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Athletes preferences and willingness to pay for innovative high-protein functional foods

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ABSTRACT

The growing number of athletes in the population leads to an increasing demand for high-protein functional foods to which food industries are trying to respond with new products and strategies that can meet the needs of athletes. An experimental auction was performed to elicit athletes' willingness to pay for an innovative high-protein bread, correlating it to specific food values. For a deeper understanding of the determinants of respondents' choices for high-protein bread and preferences regarding food values, the combination of Best-Worst Scaling and Cluster Analysis was used. The Cluster Analysis identified five different groups of athletes, each characterised by specific preferences and willingness to pay. Participants with high attention for the nutritional aspect and needs related to sports activity, are willing to pay more than the other ones. The investigated issue is crucial for customizing marketing strategies and meeting the needs of different athlete segments.

1. Introduction

The coronavirus pandemic has had a lasting impact on global daily life particularly evident in the post-pandemic context (Park et al., 2022). Notably, it has affected physical activity promotion, encompassing various activities beyond professional sports (Di Renzo et al., 2020), such as outdoor walks, jogging and light exercise.

Despite pandemic-related restrictions easing, Google Community Mobility reports (2022) revealed increased travel trends to places like public parks and gardens in Italy, contrasting with reduced engagement in sedentary recreational activities. Similarly, the report of Strava Metro (2023) shows significant increases in users registered on the app and physical activity performed (Fischer et al., 2022). Strava app, with its vast database of more than 120 million global users, has established itself as the leading fitness app, thus contributing significantly to studies of athlete behavior (Strava Metro, 2023). These shifts underscore the enduring effects on physical activity patterns, extending beyond the pandemic period (Venter et al., 2021).

Among these changes, eating habits have also evolved (Knightley et al., 2023; Vidal et al., 2021), driven by the known benefits these provide on health and wellness, when combined with exercise (Romero-Blanco et al., 2020). Consumers are showing increased interest in nutrition, physical activity, and food quality, necessitating the development of functional foods tailored to these preferences (Hassoun et al., 2022). It is evident, in fact, that this new conception of food has resulted in a greater understanding of what and how we eat, as well as the effect that our food choices have on our health (Migliore et al., 2022; Pappalardo et al., 2018), the way food is chosen and the care taken in reading labels (Cerroni et al., 2022), and the conception of unconventional foods (Selvaggi et al., 2023), unrelated to traditional foods (Farha & Uddin, 2020).

This situation has promoted the consume of foods enriched with functional properties, which, with healthier profiles and more sustainable and simple ingredients, have effectively responded to the growing number of athletes in the population and to the changing needs and expectations of conscious consumers (Aday & Aday, 2020). Recent researches underscore the nutritional benefits and health-promoting properties of functional foods, emphasizing their critical role in improve consumer health and well-being (Matos et al., 2024). These studies have demonstrated their potential to significantly contribute to maintaining health and preventing diseases, thereby driving a growing demand among consumers (Gupta et al., 2023; Miolla et al., 2023).

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Regulations underscore the importance of nutritional and health claims in shaping consumer choices, particularly in the context of high-protein foods (Aiking & de Boer, 2020). The significance of protein intake, which is recognized to be of great importance (Hartmann & Siegrist, 2016) as essential for overall health and wellness (Stokes et al., 2018), has driven food innovation of high-protein foods, particularly for one of the world's most widely consumed products, bread (García-Segovia et al., 2020).

Consumer preferences, influenced by diverse factors, require tailored marketing strategies and food product adaptations (Bimbo et al., 2017; Guiné et al., 2020; Kelly et al., 2018). However, while consumer preferences continue to evolve, research specifically targeting athletes' preferences present significant limitations and their willingness to pay (WTP) for high-protein foods is entirely absent. So, this study aims to highlight the innovative aspect of conducting an economic survey specifically targeting athletes, shedding light on their food preferences and needs. Thus, the purpose of this research is to clarify how perceived benefits influence athletes' food preferences and purchaising decisions.

In this context, this study fills a crucial gap by focusing on estimating WTP among athletes for high-protein bread using the experimental auction method, correlating it with specific food values. The protein bread offers a unique combination of essential nutrients, including complex carbohydrates, fiber, and high-quality protein (Dhinda et al., 2012). From a practical point of view, protein bread is also convenient and versatile and it can be easily integrated into the daily balanced diet (Carocho et al., 2020). Finally, protein bread can offer a variety of flavors and textures, allowing it to meet personal preferences and maintain a tasty and satisfying diet (Pořízka et al., 2023).

The experimental auction method, based on revealed preferences, has gained wide use in the literature for examining consumer preferences, being particularly suitable for this purpose (Lusk et al., 2004). Therefore, this methodology was adopted in order to assess if the potential health benefits of the investigated product have an economically and statistically significant influence on athletes' overall evaluation of the food.

In addition, to gain a more extensive understanding of the attitudes and preferences of the interviewees regarding food in general, the Best-Worst (BW) Scaling approach (Finn & Louviere, 1992; Parvin et al., 2016) was used to assess the influence of Food Values on athlete purchasing behavior for foods. Moreover, the Cluster Analysis (CA) was adopted to identify the athlete segments for the innovative food. The literature review reveals that CA has been used in several studies to identify consumer segments based on their attitudes towards functional foods (Sgroi et al., 2024; Yeh et al., 2020).

2. Materials and methods

2.1. Data collection

This study was based on estimates the WTP of athletes toward a high-protein functional food, specially focusing on a high protein bread as the product of interest.

In Sicily (Italy), from May to October 2022, athletes were recruited in some sports centers (gyms, swimming pools, outdoor parks) and invited to come in an experimental laboratory at agreed dates and times for the experimental phase. The choice of Sicily as the study area is due to the presence of the company that produced this innovative high-protein bread (as part of an EU-funded research project). The Sicilian market is the company's target market and the Sicilian consumer represents the target of an average athlete in other geographical areas as well.

The dimension of the sample (Keller, 2012) was calculated fixing a confidence level of 95%, supposing that 20% of the population athlete (expected prevalence of 0.20), with an absolute precision of 6% (0.06), applying the following formula:

$$n = \frac{t^2\, P\,(1-P)}{D^2}$$

where n is the dimension of the sample, t is the distribution, P is the expected prevalence and D the absolute precision, the dimension of the sample is resulted equal to 171.

In the recruitment phase, two screening questions were asked to select only participants who practiced sport more frequently than once/week and were at least 18 years old.

Against 521 contacts and 333 fixed appointments, 189 useful observations were collected at the end of the survey, which means a show-up rate of approximately 57%. Participants who showed up at the appointed time and date were placed in the computer room (experimental laboratory) and assigned a random and anonymous ID, in accordance with the procedures of the privacy regulations.

2.2. Experimental procedure

The experimental procedure was divided into three main phases: i) participants were asked to rate their food preferences using the BW approach; ii) an experimental auction was conducted to determine WTP for high-protein bread; iii) a questionnaire was administered to collect detailed sociodemographic information and specific information on the frequency and type of physical activity performed.

2.2.1. Best-Worst approach

In the first phase of the research, each athlete answered a questionnaire designed according to the Best-Worst scaling approach, developed by Marley and Louviere (Marley & Pihlens, 2011). The questionnaire consisted of sets of questions concerning "food values" referred to food in general. This question model was chosen in order to identify the importance of the factors that athletes take into consideration when making their food purchasing choices (Lusk & Briggeman, 2009). Compared to Food Values as listed by Lusk (2011), the food value "tradition", "origin" and "environmental Impact" were excluded as this study refers to athletes. Instead of "sport performance", "claim" and "healthiness" were included because athletes are increasingly interested in these issues.

Table 1 shows all the food values considered for the experimental design.

The values were randomly aggregated so that each attribute was repeated the same number of times. The 9 food values were divided into sets of 5 attributes, for a total of 9 BW question sets. An example question set is shown in Fig. 1. In each set, the question remained the same. For each question, only one food value had to be indicated as "Best" and one as "Worst". The scores for each attribute were summed across all participants to produce a total score for each attribute: higher positive scores indicate greater importance and higher negative scores indicate less importance.

Table 1
Food values (adapted from Lusk, 2011).

	ATTRIBUTE	DESCRIPTION
1	Price	How much you pay for a product
2	Convenience	Easy and convenient to cook and consume a product
3	Naturalness	Food produced without the aid of modern technologies such as GMOs, hormone treatments, etc.
4	Appearance	The food looks attractive and appetizing
5	Safety	When consuming a product poses no risk to your health
6	Taste	The taste of food when you eat it
7	Healthiness	When a product is good for your health
8	Sport performance	The impact it has on sporting performance
9	Claim	A claim that states, suggests or implies that a food has particular beneficial nutritional properties

1. When buying food, which of the following is the most important and which is the least important? (Please mark with an "X" only one attribute as "most important" and one as "less important")

Most important	Attribute	Less important
☐	**Price** *(How much do you pay for a product)*	☐
☐	**Convenience** *(Ease and comfort in cooking and consuming a product)*	☐
☐	**Appearance** *(Food looks attractive and appetising)*	☐
☐	**Claim** *(Claim claiming, suggesting or implying that a food has particular beneficial nutritional properties)*	☐
☐	**Safety** *(When consuming a product does not pose a risk to your health)*	☐

Fig. 1. Example of a BW question.

2.2.2. Second price auction procedure

After completion of the BW questions, a second-price auction (Akaichi et al., 2017; Pappalardo & Lusk, 2016) was performed to elicit athletes' WTP. The second-price auction or Vickrey auction (Vickrey, 1961) is based on the written offer of one's WTP by participants who do not know the bids of others. The winner is the participant who makes the highest bid, however, he or she will not pay the price he or she bid, but rather the second highest bid that was made in the same session.

The participants present at each session (max. 10) were divided into subgroups of 4 or 5 participants each. So, 23 auction sessions were conducted with 3 rounds each.

The participants were presented with the subject of the experimental auction, i.e. a pack of no. 2 high-protein bread (see Photo 1), with a total weight of 100 g (50 g/each), presented in an anonymous, unbranded packaging.

Due to the positive feedback found in the literature (Bouaziz et al., 2020; Belc et al., 2021; Cabello-Olmo et al., 2023), in order to satisfy the high protein content requirement, the formulation of the high-protein bread studied was based on the addition of vegetable protein sources such as chickpea flour (*Cicer arietinum*) and soy protein, together with animal proteins such as whey protein. In addition, sesame, sunflower and flax seeds were added, which contain plant-derived omega-3 poly-unsaturated fatty acids, especially α-linolenic acid, known for their immune-stimulating and health-beneficial properties (Giri, 2021, chap. 8).

The physical (yield 86.21%, average moisture 36.61%) and nutraceutical (20g/100g in protein) properties evaluated confirmed that the functional bread has similar characteristics to traditional bread made from wheat flour, but improved nutritional properties.

Photo 1. Experimental protein bread.

As soon as all participants were ready to start, the moderator explained that for this economic experiment, a real food product was used that really had to be purchased, through a monetary transaction.

Before the real auction session, a test auction session was carried out to ensure that the participants understood the mechanism of the experimental auction, but no product-money transition took place.

At the end of the third round of the real auction, as this was a non-hypothetical economic experiment, the 100g pack of high-protein bread was purchased by the winners of the session randomly selected.

At the end of the experimental auction, a questionnaire was administered to obtain athlete profiling through main socio-demographic characteristics.

At the end of the experimental procedure, each participant was given a gadget-box (equivalent to €15.00 value) for his/her participation.

2.3. Data processing

The collected data were processed through a CA approach. This approach is useful to segment athletes based on their attributes, such as purchasing behaviors, preferences, or demographic characteristics (Van Mierlo et al., 2021). The purpose of the CA was to profile athletes into clusters based on factors that motivate their food choices (i.e. food values), an important factor in understanding the specific requirements and needs of each segment (Maesano et al., 2022).

Preliminarily and before the CA, the importance attributed by athletes by BW approach to each food value was calculated. Using the obtained data of the choice between the "Best" or "Worst" attribute, the average level of importance attributed to each attribute was calculated using the following equation for each participant:

$$Average\ Score = Count_{best} - Count_{worst}$$

where "$Count_{best}$" represents the total number of times each attribute was chosen as "best", and "$Count_{worst}$" is the total number of times each attribute was listed as "worst". Participants' choices were then scored as follows: each attribute selected as most important was assigned a score of +1, and each attribute selected as least important (worst) was assigned a score of −1. So, the resulting value can range from +5 to −5, as each attribute is proposed 5 times.

Based on the individual BW scores, the CA using the k-means method was conducted.

One of the issues of the k-means method is that the estimation results depend on the starting partition (Mooi et al., 2018). Therefore, we first conduct a hierarchical CA using Ward's method to determine the number of clusters k and the starting partition based on the dendrogram.

Then, a non-hierarchical CA using the k-means method is performed based on the starting partition obtained from the hierarchical CA (Burke et al., 2014; Kuivanen et al., 2016).

The k-means method was conducted with 10,000 iterations. We did not use z-scores for individual BW scores because all of them possibly range from +5 to −5. The efficiency of Ward's method and k-means method was evaluated by the Variance ratio criterion (VRC) and Davies-Bouldin (DB) Index, respectively, and the implementation of the k-means method confirms the improvement in efficiency. DB index was calculated by statistical software R studio ver. 2023.03.0. To characterize the final set of clusters, they were examined in terms of their inherent structure, i.e., the mean value of food values and demographic characteristics of athletes for each cluster.

Finally, the average WTP was calculated for each identified cluster using the following formula:

$$Average\ WTP = \frac{\Sigma(WTP)}{n}$$

Where: "Average WTP" is the overall average WTP, "WTP" is the value of an individual's WTP and "n" is the number of individuals in the cluster.

This process involved an interpretation of the cluster profiles in relation to the WTP that emerged during the experimental auction. The focus was on analyzing the differences in WTP among the identified clusters and interpreting the cluster profiles with respect to the relevant variables. This approach aimed to clearly identify and define the variables, i.e., food values, that influence WTP.

By Bartlett's equal-variances test, equivariance for WTP among each cluster was rejected at the 1% level. Moreover, the results of skewness and kurtosis test also showed no normality in several clusters. Thus, A Kruskal-Wallis test and Dunn's test, which are nonparametric test, were used to compare the WTP averages among the clusters and determine whether there is a significant difference between the averages. The results of Dunn's test were adjusted by Bonferroni method. All tests were conducted by STATA® SE 17.0 software.

Two hypotheses were considered:

- Null hypothesis: the average WTP is the same in all clusters.
- Alternative hypothesis: the mean WTP is different in at least one cluster.

Finally, the p-value was calculated to analyze the difference of WTP values among clusters. If the p-value is less than the significance level ($\alpha = 0.10$), the null hypothesis is rejected and it is concluded that the WTP is different in two compared clusters.

3. Results

3.1. Sample characteristics

Table 2 provides a detailed overview of the demographic characteristics, eating habits and sports practices of the participants. The sample of 189 athletes who completed the experimental phase consisted of 59% men and 41% women. The most represented age group is 18–35 years old (61.38%), followed by 36–50 years old (24.34%) and finally 51–69 years old (14.29%). Furthermore, in terms of educational level, most participants have a medium to high level of education, with 43.92% having a high school diploma and 41.27% having a university degree.

The most frequent pattern of income receipt per family unit was by two people (40.2%), followed by a single income earner (32.3%), three income earners (16.40%) and four income earners (11.11%). In the survey conducted, the most represented net household income bracket was between 20,000 and 39,999 €/year (42.33%), followed by the lowest range, less than 20,000 €/year (29.63%) and between €40,000 and €59,999 (16.40%).

Table 2
Characteristics of the sample.

Variable	n.	%
Gender		
Male	111	58.72%
Female	77	40.74%
I prefer not to answer	1	0.54%
Age		
18-35	116	61.38%
36-50	46	24.34%
51-69	27	14.28%
Household income recipients		
1	61	32.28%
2	76	40.21%
3	31	16.40%
4	21	11.11%
Annual net household income		
less than €20,000	56	29.63%
between €20,000 and €39,999	80	42.33%
between €40,000 and €59,999	31	16.40%
between €60,000 and € 79,999	13	6.88%
more than €80,000	7	3.70%
I prefer not to answer	2	1.06%
Level of education		
Secondary school	2	1.06%
High school	83	43.92%
University degree	78	41.27%
Post-graduate	26	13.75%
Frequency of purchasing protein products		
never	24	12.70%
rarely	51	26.98%
sometimes	67	34.45%
often	32	16.93%
very often	15	7.94%
Most frequently purchased protein products		
bars	69	36.51%
bread	28	14.81%
protein powder	37	19.58%
pizza	8	4.23%
other	24	12.70%
I do not buy any	23	12.17%
Place of purchase of protein products		
supermarket	120	63.49%
pharmacy/parapharmacy	4	2.12%
specialized sports nutrition shop	43	22.75%
I do not buy any	22	11.64%
How long have you been practising sport		
less than 1 year	32	16.93%
from 1 to 3 years	27	14.29%
over 3 years	130	68.78%
Activity level		
amateur	140	74.07%
competitive	30	15.87%
elite	19	10.05%
Following a food plan		
yes	46	24.34%
no	143	75.66%
Importance of food for improving health and well-being		
very important	142	75.13%
quite important	36	19.05%
important	10	5.29%
unimportant	1	0.53%
not important	0	0%

With respect to the purchasing habits of protein products, the majority of participants buy such products sometimes (34.45%), rarely (26.98%) or often (16.93%), with a preference for protein bars (36.51%) followed by protein powder (19.58%) and protein bread (14.81%). Most participants buy these products at the supermarket (63.49%), followed by specialized sports nutrition stores (22.75%).

The majority of participants have been practicing sports for more than three years (68.78%) and most identify themselves as amateur athletes (74.07%), followed by competitive athletes (15.87%) and elite athletes (10.05%).

Importantly, the very large majority of participants (75.13%) believe that nutrition is very important for improving health and well-being, while only a small percentage consider it quite important (19.05%). However, only 24.34% follow an eating plan. This could be due to the fact that participants may feel that they have a balanced diet without the need to follow a formal food plan.

3.2. Best-Worst findings

The BW Scaling analysis, carried out in order to understand the food values that influence athletes at the time of purchase, produced the results shown in Table 3. The food value with the highest average score among all attributes proposed as possible drivers in the choice of purchase is "food safety", followed by "taste" and "healthiness". The food values that, on the other hand, were considered less important were "convenience", "appearance" and "sports performance".

3.3. Cluster Analysis

The results of a hierarchical CA using Ward's method are shown in Fig. 2. We chose five clusters from the visual inspection which focused on the distance clusters. Moving from hierarchical to non-hierarchical CA, the VRC improved from 27.72 to 32.02, and the DB Index improved from 2.39 to 2.19.

Mean BW scores for each cluster are shown in Table 4. Cluster 1 considers quality aspects such as safety and healthiness to be very important, but also pays attention to taste, sport performance, naturalness and claims. It considers convenience, price and appearance of food products to be unimportant. This cluster consists of health-conscious athletes who pay particular attention to the safety and healthiness of food products. They are careful in choosing food products that are healthy and nutritious, but do not ignore the sensory aspect of food. Thus, we can call cluster 1 as "Flavor-Conscious Health Fans".

Athletes of cluster 2 do not attribute much importance to taste, naturalness, appearance, product claims and convenience. Their buying choices are rather based on price and influence on sports performance, but they also pay attention to safety and healthiness. The cluster, therefore, is composed of budget-conscious athletes looking for food solutions that are convenient from an economic point of view, but meet the nutritional aspect and needs of sports activity. We can call "Budget-Focused Athletes".

Cluster 3 is not particularly interested in taste, price, appearance and product claims. They base their choices on factors such as convenience, sport performance, safety, healthiness and naturalness. Athletes in this cluster are athletes who favour the convenience of products in their purchasing choices. They are motivated to consume products that are easy to consume and adapted to an active lifestyle, but are conscious that, at the same time, they must choose foods that are healthy and safe, which are important aspects to support nutritional needs and sports activity. We call this group "Health- and Convenience- oriented athletes".

Within cluster 4, they pay more attention to the attributes of safety, naturalness, healthiness and taste of food, and less attention to price. On the other hand, they do not give much importance to product claims, appearance, convenience and sports performance. This cluster includes athletes who are supporters of a natural diet and who attach great importance to food quality and safety. They look for products that are in line with their health values and are aware of the health impact of ingredients, their quality and origin, as well as the balance between taste and price. Thus, we call cluster 4 "Quality-Conscious Natural Food Advocates".

Lastly, cluster 5 considers taste and price to be most important and pays attention to product safety and appearance. They show less interest in healthiness and naturalness and even less interest in convenience, product claims and sports performance. Athletes in this cluster are looking for products that offer, in the food context, a combination of sensory quality and accessible price. They pay attention to taste, attractive appearance and the overall product experience. However, they do not ignore the guarantee of an adequate level of safety in the consumption of food and the observance of quality standards. We can call them "Athletes seeking sensory experiences and safety".

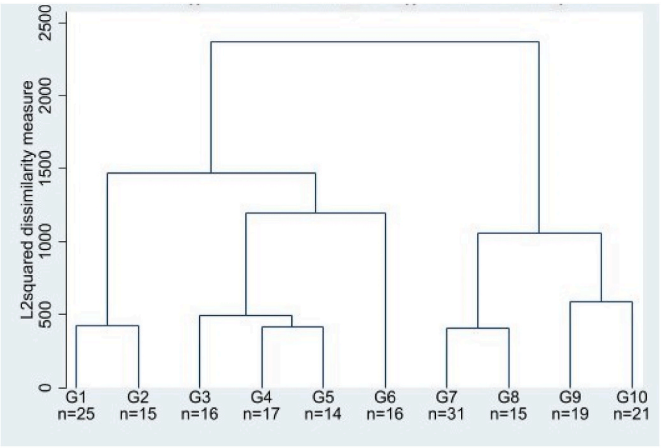

Fig. 2. Estimation results of the hierarchical CA.

Table 3
Results of BW scaling.

	Average	Dev. St	Min	Max
Price	0.39	2.63	−5	5
Convenience	−1.50	2.43	−5	5
Naturalness	0.42	2.02	−5	5
Appearance	−1.06	1.89	−5	5
Safety	1.46	1.88	−4	5
Taste	1.05	1.85	−4	5
Healthiness	0.95	1.74	−4	5
Sport performance	−0.71	2.89	−5	5
Claim	−0.99	2.07	−5	5

3.4. Consumers' willingness to pay from the experimental auction

The analysis of the WTP of each identified cluster, to purchase a 100g packet of high-protein bread, was estimated by a second-price experimental auction.

The results obtained revealed an average WTP of 1.63 €/100g, showing significant variations between the various clusters, which are detailed in Table 5.

The assignment of average WTP values for each cluster was performed by applying the k-mean method.

Cluster 1 reported an average WTP of 1.76 € per unit of product. Moreover, the analysis shows a higher WTP within cluster 2, with an average of 1.93 € per unit of auctioned product.

Individuals associated with cluster 3 show a lower average WTP than the previous clusters (1.52 €/100g).

The average WTP of cluster 4 of 1.60 €/100g is perfectly within the average range.

Finally, cluster 5 has the lowest average WTP among all clusters, with a value of 1.25 €/100g.

The mean WTP values for each cluster were compared with Kruskal-Wallis test and Dunn's test in order to identify any statistically significant differences between them. The test's p-value was 0.022. Thus, we can reject the null hypothesis that there is no difference in means among clusters at the 5% level. In addition, the values of the comparison performed are shown in Table 6.

As shown in Table 6, there are statistically significant differences only between the average WTPs of clusters 2 and 5, with a p-value of 0.017. In fact, participants in cluster 2 bid on average 0.675 € more than

Table 4
Mean BW Scores and Ranks of each cluster in the non-hierarchical CA.

Food values	Cluster 1 *(47 athletes)*		Cluster 2 *(36 athletes)*		Cluster 3 *(21 athletes)*		Cluster 4 *(50 athletes)*		Cluster 5 *(35 athletes)*		Total sample *(189 athletes)*	
	Mean BW Score	Rank	Mean BW Score	Rank	Mean BW Score	Rank	Mean BW Score	Rank	Mean BW Score	Rank	Mean BW Score	Rank
Price	−2.38	8	2.47	1	−0.76	7	0.64	5	2.31	2	0.39	5
Convenience	−2.49	9	−2.47	9	2.95	1	−1.90	8	−1.26	7	−1.50	9
Naturalness	0.60	5	−0.58	6	0.29	5	2.00	2	−0.97	6	0.42	4
Appearance	−1.53	7	−1.19	7	−1.38	8	1.68	7	0.80	3	−1.06	8
Safety	1.96	1	0.89	3	1.10	3	2.28	1	0.40	4	1.46	1
Taste	0.96	3	−0.11	5	−0.14	6	1.10	4	3.00	1	1.05	2
Healthiness	1.57	2	0.36	4	0.90	4	1.76	3	−0.43	5	0.95	3
Sport Perf	0.87	4	2.00	2	1.14	2	−3.64	9	−2.54	9	−0.71	6
Claim	0.45	6	−1.36	8	−4.10	9	−0.56	6	−1.31	8	−0.99	7

Note: The results of the Kruskal-Wallis tests showed significant differences in the means among the clusters for all food values at the 1% level.

Table 5
Average values of WTP, by cluster.

Cluster ID	Mean Bid (€/100g)	Std. Dev.	Freq.
1	1.76	1.02	47
2	1.93	1.61	36
3	1.52	0.66	21
4	1.60	0.72	50
5	1.25	0.73	35
Total sample	1.63	0.91	189

Table 6
Comparison of mean bid by cluster ID (Bonferroni).

Cluster ID	1	2	3	4
2	0.162 *(1.000)*			
3	−0.2473 *(1.000)*	−0.410 *(0.965)*		
4	−0.159 *(1.000)*	−0.321 *(1.000)*	0.088 *(1.000)*	
5	−0.513 *(0.110)*	−0.675 *(0.017)*	−0.265 *(1.000)*	−0.353 *(0.742)*

Note: The upper line of Table 6 shows the difference in means, and the lower line shows the p-value of Dunn's test adjusted by the Bonferroni method.

those in cluster 5. These are the two clusters that assign the highest importance to food value "price".

4. Discussion

In this study, we evaluated the willingness to pay of a sample of athletes for a potentially important new food in their diet, that is a new type of bread with a high protein content. We also wanted to identify which 'food values' could influence the athletes' willingness to pay for this protein bread, highlighting the relevance of this product in the context of the growing focus on nutrition and wellness.

However, in contrast to previous studies, in our research we did not directly assess the effects of food values on willingness to pay but took into account the potential heterogeneity of preferences within the interviewed sample of athletes. In other words, we assessed how athletes evaluate protein bread by taking into account the importance they assign to food values. This difference, which at first impression seems insignificant, is important since athletes do not have the same preferences when purchasing food, and consequently it is interesting to assess whether differences among athletes in preferences for food values may influence their willingness to pay to purchase protein bread.

Our results reveal significant heterogeneity in athletes' preferences, suggesting that there is no single athlete profile. This evidence, confirming the findings of the study conducted by Arenas-Jal et al. (2020), highlights the importance of segmenting the market according to athlete preferences and priorities to tailor marketing strategies to meet the needs of each segment. In addition, our study highlights and confirms the crucial role of food values in determining WTP revealed in the literature (Chang, 2018; Yeh et al., 2020).

The use of the BW Scaling approach helped to better understand the influence of food values on athlete purchasing behavior, enabling a more in-depth assessment of athletes' food preferences. To this end, through the CA, the sample of athletes interviewed was divided into clusters according to the scores they assigned to food values understood as the attributes one looks for when buying food in general.

Positive food value scores indicate that athletes prefer such values when making their food choices. While, negative scores assigned to food values represent athletes' unfavourable perceptions of those specific attributes, meaning that athletes do not consider these attributes as priorities or relevant in their food choices.

Our analysis resulted in the identification of 5 clusters of athletes each differentiated by specific characteristics according to the importance they assigned to food values.

A first interesting result from our investigation is that all athlete clusters showed a positive willingness to pay for high-protein bread. This implies that regardless of the importance assigned to food values, all athlete clusters identified in our study are interested in consuming bread enriched with protein ingredients. This result has important implications as it means that protein bread is appreciated not only by athletes who prioritise health aspects, even irrespective of price, but also by those who do not give up taste aspects and those who pay attention to the aspects of naturalness or convenience in food consumption.

Second important finding in our research is that no statistically significant differences in WTP for protein bread were found among the five clusters identified with the CA. This means that although there were differences in the importance assigned to food values among the interviewed athletes, they exhibited essentially the same average WTP values for protein bread. The only statistically significant difference in WTP between the five clusters analysed was recorded between cluster 2 'Budget-Focused Athletes' and cluster 5 'Athletes seeking sensory experiences and safety'.

The investigated differences between the cluster in terms of willingness to pay values, according to the findings of the non-hierarchical CA, can be attributed substantially to the participants' perceptions of 2 food values, "taste" and "sport performance", to which the participants in the two clusters assigned different and opposite scores. Specifically, with regard to "taste", it represents a very important food value for cluster 5 and unimportant (almost indifferent) for cluster 2. In contrast, to the food value "sport performance" is assigned a positive and high score in cluster 2 (+2.00) compared to the negative score assigned to it in cluster 5 (−2.54).

This result is probably due to the fact that the athletes within Cluster 2 do not attach much importance to price as they are interested in

purchasing food with attributes such as safety and wholesomeness regardless of its cost. Conversely, athletes in Cluster 5 place importance on taste and other sensory aspects.

Third issue that became evident in our research is related to the importance that the interviewed athletes assigned to the food values used in the survey. In particular, the most important food values were healthiness, safety but also taste and price.

This is consistent with previous studies which have shown that consumers judge the aforementioned food values to be important (Ali & Ali, 2020; Istanti et al., 2020; Jürkenbeck & Spiller, 2021; Liu et al., 2020) and that athletes therefore evaluate food values in the same way as normal consumers. To reinforce this finding and almost surprisingly, our survey revealed the low importance attached by athletes to the 'sport performance' value. Although the target group selected for the study was athletes, the negative value reported for "sport performance" (−0,71) indicates that athletes may not associate the sporting effectiveness of a food as an important element in their food choice. It is commonly believed that athletes choose those foods that can positively influence sports performance but from what emerged in our analysis this aspect is considered less important than other attributes such as healthiness, safety and price. This surprising finding, which differs from previous research conducted by Arenas-Jal et al. (2020) that links nutrition to performance enhancement, suggests that athletes may view nutrition in terms of general health maintenance rather than specific performance enhancement.

Ultimately, the results that emerged in our study show that protein bread is a product that is appreciated by athletes and the reasons for this may be related to the fact that protein bread is first and foremost a 'bread', i.e. a typical food of the Mediterranean diet to which we typically associate food values such as quality, naturalness, wholesomeness, taste and other attributes that play a key role in the process of food purchasing by athletes and consumers in general.

4.1. Implications for all stakeholders

Overall, the knowledge emerging from the analysis of athlete values, preferences and motivations can significantly contribute to the food industry's strategic decision-making processes. By understanding the specific needs and desires of athletes, companies can develop successful product offerings that are precisely tailored to respond to these preferences. Indeed, this study suggests substantial implications for the food industry by enabling more precise market segmentation, which allows the identification of more effective marketing strategies.

Ultimately, this study underscores the importance of integrating athlete feedback into the product development cycle. By continuously engaging with athletes and incorporating their insights, the food industry can innovate more effectively, ensuring that new products not only meet but exceed the expectations of this demanding market. This iterative process of feedback and development helps in staying ahead of trends and maintaining a competitive edge in the market.

5. Conclusion

The study provides detailed insight into the preferences and priorities of athletes toward a specific food product. High-protein functional foods can be designed in line with the key motivation for their purchase among athletes. The focus on health improvement highlights the necessity for these products to not only meet nutritional needs but also to align with the broader values and expectations of this consumer segment. Although it is commonly assumed that athletes, due to their specific nutritional needs and dietary focus, develop particular preferences for certain foods, our observations do not support this idea. In general, based on the research conducted, our results reveal that athletes' food preferences are similar to those of non-athletes or the general consumers.

The results of the study suggest that the information gathered can guide the development of targeted food policies and marketing strategies to promote functional foods among health-conscious consumers, thereby improving the population's dietary choices.

5.1. Limitations of the study and future research directions

This study identified some limitations that deserve consideration as a guide for future research perspectives. Further research could expand the study sample to include a diverse range of athletes, both geographically and in terms of discipline. In addition, the methodology used may not have fully captured all the nuances of athletes' dietary preferences and behaviors, which may be influenced by unmeasured variables such as the effect of nutritional information and health claims on purchasing behavior. Finally, given the specificity of this study, future research should aim to confirm and expand these findings across different contexts and product categories within the functional food. This would help ensure the robustness and generalizability of the results beyond the specific product (high-protein bread) and consumer segment (athletes) examined in this study.

Ethics approval statement

Approval to conduct this study was granted by the Department of Agriculture, Food and Environment (Di3A) of Catania University, in accordance with its ethical review and approval procedures.

CRediT authorship contribution statement

Matilde Reitano: Writing – review & editing, Writing – original draft, Investigation. **Roberta Selvaggi:** Writing – review & editing, Writing – original draft, Validation, Software, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Gaetano Chinnici:** Writing – review & editing, Writing – original draft, Software, Methodology, Funding acquisition, Data curation. **Gioacchino Pappalardo:** Writing – review & editing, Writing – original draft, Supervision, Methodology, Formal analysis, Data curation, Conceptualization. **Kohei Yagi:** Supervision, Software, Methodology, Data curation. **Biagio Pecorino:** Validation, Supervision.

Declaration of competing interest

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

Data availability

Data will be made available on request.

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