in the study. Many older people in Italy are less likely to participate in surveys due to technological barriers, privacy concerns, lack of time or interest and communication preferences. This might explain the lower number of older people in this study. Future research should consider alternative recruitment and data collection methods to represent more accurately the older population. Hence, the sample might not be representative of the Italian resident population, but of the predominant poultry products shoppers in Italy. The methodological approach used in this study also has some limitations, namely, the exclusion of consumers from other countries could represent a bias. To address this limitation, future studies should include consumers from different countries to enable wider geographic reach and strengthen the validity of the results obtained.

The development of food policies protecting local breeds are crucial to maintain biodiversity, ensure food safety, preserve cultural heritage, promote sustainable farming practices, support small-scale farmers and encourage the development of niche markets for these products, to the benefit of both producers and consumer. However, it is important to note that the success of products from local breeds are challenged by production costs, market acceptance and scalability.

Conclusions

The present study highlights Italian consumers' perceptions and preferences for native poultry products, emphasising the importance of nutritional attributes and sustainability. The results of the present study reveal that local poultry breeds are perceived as having comparable or superior quality to commercial lines, suggesting the presence of a competitive edge in the market. Socio-demographic factors, especially gender and age, influence preferences for chicken meat and eggs. Preferences are linked to the perceptions of quality, geographical proximity, and production levels, while WTP is closely linked to perceived benefits and risks. These findings suggest a need for targeted communication strategies to promote the quality and sustainability benefits of local poultry products.

Credit authorship contribution statement

Eleonora Erika Cappone Formal analysis, Writing - original draft, Investigation; **Valeria Zambotto**: Conceptualisation, Methodology, Writing - review & editing; **Jatziri Mota-Gutierrez:** Supervision, Data curation, Investigation, Methodology, Visualisation, Writing - original draft; **Dominga Soglia**: Writing – review & editing; **Giulia Maria Daniele**: Writing – review & editing; **Marta Cianciabella:** Writing – review & editing; **Andrea Pieroni:** Writing – review & editing; **Renata Soukand:** Writing – review & editing **Mauro Penasa:** Writing – review & editing; **Arianna Buccioni:** Writing – review & editing; **Margherita Marzoni:** Writing – review & editing; **Nicolaia Iaffaldano:** Writing – review & editing; **Cesare Castellini:** Writing – review & editing; **Silvia Cerolini:** Writing - review & editing; **Claudio Forte:** Writing – review & editing; **Achille Schiavone:** Conceptualisation, Validation, Funding acquisition, Resources, Writing - review & editing.

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Data availability statement

The data that support the findings of this study are available from the corresponding author upon reasonable request.

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