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Abstract

Purpose-University gardens are innovative educational spaces that facilitate posing topics relevant to civic education, such as healthy and sustainable eating. This work aims to provide reliable quantitative tools to assess learning about sustainable food practices after garden-based interventions within higher education.

Design/methodology/approach-Based on their previous qualitative research on learning promoted by garden-basedinterventions, the researchers designed two Likert-scale questionnaires. The first is the "Growing Food Habits_Purchase" (GFH_P) scale, which informs on the habits or profiles of people who can make food purchasing decisions. The second is the "Growing Food Habits_Intake" (GFH_I) scale, which informs on the habits or profiles of people regarding food consumption (diet).

Findings- After validation, GFH_P consists of 14 items in four dimensions (reliability through McDonald' $\omega = 0.721$; Total Variance Explained = 52.97%), and GFH_I consists of 12 items in four dimensions ($\omega = 0.872$; TVE = 60.699%). These two scales constitute valuable tools for applying before and after educational interventions at university gardens to assess progress in food purchasing and intake habits. Their use can demonstrate the actual contribution of garden-based learning to the transition toward more sustainable diets that is key to transforming the food system.

Originality- This work responds to the need for quantitative instruments that allow for a rigorous evaluation of the academic impacts of garden-based learning. To date, there were no validated questionnaires to assess the educational impact of gardens as teaching-learning environments for food education.

Keywords University gardens · Food sustainability · Questionnaire · Validation

Paper type Research paper

Introduction

The scientific community has highlighted the pressures that human food exerts on the environment at a global level, significantly contributing to climate change, loss of biodiversity, overexploitation of aquifers, changes in land use, interference in the biogeochemical cycles of nitrogen and phosphorus, and chemical contamination of soil and water (IPCC, 2019). Indeed, the food system has been identified as one of the sectors that contribute most to this deterioration, not only through the impact of agricultural and livestock practices, but also due to food processing, transport, and consumption (Springmann *et al.*, 2018). The EAT-Lancet Commission points directly to meat and dairy as the forms of production with the highest environmental impact (greenhouse gas

production, energy and resource consumption), compared to fruit and vegetable production (Willett *et al.*, 2019).

With the aim of limiting the impact of the food system and spurring a transformation in the way food is conceived, international agencies have advocated rethinking how food is produced, processed, transformed, transported, sold, and consumed (Sage *et al.*, 2021). The World Food and Agriculture Organization (FAO) has focused on diet as a starting point from which shaping the way in which food is produced, obtained, distributed, marketed, chosen, prepared, and consumed, with proposals on the need to move towards diets with lower environmental impact as the main priority for action (FAO, 2012). In other words, we are witnessing a paradigm shift in the food system that aims to produce sustainable food, proposing a strategy of transitioning to more sustainable diets: "those diets with low environmental impacts which contribute to food and nutrition security and to healthy life for present and future generations. Sustainable diets are protective and respectful of biodiversity and ecosystems, culturally acceptable, accessible, economically fair and affordable; nutritionally adequate, safe and healthy; while optimizing natural and human resources" (FAO, 2012: p. 7).

Young people are particularly important to the transition towards sustainable food systems, since, in the medium and long term, they are the citizens of the future food models (Bumbac *et al.,* 2020). This group is concerned about the climate impact of food consumption (Tepper *et al.,* 2020) and has positive attitudes towards sustainable products (Bumbac *et al.*, 2020). Personal health is a main motivation for young consumers to engage in ethical or sustainable food consumption (Pham *et al.*, 2019; Lago *et al.*, 2020), which is conditioned by the ease of purchase and by their confidence that such purchase is environmentally friendly (Vermeir and Verbeke, 2008), with particular concern for animal welfare (Oke *et al*. 2020). Gaspar *et al*. (2023) showed that 70.4% of students at a Spanish university have heard of food sustainability, while 77% follow a diet that can be considered sustainable (consuming local, seasonal products; with low environmental impact and minimal food waste). However, mistaken beliefs and lack of knowledge on important issues have also been evidenced; for instance, young people give little importance to reducing meat consumption compared to other issues, such as the use of plastic, recycling packaging (Slotnick *et al*., 2023), or food waste (Bravi *et al*., 2019).

Literature review

Understanding food choices is complex, given the diversity of factors that play a role in them, such as socio-demographic factors, attitudes, values, norms, and consumption and cultural contexts. Comprehensive models have been developed to sketch the way people construct the process of choosing foods in general. For instance, the Theory of Planned Behavior (TPB), which is often used to approach the study of health-related decision-making in youth, predicts behaviors based on three constructs: the attitude toward the act or behavior, the subjective norm -which relates to perceived attitudes of peers and respected figures toward it-, and perceived behavioral control -the perceived ability to perform the behavior-. Thus, these three constructs predict behavioral intention, which, together with perceptions of behavioral control, account for considerable variation in displayed behaviors or acts (Ajzen, 1991). TPB model has been adapted to study the purchase and consumption of organic food in European countries (Serebrennikov *et al.*,

2024) and non-Western countries (Randall *et al.*, 2024; Shan *et al*., 2025). Multiple adaptations have added new constructs to the TPB model in addition to the initial three factors (general sustainable behavior, frequency to buy, face consciousness, etc.)

For its part, the Food Choice Questionnaire (FCQ) (Steptoe *et al.*, 1995) predicts general food choices based on their determinants. The FCQ consists of 36 items measuring the importance of nine distinct food choice motives: health, mood, convenience, sensory appeal, natural content, price, weight control, familiarity, and ethical concern (Fotopoulos *et al.*, 2009). Such model has been applied in cross-cultural contexts such as Asian countries (Japan, Taiwan, Malaysia and New Zealand) (Prescott *et al.*, 2002) or sub-Saharan as Malawi (Gama *et al*., 2018); as well as in specific groups such as ultra-endurance athletes (Blennerhassett *et al.*, 2018). The Sustainable Food Choice Questionnaire (SUS-FCQ) is developed as an addition to the FCQ to include the full concept of sustainability (Verain *et al*., 2021). It considers factors such as environmental concern, animal welfare, ethical concerns, local or seasonal production, but underlying motives such as taste or other sensory characteristics are not included (Kloppenburg *et al.*, 2000; Tobler *et al*., 2011).

In sum, while existing instruments have approached the study of food choice motives, including sustainable foods, they also show limitations, for instance because they are too general or because the motives for food choice are specific to the product category or context. We present the "Growing Eating Habits" questionnaires (GFH_P, for purchase; and GFH_I, for reception) that allow for the pre/post evaluation of educational interventions on sustainable eating habits in young people, particularly but not exclusively during garden-based programs (Table I).

Table I Comparison of existing instruments aimed to assess food habits.

Source: Prepared by authors.

In the transition toward more sustainable food systems, education has emerged as a key factor, since consumers can to put pressure on the market and the food industry through their food choices (MacKendrick, 2018). A main measure from public bodies is promoting food sustainability among consumers through awareness-raising and/or sensitization campaigns, or through individual or collective activities in the context of formal education (Damico *et al.*, 2023). A particularly valuable resource for food education is gardens (Skelton *et al.*, 2020; Author 2 *et al.*, 2022). A common approach to the use of gardens in primary education has been encouraging students' contact with and preferences for fruits and vegetables (Ohly *et al.*, 2016), especially in the context of societies where sedentary lifestyles and modern eating habits lead to a high risk of diseases such as obesity and diabetes (Williams and Dixon, 2013).

From a broad perspective, a garden is an agroecosystem: a functional system of complementary relationships between living organisms and their environment, which is managed by humans for the purpose of food production (Altieri, 1995). Thus, it constitutes an interface between nature and human action and facilitates educating in critical reflection on how people relate to the environment (Corrochano *et al.*, 2025). In particular, gardening at university has been evidenced to promote students' reflection on how they eat (how many vegetables; what kind; where, when, and how they are produced), and students' valuation of food quality, alongside with other issues relevant

to the construction of socially and environmentally committed citizens (Author 2 *et al.*, 2021, 2022; Sherry, 2022) or the transformation of learner self-identity (Kioupi and Giannopoulos, 2026). However, up to date there are no validated quantitative instruments allowing assessment of such learning derived from gardening in a rigorous and consistent manner (Williams and Dixon, 2013).

Questionnaires collecting information on sustainable eating habits and on knowledge and attitudes towards food sustainability are essential to assess the impact of educational interventions and to guide strategies that allow society to transition (Reis *et al.*, 2024). In Spain, recent studies have validated questionnaires on food sustainability for different population groups, such as health professionals (Fresán *et al.,* 2023), consumers (Sánchez-Bravo *et al*., 2020), university students (Gaspar *et al*., 2023), and the general population (Muñoz-Martínez *et al*., 2025). The present work aims to make a substantial contribution in this regard by introducing two Likert-scale questionnaires to assess changes in food purchase and consumption after garden-based learning interventions. These questionnaires were designed based on the declarations of Spanish pre-service teachers about their learning and reflections on food through their experience of gardening at university and have been validated based on data from Spanish pre-service teachers. Their psychometric characteristics -reliability and validity- following an empirical study are presented, and their potential use is discussed.

Methodology

The main objective of this research was testing the psychometric characteristics of two quantitative tools for evaluating learning on healthy and sustainable food driven by organic gardens in higher education, finally impacting purchasing habits and food-intake habits (Appendices A-B). The design was descriptive and exploratory.

The design was based on the specific statements made by university students of Education degrees regarding what they learned or reflected about food production and consumption through their experience of garden-based learning, as published in two prior qualitative studies (Author 2 *et al.*, 2019; Author 2 *et al*., 2021). Based on such information, a battery of items was designed by two experienced researchers through a process of dialogue and reflection, which were afterwards reviewed by a set of experts for refinement. Specifically, content validation was conducted using the expert judgment technique, in a process that involved 13 lecturers with experience in research methods, education for sustainable development, garden-based learning, and food, who assessed every item in terms of clarity of the statements, significance of the information selected, and item relevance in their respective dimensions (Author 2 & Author 3, 2022; Author 3 & Author 2, 2022).

Sample

The sample comprised N=843 university students from eight Spanish public universities located in the Autonomous Communities of Castile and León, Andalusia, Valencia, and the Basque Country; 85.6% being female, and 14.4% male. Average age was 21.33 years (SD=3.265; SE=0.112), the sample ranging from 17 to 56 years old. The participants were taking a degree in Social, Pre-school, or Primary Education: 49% were in their third year, 26.7% in their fourth year, 15.4% in their first year, and 8.9% in their second year. Please

note that female students predominate in such programs, so similar gender disproportions appear in other validation studies in similar contexts (Alvarez García *et al*., 2018; Grijalvo *et al*., 2025). Pre-service teachers are considered a target group of particular interest in sustainability research, since they will become agents of change in future societies through their professional practice (Van der Heijden *et al.*, 2015).

Tools

The "Growing Food Habits_Purchase" scale (GFH_P) assesses people's habits when buying food and is thus intended for those who make decisions about food purchase. It presents five response options (0 = never, 1 = almost never, 2 = sometimes, 3 = almost always, and 4 = always). It comprises 16 items, eight of which are grouped into five indicators within the first dimension, and the other eight into two indicators within the second dimension (Table II).

Table II Relationship of dimensions, indicators, and items in the GFH_P

Source: Prepared by authors.

The "Growing Food Habits_Intake" scale (GFH_I) assesses habits related to daily food intake. It presents the same options as the GFH_P. It comprises 14 items, seven of which correspond to four indicators in the first dimension and the other seven corresponding to two indicators in the second dimension (Table III).

Table III Relationship between dimensions, indicators, and items in the GFH_I

Source: Prepared by authors.

Procedure

The non-probabilistic incidental sampling technique was used, by selecting students through several university teachers participating in the Teaching Innovation Group "XXX" of the University of X. Those teachers were emailed the link to the survey in digital format (*Google Forms*), together with an implementation protocol, and a video presentation of the research for the students. The questionnaire was administered in the academic years 2021–2022 and 2022–2023, following ethical principles such as voluntary participation, respect of anonymity, and confidentiality of data. The survey took 6–12 minutes, within the time frame proposed by Cea D'Ancona (2004).

The quality of a tool can be measured in terms of its psychometric characteristics, represented by its internal consistency (reliability) and construct validity (Prieto Adañez and Delgado González, 2010). Due to the ordinal nature of the data, internal consistency was calculated using McDonald's omega coefficient (ω) (Ventura-León and Caycho-Rodríguez, 2017; Viladrich *et al.*, 2017), with a 95% reliability index.

Data analysis

Construct validity was verified by confirmatory factor analysis (CFA; maximum likelihood method) of the model extracted with exploratory factor analysis (EFA). In the EFA, principal component analysis was used as the extraction method, and varimax rotation with Kaiser normalization was used to create a factor structure with a model with a better fit. Because EFA only enables determination of the number of factors, but not their composition or relationships with other variables, CFA was applied (Lloret-Segura *et al.*, 2014). In the CFA, the goodness-of-fit criteria used were Kock's (2014), with parameters using the maximum likelihood method, as it is invariant to the type of scale, consistent and unbiased. In relation to the absolute fit measures, chi-square (χ^2) was used to indicate a good fit of the model by testing its significance, as was the Root Mean Square Error of Approximation (RMSEA), where a value is accepted if less than or equal to 0.05 (Levy and Varela, 2006) or 0.08 (Ghorbanhosseini, 2013). In relation to the incremental fit measures (Jöreskog and Sörbom, 1984; Ghorbanhosseini, 2013; Varela, 2006), the comparative fit index (CFI) and the incremental fit index (IFI) were used, where a value is considered adequate if higher than 0.90 and excellent if higher than 0.95; the normed fit index (NFI) was also used, which must have a value higher than 0.90. The analyses were conducted with IBM SPSS software version 28.0, and the AFC with IBM Amos Graphics version 26.0.

Results

Analyzing the items, reliability and exploratory factor analysis of GFH_P scale

The values of skewness and kurtosis in the GFH_P scale do not exceed 2 (Table IV), except for item 3, which would be advisable to eliminate (Lloret-Segura *et al.*, 2014). However, it was decided to maintain it, since it is key for ω to present a value when calculating reliability. The original number of items, 16, was reduced to 14 after eliminating items 7 and 12. This improved the reliability from 0.708 to 0.721, and the total variance explained (TVE), which was initially below 50% (with a value of 48.593%). For that, the "Reliability if item deleted" table was examined, and it was observed that removing item 12 increased ω to 0.730. Although the TVE exceeded the minimum threshold (50.953%), it was considered appropriate to further improve it, discussing each potential deletion in terms of conceptual relevance. Finally, it was concluded that the joint removal of items 12 and 7 provided better coherence in the factor grouping than removing item 12 alone (factor 1: items 1, 2, 10, 11, and 13; factor 2: items 7, 14, 15, and 16; factor 3: items 5 and 6; factor 4: items 3, 4, 8, and 9).

Table IV Descriptive statistics of the GFH_P

Source: Prepared by authors.

With respect to construct validity, the Kaiser-Meyer-Olkin sample adequacy index (KMO) had a value of 0.785, indicating that the data were correctly adequate to perform the EFA. Bartlett's sphericity test was significant ($\chi2$=1981.315; df=91 and p<.0001), indicating good model fit. The factorial solution is formed by four factors, which were extracted after varimax rotation with Kaiser normalization and the process converged on the sixth iteration, explaining 52.970% of the total variance (TV). This factorial solution

explains more than 50% of the total variability of response to the test, so the construct validity is considered adequate (Merenda, 1997).

The GFH_P scale consists of 14 items grouped into four dimensions (Table V and VI), which are *Unhealthy Purchasing* (UnHePurch): items 1, 11, 2 and 10; *Sustainable Purchasing* (SusPurch): items 15, 14, 16 and 3; *Seasonal Purchasing* (SeasPurch): items 6, 5 and 13; and *Non-Sustainable Purchasing* (NonSusPurch): items 4, 9 and 8.

Table V Matrix of the rotated components of the GFH_P, including factor loadings that indicate the correlation between the original variables and the rotated factors, showing how each variable contributes to each factor.

Source: Prepared by authors.

Table VI Results of relationship of dimensions, indicators, and items in the GFH_P

Source: Prepared by authors.

Regarding the inter-factor correlations, using Pearson's coefficient, the results showed a pattern, which is consistent with theoretical assumptions: healthy and sustainable practices are correlated to each other, and oppose unhealthy or non-sustainable practices.

Correlations showed a coherent pattern among the purchasing habit dimensions. *UnHealthy Purchasing* (UnHePurch) was negatively related to *Sustainable Purchasing* (SusPurch) ($r = –.214$, $p < .01$) and to *Seasonal Purchasing* (SeasPurch) ($r = –.288$, $p < .01$), indicating that higher levels of unhealthy purchasing are associated with lower engagement in sustainable and seasonal purchasing. It was also positively related to *Non-Sustainable Purchasing* (NonSusPurch) ($r = .291$, $p < .01$), which confirms its conceptual coherence.

In contrast, *Sustainable Purchasing* (SusPurch) correlated positively with *Seasonal Purchasing* (SeasPurch) ($r = .334$, $p < .01$) and negatively with *Non-Sustainable Purchasing* (NonSusPurch) ($r = –.178$, $p < .01$), suggesting that individuals who purchase sustainably also tend to buy seasonal products and avoid non-sustainable practices. Finally, *Seasonal Purchasing* (SeasPurch) showed a weak negative correlation with *Non-Sustainable Purchasing* ($r = –.075$, $p < .05$), which also aligns with expectations.

Analysis of the items, reliability, and Exploratory Factor Analysis of the GFH_I scale

Table VII presents the values of skewness and kurtosis in the GFH_I scale, which do not exceed 3 or 2, except for the item 14 that presents a value close to 3 (2.933), which was eliminated in line with the recommendations of Lloret-Segura *et al.* (2014). This enabled the researchers to check whether the value for McDonald's omega for the tool improved. In addition to eliminating the last of the 14 initial items (ω=0.854; TVE=57.429%), item 3 was also dispensed with, thus improving reliability (ω=0.872; TVE=60.699%). The reduction to the final 12 items allowed a satisfactory internal consistency, in addition to improving the TVE (initially it was 54.632%). Although removing item 14 allowed the minimum thresholds for both ω and TVE to be exceeded, it was considered appropriate

to further optimize these values and enhance the coherence of the factor structure. To this end, each potential deletion was discussed based on its conceptual relevance. Ultimately, it was concluded that the joint removal of items 14 and 3 provided a more coherent factor organization than removing item 14 alone (factor 1: items 7, 8, 10, 11, and 13; factor 2: items 1, 2, 4, and 5; factor 3: items 9 and 12; factor 4: items 6 and 3).

Table VII Descriptive statistics of the GFH_I scale

Source: Prepared by authors

With respect to construct validity, the KMO test gave a value of 0.812, indicating the data are correctly adequate to perform the PSA. Bartlett's sphericity test was significant ($\chi 2$=2299.307; df=66 and p<.0001), indicating a good fit of the model. The factorial solution is formed by four factors, which were extracted after varimax rotation with Kaiser normalization, and the process converged in the fourth iteration (Table VI), which explain 60.699% of the total variance. This factorial solution explains more than 50% of the total variability of response to the test (Merenda, 1997), so the construct validity is considered adequate.

The GFH_I scale therefore comprises 12 items grouped into four dimensions (Table VIII y IX): *Healthy Intake* (HeInt): items 7, 10, 8 and 13; *UnHealthy Intake* (UnHeInt): items 4, 5, 1 and 2; *Sustainable Intake* (SusInt): items 12 and 9; and *Sensory Experiences* (SE): items 6 and 11.

Table VIII Matrix of rotated components of the GFH_I, including factor loadings that indicate the correlation between the original variables and the rotated factors, showing how each variable contributes to each factor.

Source: Prepared by authors

Table IX Results of relationship between dimensions, indicators, and items in the GFH_I

Source: Prepared by authors.

Regarding the inter-factor correlations, using Pearson's coefficient, the results showed significant and coherent associations among the different food intake profiles. *Healthy Intake* presented a negative correlation with *UnHealthy Intake (*UnHeInt) (r = –.423, p < .01), indicating that higher healthy intake is associated with lower consumption of unhealthy foods. Likewise, *Healthy Intake* (HeInt) correlated positively with *Sustainable Intake* (SusInt) (r = .388, p < .01) and, to a lesser extent, with Sensory Experiences (SE) (r = .145, p < .01), suggesting that individuals who follow a healthy diet also tend to consume sustainably, and to value sensory experiences.

In turn, *UnHealthy Intake* (UnHeInt) showed negative correlations with both *Sustainable Intake* (SusInt*)* (r = –.263, p < .01) and *Sensory Experiences* (SE) (r = –.153, p < .01), indicating that those who consume more unhealthy foods tend to show fewer sustainable intake behaviors and lower sensory appreciation. Finally, *Sustainable Intake* (SusInt) presented a positive but very weak correlation with *Sensory Experiences* (SE) (r = .063, p < .05), suggesting a minimal relationship between these two dimensions.

Confirmatory Factor Analysis

The model for the GFH_P scale is constituted by four latent variables that represent the dimensions obtained in the EFA, and 14 observable variables that refer to the items in the final scale (Figure I). The model fit indices show a significant value of the chi-square test (χ^2=208.193; df=69; p<0.001). As this test is highly sensitive to sample size, other fit indices are also used: all of them showed values higher than or almost at 0.9 (IFI=0.928; NFI=0.896; CFI=0.927), as established by Kock (2014) and Marsh *et al.* (2020). Likewise, the RMSEA showed an acceptable value of 0.064 (lower than 0.08), as well as the CMIN/DF, with the coefficient below 5, at a value of 3.017 (Table X).

Figure I Structural model of the GFH_P by confirmatory analysis.

Source: Prepared by authors.

Table X Fit indices for the model for CFA on the two scales

Source: Prepared by authors.

Figure II Structural model of the GFH_I by confirmatory analysis.

Source: Prepared by authors

The model for the GFH_I scale is constituted by four latent variables that represent the dimensions obtained by EFA and 12 observable variables that refer to the items in the final scale (Figure II). The model fit indices show a significant value for the chi-square test (χ^2=183.415; df=48; p<0.001). As this test is highly sensitive to sample size, other fit indices are also used: all of them showed values higher than 0.9 (IFI=0.917; NFI=0.921; CFI=0.940), adequate for model fit. The RMSEA showed an acceptable value of 0.058 (lower than 0.08), and the CMIN/DF of 3.821 (value lower than 5). The adequate fit of the model is confirmed (see Table X).

The results show that the *Unhealthy Purchases* (UnHePurch) and *Seasonal Purchases* (SeasPurch) factors have adequate factor loadings, with all items exceeding the minimum recommended threshold of $\lambda \geq 0.50$ (Hair *et al.*, 2019). In particular, *SeasPurch* showed the best performance, with GFH_P05 reaching $\lambda = 0.70$. The *Sustainable Purchases* (SusPurch) construct shows mixed performance, with satisfactory loadings for GFH_P14 and GFH_P15, but below the acceptable threshold for items GFH_P03 and GFH_P16, suggesting a weak contribution to the construct's measurement. The *Non-Sustainable Purchases* (NonSusPurch) construct has low factor loadings for all three items (values below .40), indicating that the items explain less than 15% of the construct's variance, suggesting convergent validity issues and requiring a conceptual and operational review of this factor. The standardized factor loadings (λ) of each item on its corresponding latent construct in the GFH_P scale (Table XI).

Table XI Standardized factor loadings in GFH_P

Source: Prepared by authors.

After consulting the standardized factor loadings on the GFH_I scale (Table XII), the *HeInt, UnHeInt*, and *SusInt* factors show evidence of acceptable convergent validity (except for GFH_I08). The SE factor does not meet the minimum psychometric standards and may need to be reformulated in subsequent analyses.

Table XII Standardized factor loadings in GFH_I

Source: Prepared by authors.

Discussion

This work presents the validation of two Likert-type scales to reliably assess learning about sustainable food practices after garden-based interventions within higher education. The "Growing Food Habits_Purchase" scale (GFH_P) is constituted of 14 items grouped into four dimensions. The first dimension, *Unhealthy Purchasing*, corresponds to students who do not exclude unhealthy foods from their shopping basket, and includes items 1, 2, 10, and 11, related to the purchase of soft drinks, precooked food, fast food, and processed sweet goods. The second dimension, *Sustainable Purchasing*, includes items 3, 14, 15, and 16, and indicates that students seek to buy organically produced food, with short supply chains, and that they grow food for self-consumption to a certain extent. The third dimension, *Seasonal Purchasing*, includes items 5, 6, and 13, related to the search for quality fruits and vegetables that are at their seasonal best. Finally, *Non-Sustainable Purchasing*, involves not taking any sustainability criteria into account (even not avoiding food waste), and includes items 4, 8, and 9.

Thus, our study portraits different profiles of young university students in relation to food purchasing. *UnHePurch* relates to young consumers who buy based fundamentally on hedonistic criteria, being irresponsible regarding the impact that buying unhealthy food may have on their health. This profile represents well the usual preference of young people for processed foods and sugary drinks (Harris and Bargh, 2009). *SusPurch* represents the young sustainable consumers who are aware of their food choices' impact on the environment, economy, and society. They show the traits of a food citizen (Lozano and Gómez Benito, 2017; Bumbac *et al.*, 2020). Thirdly, there is a demanding consumer profile, *SeasPurch*; these consumers pursue quality, naturalness, and seasonality (i.e., better taste, texture, or smell) because they consider such characteristics to be beneficial to their health (Tobler et al., 2011). Thus, whereas for the *SusPurch* group, purchasing criteria are more socially committed, for the *SeasPurch*, purchasing criteria are more related to personal health. Finally, our results point to the profile of young consumers who are more thoughtless, those in *NonSusPurch*; they prioritize buying what they like, at a good price, and they buy even more than needed (Bravi *et al.*, 2019).

The "Growing Food Habits_Intake" scale (GFH_I) consists of 12 items divided among four dimensions. The first dimension, *HeInt* includes items 7, 8, 10, and 13, and provides information related to a consumer profile that has a varied diet based on fruits and vegetables. The second one, *UnHeInt*, corresponds to students who do not exclude clearly unhealthy foods, and includes items 1, 2, 4, and 5, collecting information on the intake of soft drinks, convenience food, fast food, and processed sweet goods. *SusInt* includes items 9 and 12 and relates to students who pursue organic and local production of fruits and

vegetables. Finally, *Sensory Experiences* includes items 6 and 11, covering a profile who values the flavor and texture of their food above other criteria.

Thus, our study portraits different profiles of young university students in relation to food intake. On the one hand, there is a group of healthy students (HeInt), aware of their food choices' impact on health, with diets relying on vegetables and seeking variety and seasonality, but unaware of food choice impacts on sustainability. Several studies agree that personal health is the main motivation for young people to engage in ethical or sustainable food consumption (Pham *et al.*, 2019; Lago *et al.*, 2020). However, there is also a profile of conscious sustainable students (SustInt), who directly opt for organic and local foods. Gaspar *et al.* (2023) revealed that 77% of students at a Spanish university followed a sustainable diet, understood as one that consists of local, seasonal products with low environmental impact. In contrast, the *UnHeInt* corresponds to young people who consume food based on hedonistic criteria, with high-calorie diets where pre-cooked food, "fast foods", processed sweets, and soft drinks are common. Burningham and Venn (2022) pointed out that fast food and visits to the establishments where it is sold are normalized in the lifestyle of young people. Finally, *SE* includes sensitive students who value, overall, the enjoyment of eating (Kloppenburg *et al.*, 2000; Verain *et al.*, 2015).

The GFH_P and GFH_I scales can be useful as a starting point for educators, NGOs, or policymakers. On the one hand, their items reveal specific issues that are important for young university students, such as the consumption of pre-cooked food or carbonated drinks, the price of food, the quality of fruit and vegetables, or how they are produced, among others. Those issues should be addressed in any educational program aiming to improve young people's food behavior in terms of purchasing and consumption. On the other hand, their dimensions correspond to generic consumer profiles; thus, there are students whose diet is predominantly hedonistic (they consume pre-cooked food, fast food, soft drinks, pastries), others whose criteria are basically selfish (they buy cheap, what they like, and more than they need), and other groups which incorporate health criteria (showing choices based on more personal, selfish motivations) or sustainability criteria (showing choices based on more social, ethical motivations). Compared to other food choice models and their different adaptations (Ajzen, 1991; Steptoe *et al.*, 1995; Verain *et al.*, 2021), these scales provide a novel and specific instrument for assessing sustainable eating habits in educational environments. The snapshot provided by these scales reflects the key issues that educators and other social change agents should consider in designing programs, developing curricula, or crafting community engagement strategies.

Regarding limitations and future directions, it is worthy noting that the validation of GFH_P and GFH_I scales has been conducted on a sample constituted exclusively by university students of Education degrees in Spain, so the generalizability of the findings to other populations -such as students from different academic disciplines, other age groups, or different cultural contexts- requires of further studies across different educational and cultural settings. To other respect, the use of the Maximum Likelihood (ML) estimator, although standard, may be less optimal for ordinal data, for which the use of WLSMV is recommended in future work for greater psychometric precision. Moreover, no formal evidence of convergent and discriminant validity (AVE, HTMT) or criterion validity using objective behavioral indicators has been reported due to the lack of robust external metrics in the current dataset. Measurement invariance by gender or

university was not examined, so in future research this analysis would ensure bias-free comparisons between groups and to guarantee the stability of the factor structure.

Conclusions

This work responds to the need for quantitative instruments allowing rigorous assessment of the academic outcomes of garden-based interventions (Williams and Dixon, 2013), for the case of higher education. The introduced scales, GFH_P and GFH_I, are valuable tools to be applied before and after educational interventions to assessing shifts in food habits of purchase and intake, and to evidencing the contribution of garden-based learning to the transition towards more sustainable diets that is considered key to transforming the food system (Sherry, 2022). They have already been used to test the implementation of a teaching-learning sequence on sustainable food contextualized in the garden, showing positive impacts (-- and Author 2, 2025). They could also be used in researching the food habits of young people at secondary or higher education, or of citizens participating in sustainable food awareness campaigns.

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Appendix A

See Tables XIII-XIV

Table XIII Total pool of items, in English, initially included in the GFH_P scale

Source: Prepared by authors.

Table XIV Total pool of items, in English, initially included in the GFH_I scale

Source: Prepared by authors

Appendix B

See Tables XV-XVI

Table XV Total pool of items, in Spanish, initially included in the GFH_P scale

Source: Prepared by authors

Table XVI Total pool of items, in Spanish, initially included in the GFH_I scale

Source: Prepared by authors

Appendix C

Scoring Instructions for the Food Growing Habits_Purchase (GFH_P) Scale

The "Growing Food Habits_Purchase" (GFH_P) scale assesses individuals' habits when purchasing food and is therefore intended for those who can make decisions about food purchasing. Each item includes five response options (0 = never, 1 = almost never, 2 = sometimes, 3 = almost always, and 4 = always). Table XVII presents the order of the items in the GFH_P scale.

Table XVII Order of the items in the GFH_P scale in Spanish and English.

It consists of 14 items, of which 6 are positively worded (items 5, 6, 11, 12, 13, and 14) and 8 are negatively worded (items 1, 2, 3, 4, 7, 8, 9, and 10). Therefore, when calculating the total score by summing all values, the response options of the 8 negatively worded items should first be reversed (i.e., recoding within each item: 0 to 4, 1 to 3, 2 to 2, 3 to 1, and 4 to 0).

The GFH_P is a useful instrument due to the robustness of its psychometric properties, with $\omega = 0.721$ (Omega coefficient) and a Total Variance Explained of 52.97%. In addition, the model fit indices show a significant chi-square value ($\chi^2 = 208.193$; $df = 69$; $p < 0.001$), and the scale demonstrates adequate fit according to IFI = 0.928, NFI = 0.896, CFI = 0.927, RMSEA = 0.064, and CMIN/DF = 3.017. Within food purchasing habits, four factors are distinguished, whose computation and interpretation can be found in Table XVIII:

- **Seasonal Purchasing:** assesses purchasing behaviors related to seeking high-quality fruits and vegetables at their seasonal peak. Scores can range from 0 to 12 (higher values indicate a stronger tendency toward seasonal purchasing) and are obtained by summing items 5, 6, and 11.
- **Sustainable Purchasing:** evaluates the type of foods selected based on whether they are organically produced, sourced through short supply chains, and, to some extent, whether individuals grow their own food for self-consumption. Scores can range from 0 to 16 (higher values indicate a stronger tendency toward sustainable purchasing) and are calculated by summing items 3, 12, 13, and 14 (after reverse-coding item 3).
- **Non-Sustainable Purchasing:** assesses purchasing habits that do not consider any sustainability criteria, such as avoiding food waste (item 4 on taste preferences; item 7 on awareness of food waste—e.g., zero waste: amount of food purchased—and item 8 on economic cost). Scores can range from 0 to 12 (higher values indicate a stronger tendency toward non-sustainable purchasing) and are calculated by summing items 4, 7, and 8.
- **Unhealthy Purchasing:** evaluates habits that do not exclude unhealthy foods from the shopping basket, such as purchasing soft drinks, precooked foods, fast food, and processed sweet goods. Scores can range from 0 to 16 (higher values indicate a stronger tendency toward unhealthy purchasing) and are calculated by summing items 1, 2, 9, and 10.

Table XVIII Calculation and interpretation of different types of purchasing habits in GFH_P.

Scoring Instructions for the Growing Food Habits_Intake (GFH_I) Scale

The Growing Food Habits_Intake (GFH_I) scale assesses individuals' habits related to the food they consume (diet). Each item offers five response options (0 = never, 1 = almost never, 2 = sometimes, 3 = almost always, and 4 = always). Table XIX presents the order of the items in the GFH_I scale.

Table XIX Order of the items in the GFH_I scale in Spanish and English.

It consists of 12 items, of which 6 are positively worded (items 6, 8, 9, 10, 11, and 12) and 6 are negatively worded (items 1, 2, 3, 4, 5, and 7). Therefore, when calculating the total score of the scale by summing all item values, the response options of the 6 negatively worded items must first be reversed (i.e., recoding within each item: 0 to 4, 1 to 3, 2 to 2, 3 to 1, and 4 to 0).

The GFH_I is a useful instrument due to the robustness of its psychometric properties, with $\omega = 0.872$ (Omega coefficient) and a Total Variance Explained of 60.699%. In addition, the model fit indices show a significant chi-square value ($\chi^2 = 183.415$; $df = 48$; $p < 0.001$), and the scale demonstrates adequate fit according to IFI = 0.917, NFI = 0.921,

CFI = 0.940, RMSEA = 0.058, and CMIN/DF = 3.821. Within food intake habits, four factors are distinguished (Table XX shows how each one is calculated and interpreted):

- **Healthy Intake:** assesses whether individuals tend to follow a varied diet based on the consumption of fruits and vegetables. Scores range from 0 to 16 (higher values indicate a stronger tendency toward healthy intake) and are obtained by summing items 6, 9, 7, and 12 (after reverse-coding item 7).
- **UnHealthy Intake:** assesses whether individuals do not exclude foods clearly classified as unhealthy from their diet, including the intake of soft drinks, convenience foods, fast food, and processed sweet goods. Scores range from 0 to 16 (higher values indicate a stronger tendency toward unhealthy intake) and are calculated by summing items 1, 2, 3, and 4.
- **Sustainable Intake:** evaluates habits that give attention to the organic and local production of fruits and vegetables. Scores range from 0 to 8 (higher values indicate a stronger tendency toward sustainable intake) and are obtained by summing items 8 and 11.
- **Sensory Experiences:** assesses habits in which individuals value the taste and texture of foods above other criteria. Scores range from 0 to 8 (higher values indicate a stronger tendency toward sensory experiences) and are calculated by summing items 5 and 10 (after reverse-coding item 5).

Table XX Calculation and interpretation of the different types of diet intake habits in the GFH_I.

Table I COMPARISON OF EXISTING INSTRUMENTS AIMED TO ASSESS FOOD HABITS

Instrument	Target Population	Item topics	Methodology	Strengths	Limitations
Theory of Planned Behavior (TPB) applied for organic food behavior (Serebrennikov *et al.*, 2024, Randall *et al.*, 2024; Shan *et al.*, 2025) based on Theory of Planned Behavior (TPB) (Ajzen, 1991)	General population from European and non-European or non-Western countries (China)	Attitude, subjective (social) norms, Perceived Behavioral Control (PBC), general sustainable behavior, purchase frequency	Confirmatory factor analysis (CFA) Standalone factor analysis	Multiple adaptations to adapt food choice behavior to the purchase and consumption of organic food products in different countries and to various types of products, including of animal origin (meat, milk, yogurt and cheese), fruits and vegetables.	Ignores other behaviors not directly related to the purchase and tasting of organic food Criticized for ignoring cultural differences (Randall et al., 2024)
Food Choice Questionnaire (FCQ) (Fotopoulos et al., 2009) developed by Steptoe *et al.*, 1995).	General population	Health, mood, convenience, sensory appeal, natural content, price, weight control, familiarity, and ethical concern.	Confirmatory factor analysis (CFA) Hierarchical cluster analysis (HCA)	Several adaptations in different European and non-European countries, Considers the differences between sociodemographic profiles of consumers	Significant differences in results between nationalities
Sustainable Food Choice Questionnaire (SUS-FCQ) (Verain *et al.*, 2021)	General consumers (The Netherlands, Denmark, Czech Republic, France and Italy)	General sustainability, animal welfare, ethical concern, environmental welfare, local and seasonal	Exploratory factor analysis Confirmatory factor analysis (CFA)	Sustainability criteria are included in the food choice	Does not consider the choice of foods from a specific category or in specific contexts
Growing Food Habits_Purchase (GFH_P)	University students from degrees in Social, Pre-school, or Primary education	Economic cost, healthiness, taste preferences, sustainability, awareness of food waste, choosing fresh food, choosing processed foods	Exploratory factor analysis (EFA) Confirmatory factor analysis (CFA)	Useful to (pre/post) assess educational interventions on food habits, whether or not garden-based Sustainability criteria are included	Sample constituted exclusively by university students (Education) in Spain
Growing Food Habits_Intake (GFH_I)	University students from	Principal motivation, varied diet of	Exploratory factor	Useful to (pre/post) assess educational	Sample constituted exclusively

	degrees in Social, Pre-school, or Primary education	fruit and vegetables, eating sustainable foods, food waste, plant-based or animal-based foods, food preparation or processing	analysis (EFA) Confirmatory factor analysis (CFA)	interventions on food habits, whether or not garden-based Sustainability criteria are included	by university students (Education) in Spain

Table II RELATIONSHIP OF DIMENSIONS, INDICATORS, AND ITEMS IN THE GFH_P

DIMENSION	INDICATOR	ITEM
D1- General criteria for food shopping	Economic cost	9. When I buy food, affordability is the main factor in my decisions.*
	Healthiness	13. I aim to buy foods that are healthy.
	Taste preferences	4. When I buy food, above all, I choose what I like personally.*
	Sustainability (organic, seasonal, short food supply chains)	14. I buy organically produced foods.
		5. I aim to buy fruit and vegetables that are in season.
		15. I buy foods that use short supply chains (direct from farmer, food cooperatives, small businesses, etc.)
		3. I buy most of my food at a supermarket.*
	Awareness of food waste (zero waste: quantity of food bought)	8. I tend to buy more food than I actually end up eating.*
D2-Food shopping based on properties (analyzing information)	Choosing fresh food based on sense impressions (including food grown oneself)	6. When shopping, I look for good quality fruit and vegetables, paying attention to ripeness, smell, firmness, etc.
		7. When choosing fruit or vegetables, appearance is more important to me than sustainable production.* **
		16. I grow herbs, vegetables, or fruit for my own consumption.
	Choosing processed foods based on labeling information.	12. When I buy packaged foods, I am not influenced by the information on the label (place of origin, ingredients, etc.)* **
		10. I buy precooked food that is packaged or canned (lasagnas, meatballs, etc.)*
		2. I buy "fast food" (from pizzerias, burger outlets, etc.) *
		11. I buy processed sweet goods (factory-made pastries, packaged desserts, etc.)*
		1. I buy soft drinks (sweet, carbonated drinks) *

(*) *Items formulated negatively.*

Aa (**) Items eliminated after the validation process

Table III Relationship between dimensions, indicators, and items in the GFH_I

DIMENSION	INDICATOR	ITEM
D1-General habits related to food intake	Principal motivation	13. I aim to eat foods that are healthy.
		6. Above all, I eat food that I like personally.*
	A varied diet of fruit and vegetables	10. I eat a variety of fruits and vegetables.
	Eating sustainable foods	12. I eat organically produced foods.
		8. I eat certain fruits and vegetables throughout the year, even when they are out of season.*
		9. I try to eat fruit and vegetables grown locally.
	Food waste	14. I aim not to throw food away.**
D2-Food intake by food types	Plant-based or animal-based foods	7. I eat plant-based foods (fruit, vegetables, pulses, herbs, etc.).
		3. I eat meat.* **
	Preparation or processing of foods	11. I eat raw or lightly cooked foods.
		2. I eat precooked food that is packaged or canned (lasagnas, meatballs, etc.).*
		1. I eat "fast food" (from pizzerias, burger outlets, etc.).*
		4. I eat processed sweet goods (factory-made pastries, packaged desserts, etc.).*
		5. I drink soft drinks (sweetened, carbonated drinks).*

(*) *Items formulated negatively.*
Aa (**) Items eliminated after the validation process.

Table IV Descriptive statistics of the GFH_P

	Statistical mean	Statistical Standard Dev.	Skewness Statistical	Skewness Standard error	Kurtosis Statistical	Kurtosis Standard error
GFH_P01	1.37	1.024	.529	.084	–.104	.168
GFH_P02	1.75	.685	–.108	.084	1.006	.168
GFH_P03	3.31	.723	–1.114	.084	**2.140**	.168
GFH_P04	3.29	.793	–1.068	.084	1.324	.168
GFH_P05	3.01	1.049	–1.001	.084	.464	.168
GFH_P06	3.26	1.054	–1.478	.084	1.517	.168
GFH_P07	2.05	1.146	–.148	.084	–.686	.168
GFH_P08	1.57	1.007	.355	.084	–.236	.168
GFH_P09	2.37	.963	–.181	.084	–.078	.168
GFH_P10	1.19	.941	.449	.084	–.214	.168
GFH_P11	1.64	.947	.281	.084	.095	.168
GFH_P12	1.72	1.146	.219	.084	–.645	.168
GFH_P13	2.91	.816	–.598	.084	.650	.168
GFH_P14	1.58	.920	.165	.084	.047	.168
GFH_P15	1.75	.945	.021	.084	–.111	.168
GFH_P16	1.01	1.408	1.093	.084	–.256	.168

Table V Matrix of the rotated components of the GFH_P, including factor loadings that indicate the correlation between the original variables and the rotated factors, showing how each variable contributes to each factor.

	Component			
	1	2	3	4
GFH_P01	.742			
GFH_P11	.722			
GFH_P02	.693			
GFH_P10	.616			
GFH_P15		.770		
GFH_P14		.679		
GFH_P16		.642		
GFH_P03		–.531		.474
GFH_P06			.837	
GFH_P05			.809	
GFH_P13	–.490		.490	
GFH_P04				.696
GFH_P09				.665
GFH_P08				.362

Extraction method: principal component analysis. Rotation method: varimax with Kaiser norming. The rotation converges after six iterations.

Table VI Results of relationship of dimensions, indicators, and items in the GFH_P

DIMENSION	INDICATOR	ITEM
Unhealthy Purchasing (UnHePurch)	Choosing processed foods (based on labeling information)	10. I buy precooked food that is packaged or canned (lasagnas, meatballs, etc.) *
		2. I buy "fast food" (from pizzerias, burger outlets, etc.) *
		11. I buy processed sweet goods (factory-made pastries, packaged desserts, etc.)*
	Choosing soft dinks	1. I buy soft drinks (sweet, carbonated drinks) *
Sustainable Purchasing (SusPurch)	Sustainability (organic, seasonal, short food supply chains)	14. I buy organically produced foods.
		15. I buy foods that use short supply chains (direct from farmer, food cooperatives, small businesses, etc.)
		3. I buy most of my food at a supermarket.*
	Choosing food grown oneself	16. I grow herbs, vegetables, or fruit for my own consumption.
Seasonal Purchasing (SeasPurch)	Seasonal fruit and vegetables	5. I aim to buy fruit and vegetables that are in season.
	Choosing fresh food based on sense impressions	6. When shopping, I look for good quality fruit and vegetables, paying attention to ripeness, smell, firmness, etc.
	Healthiness	13. I aim to buy foods that are healthy.
Non-Sustainable Purchasing (NonSusPurch)	Taste preferences	4. When I buy food, above all, I choose what I like personally.*
	Awareness of food waste (zero waste: quantity of food bought)	8. I tend to buy more food than I actually end up eating.*
	Economic cost	9. When I buy food, affordability is the main factor in my decisions.*

(*) Items formulated negatively.

Table VII Descriptive statistics of the GFH_I scale

	Statistical mean	Statistical Standard Dev.	Skewness Statistical	Standard error	Kurtosis Statistical	Standard error
GFH_I01	1.70	.633	–.107	.084	1.145	.168
GFH_I02	1.17	.846	.052	.084	–.862	.168
GFH_I03	2.80	.886	–.957	.084	1.550	.168
GFH_I04	1.55	.813	.266	.084	.412	.168
GFH_I05	1.28	.900	.527	.084	.361	.168
GFH_I06	3.09	.680	–.318	.084	–.126	.168
GFH_I07	2.95	.830	–.465	.084	.028	.168
GFH_I08	2.42	.974	–.031	.084	–.417	.168
GFH_I09	1.95	1.129	.128	.084	–.701	.168
GFH_I10	2.64	1.078	–.329	.084	–.733	.168
GFH_I11	1.14	.909	.301	.084	–.599	.168
GFH_I12	1.65	.783	–.080	.084	.265	.168
GFH_I13	2.87	.765	–.246	.084	–.186	.168
GFH_I14	3.33	.763	–1.388	.084	**2.933**	.168

Table VIII Matrix of rotated components of the GFH_I, including factor loadings that indicate the correlation between the original variables and the rotated factors, showing how each variable contributes to each factor.

	Components			
	1	2	3	4
GFH_I07	.794			
GFH_I10	.762			
GFH_I08	.718			
GFH_I13	.615	–.439		
GFH_I04		.724		
GFH_I05		.710		
GFH_I01		.694		
GFH_I02		.673		
GFH_I12			.839	
GFH_I09			.817	
GFH_I06				.895
GFH_I11	.310			.417

Extraction method: principal component analysis. Rotation method: varimax with Kaiser norming. The rotation converges after four iterations.

Table IX Results of relationship between dimensions, indicators, and items in the GFH_I

DIMENSION	INDICATOR	ITEM
Healthy Intake (HeInt)	Plant-based foods	7. I eat plant-based foods (fruit, vegetables, pulses, herbs, etc.).
	Eating seasonal fruit and vegetables	8. I eat certain fruits and vegetables throughout the year, even when they are out of season.*
	A varied diet of fruit and vegetables	10. I eat a variety of fruits and vegetables.
	Eating healthy foods	13. I aim to eat foods that are healthy.
UnHealthy Intake (UnHeInt)	Preparation or processing of foods	1. I eat "fast food" (from pizzerias, burger outlets, etc.).*
		2. I eat precooked food that is packaged or canned (lasagnas, meatballs, etc.).*
		4. I eat processed sweet goods (factory-made pastries, packaged desserts, etc.).*
		5. I drink soft drinks (sweetened, carbonated drinks).*
Sustainable Intake (SusInt)	Eating sustainable foods	9. I try to eat fruit and vegetables grown locally.
		12. I eat organically produced foods.
Sensory Experiences (SE)	Tasting	6. Above all, I eat food that I like personally.*
	Sensory appeal	11. I eat raw or lightly cooked foods.

(*) Items formulated negatively.

Table X Fit indices for the model for CFA on the two scales

Model	χ^2	RMSEA	CFI	IFI	NFI	CMIN/DF χ^2 Normed
Expected	>0.05	<0.05 or 0.08	0.90–1	0.90–1	0.90–1	<5
GFH_P	208.193	0.049	0.927	0.928	0.896	3.017
GFH_I	183.415	0.058	0.940	0.917	0.921	3.821

Test Chi-squared; Root Mean Square Error Approximation (RMSEA); Increment Fit Index (IFI); Normed Fit Index (NFI); Comparative Fit Index (CFI), all of which gave different values.

Table XI STANDARDIZED FACTOR LOADINGS IN GFH_P

Item	**Factor**	λ
GFH_P01	UnHePurch	0.53
GFH_P02	UnHePurch	.610
GFH_P10	UnHePurch	.578
GFH_P11	UnHePurch	.640
GFH_P03	SusPurch	.413
GFH_P14	SusPurch	.684
GFH_P15	SusPurch	.694
GFH_P16	SusPurch	.404
GFH_P05	SeasPurch	.703
GFH_P06	SeasPurch	.558
GFH_P13	SeasPurch	.665
GFH_P04	NonSusPurch	.232
GFH_P08	NonSusPurch	.370
GFH_P09	NonSusPurch	.381

Table XII Standardized factor loadings in GFH_I

Item	Factor	λ
GFH_I07	HeInt	0.777
GFH_I08	HeInt	0.412
GFH_I10	HeInt	0.84
GFH_I13	HeInt	0.707
GFH_I01	UnHeInt	0.663
GFH_I02	UnHeInt	0.563
GFH_I04	UnHeInt	0.675
GFH_I05	UnHeInt	0.504
GFH_I09	SusInt	0.795
GFH_I12	SusInt	0.611
GFH_I06	SE	0.073
GFH_I11	SE	-0.414

Table XIII Total pool of items, in English, initially included in the GFH_P scale

Q1. I buy soft drinks (sweet, carbonated drinks).
Q2. I buy “fast food” (from pizzerias, burger outlets, etc.).
Q3. I buy most of my food at a supermarket.
Q4. When shopping, above all, I choose what I like personally.
Q5. I aim to buy fruit and vegetables that are in season.
Q6. When shopping, I look for good quality fruit and vegetables, paying attention to ripeness, smell, firmness, etc.
Q7. When choosing fruit and vegetables, appearance is more important to me than sustainable production.
Q8. I tend to buy more food than I actually end up eating.
Q9. When shopping for food, affordability is the main factor in my decisions.
Q10. I buy precooked food that is packaged or canned (lasagnas, meatballs, etc.)
Q11. I buy processed sweet goods (factory-made pastries, packaged desserts, etc.)
Q12. When I buy packaged products, I am not influenced by the information on the label (place of origin, ingredients, etc.)
Q13. I aim to buy foods that are healthy.
Q14. I buy organically produced foods.
Q15. I buy foods that have short supply chains (direct from farmer, food cooperatives, small businesses, etc.)
Q16. I grow herbs, vegetables, or fruit for my own consumption.

Table XIV Total pool of items, in English, initially included in the GFH_I scale

Q1. I eat “fast food” (from pizzerias, burger outlets, etc.)
Q2. I eat precooked food that is packaged or canned (lasagnas, meatballs, etc.)
Q3. I eat meat.
Q4. I eat processed sweet goods (factory-made pastries, packaged desserts, etc.)
Q5. I drink soft drinks (sweetened, carbonated drinks)
Q6. Above all, I eat foods that I like personally.
Q7. I eat plant-based foods (fruit, vegetables, pulses, herbs, etc.)
Q8. I eat certain fruits and vegetables throughout the year, even when they are out of season.
Q9. I try to eat fruit and vegetables that are grown locally.
Q10. I eat a variety of fruits and vegetables.
Q11. I eat raw and lightly cooked foods.
Q12. I eat organically produced foods.
Q13. I aim to eat foods that are healthy.
Q14. I aim not to throw food away.

Table XV Total pool of items, in Spanish, initially included in the GFH_P scale

Q1. Compro refrescos (bebidas azucaradas y carbonatadas)
Q2. Compro "comida rápida" (de pizzerías, hamburgueserías…)
Q3. La mayoría de alimentos los compro en el supermercado
Q4. Cuando compro alimentos, escojo sobre todo los que me gustan
Q5. Procuro comprar frutas y verduras de temporada
Q6. Al comprar, busco frutas y verduras de calidad, fijándome en si están maduras, su olor, textura…
Q7. Cuando escojo frutas o verduras, para mí es más importante su apariencia a que sean de producción sostenible
Q8. Me pasa que suelo comprar más cantidad de alimentos de la que luego consumo
Q9. Cuando compro alimentos, mi criterio para decidir es que sean asequibles económicamente
Q10. Compro comida precocinada que está envasada o enlatada (lasañas, albóndigas…)
Q11. Compro dulces procesados (bollería industrial, postres envasados…)
Q12. Cuando compro productos envasados, no me influye la información que contienen las etiquetas (lugar de origen, ingredientes...)
Q13. Procuro comprar alimentos que sean saludables
Q14. Compro alimentos de producción ecológica
Q15. Compro alimentos que utilizan canales de comercialización cortos (al agricultor, en cooperativas de consumo, en pequeños comercios…)
Q16. Cultivo hierbas aromáticas, verduras o frutas para mi autoconsumo

Table XVI Total pool of items, in Spanish, initially included in the GFH_P scale

Q1. Compro refrescos (bebidas azucaradas y carbonatadas)
Q2. Compro "comida rápida" (de pizzerías, hamburgueserías…)
Q3. La mayoría de alimentos los compro en el supermercado
Q4. Cuando compro alimentos, escojo sobre todo los que me gustan
Q5. Procuro comprar frutas y verduras de temporada
Q6. Al comprar, busco frutas y verduras de calidad, fijándome en si están maduras, su olor, textura…
Q7. Cuando escojo frutas o verduras, para mí es más importante su apariencia a que sean de producción sostenible
Q8. Me pasa que suelo comprar más cantidad de alimentos de la que luego consumo
Q9. Cuando compro alimentos, mi criterio para decidir es que sean asequibles económicamente
Q10. Compro comida precocinada que está envasada o enlatada (lasañas, albóndigas…)
Q11. Compro dulces procesados (bollería industrial, postres envasados…)
Q12. Cuando compro productos envasados, no me influye la información que contienen las etiquetas (lugar de origen, ingredientes...)
Q13. Procuro comprar alimentos que sean saludables
Q14. Compro alimentos de producción ecológica
Q15. Compro alimentos que utilizan canales de comercialización cortos (al agricultor, en cooperativas de consumo, en pequeños comercios…)
Q16. Cultivo hierbas aromáticas, verduras o frutas para mi autoconsumo

Table XVII Order of the items in the GFH_P scale in Spanish and English

Item		Response values				
Spanish	**English**	**0**	**1**	**2**	**3**	**4**
1. Compro refrescos (bebidas azucaradas y carbonatadas).	1. I buy soft drinks (sweet, carbonated drinks).					
2. Compro "comida rápida" (de pizzerías, hamburgueserías…).	2. I buy "fast food" (from pizzerias, burger outlets, etc.).					
3. La mayoría de alimentos los compro en el supermercado.	3. I buy most of my food at a supermarket.					
4. Cuando compro alimentos, escojo sobre todo los que me gustan.	4. When I buy food, above all, I choose what I like personally.					
5. Procuro comprar frutas y verduras de temporada.	5. I aim to buy fruit and vegetables that are in season.					
6. Al comprar, busco frutas y verduras de calidad, fijándome en si están maduras, su olor, textura…	6. When shopping, I look for good quality fruit and vegetables, paying attention to ripeness, smell, firmness, etc.					
7. Me pasa que suelo comprar más cantidad de alimentos de la que luego consumo.	7. I tend to buy more food than I actually end up eating.					
8. Cuando compro alimentos, mi criterio para decidir es que sean asequibles económicamente.	8. When I buy food, affordability is the main factor in my decisions.					
9. Compro comida precocinada que está envasada o enlatada (lasañas, albóndigas…).	9. I buy precooked food that is packaged or canned (lasagnas, meatballs, etc.).					
10. Compro dulces procesados (bollería industrial, postres envasados…).	10. I buy processed sweet goods (factory-made pastries, packaged desserts, etc.).					
11. Procuro comprar alimentos que sean saludables.	11. I aim to buy foods that are healthy.					

12. Compro alimentos de producción ecológica.	12. I buy organically produced foods.					
13. Compro alimentos que utilizan canales de comercialización cortos (al agricultor, en cooperativas de consumo, en pequeños comercios…).	13. I buy foods that use short supply chains (direct from farmer, food cooperatives, small businesses, etc.).					
14. Cultivo hierbas aromáticas, verduras o frutas para mi autoconsumo.	14. I grow herbs, vegetables, or fruit for my own consumption.					

Table XVIII Calculation and interpretation of different types of purchasing habits in GFH_P.

Type of Purchasing Habits	Calculation[1]	Possible Values[2]	Prior to Calculation[3]
Food Growing Habits	All GFH_P items	0 to 56	1, 2, 3, 4, 7, 8, 9, and 10
Seasonal	5, 6 and 11	0 to 12	----
Sustainable	3, 12, 13 and 14	0 to 16	3
Non-Sustainable	4, 7 and 8	0 to 12	---
Unhealthy	1, 2, 9 and 10	0 to 16	---

[1]Calculated by summing the specified items.
[2]Interpretation: Higher scores indicate a stronger tendency toward that particular purchasing habit.
[3]Before performing the summation, reverse-code the items listed in this column: 0 becomes 4, 1 becomes 3, 2 becomes 2, 3 becomes 1, and 4 becomes 0.

Table XIX Order of the items in the GFH_I scale in Spanish and English.

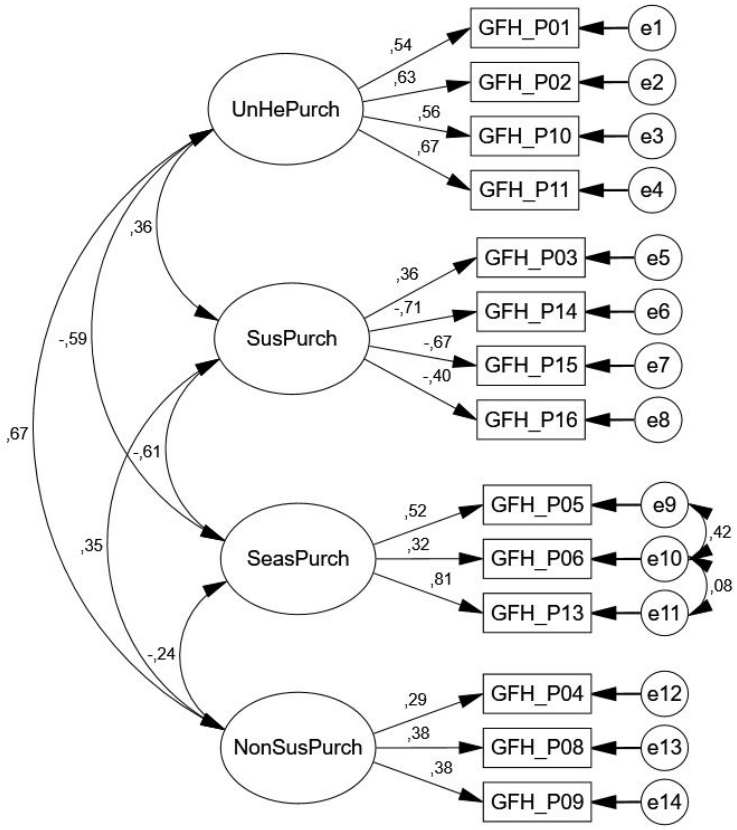
Item		Response values				
Spanish	**English**	**0**	**1**	**2**	**3**	**4**
1. Como "comida rápida" (de pizzerías, hamburgueserías…).	1. I eat "fast food" (from pizzerias, burger outlets, etc.).					
2. Como comida precocinada que está envasada o enlatada (lasañas, albóndigas…).	2. I eat precooked food that is packaged or canned (lasagnas, meatballs, etc.).					
3. Como dulces procesados (bollería industrial, postres envasados).	3. I eat processed sweet goods (factory-made pastries, packaged desserts, etc.).					
4. Consumo refrescos (bebidas azucaradas y carbonatadas).	4. I drink soft drinks (sweetened, carbonated drinks).					
5. Sobre todo, como aquellos alimentos que me gustan.	5. Above all, I eat food that I like personally.					
6. Como alimentos de origen vegetal (frutas, verduras, legumbres, hierbas aromáticas…).	6. I eat plant-based foods (fruit, vegetables, pulses, herbs, etc.).					
7. Como ciertas frutas y verduras a lo largo de todo el año, aunque no sean de temporada.	7. I eat certain fruits and vegetables throughout the year, even when they are out of season.					
8. Intento comer fruta y verdura cultivada cerca de donde vivo.	8. I try to eat fruit and vegetables grown locally.					
9. Como bastante variedad de frutas y verduras.	9. I eat a variety of fruits and vegetables.					
10. Como alimentos crudos o pocos cocinados.	10. I eat raw or lightly cooked foods.					
11. Como alimentos que se han producido de manera ecológica.	11. I eat organically produced foods.					
12. Procuro comer alimentos que sean saludables.	12. I aim to eat foods that are healthy.					

Table XVIII Calculation and interpretation of the different types of diet intake habits in the GFH_I

Type of Intake Habits	Calculation[1]	Possible Values[2]	Prior to Calculation[3]
Growing Food	All GFH_I items	0 to 56	1, 2, 3, 4, 5 and 7
Healthy	6, 9, 7 and 12	0 to 16	7
UnHealthy	1, 2, 3 and 4	0 to 16	---
Sustainable	8 and 11	0 to 8	---
Sensory Experiences	5 and 10	0 to 8	5

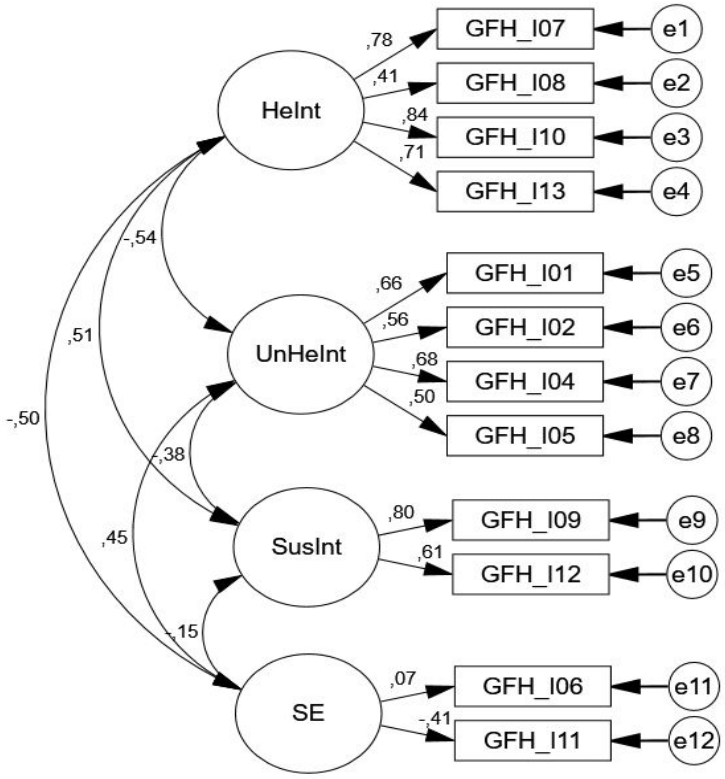
[1] Calculated by summing the specified items.
[2] Interpretation: Higher values indicate a stronger tendency toward that particular type of intake.
[3] Before performing the summation, reverse-code the items listed in this column. That is: 0 becomes 4, 1 becomes 3, 2 becomes 2, 3 becomes 1, and 4 becomes 0.

Figure I STRUCTURAL MODEL OF THE GFH_P BY CONFIRMATORY ANALYSIS



Source: Prepared by authors.

Figure II STRUCTURAL MODEL OF THE GFH_I BY CONFIRMATORY ANALYSIS



Source: Prepared by authors.