DEPARTMENT OF AGRICULTURAL, FOOD AND ENVIRONMENTAL SCIENCES

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Consumer Acceptance and Willingness to Pay for Spirulina Drinks: Comparing Italian Organic and Vietnamese Conventional Spirulina

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Student: ELIF HULAGU

Supervisor: Prof. RAFFAELE ZANOLI

Assistant supervisors:

Prof. NASPETTI SIMONE

Ph.D. EMEL OZTURK CIRAK

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ACRONYMS AND ABBREVIATIONS

ANOVA	Analysis of variance
D3A	Dipartimento di Scienze Agrarie, Alimentari e Ambientali (Department of Agricultural, Food and Environmental Sciences)
df	Degrees of Freedom
FNS	Food Neophobia Scale
FRL	Food-Related Lifestyle
GDPR	General Data Protection Regulation
GHI	General Health Interest
GLA	Gamma-Linolenic Acid
IT-Org	Italian organic spirulina beverage, informed (true-label) condition
M	Mean
MAECI	Ministero degli Affari Esteri e della Cooperazione Internazionale (Italian Ministry of Foreign Affairs and International Cooperation)
PSPP	Statistical analysis software (GNU Project), used for all analyses reported in Chapter 3
SD	Standard Deviation
UNIVPM	Università Politecnica delle Marche
VN-Conv	Vietnamese conventional spirulina beverage, informed (true-label) condition
VN-Org	Vietnamese conventional spirulina beverage presented with a false organic label (deception condition)
WTP	Willingness to Pay

INTRODUCTION

In recent years, microalgae-based foods and beverages have gained increasing attention from both researchers and the food industry due to their nutritional value and potential contribution to more sustainable food systems (Lafarga et al., 2021). Among the different microalgae species, *Arthrospira platensis*, commonly known as spirulina, is the most widely cultivated and commercialized, thanks to its rich micronutrient composition and high protein content (Grahl et al., 2018).

Despite these nutritional advantages, the market success of spirulina-based beverages remains limited. One of the main reasons is related to their sensory characteristics. Spirulina is often associated with a grassy flavor, a marine-like aroma, and an intense blue-green color, which many consumers perceive negatively (Migliore et al., 2025). In addition, psychological factors may also affect consumer behavior. For instance, food neophobia, defined as the reluctance to try unfamiliar foods, has been identified as an important barrier to the acceptance of spirulina-based products (Rombach and Dean, 2025).

In addition to sensory attributes, consumer evaluations of spirulina products may be impacted by details on the product's manufacturing process and location. Regardless of the inherent sensory qualities, origin, and certification cues might influence expectations before tasting and assessments following it (Delrue et al., 2017). These effects, frequently referred to as "halo effects", occur when consumers believe that a product is safer, more sustainable, or of greater quality than it actually is (Verlegh, 2001). Therefore, understanding how these informational cues affect sensory evaluation is essential for the successful marketing of spirulina-based beverages.

In addition, informational cues may affect consumers' willingness to pay (WTP), another key indicator of market acceptance. Previous studies investigating consumer willingness to pay (WTP) for spirulina products have mainly relied on hypothetical approaches, such as surveys and discrete choice experiments (Maehle and Skjeret, 2022). Although these methods provide valuable insights into consumer preferences, they may not accurately reflect real purchasing behavior because participants do not face actual economic consequences. The auction mechanisms offer a more realistic alternative by requiring participants to make decisions involving real monetary transactions. For this reason, auction-based methods are considered more reliable for measuring consumers' willingness to pay for products (Ausubel & Milgrom, 2005).

Considering this background, this thesis aims to investigate how origin and organic certification influence consumer acceptance and willingness to pay for beverages produced from Italian organic and Vietnamese conventional spirulina. The study was conducted as part of the MAECI (Italian Ministry of Foreign Affairs and International Cooperation) experimental research project at the Department of Agricultural, Food and Environmental Sciences (D3A), Università Politecnica delle Marche (UNIVPM), Ancona.

The specific objectives of this thesis are:

- To provide a literature review on spirulina as a functional food ingredient, focusing on its nutritional characteristics, market development, and the main factors influencing consumer acceptance.

- To examine whether Italian consumers perceive sensory differences between Italian organic and Vietnamese conventional spirulina beverages under blind tasting conditions.
- To assess the impact of origin and organic certification information on consumer liking under informed tasting conditions.
- To investigate the presence of an organic certification halo effect by comparing consumer responses to the same Vietnamese spirulina beverage presented with and without an organic label.
- To examine whether socio-demographic characteristics and previous experience with spirulina influence liking and willingness to pay.
- To analyze the role of food neophobia (Food Neophobia Scale, FNS), general health interest (GHI), and food-related lifestyle (FRL) dimensions, namely Innovativeness, Responsibility, and Involvement, in shaping consumer preferences and willingness to pay.
- To measure consumers' willingness to pay for Italian organic and Vietnamese conventional spirulina beverages using a Vickrey 2-unit third-price auction mechanism.

The thesis is organized into three main chapters. Chapter 1 reviews the literature related to spirulina, its nutritional and functional properties, and the factors affecting consumer acceptance and willingness to pay. Chapter 2 describes the materials and methods adopted in the study. Chapter 3 presents and discusses the empirical findings. Finally, the thesis concludes by summarizing the main results, discussing their practical implications, and suggesting directions for future research.

CHAPTER 1

BACKGROUND AND CONTEXT

Spirulina, *Arthrospira platensis,* is a blue-green microalga that has been consumed by humans for centuries. Historical evidence shows that it was used as a food source by the Aztec civilization and by communities living around Lake Chad (Habib et al., 2008). Today, spirulina is one of the most widely cultivated microalgae worldwide. Its popularity has grown steadily due to increasing consumer interest in plant-based proteins, functional foods, and sustainable nutrition.

1.1 Spirulina as a Functional Food and Beverage

Spirulina is widely recognized for its rich nutritional composition. Its protein content generally ranges between 50% and 70% of dry weight, making it one of the most protein-rich plant-based ingredients available. In addition, spirulina contains all essential amino acids, which increases its nutritional value compared with many other plant-based protein sources (Grahl et al., 2018). Besides protein, spirulina provides several important micronutrients, including B vitamins (B1, B2, and B12), beta-carotene, iron, calcium, magnesium, and gamma-linolenic acid (GLA). GLA is an omega-6 fatty acid associated with anti-inflammatory properties and a favorable omega-6 to omega-3 ratio (Chaudhary et al., 2026). One of the most studied compounds in spirulina is phycocyanin, the pigment responsible for its characteristic blue-green color. Research suggests that phycocyanin possesses antioxidant, anti-inflammatory, and immunomodulatory properties (Grahl et al., 2018). It has also attracted attention for its potential antitumor, hepatoprotective, and neuroprotective effects. These characteristics contribute to spirulina's growing use as a functional food ingredient (Grahl et al., 2018).

The beverage sector is one of the most important application areas for spirulina. Functional drinks enriched with spirulina appeal to consumers looking for convenient products that provide additional nutritional benefits. The growing demand for plant-based and health-oriented foods has further increased interest in spirulina beverages (Grahl et al., 2018).

1.2 Market Development and Sensory Challenges

Spirulina has been used as a dietary supplement for a long time, but its application in conventional food and beverages is continually evolving and varies across regions. The global spirulina market is still growing, with North America holding the most market share, followed by Asia-Pacific and Europe, and rising markets in Latin America, the Middle East, and Africa (Migliore et al., 2025). However, consumer familiarity varies across countries. Research has shown that awareness, acceptance, and willingness to pay for spirulina-based products are influenced by consumers' familiarity with the product (Migliore et al., 2025). For example, French consumers have shown greater interest in spirulina than consumers in Germany and the Netherlands,

although knowledge and awareness is low in nations like in Greece and Turkey (Migliore et al., 2025). These differences in familiarity may also influence how spirulina-based products are perceived. Even though spirulina has significant nutrients and health benefits, it is often linked with a strong green color and earthy, grassy, marine, or fish-like flavors that might be unpleasant for some people. The way it looks and tastes can affect how much people like it, especially in beverages where appearance and flavor are important (Chaudhary et al., 2026). Moreover, these sensory traits are affected by cultivation procedures, storage conditions and geographical origin which causes differences in taste, smell, and the overall experience of the product (Cvetković et al., 2025). Although technological developments have enhanced the formulation of spirulina-containing products, very few studies have assessed sensory acceptance, including customers' willingness to pay, which is one of the motivations for this thesis study.

1.3 Determinants of Consumer Acceptance and WTP

Consumer acceptance of novel functional foods depends on a combination of sensory characteristics and product-related information. While taste, aroma, and appearance play a central role, psychological and contextual factors also significantly shape consumer responses. Among them, food neophobia, which is defined as the unwillingness to try new foods (Pliner and Hobden, 1992), has been widely recognized as a key barrier to the acceptance of novel foods and beverages, including spirulina-based products. Previous research has shown that individuals with higher levels of food neophobia are generally less willing to try spirulina-based foods and beverages. In contrast, consumers who are already familiar with algae-based products tend to show higher acceptance and greater willingness to pay (Rombach and Dean, 2025).

In addition to food neophobia, broader individual attitudes towards health and food choices also play an important role in shaping consumer behavior. Approaches such as General Health Interest (GHI) and Food-Related Lifestyle (FRL) help explain differences in consumer behavior. In particular, dimensions such as Innovativeness, Involvement, and Responsibility may affect how consumers evaluate novel functional foods and how they respond to sustainability-related information (Szakály et al., 2011).

Beyond individual psychological traits, extrinsic product cues such as country of origin and organic certification also strongly influence consumer expectations. These cues may act as quality aspects that shape consumer expectations before tasting. Through the halo effect, which means consumers may perceive products labeled as organic or locally produced as healthier, safer, or more environmentally friendly, regardless of their actual sensory quality (Verlegh, 2001). To examine this phenomenon, the present study includes a deception condition that allows the organic certification effect to be separated from actual product differences.

In the context of spirulina-based beverages, origin information is particularly relevant due to differences in production systems. Italian and Vietnamese spirulina belong to the same species, *Arthrospira platensis*, but differ in cultivation environments and processing conditions, which may influence both actual product characteristics and consumer expectations. Italian spirulina is commonly produced in controlled greenhouse systems, ensuring stable growing conditions and consistent product quality (Zrimec et al., 2024), whereas Vietnamese spirulina is mainly cultivated in open-pond systems under tropical climatic conditions

(Nguyen et al., 2021). Open-pond systems are generally associated with lower production costs but higher environmental variability, which may contribute to differences in sensory properties (Delrue et al., 2017).

Consumer responses to both intrinsic and extrinsic factors are ultimately reflected in their willingness to pay (WTP), which is commonly used as an indicator of perceived product value and market potential. Previous studies investigating WTP for spirulina products have mainly relied on hypothetical approaches such as contingent valuation surveys and discrete choice experiments (Maehle & Skjeret, 2022). Although these methods provide useful insights, they are subject to hypothetical bias, as respondents do not face real economic consequences. To overcome the limitations of hypothetical methods, incentive-compatible mechanisms such as experimental auctions have been introduced. In the Vickrey 2-unit third-price auction adopted in this study, participants are encouraged to reveal their true willingness to pay because strategic bidding does not provide an advantage (Ausubel & Milgrom, 2005). As a result, auction-based methods are often considered more reliable indicators of actual consumer behavior.

These conceptual relationships provide the theoretical foundation for the thesis methodology, which examines the effects of sensory experience and extrinsic information using an experimental design that integrates hedonic evaluation and incentive-compatible willingness-to-pay measures.

CHAPTER 2

MATERIALS AND METHODS

2.1 Study Design

This study employed a within-subject experimental design to investigate consumer acceptance and willingness to pay (WTP) for spirulina-based beverages produced from Italian organic and Vietnamese conventional spirulina. The research combined a 9-point hedonic scale for sensory evaluation with a Vickrey 2-unit third-price auction mechanism to measure willingness to pay. This approach allowed the assessment of sensory liking, information effects, and willingness to pay within a single experimental session.

The design of this study is based on the blind-informed/expectancy-disconfirmation model (Oliver, 1980). According to this model, product evaluations are influenced not only by sensory experience but also by expectations formed before consumption. This design helps to explain how information about origin and organic certification may influence consumer liking and willingness to pay. During the blind tasting phase, participants evaluated the beverages without any information, and during the informed tasting phase, they were given knowledge about the beverage's origin and production process. Additionally, a deception condition was added to investigate whether organic certification alone affected consumer evaluations. In this condition, Vietnamese conventional spirulina was presented to participants with an organic label in order to examine the effect of organic certification independently from actual product characteristics.

The study addressed the following research questions:

Q1: Do consumers perceive sensory differences between Vietnamese conventional (Blind VN) and Italian organic (Blind IT) spirulina beverages under blind tasting conditions?

Q2: Does information about product origin (Italian versus Vietnamese) influence consumer liking during the informed tasting phase?

Q3: Does information about the production method (organic versus conventional) affect consumer liking?

Q4: Does organic certification generate a halo effect? In other words, is the effect stronger when consumers compare organic and conventional products or when they compare two products carrying an organic label but originating from different countries?

Q5: To what extent do individual characteristics, including socio-demographic variables, food neophobia, general health interest, and food-related lifestyle, influence liking, willingness to pay, and information effects?

Q6: How much are consumers willing to pay for Italian organic and Vietnamese conventional spirulina beverages, and how does willingness to pay vary according to origin and organic certification?

All participants provided written informed consent before taking part in the study. Personal data were anonymized and processed in compliance with GDPR requirements. The full experimental design is presented in *Figure 2-1 below.*

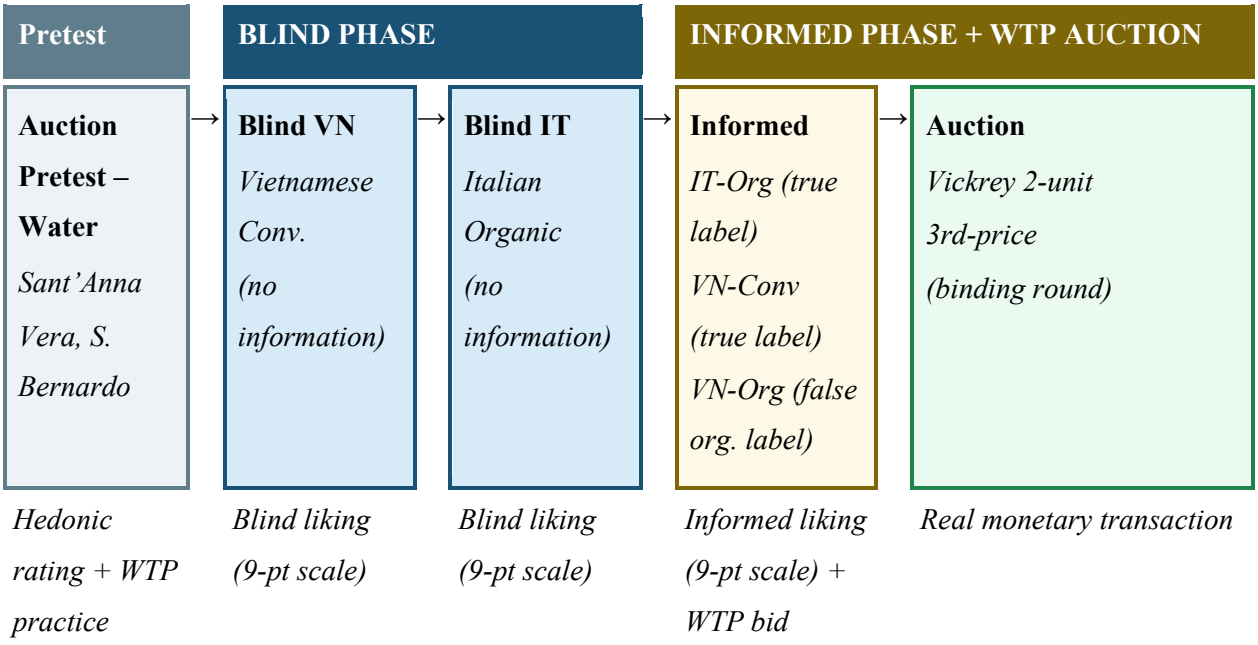

Figure 2.1: Experimental design of the spirulina consumer panel

2.2 Participants

A total of 100 Italian participants were recruited from the Marche region through cold calling, face-to-face outreach at university campuses and nearby supermarkets, and volunteer mailing lists. To be eligible, participants had to be Italian citizens, responsible for grocery shopping in their household, have no food allergies or health conditions that could affect participation, and not be employed in food-related sectors such as agriculture, the food industry, or market research. As a requirement of eligibility, individuals with sensory impairments affecting taste or smell were excluded. Moreover, participants were instructed not to eat, drink (except water), smoke, or consume coffee or tea for at least two hours before the tasting session to minimize potential influences on sensory evaluation.

To obtain a diverse sample, recruitment was guided by predefined demographic quotas based on age, gender, education level, and employment status. The target distribution included participants aged 20–39 years (n = 24), 40–59 years (n = 35), and 60 years or older (n = 41); 49 males and 51 females; 82% with a medium-to-low level of education and 18% with a university degree or higher; and 61 economically active and 39 inactive participants, including students, unemployed individuals, homemakers, and retirees. To minimize endowment bias during the auction, each participant received a €10 monetary gift at the beginning of the session before any tasting activities took place. However, since there was a time restriction, these quotas were used as recruitment targets rather than strict requirements, and not all quotas were fully achieved. Differences between the planned and final sample composition are presented as study limitations in the "Conclusion" section.

2.3 Sample Preparations and Experimental Procedure

The experimental procedure consisted of sample preparation, a water pretest and auction, and the tasting sessions, which included blind tasting, informed tasting, and a final auction.

Two spirulina samples, belonging to the species A*rthrospira platensis* but differing in geographical origin and production method, were prepared for the experiment. The first sample was Italian certified organic spirulina produced by Becagli (Italy), cultivated in controlled greenhouse systems in Tuscany. The second sample was Vietnamese conventional spirulina, produced by VASTCOM (Vietnam), cultivated in open-pond systems. Both samples are supplied as frozen 10 g sachets, which were stored at −20°C.

Spirulina beverages were prepared following a standardized protocol to ensure consistency across tasting sessions. A stock solution was prepared one day before each experiment by dissolving separately 10 g of Italian and Vietnamese spirulina powder in 200 mL of still water using a mixer for 1 minute and storing the solution under refrigerated conditions until use to allow complete dissolution and stabilization of color and flavor. On the day of the experiment, the final beverage was prepared according to a fixed recipe, which was determined with pilot tests. Accordingly, the spirulina beverage consisted of 7.5 g/L spirulina, 60 mL/L organic lemon juice, 50 mL/L organic grape sugar syrup, water, and a pinch of salt. The beverages were prepared approximately one hour before the tasting session, portioned into 20 mL samples, and served in an odour-

neutral plastic cup. To prevent identification bias, all samples were labelled with randomly generated three-digit codes.

The tasting sessions were conducted in groups of 10-12 participants. Each participant was seated in an individual tasting booth to prevent communication and ensure independent evaluations. Sessions lasted approximately 30–40 minutes. Upon arrival, participants were given a consent form, a socio-demographic questionnaire, a very short and general information card about spirulina (to provide an equal basis for all participants), and a €10 participation incentive. After completing the consent form and questionnaire, participants proceeded through three consecutive stages: a water auction pretest, a blind tasting phase, and an informed tasting phase, and final spirulina auction. To minimize carryover effects, participants were told to cleanse their palate with still water between samples and wait at least 2–3 minutes before tasting the next beverage.

Before the main experiment, participants completed a water-auction pretest to ensure that they understood the Vickrey 2-unit third-price auction mechanism and to reduce the likelihood of strategic bidding. In this pre-test, three commercially available bottled waters (Sant'Anna, Vera, and S. Bernardo) were used. Each water sample was presented in its original 500 ml bottle and then poured into small plastic cups. Participants evaluated each sample using the 9-point hedonic scale and submitted a willingness-to-pay on the auction form for each bottle. After all bids had been collected, one of the water brands was randomly selected as the binding product, and participants whose bids exceeded the third-highest bid were declared winners. No payment was required at this stage, as this was a practice round designed to familiarise participants with the auction mechanism.

Following the pretest, participants proceeded to the blind tasting phase. In this phase, participants evaluated Blind VN (Vietnamese conventional spirulina) and Blind IT (Italian organic spirulina) without receiving any product information. The samples were presented sequentially in a pre-assigned counterbalanced order based on a Latin square design to minimize order and carryover effects. Serving cups were labeled with three-digit codes aligning with corresponding participant sample tasting order. For each sample, participants observed the appearance, smelled the beverage, tasted the sample, and rated overall liking using a 9-point hedonic scale (1 = "extremely dislike"; 5 = "neither like nor dislike"; 9 = "extremely like").

Following the blind tasting phase, participants proceeded to the informed tasting phase, where they assessed three products: IT-Org (Italian organic spirulina), VN-Conv (Vietnamese conventional spirulina, true label), and VN-Org (Vietnamese conventional spirulina presented with a false organic label). The samples were served sequentially in a randomized and counterbalanced order. Each sample was accompanied by a product information card indicating its origin and production method. The evaluation procedure used the same 9-point hedonic scale as in the blind tasting phase. In addition, participants also submitted a willingness-to-pay (WTP) bid for a hypothetical 250 mL serving of the beverage. Participants were required to cleanse their palate with still water between samples and wait at least 5–6 minutes before evaluating the next product.

After the informed tasting phase**,** the spirulina auction was conducted. One of the three informed samples (VN-Conv, IT-Org, or VN-Org) was randomly selected as the binding auction round. All bids

submitted for the selected product were collected and ranked. The third-highest bid was identified, and participants whose bids exceeded this value were declared winners. Winners paid the third-highest price and received a sachet of spirulina powder, supplied by Becagli, together with the recipe used in the experiment to prepare a similar beverage at home

2.4 Data collection and measurement scales

Participant responses were collected using a sociodemographic questionnaire, sensory evaluation, and WTP forms. Overall liking was measured using a 9-point hedonic scale, while WTP was measured in euros, with offers given for 250 ml spirulina beverages.

In the sociodemographic questionnaire, participants also responded to questions on age, sex, educational level, employment status (active or inactive), physical activity regularity, and any previous experience with spirulina-based products. Additionally, Food neophobia was measured using the 10-item Food Neophobia Scale (FNS) developed by Pliner and Hobden (1992). Each statement was evaluated using a 7-point Likert scale, with higher scores indicating a greater reluctance to try new foods. General Health Interest (GHI) was measured using the 8-item General Health Interest subscale of the Health and Taste Attitude Scales (Saba et al., 2018). All items were rated on a 7-point Likert scale. Furthermore, three dimensions of the Food-Related Lifestyle (FRL) instrument (Brunsø et al., 2021) were included in the study. Each dimension was measured using three items rated on a 7-point Likert scale. The dimensions are described as Innovativeness, which reflects an individual's tendency to seek out and try new food products. Involvement refers to the importance and personal relevance of food and eating in everyday life. Responsibility measures the extent to which environmental and social sustainability considerations influence food choices (Brunsø et al., 2021).

2.5 Statistical Analysis

Data were analyzed using PSPP statistical software. During the analyses, data preparation, including reverse-coding for negatively worded items in the FNS and GHI scales, descriptive statistics, and the assessment of the internal consistency of the psychographic scales using Cronbach's alpha coefficient, were performed. A Cronbach's alpha value of 0.70 or higher was considered indicative of acceptable internal consistency (Pinto et al., 2013).

Descriptive statistics were calculated for all socio-demographic variables, including age, educational level, employment status, and physical activity frequency, as well as for blind liking scores, informed liking scores, and willingness-to-pay (WTP) bids across all sample conditions. In addition, comparative analyses were performed utilizing paired sample t-tests, Welch’s independent t-test, and one-way ANOVA. All statistical tests were two-tailed, with the significance level set at $p < 0.05$. To report effect size, Cohen’s d values were used to indicate small (0.20), medium (0.50), and large (0.80) effects (Brydges, 2019). The analyses included four main groups of comparisons as blind tasting comparisons, information effect comparisons, origin and certification comparisons and willingness-to-pay comparisons.

To examine liking scores and WTP bids, t-tests were performed. The first comparison was conducted to determine whether participants noticed intrinsic sensory differences between Vietnamese conventional and Italian organic spirulina in blind liking conditions. The second comparison involves blind and information liking conditions to evaluate information effect (Blind IT vs. IT-Org and Blind VN vs. VN-Conv, the effect of origin and production method). The third comparison was performed to distinguish the individual and combined effects of origin and certification. To accomplish this, sub-comparisons were carried out. These sub-comparisons are VN-Conv vs. VN-Org to assess the impact of organic certification for the same product, IT-Org vs. VN-Org to isolate the impact of country of origin while maintaining certification constant, and IT-Org vs. VN-Conv to assess the combined effect of origin and production method. Finally, the same comparisons were performed for WTP bids.

Participants were further classified according to their scores on the psychographic scales. Food Neophobia Scale (FNS) scores were divided into three groups using tertiles: Low, Medium, and High Neophobia. The tertile cut-off points were selected from the observed score distribution. Differences between groups were analyzed using one-way ANOVA. For the General Health Interest (GHI) scale and the three Food-Related Lifestyle (FRL) dimensions (Innovativeness, Involvement, and Responsibility), participants were divided into High and Low groups using the sample mean as the cut-off value instead of the tertile approach. Since the FRL subscales had only three items, using a tertile method would have created groups that do not have meaningful distinction from each other. The same approach was applied to the GHI scale to ensure consistency.

CHAPTER 3: RESULTS AND DISCUSSION

This chapter presents the results of the consumer study described in Chapter 2 and addresses the six research questions. The findings were organized according to the study objectives and include both sensory evaluations and willingness-to-pay (WTP) measures. The results were presented in three stages. First, descriptive statistics and scale reliability are reported. Second, differences in liking and willingness to pay across the tasting conditions are examined. Finally, the influence of socio-demographic and psychographic characteristics on product liking was explored.

3.1. Descriptive statistics and scale reliability

3.1.1 Sample Description

The analyses presented in this chapter are based on the 100 Italian consumers who participated in the study. Table 3-1 below summarizes the demographic characteristics of the sample, including age, sex, educational level, employment status, and physical activity. These characteristics indicate that the sample captures consumer responses across a range of demographic groups.

Table 3-1: Composition of the Analytic Sample (n = 100)

Variable	Category	n	%
Age (years)	M = 44.4, SD = 15.3, range 20–77		
	18–34	31	31%
	35–54	37	37%
	55 and above	32	32%
Sex	Male	54	54%
	Female	46	46%
Education	Middle/high school	40	40%
	Bachelor's degree	16	16%
	Master's degree / PhD	44	44%
Employment status	Active	65	65%
	Not active	35	35%
Physical activity	Regular	68	68%
	Occasional	17	17%
	Never	15	15%

3.1.2 Reliability of the Psychographic Scales

The reliability of each scale and subscale was assessed using Cronbach's alpha (α) (Pinto et al., 2013). The FRL instrument was examined both as an overall scale and as three subscales reflecting its underlying dimensions: Involvement, Innovativeness, and Responsibility, as presented in Table 3-2 below.

Table 3-2: Internal Consistency of the Psychographic Scales

Scale	No. of items	Cronbach's α
Food Neophobia Scale (FNS)	10	**.81**
General Health Interest (GHI)	8	**.83**
FRL – Innovativeness	3	**.81**
FRL – Responsibility	3	**.77**
FRL – Involvement	3	**.80**
FRL – Total (9 items combined)	9	**.79**

As shown in Table 3-2, all the scales demonstrated acceptable internal consistency, with Cronbach's alpha coefficients ranging from .77 to .83, exceeding the recommended threshold of α = .70. Among the scales,

the General Health Interest (GHI) scale showed the highest reliability (α = .83), while the FRL–Responsibility subscale yielded the lowest coefficient (α = .77), which nevertheless remained within the acceptable range. The slightly lower reliability observed for the FRL–Responsibility subscale may be attributed to the relatively small number of items, as Cronbach's alpha is influenced by scale length (Tavakol & Dennick, 2011). Overall, the results show that the psychographic measures used in this study were sufficiently reliable for subsequent analysis.

3.1.3 Descriptive Statistics of Liking and Willingness to Pay

As shown in Table 3-3 below, descriptive statistics for liking scores and willingness-to-pay (WTP) bids across all experimental conditions, before the comparative analyses reported in the remainder of this chapter. Mean liking scores were relatively high across conditions, ranging from 6.22 to 6.60 on the 9-point hedonic scale. Among the informed conditions, the Italian organic product received the highest mean liking score (M = 6.60) and the highest mean WTP (€1.24), whereas the informed Vietnamese conventional product showed the lowest mean liking score (M = 6.22) and the lowest mean WTP (€0.94). These descriptive results provide an initial overview of participants' evaluations before the statistical analyses presented in the following sections.

Table 3-3: Descriptive Statistics for Liking and Willingness to Pay (n = 100)

Condition	Liking M (SD)	WTP M (SD), €
Blind VN	6.51 (1.37)	—
Blind IT	6.54 (1.34)	—
VN-Conv (informed)	6.22 (1.26)	0.94 (0.79)
IT-Org (informed)	6.60 (1.26)	1.24 (0.96)
VN-Org (deception)	6.40 (1.15)	1.10 (0.88)

Note: Liking was measured on a 9-point hedonic scale (1 = "dislike extremely," 9 = "like extremely"). WTP bids were collected only for the informed conditions (VN-Conv, IT-Org, VN-Org); no WTP bid was elicited during the blind tasting phase.

3.2. Differences in Liking and Willingness to Pay Across Tasting Conditions

3.2.1 Blind Tasting

The results of the comparison between VN and IT spirulina under blind liking conditions are given in Table 3-4. According to the t-test, there was no significant difference among samples (p=.823): the two beverages received very similar scores, indicating that participants did not perceive meaningful sensory differences between the Vietnamese and Italian spirulina drinks. Since no product information was given during the blind tasting, expectation-based effects were minimized, which is consistent with the expectancy-disconfirmation framework used in this study. Therefore, any differences perceived once product details were

revealed are more likely to reflect the effect of origin and certification information than the intrinsic sensory profile of the beverages.

Table 3-4: Liking Under Blind Conditions, Vietnamese vs Italian Spirulina

Comparison	Blind VN M (SD)	Blind IT M (SD)	t	d	p
Blind VN vs Blind IT	6.51 (1.37)	6.54 (1.34)	-0.22	-0.02	.823

3.2.2 Effect of Information Disclosure on Liking

The effect of product information on liking was assessed by comparing each blind sample with its corresponding informed condition (Table 3-5).

Table 3-5: Blind vs Informed Liking, by Sample

Comparison	Blind M (SD)	Informed M (SD)	t	d	p
Blind VN vs VN-Conv (informed)	6.51 (1.37)	6.22 (1.26)	2.22	0.22	**.029***
Blind VN vs VN-Org (deception)	6.51 (1.37)	6.40 (1.15)	0.85	0.09	.397
Blind IT vs IT-Org (informed)	6.54 (1.34)	6.60 (1.26)	-0.59	-0.06	.555

*p<0.05

These findings show that disclosing a Vietnamese conventional origin was the only information disclosure that significantly affected liking, resulting in a decrease from 6.51 to 6.22 (p=.029). By contrast, neither the Italian organic label (p = .555) nor the false organic label applied to the Vietnamese sample (p = .397) produced a significant change in consumer evaluations. Since no differences were found under blind conditions (p = .823), this decrease in liking is more likely to be related to the information provided than to sensory properties. Instead, the findings suggest that information related to the product's origin and conventional production influenced participants' evaluations after tasting. Similar effects have been reported in the country-of-origin literature, where product origin acts as an extrinsic cue that shapes consumer evaluations beyond the product's sensory characteristics (Thøgersen et al., 2018). The origin and certification comparisons reported in the following section showed a different pattern, with changes in willingness to pay outweighing those in liking.

3.2.3 Origin and Organic Label Effects

To examine the effect of origin, comparisons were conducted both with organic certification held constant (IT-Org vs. VN-Org) and under a more realistic market scenario in which origin and production method differed simultaneously (IT-Org vs. VN-Conv) (Table 3-6)

When organic certification was held constant, origin significantly affected willingness to pay ($p = .003$) but not liking ($p = .082$). More specifically, Italian origin generated the largest effects observed in this study, increasing both liking ($p < .001$) and willingness to pay ($p < .001$). These finding might imply that origin information has a greater influence on WTP than on sensory acceptance. This finding is consistent with previous research showing that country of origin can act as an important quality cue, influencing consumer evaluations independently of intrinsic product characteristics (Verlegh, 2001). The larger effect observed for willingness to pay than for liking might suggest that origin information may have a stronger influence on consumers' willingness to pay for the product than on their sensory evaluation. A similar trend was found in the organic-label comparison, indicating that different forms of product information influenced customer evaluations in different ways.

Table 3-6: Origin Comparisons between VN and IT samples, Liking and WTP

Comparison	**VN-ORGMM-(SD)**	**IT-ORGMM-(SD)**	**t**	**d**	**p**
Liking: VN-Org vs IT-Org	6.40 (1.15)	6.60 (1.26)	-1.76	-0.18	.082
WTP: VN-Org vs IT-Org	1.10 (0.88)	1.24 (0.96)	-3.10	-0.31	**.003***
Liking: VN-Conv vs IT-Org	6.22 (1.26)	6.60 (1.26)	-3.49	-0.35	**<.001****
WTP: VN-Conv vs IT-Org	0.94 (0.79)	1.24 (0.96)	-6.32	-0.63	**<.001****

*p<0.01

**p<0.001

The organic certification halo effect was examined by comparing VN-Conv and VN-Org, two conditions involving the same product presented with different label information (Table 3-7).

Table 3-7: VN Conventional vs VN Organic Label

Comparison	**VN Conventional M (SD)**	**VN Organic M (SD)**	**t**	**d**	**p**
Liking	6.22 (1.26)	6.40 (1.15)	-1.63	-0.16	.106
WTP	0.94 (0.79)	1.10 (0.88)	-3.56	-0.36	**<.001***

*p<0.001

The conventional and organic-label conditions showed similar liking scores (6.22 vs. 6.40; p = .106), indicating that the organic label had no significant effect on liking. In contrast, willingness to pay increased significantly when the same product was presented with an organic label, rising from €0.94 to €1.10 (p < .001). As the two conditions involved exactly the same beverage, this difference cannot be explained by sensory characteristics. Instead, the results suggest that the organic label itself increased the product's perceived value, reflecting an organic certification halo effect. Taken together, findings obtained from origin and organic-label comparisons imply that product information had high influence on WTP than on liking. This might be explained by liking and willingness to pay reflect different aspects of evaluation. While liking is based primarily on sensory experience, willingness to pay is more related to perception of product value. Consequently, extrinsic cues like origin and certification might exert greatermig influence through quality assessment (Grunert, 2005). Similar findings have been reported in studies of organic foods, where certification acts as an extrinsic quality cue that increases consumer valuation without necessarily improving sensory evaluations (Van Ittersum et al., 2007).

3.3 Influence of Socio-Demographic and Psychographic Characteristics

3.3.1 Effects of Socio-Demographic Characteristics

The five liking measures and the three willingness-to-pay (WTP) measures were compared with respect to sex, age, educational level, employment, and frequency of physical activity (See Table 3-8). Results showed no significant differences across the sociodemographic groups (all p >.05). suggesting that consumer responses to the spirulina drinks were largely consistent across the sociodemographic factors examined in this research. Thus, since socio-demographic characteristics did not indicate tangible variation in liking and WTP, responses might be influenced more by personal attitudes and perceptions of the product. This interpretation is in line with the results shown in the sections that follow, where liking and willingness to pay were more strongly correlated with food-related lifestyle variables and prior experience.

Table 3-8: Socio-Demographic Comparisons – Test Statistic (p) by Outcome

Outcome	Sex	Age	Education	Employment	Physical activity
Blind VN	-0.51 (.615)	1.01 (.368)	0.12 (.886)	0.34 (.737)	1.88 (.159)
Blind IT	-0.17 (.865)	0.19 (.827)	0.81 (.446)	-0.30 (.768)	0.38 (.687)
VN-Conv (informed)	-0.30 (.766)	0.42 (.656)	1.03 (.361)	0.87 (.386)	0.13 (.880)
IT-Org (informed)	-1.50 (.138)	0.29 (.747)	0.49 (.615)	0.00 (1.000)	2.81 (.065)
VN-Org (deception)	0.07 (.945)	0.59 (.559)	0.18 (.834)	0.89 (.378)	2.04 (.135)
WTP VN-Conv	1.08 (.283)	0.52 (.597)	1.00 (.372)	-0.52 (.603)	2.19 (.117)
WTP IT-Org	1.19 (.238)	1.06 (.350)	2.38 (.098)	-0.37 (.710)	2.23 (.113)

WTP VN-Org	1.71 (.090)	0.58 (.564)	1.23 (.297)	0.18 (.855)	1.99 (.142)

Note: *Values shown are the test statistic, with the p-value in parentheses: t for Sex and Employment (Welch's t-test); F for Age, Education, and Physical Activity (one-way ANOVA, df = 2, 97).*

Results regarding the impact of prior experience with spirulina on blind liking and WTP are presented in Table 3-9. Accordingly, experience was significantly associated with both liking and willingness to pay (WTP). Individuals who had previously consumed spirulina rated both blind samples more favorably (Blind VN: 6.96 vs. 6.37, p =.050; Blind IT: 7.00 vs. 6.39, p =.049) and reported higher willingness-to-pay values for all three informed products (VN-Conv: p =.019; IT-Org: p =.004; VN-Org: p =.027). Respondents who had or did not have prior spirulina experience did not substantially vary on the three informed liking measures (VN-Conv, IT-Org, and VN-Org) (all p >.20). Considering no socio-demographic differences were found, the following analysis centered on individual psychological factors that could better explain consumer responses

Table 3-9: Liking and WTP by Prior Tasting Experience

Outcome	**Tasted before M (SD)**	**Not tasted M (SD)**	**t**	**p**
Blind VN	6.96 (1.20)	6.37 (1.40)	2.02	**.050**
Blind IT	7.00 (1.25)	6.39 (1.35)	2.03	**.049**
WTP VN-Conv	1.35 (0.99)	0.81 (0.68)	2.49	**.019**
WTP IT-Org	1.76 (0.96)	1.07 (0.90)	3.11	**.004**
WTP VN-Org	1.48 (0.95)	0.98 (0.83)	2.31	**.027**

These results imply that willingness to pay was more consistently linked to prior spirulina experience than liking. Under blind tests, participants with previous experience had higher liking scores; however, these differences vanished when product information was given. Concerning algae-based foods and other innovative food products, comparable correlations between familiarity and consumer acceptance have reported (Wassmann et al., 2023). One possible explanation is that previous experience gives customers a direct reference for assessing spirulina-based products, decreasing the uncertainty related to unfamiliar food product. This familiarity may also boost consumers' confidence when determining a monetary value for the product resulting in a larger willingness to pay. Unlike the socio-demographic and psychological factors investigated in this study, prior spirulina experience demonstrated consistent relationships with both liking and willingness to pay.

3.3.2 Food Neophobia (FNS)

The effect of food neophobia on preferences for the Italian organic spirulina over the Vietnamese products was examined by comparing Low, Medium, and High Neophobia groups (Table 3-10).

Table 3-10: Italy over Vietnam Preference, Within Each Neophobia Group

Neophobia group	LikingIT-Org vs VN-Conv) p	WTP- IT-Org vs VN-Conv p	Liking IT-Org vs VN-Org p	WTP - IT-Org vs VN-Org p
Low (n = 38)	**.027**	**<.001**	.086	**.017**
Medium (n = 29)	.075	**<.001**	.885	.639
High (n = 33)	.059	**.002**	.143	**.016**

The tertiles of the overall FNS scores (10 items, 7-point scale, theoretical range 10–70, observed range 10–52; M = 28.08, SD = 10.08) were Low (≤23, n = 38), Medium (24–31, n = 29), and High (≥32, n = 33). These findings suggest that food neophobia had little influence on consumer evaluations in the present study, regardless of whether the comparisons were conducted under blind or informed conditions. This may be explained by the study design, in which participants first evaluated the beverages before receiving any product information. Accordingly, the findings are consistent with the expectancy-disconfirmation framework adopted in this study, suggesting that consumer evaluations were influenced more by the tasting experience and product information than by food neophobia.

3.3.3 General Health Interest (GHI) and Food-Related Lifestyle (FRL)

For the GHI and the FRL dimensions, participants were divided into High and Low groups using the sample mean as the cut-off value. This approach produced reasonably balanced groups across all scales (Table 3-11).

Table 3-11: Group Classification for GHI and FRL Dimensions

Variable	Mean (cutoff)	Observed range	n (High)	n (Low)
GHI (Health Interest)	40.32	20–55	55	45
FRL Innovativeness	16.32	5–21	55	45
FRL Responsibility	15.99	6–21	57	43
FRL Involvement	16.13	5–21	53	47
FRL Total	48.44	30–63	54	46

Regarding GHI, no correlation was found with liking scores or WTP. Effect sizes were consistently minor ($|d| < 0.21$), and none of the comparisons between the High- and Low-GHI groups approached statistical significance (all $p > .30$; see Table 3-12). GHI was not associated with a consistent pattern across any situation, including the organic-label premium, in contrast to Innovativeness and Responsibility, which had strong correlations with assessments of the Italian organic product. These results imply that consumer responses to the spirulina beverages in the current sample were not significantly influenced by general health interest. Evaluations may have been influenced more by information and product-specific features than by more general

health related attitudes. Similar results have been shown for other innovative beverages, where consumer adoption was not significantly impacted by health considerations (Rebouças et al., 2017).

Table 3-12: Liking and WTP by GHI Group

Outcome	High M (SD)	Low M (SD)	t	d	p
Blind VN	6.56 (1.33)	6.44 (1.44)	0.43	0.09	.671
Blind IT	6.51 (1.30)	6.58 (1.41)	-0.25	-0.05	.802
VN-Conv (informed)	6.13 (1.06)	6.33 (1.48)	-0.79	-0.16	.434
IT-Org (informed)	6.67 (1.19)	6.51 (1.36)	0.63	0.13	.533
VN-Org (deception)	6.29 (1.01)	6.53 (1.29)	-1.03	-0.21	.307
WTP VN-Conv	0.92 (0.85)	0.98 (0.73)	-0.38	-0.08	.705
WTP IT-Org	1.29 (0.97)	1.17 (0.95)	0.65	0.13	.520
WTP VN-Org	1.12 (0.96)	1.07 (0.79)	0.30	0.06	.767

The association between the Food-Related Lifestyle (FRL) Innovativeness dimension and consumer evaluations was examined by comparing participants with High and Low Innovativeness scores (Table 3-13).

Table 3-13: Liking and WTP by FRL Innovativeness Group

Outcome	High Innov. M (SD)	Low Innov. M (SD)	t	d	p
Blind VN	6.71 (1.29)	6.27 (1.45)	1.59	0.32	.114
Blind IT	6.76 (1.23)	6.27 (1.44)	1.83	0.37	.070
VN-Conv (informed)	6.29 (1.26)	6.13 (1.27)	0.62	0.12	.537
IT-Org (informed)	6.87 (1.23)	6.27 (1.23)	2.45	0.49	**.016**
VN-Org (deception)	6.45 (1.12)	6.33 (1.19)	0.52	0.11	.603
WTP VN-Conv	0.99 (0.82)	0.88 (0.77)	0.68	0.14	.501
WTP IT-Org	1.37 (0.98)	1.07 (0.92)	1.58	0.32	.117
WTP VN-Org	1.19 (0.96)	0.99 (0.79)	1.14	0.23	.256

The only significant difference was observed for the informed Italian organic spirulina, which received higher liking ratings from the High-Innovativeness group than from the Low-Innovativeness group ($p = .016$). No significant differences were found for the remaining liking or willingness-to-pay measures. These findings suggest that food innovativeness was associated specifically with greater appreciation of the Italian organic spirulina rather than with a consistent preference across all spirulina products. This result is broadly consistent

with the Food-Related Lifestyle framework, which proposes that more innovative consumers are generally more open to trying novel food products (Brunsø et al., 2021).

Responsibility dimension (concern for environmental and social sustainability) showed a broader pattern of effects (See Table 3-14).

Table 3-14: Liking and WTP by FRL Responsibility Group

Outcome	High Resp. M (SD)	Low Resp. M (SD)	t	d	p
Blind VN	6.81 (1.25)	6.12 (1.45)	2.50	0.51	**.014**
Blind IT	6.70 (1.40)	6.33 (1.25)	1.41	0.28	.160
VN-Conv (informed)	6.32 (1.12)	6.09 (1.43)	0.85	0.17	.401
IT-Org (informed)	6.89 (1.22)	6.21 (1.23)	2.77	0.56	**.007**
VN-Org (deception)	6.56 (1.00)	6.19 (1.30)	1.58	0.32	.119
WTP VN-Conv	1.05 (0.82)	0.80 (0.74)	1.57	0.31	.120
WTP IT-Org	1.43 (1.00)	0.98 (0.83)	2.48	0.49	**.015**
WTP VN-Org	1.20 (0.86)	0.97 (0.90)	1.28	0.26	.203

Blind liking VN was higher among respondents in the High-Responsibility group than in the Low-Responsibility group (6.81 vs. 6.12; p =.014). Additionally, they expressed a greater willingness to pay for IT-Org (€1.43 vs. €0.98; p =.015) and rated IT-Org significantly higher (6.89 vs. 6.21; p =.007). The remaining liking and willingness-to-pay metrics showed no significant variations, and there was no group difference in the organic-label premium. When considered overall, these results imply that evaluations of the Italian organic spirulina beverage were more strongly linked to responsibility than to responses to organic labeling alone. This interpretation aligns with the Food-Related Lifestyle framework, which connects sustainability-focused food choices and purchasing behavior to food attitudes connected to responsibility (Brunsø et al., 2021).

Regarding involvement, there were no apparent differences in willingness-to-pay or liking metrics (Table 3-15). Effect sizes were minor ($|d| \leq 0.23$) and all comparisons between the High- and Low-Involvement groups were non-significant (all p >.24). Similarly, neither overall liking (p =.349) nor overall willingness to pay (p =.218) was connected with the overall FRL score. These results imply that the Innovativeness and Responsibility dimensions were the primary drivers of the FRL effects seen in this study, whereas Involvement did not show a significant impact on consumer responses to the spirulina beverages.

Table 3-15: Liking and WTP by FRL Involvement Group

Outcome	High M (SD)	Low M (SD)	t	d	p
Blind VN	6.51 (1.55)	6.51 (1.16)	-0.00	-0.00	.996

Blind IT	6.57 (1.35)	6.51 (1.35)	0.20	0.04	.838
VN-Conv (informed)	6.25 (1.24)	6.19 (1.30)	0.21	0.04	.833
IT-Org (informed)	6.62 (1.29)	6.57 (1.25)	0.19	0.04	.850
VN-Org (deception)	6.36 (1.26)	6.45 (1.02)	-0.39	-0.08	.699
WTP VN-Conv	0.86 (0.77)	1.04 (0.81)	-1.16	-0.23	.249
WTP IT-Org	1.18 (0.95)	1.31 (0.98)	-0.68	-0.14	.498
WTP VN-Org	1.04 (0.92)	1.17 (0.85)	-0.76	-0.15	.447

CONCLUSIONS

This thesis investigated consumer acceptance of and willingness to pay for spirulina-based beverages produced from Italian organic and Vietnamese conventional spirulina. The study integrated a Vickrey 2-unit third-price auction with sensory evaluation using a 9-point hedonic scale, enabling the measurement of both actual willingness to pay and consumer preferences of 100 Italian participants in total. Overall, the findings indicate that how consumers perceived spirulina drinks was more influenced by the details they were given regarding the product's origin and certification rather than by the actual sensory qualities of the drink itself.

The findings demonstrated that under blind tasting conditions, consumers did not notice any significant sensory differences between the Vietnamese conventional spirulina and Italian organic spirulina drinks. However, once origin and production method information was given, consumer preferences changed. Specifically, disclosing the Vietnamese conventional label significantly decreased liking, indicating that product information had a greater impact on preferences than the beverages' sensory qualities.

Origin has a clear impact on willingness to pay, independent of certification. Participants were willing to pay more for the Italian organic product than for the Vietnamese product that was falsely labeled as organic, even though both products had an organic label. This difference might be attributed to origin alone, because certification was the same in both situations. When the true conventional Vietnamese product was compared to the Italian organic product in the more realistic market scenario, the origin effect was even greater, reflecting the combined influence of origin and certification together.

The organic label produced notable results. Although liking did not significantly improve, presenting the same Vietnamese product with a false organic label instead of its real conventional label considerably increased the willingness to pay. This implies that consumers' economic assessment of the Vietnamese product was impacted by organic certification, but their sensory assessment was unaffected. This demonstrates that labels can influence consumer opinions apart from the actual tasting experience, which aligns with the expectancy-disconfirmation framework studied in this thesis. Overall, these results imply that consumer choices and willingness to pay were driven more by extrinsic factors than by sensory experience itself.

Another reliable indicator of participant responses among the individual-level variables taken into account was prior spirulina experience. During the blind phase, participants who had previously consumed spirulina drinks rated both samples higher and expressed a greater willingness to pay under all informed tasting conditions. Thus, prior spirulina experience emerges as one of the most influential factors affecting willingness to pay. By contrast, there was no significant correlation found between liking or willingness to pay and sex, age, education level, employment status, physical activity, food neophobia, or general health interest. Only the Innovativeness and Responsibility elements within the Food-Related Lifestyle framework demonstrated significant correlations with participant answers, while Involvement did not.

The findings of this study have several practical implications. For Italian spirulina producers, the findings point out the importance of origin as a marketing factor capable of creating a significant price increase.

Clear information about production origins may thus be a useful method for increasing product value. For producers and distributors of imported spirulina, the findings show that consumers may react poorly to conventional non-Italian beverages if origin information is revealed. Although organic certification increased willingness to pay, it did not improve sensory acceptance. The VN-Org condition suggests that certification alone was not sufficient to overcome consumers' lower evaluation of the Vietnamese spirulina beverage.

The results should be interpreted with consideration of several limitations. First, the study was limited to one area of the Marche region in Italy, which would restrict how broadly the results can be applied to other areas or nations. Second, there were some differences between the actual sample and the intended recruitment quotas, especially in terms of age distribution and educational attainment; these variations should be considered when evaluating the findings. Another limitation concerns the mean-split classifications used for the analysis of the GHI and FRL dimensions, which may have decreased statistical power by reducing continuous individual differences into categorical groups. As a result, the interpretation of these results should be done with caution.

Future research could extend this approach to different product categories, certification schemes, and countries of origin. It would also be valuable to investigate whether frequent exposure to spirulina-based products improves acceptability over time and reduces the adverse effect of non-Italian origin information, which could bring further understanding of the long-term market potential of spirulina beverages.

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