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From Taste to Non-Waste: Food Patterns and Family Eating Styles Behind Children's Acceptance of a Planetary Healthy School Recipe—Findings from a Large-Scale Study in EU School Canteens

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Abstract

Public school canteens are increasingly recognized as welfare institutions democratizing food access and promoting healthier and more sustainable dietary patterns, as well as arenas where children's tastes are shaped through family socialization and collective dining. Drawing on cultural sociology and practice theory, this study conceptualizes children's acceptance of new sustainable dishes as negotiation between competing normative contexts, where early forms of singularization emerge. The analysis draws on a large-scale dataset involving 2481 children aged 9–15 across 16 schools in 12 European countries. Acceptance of plant-based meals was assessed by combining self-reported food-related values and participant observation of plate waste. The findings indicate that 75.6% showed at least partial acceptance, with 46.9% leaving nothing on the plate. Among twelve socio-cultural constructs, six showed statistically significant ($p < 0.05$) associations with plate waste, among which food neophilia was the strongest predictor, followed by peer-oriented canteen sociability and ethical-environmental values, while hedonic orientation predicted higher waste. The results suggest that acceptance is co-produced through home kitchen cultures and institutional settings. Strengthening school–family alignment, embedding menus in local gastronomic contexts, and enhancing conviviality can improve acceptance and reduce waste, positioning canteens as sites for sustainable food systems and democratic gastro-citizenship.

Keywords: sustainable school canteen; food-waste reduction; sustainable food systems; food-related value patterns; healthier dietary patterns; democratic gastro-citizenship



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1. Introduction

Public school canteens in developed democracies are increasingly recognized as welfare institutions that equalize access to food while promoting healthier and more sustainable dietary patterns [1]. Within the public school system, the provision of standardized meals across socio-economic backgrounds contributes to reducing inequalities in access to nutrition and to shaping early healthy food habits [2]. These developments have long prompted scholars to conceptualize food-related behaviors, especially those performed in the normative context of the school meal, as a form of civic engagement, giving rise to the notion of food citizenship, defined as the ensemble of practices through which individuals actively contribute to a democratic, socially just, and environmentally sustainable food

system [3]. Empirical evidence shows that regular participation in school meal programs is also associated with improved dietary quality and health outcomes [4–6]. Nevertheless, democratizing access by homogenizing the meal regardless of financial status is not sufficient for school canteens to function as key sites of ‘gastro-citizenship’, a notion here extended beyond its critical account of exclusionary dynamics [7] to a full and substantive exercise of civic rights through equitable and culturally meaningful access to food. Equal access may in fact produce a paradoxical exclusion of those children whose cultural or family-based food patterns render the served meal inappropriate, generating a tension between formal inclusion and substantive participation that calls for harmonizing (in tandem with innovating) menu design as an indicator of full participation in gastro-citizenship. This requires prior recognition of children’s cultural food backgrounds, all the more so given the competing normative weight that the family table and the school canteen carry at this developmental stage.

School canteens represent a hybrid food environment, situated between the home kitchen and institutional dining settings, where children’s tastes are not only expressed, but also actively negotiated. Drawing on Bourdieu’s sociology of taste [8], children’s tastes (though still at a developmental stage) are already recognizable as an organized set of dispositions to ‘differentiate’ and ‘appreciate’ (p. 466) relying on habitus: an internalized system of durable dispositions shared by individuals occupying a similar social position and acquired through unreflective participation in everyday practice rather than conscious deliberation [9]. Applied to food, habitus accounts for how taste, preference, and eating routines are gradually internalized within the family and reproduced as seemingly natural dispositions, anchoring children’s early food orientations in the structures of their home environment. Yet this constitutive non-reflexivity of habitus is not absolute: Bourdieu himself noted that emerging practices can carry reflexive and ethical elements, revealing the axiological coherence of a new ethos as “a materialized coincidence of ‘is’ and ‘ought’” [8] (p. 339). Practice and values are, in this sense, inseparable: values constitute stable normative-affective structures that motivate action and confront the actor with potential dilemmas, rather than being externally imposed or merely habitual, so that food preferences can be understood as a domain in which social position, disposition, and value converge, socially structured in everyday practices. This Bourdieusian premise clarifies that habitus carries a dispositional mindset together with an axiological core, in which taste operates as a form of valuation even at a still developmental stage of individual life; what it does not fully specify, however, is what occurs when such dispositions enter a second normative field that structurally competes with (rather than simply extends) the home environment. The school canteen, with its logic at once of the “general,” based on the institutional implementation of a regulatory framework (procurement standards, nutritional guidelines, etc.), and of the “singular,” based on the adaptation of new healthier recipes to local taste and culinary heritage, constitutes precisely such a field, where Reckwitz’s logic of “singularization” [10,11] is analytically recognizable. This logic distinguishes singularities from mere idiosyncrasies: while idiosyncrasies “come about unintentionally and are often disregarded,” singularities “are socially and culturally fabricated [...] intentionally shaped, or encouraged” [10] (p. 145), through “practices of making, practices of observing, practices of valorization, and practices of perceiving” [10] (p. 146). Accordingly, taste transition is not understood as a psychological disposition, nor as a spontaneous individual trait, but as the result of a social logic through which persons, objects, practices, or collectives come to be perceived, evaluated, and treated as unique and incomparable “singularities” [11], that is, “not produced, experienced, and evaluated as a uniform copy of a general type but as something particular” [10] (p. 144). In the school canteen, singularization thus unfolds through a manifold logic: the general, implementing global procurement and

nutritional standards; the singular, adapting them to the local culinary framework, so that children's taste is treated as authentic rather than merely correct; and the peer-performed, whereby this singularity is ultimately enacted and acknowledged as unique before others. The intentional and relational nature of singularization is reinforced, within this peculiar context, by both its performative and regulated character: "singularity always involves a certain performance, it is enacted in front of an audience," in this case both adults and peers, and its value "depends on social processes of value attribution, on valorization" [10] (p. 145) rather than being simply given.

Read alongside Bourdieu's account of the evaluative and distinctive charge of taste sedimented within the family habitus, the taste singularization taking place in the school canteen appears not as a displacement of habitus but as a specification of one of its constitutive dimensions (the axiological one) under conditions of field competition. The canteen offers children a second audience before which that evaluative charge can be re-enacted, observed, and re-valorized by peers rather than simply inherited from the household. Children's food dispositions are thus not merely reproduced but begin to be singularized—not as an individualistic, narcissistic, or idiosyncratic uniqueness, but as a singularity both socially fabricated and performatively enacted, whereby taste transition acquires value insofar as it is recognized both within the institutional expectation of correctness, formalized by the canteen's regulatory infrastructure, and within a peer-based normative logic. In this perspective, children's acceptance or rejection of food reflects the interaction between family-based habitus embedded in family food values and the collective, performative norms emerging in peer contexts; an interaction that, as the following section discusses, also intersects with children's own moral and cognitive transformation during this developmental stage.

Morality in childhood has become a subject of interdisciplinary inquiry [12]: children possess a sense of morality, variously characterized by differing levels of dependence on adult morality and shaped by social determinants like family upbringing and, more broadly, primary socialization. Morality develops at the intersection of individual growth, cognitive development [13], including neural evolution [14], and social experience: it is shaped by the socio-cultural and economic contexts in which children are embedded, and it evolves alongside their capacity to understand fairness and attend to others' well-being [15,16]. Moral behaviors, particularly those sustained by prosocial cultural orientations (such as helping, sharing, and responding to others' needs) reflect broader processes of socialization through which children internalize the norms and values of their communities [17]. This internalization, however, is not immediate: according to Piaget [13] (pp. 54–60), children up to the age of eleven undergo a phase of cognitive conformity, during which their moral understanding is primarily structured around adaptation to the adult (i.e., family) world, unfolding as a gradual transition from heteronomy (where norms are experienced as externally imposed) toward autonomy, as children progressively construct their own moral frameworks through cooperative social experience. Peer cooperation plays a generative role in this transition, fostering a form of mutual respect among equals that is qualitatively distinct from the unilateral deference children extend to adults: rather than obedience to authority, this emerging moral register is grounded in honesty, fairness, and reciprocity, and rules come to be recognized as valid not because they are imposed, but because they are collectively shared [13] (pp. 55–56).

During pre-adolescence, this conformist adherence to group cultural and behavioral norms shifts from parental rules to peer-defined rules [18], giving rise to competing normative fields. This shift corresponds to the moral developmental stage that Kohlberg identifies in children aged 10–13, who operate between a self-interest orientation driven by anticipated reward (Stage 2) and an interpersonal orientation driven by the need for

social approval (Stage 3) [19]. At this juncture, a dimension of social desirability enters into play, providing a favorable terrain for what we call ‘alternative conformism’: a readiness to renegotiate inherited norms when peer recognition is at stake. Children can thus no longer be approached as passive recipients of socialized values, but as active moral agents, capable of holding and reporting differentiated value structures of their own. Drawing on Schwartz’s theory of universal human values [20] (a cross-culturally validated framework organizing values along the axes of self-transcendence vs. self-enhancement and conservation vs. openness to change), empirical studies have demonstrated that children as young as 8–11 years already exhibit value structures comparable in differentiation to those found in adults, across national and cultural contexts [21], extending the analytical reach of Schwartz’s framework to childhood and making it a particularly suitable lens for investigating children’s value-based orientations in transnational and multicultural research settings.

In this light, combining a strictly cognitivist or stage-based perspective with the practice-based one discussed above, we integrated Schwartz’s value-based psychosocial framework into the socio-cultural approach to the school canteen, assumed as a distinctive institutional space within the school which can be explored as a privileged site where food-related norms inherited from the family are not simply reproduced but actively renegotiated through relational dynamics of mutual recognition, contributing to an autonomous moral development as “singularities” rooted in the logic of collective agreement. As highlighted above, this hybrid positioning between the home and institutional food environments gives school canteens significant potential as laboratories of gastro-citizenship, where food choices acquire social and political meaning within broader transitions toward healthier and more sustainable food systems. Yet this potential carries an inherent tension: the equitable intention to expose all children to the same ‘correct’ meal may generate exclusionary dynamics for those whose culturally shaped food patterns render it inappropriate [7], a challenge to both democracy and planetary health that remains unaddressed unless acceptance is understood within the cultural axiology framing food-related patterns. Indeed, the introduction of healthier and more sustainable dishes, particularly plant-based recipes, often encounters resistance due to a mismatch with children’s already internalized tastes and food habits, resulting in increased plate waste.

This tension is particularly relevant in school catering, where food waste has been estimated to range from approximately 15% to 40% of total meal weight [22,23], implying not only environmental loss but also the loss of nutritional value and of the social and educational functions embedded in school food provision [24,25]. According to the planetary healthy diets framework, sustainable dietary patterns should be largely based on vegetables, fruits, whole grains, legumes, nuts and unsaturated fats, while reducing red meat, added sugars, highly processed foods, saturated fats and salt [26]. Yet in school canteens, the very food groups central to this transition (especially vegetables, legumes and, in some contexts, fish) are also among those most exposed to rejection and plate waste. This is inseparable from the evidence that sweet, energy-dense foods represent the dominant register of food marketing directed at children, a pattern extensively documented in North American contexts across advertising, promotional techniques, and packaging [27–29] and corroborated by a cross-national European survey of 13,035 eleven-year-olds across nine countries (several of which overlap with the present sample), which found that greater exposure to televised food advertising was associated with lower fruit and vegetable intake, while exposure to advertising for healthy foods showed the inverse pattern [30].

Food waste in canteens should therefore be understood as a multifactorial ‘wicked problem’, generated by the interaction of food-related factors (palatability, sensory acceptability), child-related factors (personal preferences, habits, culturally and socially shaped

tastes, familiarity, satiety, mistrust of foods different from those consumed at home), and organizational factors (portioning, serving methods, timing, dining environment) [31–34]. From this perspective, reducing plate waste requires not only reformulating menus according to nutritional and sustainability principles, but also understanding how children progressively recognize, accept and emotionally value unfamiliar foods [35].

Building on these premises, this study investigates how socio-cultural determinants (internalized through taste, contested across competing normative fields, and articulated through values) together shape children's acceptance of a newly introduced school recipe, designed according to nutritional and sustainability principles and adapted to local food cultures across multiple European contexts. Children's acceptance of newly proposed dishes was explored both in sensory and emotional terms, including food waste levels on the school canteen plate [36], and in socio-cultural terms, correlating children's appreciation of the served dish with home eating patterns and their self-reported value-based orientations towards food-related habits, practiced both within the family and during the school meal. The study is exploratory in design: it does not submit a pre-specified model to confirmatory testing, but examines a set of theoretically derived expectations against a large cross-national dataset in order to identify which socio-cultural orientations merit more targeted investigation.

2. Materials and Methods

2.1. Study Design: The Overall Research Goals and Socio-Cultural Focus

The study was conducted within the framework of the Horizon 2020 project "SchoolFood4Change—SF4C" (ID: 101036763) [37,38], which aims to enhance schools' critical role as catalysts for a systemic change toward more sustainable and healthier food systems. The broader SF4C intervention has food education as a distinct pillar of the project's Whole School Food Approach, whereby School Menu Design relied on active, participatory learning engaging the whole school community—teachers, pupils, families, canteen staff and cooks [39]. The research was designed as a cross-country, multi-component evaluation assessing whether school recipes developed according to sustainability and nutritional criteria could be accepted by children aged 9–15 in real canteen settings across different European countries.

Within SF4C, this specific research segment, focused on both socio-cultural and sensorial appreciation of healthier and sustainable meals, was not conceived as a stand-alone initiative, but as part of the broader train-the-trainers pathway coordinated by the University of Anonymized Name to support sustainable school menu design, chef training, and local implementation capacity. By linking recipe development, canteen-based testing and observation, and contextual survey-based information on children's food habits, this integrated approach generated evidence on which plant-forward recipes could work, for which children, and under which conditions. It addressed the following gap: while a substantial body of research supports the nutritional and environmental rationale for shifting school meals toward planetary healthy diets [26], comparatively little large-scale, cross-national evidence exists on how to operationalize this transition in ways that remain acceptable and practicable within real school canteen settings.

The research activity was implemented across 12 European countries (Austria, Belgium, Czech Republic, Denmark, Estonia, France, Germany, Hungary, Italy, Slovakia, Spain, and Sweden) and 16 geographical units/schools, focusing on dishes selected or adapted according to three operational principles: vegetarian composition, use of unrefined raw materials, and reduced salt content [32] (pp. 2–3). Recipes were not imposed as a single standardized model, but adapted from the dishes habitually served in each canteen and typical of the local area, while adhering to these shared sustainability and nutritional prin-

ciples. The rationale relies on the awareness that planetary healthy diets may significantly modify the sensory profile of school meals, while children are generally less willing than adults to compromise sensory pleasure and taste (entirely shaped at home until pre-teen age) for health or sustainability benefits. Hence, the decentralized approach was explicitly designed to ensure that each recipe reflected the local food culture, thereby increasing the likelihood of children's acceptance and reducing the risk of cultural unfamiliarity and consequent plate waste.

This design choice also proved consistent with the effort of minimizing the risk of “heterogenizing” [7] (p. 65), and ultimately excluding, those who, for multiple determinants, do not recognize themselves in the served meal, in line with the very logic of full inclusive gastro-citizenship, where sustainability and cultural appropriateness are mutually reinforcing. Therefore, the test aimed to verify not only whether the proposed dishes were nutritionally and environmentally coherent, but also whether they were taste-inclusive, that is sensorially liked, culturally appropriate, and emotionally accepted, so as to be ultimately consumed. To this end, the protocol articulated three sequential actions. First, prior to consumption, local actors (including cooks and canteen staff) documented the food provisioning, ingredient use, and cooking process in each school canteen, providing a record (and ultimately guidelines) of recipe implementation in context [36]. Second, during consumption, an educator/teacher responsible for the meal sessions in each canteen, while assisting children, conducted participant observation, corroborating, through direct insight, children's self-reported responses, especially with regard to plate waste, in the subsequent (third step) evaluation. Third, immediately after consumption, an appreciation evaluation, also including a self-reported rating of uneaten food on the plate, was carried out through a classroom-administered questionnaire designed to contextualize children's sensory responses within their broader food habitus, meant as the system of internalized dispositions, values, and socio-cultural practices acquired in the family environment [8,9]. This step provided a more sociologically integrated interpretation of acceptance beyond individual liking. Finally, in line with the Whole School Food Approach, alongside recipe creation and testing, food education was implemented at three complementary levels [39]: transnational training of teachers, canteen staff and cooks (four sessions, October 2023–September 2024) [40]; a “Recipe Framework” field for “related educational experience,” completed by school staff per recipe [41] (p. 11); and the Canteen Day Vademecum, engaging the whole school community through hands-on workshops on food production, processing and waste [42]. Except for the transnational training, these were implemented at each municipality's discretion and not standardized relative to data collection, precluding educational exposure as a controlled variable here.

2.2. Measurement of Socio-Cultural Food-Related Value Patterns: Research Hypothesis, Research Questions, Research Tool

The sociological side of the study was integrated through a dedicated socio-cultural section developed within a broader questionnaire designed to explore the acceptance of the plant-based dish newly introduced in the school canteens of children aged 9–15 across 16 schools in the 12 countries involved in the project. Acceptance was measured through observed plate waste levels during the school canteen meal and self-reported behavioral responses collected soon after meal consumption. Though the present article is focused on a cross-national analysis, its exploratory orientation follows from the decentralized design of the protocol itself, whereby acceptance is theorized—and investigated—as situated and contextually co-produced. The analysis therefore aims to identify patterns of association across heterogeneous national settings rather than to isolate effects under controlled conditions.

In this socio-cultural section, children's value orientations towards food and its related practices were measured using items theoretically grounded in Schwartz's Universal Human Values [20], a framework widely used in established European surveys [43] and in adaptations to younger populations [21].

This part of the study was framed within the following general research hypothesis (RH), meant as theoretically informed and heuristic guides rather than propositions subjected to confirmatory verification:

RH. *Socio-cultural orientations and tastes formed within family and contesting peer contexts, assumed as primary spaces of value formation, can facilitate or hinder the acceptance of new, healthier, and more sustainable foods and affect plate waste, which is treated as a proxy of acceptance or rejection.*

Given its anchoring in Schwartz's value patterns, the general hypothesis specifically referred to the following values:

- Openness to new foods (neophilia), corresponding to Schwartz's *Intellectual Autonomy, Stimulation, Self-direction* (falling into Schwartz's macro-pattern of *Openness to change*);
- Ethical and environmental awareness, corresponding to Schwartz's *Universalism, Harmony* (falling into Schwartz's macro-pattern of *Self-transcendence*);
- Sociability and food sharing, corresponding to Schwartz's *Benevolence, Harmony* (*Self-transcendence*);
- Hedonic orientation toward food, corresponding to Schwartz's *Hedonism, Stimulation, Achievement* (Schwartz's macro-pattern of *Self-enhancement*);
- Conformity to family rules, corresponding to Schwartz's *Conformity* (Schwartz's macro-pattern of *Embeddedness/conservation*);
- Preference for familiar food sources, corresponding to Schwartz's *Conformity, Security* (macro-pattern of *Embeddedness/conservation/power*);
- Frugality and food reuse, corresponding to Schwartz's *Benevolence (modesty/humility)* and *Universalism (quality of life)* (macro-pattern of *Self-transcendence/Harmony*).

The overarching hypothesis was articulated into the following sub-hypotheses, more closely connecting value-based dispositions toward food, Schwartz's value patterns, and the expected appreciation/rejection of the newly proposed food:

H1 (Openness to Change). *Higher levels of openness to change and self-direction, expressed through curiosity, autonomy, and food novelty seeking, are associated with lower rejection of new healthy and sustainable dishes and lower food waste on the plate.*

H2 (Self-Transcendence/Harmony). *Higher levels of Self-Transcendence, reflected in ethical sensitivity and prosocial food values, are associated with greater acceptance of new healthy and sustainable dishes and lower food waste on the plate.*

H3 (Social Openness and Peer Orientation). *Stronger socially and peer-oriented food attitudes, including openness to sharing and tasting foods with classmates, are associated with higher acceptance of new dishes and lower food waste on the plate.*

H4 (Conservation/Social-Defensive Orientation). *Stronger conservation-oriented food attitudes, characterized by conformity, neophobia, and family-regulated eating practices, are associated with greater rejection of new dishes and higher food waste on the plate.*

H5 (Hedonic–Energy Orientation). *Stronger hedonic and energy-oriented taste preferences, especially for sweetened products, desserts, and snacks, are associated with greater rejection of healthy and sustainable dishes and higher food waste on the plate.*

The exploration of these sub-hypotheses gave rise to the following general research questions (RQ):

RQ1: To what extent do socio-cultural values formed within family and peer contexts facilitate or hinder the acceptance of new, healthier, and more sustainable foods?

RQ2: Do they correlate with the observed acceptance/rejection of healthier and sustainable dishes newly introduced in the school meal and consequent food leftover on the plate?

These general RQs were operationalized into 12 items, constructed as self-projective illustrations representing everyday food-related situations, each accompanied by a descriptive caption. The graphical visualization was meant to facilitate children's understanding and make the task more engaging and enjoyable. Responses were collected using a 5-point Likert scale (1 = Not at all like me; 5 = Exactly like me), with each scale point also supported by emoticons representing different states of mind (Appendix A, Figure A1). These items were also intended to be correlated with children's acceptance of the newly introduced plant-based dish (a dimension assumed to be multidimensional, not merely idiosyncratic or sensory) and assessed through observed plate waste levels ranging from none to high.

Each item was constructed so that the socio-cultural orientation associated with specific food-related practices or habits reflected the human value patterns identified by Schwartz (Table 1).

Table 1. Self-projective items on socio-cultural dimensions and their correspondence to Schwartz's Universal Human Values.

Caption Describing the Illustration	Socio-Cultural Food-Related Situations	Involved Food Values	Schwartz's Value Pattern
Item 1. These children like to try dishes different from at home	Openness to trying new foods	Neophilia, Curiosity (Neoph)	Intellectual autonomy, Stimulation, Self-direction
Item 2. These children choose the groceries when they shop with parents	Active involvement in food choices	Adventure, Stimulation (Advstim)	Self-Direction, Stimulation, Intellectual autonomy
Item 3. These kids usually cook with their parents or friends	Enjoyment of cooking and food creation	Foodism, Food love (Foodies)	Mastery, Hedonism, Affective autonomy
Item 4. These children love foods made only with vegetable do not harm animals	Ethical and environmental food awareness	Ethicality, Environment (EthicEnvir)	Universalism, Harmony, Self-Transcendence
Item 5. These children like sharing their food with classmates	Willingness to share food with others	Openness, Prosocial attitudes (Sharing)	Benevolence, Harmony, Self-Transcendence
Item 6. These children enjoy lunch with classmates in the school canteen	Openness and enjoyment of social interactions during meals	Openness, Conviviality (CanteenSocial)	Universalism, Benevolence
Item 7. This child likes to taste the food offered by classmates	Openness to different and unfamiliar foods	Curiosity, Stimulation, Independence (Openness)	Self-direction, Universalism, Intellectual Autonomy
Item 8. These children eat only food provided by their family	Preference for food security and family-approved sources	Conformity, Obedience, Security (SecureSourc)	Conformity, Security, Embeddedness, Conservation

Table 1. Cont.

Caption Describing the Illustration	Socio-Cultural Food-Related Situations	Involved Food Values	Schwartz's Value Pattern
Item 9. These children only eat foods allowed by their parents	Respect for family rules in eating behavior	Conformity, Tradition, Obedience (Confrules)	Conformity, Tradition, Embeddedness, Hierarchy, Conservation
Item 10. This child prefers sweetened products because they give energy	Seeking energy and pleasure from sweet foods	Competitiveness, Self-enhancement Stimulation, Hedonism (Sweetenerg)	Mastery, Achievement, Hedonism, Stimulation, Affective Autonomy, Self-enhancement
Item 11. These children eat many desserts, cakes or crisps because taste delicious	Pursuit of food for sensory pleasure	Hedonism, Pleasure seeking, Optimism (Funhedon)	Hedonism, Stimulation, Self-enhancement
Item 12. This child leftover food from previous family meals	Frugality and care in food consumption	Modesty, Reuse (ModestyReuse)	(Benevolence, Modesty, Humility)

The first three items address the value pattern of *Openness to Change*, capturing an autonomous attitude that characterizes adventurous, foodie, and neophilic profiles driven by curiosity toward new foods and discovery-oriented lifestyles. Items 4 to 7 address the value patterns of *Self-Transcendence* and *Social Development*, capturing responsible food-related attitudes associated with other-oriented, ecological, and intercultural lifestyles. Still within this pole of moral responsibility falls the final item, item 12, which asks whether children usually eat leftover food stored in the fridge; this item captures inconspicuous, care-oriented lifestyles, reflecting modesty and food-reuse practices aimed at avoiding waste. Items 8 and 9 address the pole of *Social Defence*, encompassing the value pattern of *Conservation* and *Conformity*, capturing traditionalist and family-regulated eating styles, food neophobia toward unfamiliar foods, and a preference for safety and security, often associated with low affinity or indifference toward new culinary proposals. Items 10 and 11 address the value pattern of *Self-Enhancement* and *Optimism*, capturing self-defensive and self-enhancing food attitudes typical of competitive, conspicuous, and hedonistic consumers, who use food as a means of self-affirmation and prefer energetic, sweet, highly palatable, and immediately rewarding foods.

2.3. Statistical Methods: Descriptive and Inferential Analysis of Cross-National Value Patterns

The exploration of children's socio-cultural patterns and attitudes toward food was designed to enable the cross-national identification of meaningful connections between children's food-related behaviors in school canteens and other eating contexts, such as home meals, as well as their relationships with family traditions, openness to food novelty, sharing practices, and ethical or environmental awareness.

Specifically, descriptive statistics were computed to identify the main cross-national trends in socio-cultural food attitudes. Inferential analyses were then conducted along two lines: chi-square crosstabulations, with Cramér's V as a measure of association, and ordinal logistic regression were used to examine which sociodemographic characteristics are associated with lower plate waste; one-way ANOVA and Spearman's rank-order correlation were used to examine how the twelve socio-cultural constructs relate to plate waste levels and to levels of food acceptance. Consistently with the exploratory nature of the study, no factor-analytic validation of the constructs was undertaken—neither exploratory nor confirmatory—and the twelve items were analyzed individually as single self-projective

indicators. Hypotheses were formulated in directional rather than point-specific terms and were not pre-registered, and no correction for multiple comparisons was applied a priori. Effect sizes presented in Results should be interpreted accordingly. IBM SPSS Statistics (Version 30) was used for data analysis, and Claude Sonnet 5 for editing charts.

3. Results

3.1. The Characteristics of the Achieved Sample

The survey gathered valid responses from a total of 2481 children across 12 EU countries (Table 2).

Table 2. Valid respondents.

	N
Missing	0
Valid	2481

As shown in Table 3, the distribution of participants by country is diverse yet balanced, as it shows:

- Highest participation from Estonia (14.2%), Austria (13.1%), and Germany (12.3%), which together account for nearly 40% of the total sample;
- Italy's significant contribution, with 12.0% of the total responses;
- Mid-level contributions from Sweden (10.9%), Belgium (6.3%), France (6.2%), and Czech Republic (5.4%);
- Smaller shares from Hungary, Slovakia, Denmark, and Spain, each ranging from 4.0% to 5.6%.

Table 3. Respondent characteristics.

Country	N	Valid %	Cumulative %
Belgium	156	6.3%	6.3%
Hungary	139	5.6%	11.9%
Denmark	111	4.5%	16.4%
Czech_Republic	133	5.4%	21.7%
Germany	305	12.3%	34.0%
France	154	6.2%	40.2%
Sweden	270	10.9%	51.1%
Italy	298	12.0%	63.1%
Slovakia	139	5.6%	68.7%
Estonia	352	14.2%	82.9%
Spain	99	4.0%	86.9%
Austria	325	13.1%	100.0%
Total	2481	100.0%	
Gender	N	Valid %	Cumulative %
Female	1325	53.4%	53.4%
Male	1086	43.8%	97.2%
Other/Prefer not to declare	70	2.8%	100.0%
Total	2481	100.0%	

Table 3. *Cont.*

Age (y.o.)	N	Valid %	Cumulative %
9	696	28.1%	28.1%
10	568	22.9%	50.9%
11	212	8.5%	59.5%
12	267	10.8%	70.3%
13	386	15.6%	85.8%
14	201	8.1%	93.9%
15	151	6.1%	100.0%
Total	2481	100.0%	
Mean Age (y.o.)	Mean	Median	SD
	11.1	10	1.94
School Canteen Frequency	N	Valid %	Cumulative %
Never	116	4.7%	4.7%
1–2 times a week	293	11.8%	16.5%
3–4 times a week	592	23.9%	40.3%
Every day	1480	59.7%	100.0%
Total	2481	100.0%	

The overall sample comprised 2481 children across 12 European countries. Females accounted for 53.4% of respondents and males for 43.8%, with the remaining 2.8% identifying as other or preferring not to declare their gender.

Participants ranged in age from 9 to 15 years, with a median age of 10 and a mean of 11.1 (SD = 1.94). The age distribution was skewed toward younger children, with the largest groups being 9-year-olds (28.1%) and 10-year-olds (22.9%), followed by 13-year-olds (15.6%). This age range falls within the window identified by developmental psychology as the transitional phase between heteronomous and autonomous moral reasoning [13,18,19].

Regarding canteen attendance, the majority of children reported eating at the school canteen every day (59.7%), while 23.9% attended 3–4 times a week and 11.8% 1–2 times a week. Only 4.7% reported never using the school canteen, confirming that the sample was largely composed of regular canteen users, which is consistent with the study's focus on in-canteen food acceptance.

3.2. Transnational Variation in Children's Value-Based Food Orientations

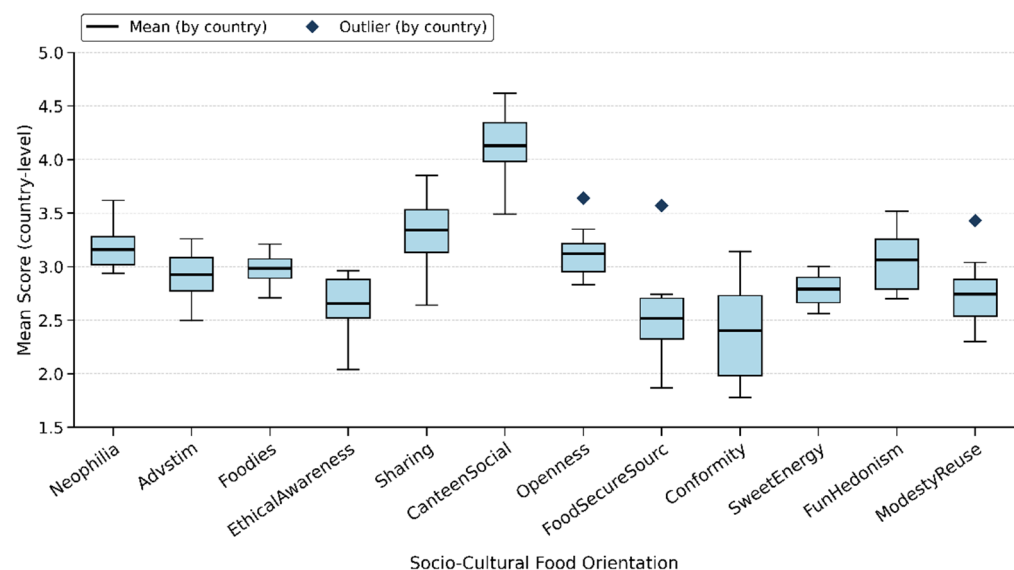
Descriptive analysis shows the cross-national distribution of children's value-based food orientations expressed by the 12 socio-cultural items. The boxplot presented in Figure 1 displays the country-level mean scores across the twelve food orientation constructs.

As visually confirmed in Figure 1, CanteenSocial stands out with both the highest median score and a compact, outlier-free box, indicating that the school canteen is uniformly perceived as a social space across the twelve countries. By contrast, the widest inter-country spread is recorded for Conformity and FoodSecureSource—consistent with family-regulated food patterns being differently configured across national contexts, as detailed below—and for EthicalAwareness, reflecting divergent cultural approaches to ethical and environmental food values, also discussed below. SweetEnergy and Foodies show the narrowest, most tightly clustered boxes, confirming these as culturally invariant orientations around a comparatively moderate-to-low mean, as the following paragraphs detail.

The results reveal five broad patterns capturing the mean (*M*) trends of children's food-related values, which are summarized in Table 4:

Table 4. Synoptic Overview of Children’s Value-Based Food Orientations across Nations.

Endorsement Pattern Across Countries	Food-Related Values (Overall Mean by Item)	Key Emerging Trend Across Europe
High & consistent endorsement	CanteenSocial ($M = 4.13$) Sharing ($M = 3.34$) Hedonism ($M = 3.06$)	Social and hedonic dimensions strongly endorsed across Europe, though Sharing shows notable cross-national spread.
Moderate to high & stable endorsement	Neophilia ($M = 3.16$) Openness ($M = 3.12$) Foodies ($M = 2.99$) Advstim ($M = 2.93$)	Moderately high and relatively homogeneous engagement with food novelty and autonomous food choices.
Moderate to weak & uniform endorsement	SweetEnergy ($M = 2.79$) ModestyReuse ($M = 2.74$)	Moderately weak and stable endorsement across all countries.
Weak & dispersed	EthicalAwareness ($M = 2.65$)	Low overall endorsement but wide national dispersion, pointing to divergent cultural approaches to ethical food values.
Weak & variable endorsement	FoodSecureSource ($M = 2.52$) Conformity ($M = 2.40$)	Weak endorsement of family-regulated food rules, with the widest cross-national variability in the dataset.

**Figure 1.** Transnational Variation in Children’s Value-Based Food Orientations: Distribution of Country-Level Mean Scores.

CanteenSocial ($M = 4.13$), Sharing ($M = 3.34$), and Hedonism ($M = 3.06$) are strongly and consistently endorsed across all surveyed countries. The school canteen is broadly perceived by children as a shared social space, and the pleasure of eating emerges as the most widespread orientation overall.

Neophilia ($M = 3.16$), Openness ($M = 3.12$), Foodies ($M = 2.99$), and Advstim (Adventure and Stimulation) ($M = 2.93$) cluster around moderate to high but relatively homogeneous means, reflecting a measured and consistent present interest in food novelty, autonomous food choices, and involvement in food preparation.

SweetEnergy ($M = 2.79$) scores cross-nationally uniformly moderate to low, suggesting a stable but moderate preference for sweetened and energy-dense foods regardless of

national context. ModestyReuse ($M = 2.74$) similarly scores uniformly moderate to low across countries, indicating that leftover-based eating practices are not a salient food orientation among children in any of the surveyed countries. EthicalAwareness ($M = 2.65$) scores low on average, but shows among the widest national dispersion of all constructs, pointing to divergent approaches to ethical and environmental food values across Europe.

Conformity ($M = 2.40$) and FoodSecureSource ($M = 2.52$) record the lowest overall means, indicating that children do not strongly tend to restrict their eating to family-approved foods or follow rigid family food rules. Both constructs also show among the widest cross-national variability, suggesting that family-regulated food patterns are differently configured across national contexts.

3.3. Cultural Dispositions Toward Food and Plate Waste Behavior

Our general hypothesis assumed the existence of a correlation between socio-cultural, value-based orientations toward food and the amount of newly proposed sustainable food left on the plate by the children. Plate waste was measured through a combined method: children's self-reported estimation, validated by the direct insight of the canteen educator responsible for each meal session. Prior to the sensory test, the canteen educators had been instructed through the sharing of operational guidelines for test administration, developed and disseminated with the involvement of the project partner cities. Both assessed the quantity of uneaten food using a visual scale consisting of six levels, ranging from "Nothing" (empty plate) to "Everything" (fully uneaten portion), as illustrated in Figure 2.

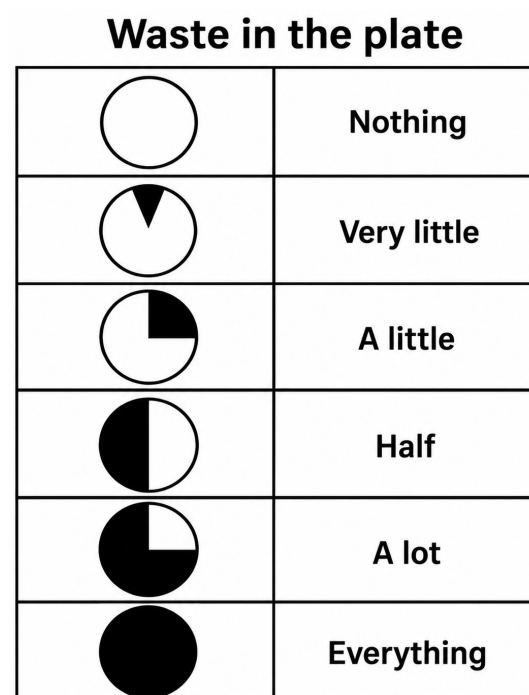


Figure 2. Visual scale used to assess the quantity of uneaten food left on the plate by children who tasted the newly proposed sustainable recipe served in the canteen.

Results were reaggreated into three levels for an easier understanding of children's appreciation of the newly served food. As shown in Table 5, nearly half of the children (46.9%) left nothing or very little food on the plate, indicating a broadly positive reception of the newly proposed sustainable recipe. A further 28.7% left a moderate amount, while 24.5% left a high quantity or the entire portion uneaten. Overall, the data suggest that the majority of children (75.6%) showed at least partial acceptance of the dish, with less than one quarter recording high levels of plate waste. This distribution provides a meaningful

dependent variable against which to examine the role of socio-cultural and value-based food orientations in shaping children's acceptance of sustainable school meals.

Table 5. Distribution of children by plate waste level of the newly proposed sustainable recipe ($N = 2481$; $M = 1.78$; $SD = 0.815$).

Plate Waste Level	N	Valid %	Cumulative %
Nothing to very low	1163	46.9%	46.9%
Moderate to medium	711	28.7%	75.5%
High to everything	607	24.5%	100.0%
Total	2481	100.0%	

To examine which sociodemographic characteristics are associated with lower acceptance of the proposed sustainable dish, a bivariate analysis (chi-square crosstabulations with Cramér's V) and an ordinal logistic regression (PLUM, link function: Logit; $N = 2481$; $\chi^2(23) = 346.006$, $p < 0.001$; Nagelkerke $R^2 = 0.148$) were conducted (Table 6).

Gender showed a small but significant bivariate association with plate waste (Cramér's $V = 0.061$, $p = 0.001$), confirmed in the multivariate model: females left more waste than males (44.5% vs. 50.8% low waste; Estimate = +0.216, $p = 0.007$). Age was also significantly associated with waste (Cramér's $V = 0.077$, $p = 0.004$), with children aged 9–13 showing higher waste than 15-year-olds in the regression model, though the pattern was not strictly linear in the bivariate distributions. The intermediate position of the 14-year-olds warrants a note, as this cohort, absent from five countries, shows the highest concentration in Eastern European contexts of any age group (56.2%), where waste levels proved highest overall for reasons connected to their specific national food policies and socio-cultural configurations. This accounts for the discrepancy between the raw distribution, where 14-year-olds record high waste levels, and the multivariate model, where the estimates place them closest to the 15-year-old reference. Canteen attendance frequency showed no significant bivariate association with plate waste (Cramér's $V = 0.039$, $p = 0.287$), yet became strongly significant in the multivariate model for all frequency levels below daily attendance ($p < 0.001$), showing a plate waste reduction trend alongside increasing canteen attendance frequency. The theoretical implications of this divergence are addressed in Section 4.

Country of origin was among the most important predictors of plate waste (Cramér's $V = 0.260$, $p < 0.001$). This finding is read alongside the degree of operability of national and regional regulatory frameworks (Table 7), which seems to interact with higher or lower levels of acceptance of the planetary-health transition. As above, the implications of these infrastructural regulations at the country level are addressed in Section 4.

Other contextual characteristics of the participating settings, such as the urban/rural distinction, could not be systematically recorded, as the large majority of participating schools were located in urban settings across all 12 countries. The only non-strictly urban context was Viimsi, Estonia, administratively classified as a rural municipality but presenting a predominantly suburban and residential profile functionally integrated into the Tallinn metropolitan area ($n = 196$). A supplementary exploratory PLUM on the Estonian subsample ($n = 352$) confirmed no significant difference in plate waste between Tallinn and Viimsi (Estimate = +0.197, $p = 0.472$, ns), empirically supporting their functional equivalence in the main analysis (Table 6).

A one-way ANOVA was conducted to test whether plate waste of the newly proposed sustainable recipe differed significantly across children's socio-cultural food orientation profiles. The findings are presented in Table 8.

Table 6. Sociodemographic Predictors of Plate Waste: Bivariate and Multivariate Analysis ($N = 2481$).

Predictor	Crosstab (Bivariate)			Ordinal Regression—PLUM		
	Low Waste %	High Waste %	Cramér's V (p)	Estimate	Wald	p
Gender (ref. = Male)						
Female	44.5%	25.4%	$V = 0.061$ (0.001)	+0.216	7.324	0.007
Other/Prefer not to declare	31.4%	37.1%	—	+0.560	5.650	0.017
Male (ref.)	50.8%	22.6%	—	—	—	—
Age (ref. = 15 years)						
9 years	45.3%	26.4%	$V = 0.077$ (0.004)	+0.661	9.461	0.002
10 years	53.9%	21.5%	—	+0.528	6.203	0.013
11 years	48.6%	24.1%	—	+0.724	9.708	0.002
12 years	44.2%	22.5%	—	+0.442	4.513	0.034
13 years	41.7%	24.4%	—	+0.496	6.561	0.010
14 years	41.3%	31.8%	—	+0.294	1.903	ns
15 years (ref.)	51.0%	21.2%	—	—	—	—
Canteen frequency (ref. = Every day)						
Never	49.1%	27.6%	$V = 0.039$ (ns)	+0.762	15.329	<0.001
1–2 times/week	47.1%	26.3%	—	+0.673	25.572	<0.001
3–4 times/week	46.3%	26.9%	—	+0.436	19.238	<0.001
Every day (ref.)	46.9%	22.9%	—	—	—	—
Country ($V = 0.260$, $p < 0.001$)—ordered by observed low waste						
Germany	70.2%	8.2%	—	−0.804	19.702	<0.001
France	69.5%	11.7%	—	−0.480	5.395	0.020
Austria (ref.)	54.5%	18.2%	—	—	—	—
Sweden	53.3%	17.0%	—	+0.281	1.858	ns
Estonia	49.4%	29.0%	—	+0.416	6.981	0.008
Belgium	41.7%	19.2%	—	+0.337	3.222	ns
Spain	41.4%	29.3%	—	+0.822	13.660	<0.001
Italy	40.3%	34.9%	—	+0.873	31.608	<0.001
Denmark	29.7%	25.2%	—	+1.112	21.760	<0.001
Czech Republic	29.3%	21.1%	—	+0.886	16.758	<0.001
Hungary	22.3%	45.3%	—	+1.826	60.479	<0.001
Slovakia	12.9%	54.0%	—	+2.119	102.194	<0.001
Estonian subsample urban vs. rural ($n = 352$; ref. = Viimsi)						
Tallinn	51.9%	28.8%	$V = 0.055$ (ns)	+0.197	0.517	ns (0.472)
Viimsi (ref.)	47.4%	29.1%	—	—	—	—

Of the twelve constructs examined, six showed statistically significant between-group differences. Although effect sizes (η^2) are consistently small, the pattern of means is theoretically coherent and largely consistent with the research hypotheses. Effect sizes of this magnitude are what the present design can be expected to yield: single self-projective items rather than validated multi-item scales, a stimulus not standardized across units, and a heterogeneous sample drawn from twelve national contexts. Their evidentiary weight accordingly rests not on the magnitude of individual associations but on convergence and directional coherence: as the Spearman correlations reported below confirm (Table 9), the same six constructs among twelve are identified by two conceptually distinct procedures, with relational and openness-related orientations consistently associated with lower waste and hedonic-energy orientations with higher waste.

Table 7. Cross-country comparison of plate-waste levels and regulatory frameworks governing school canteens.

Country	Nothing to Low Plate Waste %	Rank	Sustainability Procurement Criteria	Dietary Guidelines Adopted
Germany	70.2%	1	Yes	Yes
France	69.5%	2	Yes	Yes
Austria	54.5%	3	Yes	Yes
Sweden	53.3%	4	Voluntary	Yes
Estonia	49.4%	5	No	Yes
Belgium	41.7%	6	Yes	Regional
Spain	41.4%	7	Yes	Yes
Italy	40.3%	8	Yes	Yes
Denmark	29.7%	9	No	Yes
Czech Republic	29.3%	10	No	No
Hungary	22.3%	11	No	No
Slovakia	12.9%	12	No	Yes

Table 8. Mean scores of socio-cultural food attitudes by plate waste level of the healthy recipe (one-way ANOVA).

Socio-Cultural Food Pattern (Dependent Variables)	Plate Waste Level	Plate Waste Level	Plate Waste Level	Differences Between Groups		
	Nothing to Very Low (M)	Moderate to Medium (M)	High to Everything (M)	F (2, df)	Sig. <i>p</i> -Value	η^2
Food neophilia (likes to try dishes different from home)	3.31	3.09	2.88	27.52	<0.001	0.022
Ethical–environmental food values (preference for plant-based foods)	2.73	2.56	2.55	5.69	0.003	0.005
Enjoyment of eating together in the school canteen	4.11	4.06	3.95	3.14	0.043	0.003
Openness to tasting classmates' food	3.17	3.01	2.95	6.86	0.001	0.006
Preference for sweetened/energy-giving products	2.71	2.90	2.89	7.07	<0.001	0.006
Hedonic orientation toward desserts, cakes and crisps	2.98	3.11	3.21	7.05	<0.001	0.006

Note: Values are means. Only variables showing significant between-group differences ($p < 0.05$) are reported. Effect sizes are expressed as eta-squared (η^2). Plate waste levels refer to children leaving nothing/very little, a moderate amount, or a high amount of the healthy recipe on their plate.

Among the constructs associated with lower plate waste, food neophilia emerges as the strongest predictor, recording the highest F value in the model ($F = 27.52$, $p < 0.001$, $\eta^2 = 0.022$) and the steepest decline in mean scores across increasing waste levels ($M = 3.31$, 3.09 , 2.88). Ethical–environmental food values also showed a significant association with lower waste ($F = 5.69$, $p = 0.003$, $\eta^2 = 0.005$), though with a smaller and less progressive effect. Greater enjoyment of eating together in the school canteen ($F = 3.14$, $p = 0.043$, $\eta^2 = 0.003$) and higher openness to tasting classmates' food ($F = 6.86$, $p = 0.001$, $\eta^2 = 0.006$) were similarly associated with lower plate waste, pointing to the facilitating role of the social and peer-oriented canteen context. Conversely, preference for sweetened/energy-giving products ($F = 7.07$, $p < 0.001$, $\eta^2 = 0.006$) and hedonic orientation toward desserts, cakes, and crisps ($F = 7.05$, $p < 0.001$, $\eta^2 = 0.006$) both increased with higher waste levels ($M = 2.71$, 2.90 , 2.89 and $M = 2.98$, 3.11 , 3.21 respectively). These data offer a partial

compensation for the lack of SES information about children’s households: they show that a pre-existing ecological habitus in children—captured through the endorsement of ethical-environmental values, themselves scarcely endorsed across surveyed countries and assumed as indirect indicators of cultural stratification—favours acceptance, though it is not the main determinant, showing lower cross-group variance than other socio-cultural values. This suggests that value-based and cultural-capital resources, rather than economic stratification alone, are what our design was able to capture and what appears most explanatory here. Six constructs, namely active choosing of groceries with parents, cooking with parents or friends, sharing food per se (without openness to novelty), reusing leftovers from family meals, eating only family food perceived as secure (Securesource), and eating only foods allowed by parents (Confrules), showed no statistically significant association with plate waste. It should be noted that the latter two items recorded the lowest overall means in the dataset (2.40 and 2.52 respectively), with the majority of countries scoring well below the scale midpoint. This low prevalence of strict attachment to family-regulated food orientations across most national contexts may have contributed to the absence of statistically significant effects in the ANOVA: when a construct is uniformly weak across the sample, its discriminatory power as a predictor is structurally limited.

Table 9. Spearman’s rank-order correlations (ρ) between plate waste and socio-cultural food orientation constructs.

Socio-Cultural Food Pattern	Spearman’s ρ	Sig. (2-Tailed)
Food neophilia	−0.146	<0.001
Adventure/stimulation (choosing when grocery shopping)	0.033	0.104
Foodies (cooking with family/friends)	0.000	0.986
Ethical–environmental food values	−0.062	0.002
Sharing food with classmates	−0.019	0.342
Enjoyment of eating together in the canteen	−0.059	0.003
Openness to tasting classmates’ food	−0.072	<0.001
Preference for family-secured food sources	0.033	0.102
Compliance with family food rules	−0.035	0.081
Preference for sweetened/energy-giving products	0.069	<0.001
Hedonic orientation toward desserts and sweets	0.077	<0.001
Reuse of family leftovers (modesty)	−0.021	0.287

Note: Spearman’s ρ was used instead of Pearson’s r because both plate waste and the socio-cultural food orientation items were treated as ordinal/categorical variables, for which a non-parametric correlation coefficient is the more appropriate measure of association. Bold rows indicate constructs significant at $p < 0.05$, all of which coincide with the constructs identified as significant in the one-way ANOVA (Table 7). N ranges between 2456 and 2481 depending on pairwise missing data.

Figure 3 further illustrates the divergence between the two extreme waste profiles (children leaving nothing or very little food on the plate versus those leaving a high quantity or the entire portion) by plotting the mean scores of all twelve socio-cultural food orientation constructs for each group, highlighting the overall trend and the most contrasting patterns across the sample. The line chart confirms the patterns identified by the ANOVA: CanteenSocial forms the highest peak for both profiles, while the widest gap is recorded for food neophilia, favouring low-waste children, followed by openness to tasting classmates’ food and ethical-environmental values, also higher among low-waste children. Conversely, FunHedonism forms a local peak favouring high-waste children, alongside

a smaller gap for sweetened/energy-giving products in the same direction. Constructs related to strict compliance with family food rules, food provisioned exclusively by the family, involvement in cooking with family or friends, and reuse of food leftovers show minimal or no differences between groups.

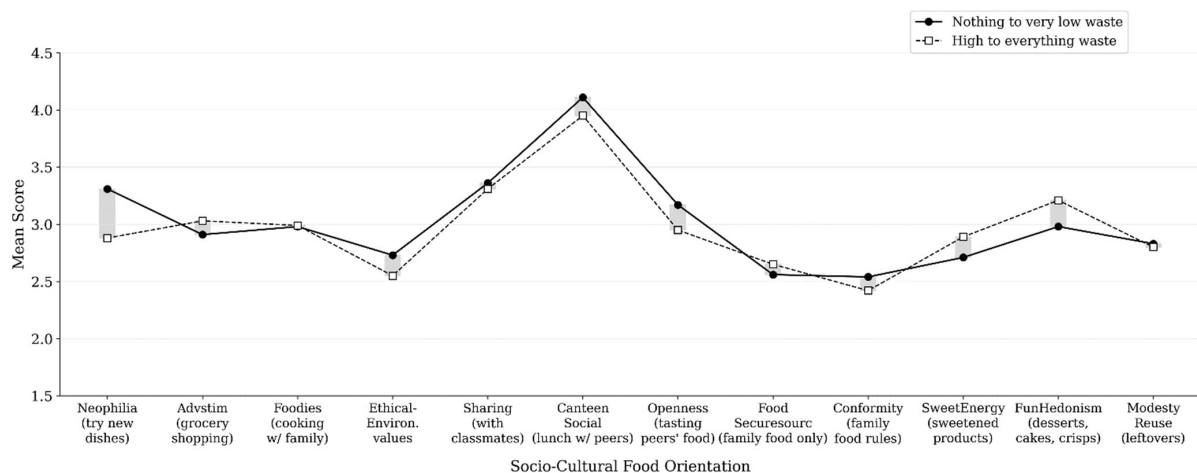


Figure 3. Mean scores of value-based food orientations by extreme plate waste levels (nothing to very low vs. high to everything). Grey shading highlights orientations for which the two waste-level groups differed.

Beyond these gaps, the two profiles trace a similar overall shape across the twelve constructs, indicating that low- and high-waste children share a broadly similar hierarchy of food-related values at the cross-national level; yet the lines cross repeatedly rather than one profile lying uniformly above the other. This shows that divergence between the two groups is not generic but selective, concentrated at specific constructs, consistent with a “singularization” process that operates on particular, socially salient dimensions rather than on the value system as a whole.

To complement the group-based comparison provided by the ANOVA, Spearman’s rank-order correlation (ρ) was computed between plate waste and each of the twelve socio-cultural food orientation constructs, treating both variables as ordinal in line with their measurement level and consistent with their treatment throughout the analysis. As shown in Table 9, six constructs reach statistical significance, and they coincide exactly with the six constructs already identified as significant in the ANOVA (Table 8): food neophilia, ethical–environmental food values, enjoyment of eating together in the canteen, openness to tasting classmates’ food, preference for sweetened/energy-giving products, and hedonic orientation toward desserts and sweets. This convergence between two conceptually distinct statistical approaches (a between-group comparison and a continuous ordinal association) reinforces the robustness of these six constructs as the most consistent correlates of plate waste in the dataset, while confirming that the remaining constructs show no reliable association with waste levels regardless of the analytical approach used.

4. Discussion

The findings support the hypothesis that children’s food acceptance and plate waste are not solely driven by sensory preferences but are socially constructed through the interplay between home kitchen practices and school dining environments, entering as contested normative fields where taste re-negotiation takes place through peer interaction dynamics.

The descriptive results offer a theoretically significant pattern when read against the developmental framework outlined in the introduction. First, the protocol’s decentralized

strategy—proposing not a standardized healthy recipe, but locally adapted ones—proved successful, given the overall low plate-waste tendency at the cross-national level. The food-related values most strongly endorsed across all surveyed countries are those associated with sociality, sharing, and conviviality in the school canteen context, followed by curiosity and openness toward food novelty; these dimensions are also the most cross-nationally consistent, suggesting a shared developmental baseline rather than a culturally specific configuration. Notably, among the constructs significantly associated with plate waste, the two hedonic-energy orientations diverge sharply in their overall endorsement: the pursuit of desserts and treats for their sensory pleasure (Hedonism) ranks among the most strongly endorsed values in the dataset, on a par with sociality and conviviality, while the more specific orientation toward sweetened products sought for their energy value (SweetEnergy) scores moderately low. Despite this gap, both are significantly associated with higher plate waste, suggesting that the energy- and pleasure-driven register of taste consistently works against the acceptance of the newly proposed sustainable dish, regardless of how widely that register is otherwise endorsed. Conformistic orientations related to family food authority and strict observance of family food rules proved less significant for the acceptance of new foods in the school canteen, contrary to expectations.

What the two hedonic-energy orientations share, despite this gap in endorsement, is their cross-national stability—and it is here that their connection to the wider food environment becomes legible. Sweet and energy-dense products constitute the dominant register of food marketing and packaging directed at children and pre-teens, a pattern documented in North American [27–29] and European [30] contexts alike, and one that operates largely irrespective of national food culture. Our data show a corresponding asymmetry: it is precisely the hedonic-energy orientations that vary least across the twelve countries, while the family-regulated orientations vary most. What differs between national contexts is the familial framing of food; what appears comparatively invariant is the hedonic register children bring to the meal. Since the products sustaining that register are also those least compatible with healthy and sustainable dietary recommendations, sustainable school meal design confronts a structurally asymmetric competition in which the relational and educational resources of the canteen are set against a marketing environment that is both pervasive and culturally homogenizing.

These findings reflect the theoretical assumption that family-based habitus (dispositions toward food shaped through patterns of family socialization [8,9]) accounts for what children bring into the canteen, and indeed it played an evident role, as reflected in the low average levels of uneaten food when children faced a newly proposed dish built from local recipes rather than from an abstract benchmark. Yet the findings also show that the canteen is not merely a site of reproduction of those dispositions. Once exposed to a peer audience, pre-teen children's food patterns reported at home and their actual behavior in relation to the newly proposed dish appear to diverge, pointing to a re-enactment before peers rather than a simple transmission from the household.

The canteen is perceived and appreciated by children not merely as a site of lunch consumption, but as a relational environment where food acquires meaning through sharing, interaction, and collective experience. The sociability of the meal, together with a neophilic and ecological habitus already nurtured at home, emerges as a central driver of acceptance. This is consistent with intervention research showing that repeated exposure to unfamiliar foods produces little gain in liking when administered in isolation, and becomes effective only when combined with peer modeling and other forms of social reinforcement [44]. This is a first indication that acceptance or rejection stems neither from an idiosyncratic attitude nor from obedient adherence to family patterns, but from a combined strategy of *singularization* [10]: taste is not simply inherited but acquires value

(and the very conditions for that value) to the extent that it is performed and recognized within a relational, in this case peer-based, logic, as theorized by Reckwitz [11].

This is further supported by the divergence between the non-significant bivariate association of canteen attendance frequency with plate waste and its highly significant effect in the multivariate model (Table 6): it is not exposure to the canteen per se that promotes acceptance, but its interaction with sociodemographic factors—gender, with males leaving less food, and age, with taste-negotiation dynamics differing by developmental stage—and the broader socio-cultural context, consistent with the multidimensional “socially fabricated” logic of singularization. Country of origin emerged as a considerable sociodemographic predictor (Cramér’s $V = 0.260$, $p < 0.001$), confirming that national context is a structurally relevant variable—not so much a culinary framework as a regulatory one (e.g., green public procurement rules, compliance with national nutritional guidelines) that governs the canteen infrastructure and the food served. As Table 7 shows, the three countries with the highest plate waste—Slovakia, Hungary and the Czech Republic—are also among those lacking mandatory national sustainability requirements in food procurement, such as eco-labels or minimum organic shares [45]; Hungary and the Czech Republic lack national dietary guidelines as well, and in the Czech case a legally binding price ceiling further constrains sustainable choices. The best-performing countries, conversely, operate under sustainability criteria that are either mandatory—federal in Germany and Austria, national in France, depending on state form and the decentralization of school food systems—or, as in Sweden, non-binding but very comprehensive. The canteen emerges as a genuinely co-produced space: frequency of attendance, stripped of these contextual factors, carries no independent predictive weight. Country of origin remains a structurally constitutive dimension of acceptance both in its culinary features, addressed by the decentralized protocol through local cooks and canteen staff, and in its infrastructural and regulatory framework, which lies beyond the reach of a recipe-design protocol and helps account for the persistence of high waste in the least regulated contexts despite culinary adaptation. This interaction of infrastructural frames (“logic of the general”) and level of acceptance (“logic of the particular”) is again consistent with the multidimensional logic of taste singularization.

Indeed, the values most consistently endorsed across countries are not those tied to strict adherence to family food rules or to greater autonomy in family grocery shopping, but those tied to sociality, sharing, and, to some extent, openness to novelty: dimensions showing a direct protective effect against waste and evoking a peer-cooperative social dynamic that plays a generative role in the gradual shift from heteronomy toward autonomy [13,19]. Consistently, conformity to family food rules records the lowest scores and the widest cross-national variability of all constructs, neither facilitating nor hindering acceptance of new foods nor affecting waste reduction: a pattern in line with Piaget’s and Kohlberg’s account of peer cooperation as generating a qualitatively distinct form of moral understanding, one grounded not in obedience to externally imposed adult norms but in the reciprocal, collectively negotiated relations through which pre-teens construct their own relational framework around food. The age gradient reported in Table 6 lends empirical weight to this reading. Controlling for national context, plate waste is highest among the younger cohorts and declines towards the oldest, with 14-year-olds occupying an intermediate position closest to the 15-year-old reference (Estimate = +0.294) and falling short of significance. This is what a shift from adult-referenced conformity to peer-referenced negotiation would be expected to produce: the pre-teen years as the period in which inherited norms become renegotiable when peer recognition is at stake, and mid-adolescence as the point at which a more settled relation to the school meal consolidates. Notably, the gradient is visible only in the multivariate model: in the raw distribution, it is obscured by the uneven allocation of

age groups across participating countries, as 14-year-olds show the highest concentration in Eastern Europe of any age group (56.2%), where waste levels were also highest overall for reasons connected to the region's specific socio-cultural configurations. This discrepancy highlights the need to hold together the developmental account with the situated, practice-based account of taste-negotiation dynamics.

The inferential analysis provides substantial empirical support for the research hypotheses; even when one is not confirmed, the results remain consistent with the theoretical assumptions underlying the research design.

H1 (Openness to Change) is strongly supported. Children's food neophilia, operationalized as a self-reported dispositional trait ("I like to try dishes different from those I use to eat at home"), rather than as an episodic behavioral report, emerges as by far the strongest predictor of low plate waste across all surveyed countries ($F = 27.52$, $p < 0.001$, $\eta^2 = 0.022$). This finding suggests that openness to novelty and self-directed food exploration are not merely idiosyncratic or momentary preferences, but consolidated, culturally embedded orientations that rely on food disposition read as habitus, shaped through family food-related socio-cultural patterns that significantly favor children's receptiveness to new sustainable, plant-based dishes in the canteen setting, even when introducing new ingredients or flavors.

H2 (Self-Transcendence) is supported. Ethical–environmental food values, operationalized as a self-reported dispositional trait ("I love plant-based foods that do not harm animals or nature"), in line with Schwartz's self-transcendence dimension, show a significant, albeit modest, association with lower plate waste ($F = 5.69$, $p = 0.003$, $\eta^2 = 0.005$). While the effect size is small, the directionality is consistent: children who express greater sensitivity toward plant-based and environmentally conscious food choices tend to leave less food on the plate. As with food neophilia, this item captures a consolidated disposition rather than an episodic judgment, suggesting that prosocial and ethical food orientations, even when only weakly present among the surveyed pre-teens, contribute measurably to the acceptance of sustainable school menus insofar as they already reflect values acquired within their daily food culture.

H3 (Social Openness and Peer Orientation) is supported across two distinct dimensions. Openness to tasting classmates' food ($F = 6.86$, $p = 0.001$, $\eta^2 = 0.006$) and enjoyment of eating together with classmates in the school canteen ($F = 3.14$, $p = 0.043$, $\eta^2 = 0.003$), both measured as self-reported social habits situated in peer interaction, rather than as general dispositional traits, are significantly associated with lower waste levels. These results indicate that the social and relational dimensions of the canteen experience, such as peer interaction, conviviality, and openness to shared food practices, act as facilitating conditions for the acceptance of unfamiliar or less familiar dishes, reflecting both pre-teen peer-oriented value legitimation and self-transcendent value orientations. The school canteen thus functions not only as a nutritional environment but as a social space in which peer dynamics actively mediate taste re-negotiation and food acceptance.

H5 (Hedonic–Energy Orientation) is supported. Preference for sweetened/energy-giving products ($F = 7.07$, $p < 0.001$, $\eta^2 = 0.006$) and hedonic orientation toward desserts, cakes, and crisps ($F = 7.05$, $p < 0.001$, $\eta^2 = 0.006$) are both significantly associated with higher plate waste. Children with stronger pleasure-driven and energy-oriented taste preferences tended to leave more of the newly proposed sustainable dish uneaten, suggesting that habituated hedonic expectations, reinforced by food marketing targeting children, may conflict with the sensory and nutritional profile of sustainable school menus.

H4 (Conservation/Social-Defensive Orientation) is not supported. Neither conformity to family food rules nor reliance on family-provisioned food showed statistically significant associations with plate waste. As discussed above, this null result is theoretically coherent:

at approximately 10–11 years of age, children are transitioning away from heteronomous compliance with family food norms toward more autonomous, peer-mediated orientations, so family food authority is already receding as a structuring force in the canteen context. The exclusionary risks inherent in school canteen-based food transitions due to potential mismatch between children's family-based dietary rules and the introduction of healthier, more sustainable dishes [7] thus appear negligible in this large-scale experiment, likely owing to the protocol's decentralized, gastronomically inclusive design, which anchored each recipe in local culinary traditions and established canteen food cultures while pursuing shared sustainability goals. This reduced the cultural distance between home food habitus and the canteen meal, supporting a model of gastro-citizenship that is substantively inclusive rather than merely formally equitable.

Although effect sizes are consistently small across all significant variables, the overall pattern is theoretically coherent: plate waste is embedded in broader cultural dispositions toward food, which originate and take shape in practical, daily domestic involvement, but are neither simply reproduced nor denied in the school canteen. Instead, they enter a dynamic, contested social logic, in which children at this pre-teen stage negotiate their singularity by conforming to a different, peer-based and relationally oriented social logic, still perceived as normative and performative, that is, embedded with social expectations.

As long-term follow-up on durable change in children's tastes was not feasible within the project's timeline, the potential impact of some findings from our exploratory analyses was inferred indirectly through data from the SROI follow-up analysis conducted in some sites in 2024, as part of the territorial Impact Maps included in Deliverable D2.6 of the project [46]. Where such follow-up monitoring was carried out (Ghent, Slovakia, the Czech Republic, Tallinn, Viimsi and Budapest), food-waste data offer a further, though cautious, descriptive indication. These contexts show socio-cultural profiles our individual-level analysis links to lower waste: above-mean sociability of the school meal in four of the six (Ghent = 4.09, Budapest = 4.30, Czech Republic = 4.12, Slovakia = 4.23; sample mean = 4.05), and lower hedonic-energy orientations—on both dimensions in the Czech Republic (Sweet-Energy/Hedonism = 2.62/2.95), Tallinn (2.55/2.79) and Viimsi (2.66/2.67), and on one dimension in Budapest (Hedonism = 2.74) and Slovakia (SweetEnergy = 2.68). Yet several of these same contexts recorded the highest plate waste in the experimental test. Where children's dispositions are favorable but waste remains high, the constraint lies not in what children bring to the canteen but in the conditions they encounter there—the regulatory and infrastructural configurations discussed above. Read this way, the food-waste reductions recorded between baseline and the 2024 implementation assessment across the SROI case studies—roughly 1 to 19 percentage points, or relative reductions of about 2% to 33.9%—are consistent with improvements in the school food offer allowing existing socio-cultural dispositions to translate more readily into consumption, an effect particularly evident in those contexts that were initially unregulated and had higher plate-waste. The uneven magnitude of improvement across contexts underscores the context-sensitive nature of sustainable school meal interventions, and the capacity of the meal offer to be received and appropriated according to the socio-cultural, relational and organizational conditions of the canteen.

5. Conclusions

This study shows that children's acceptance of sustainable school meals is co-produced through the interaction between home food cultures and school-based dining environments, rather than a simple extension of one into the other. Across Europe, children consistently value the canteen as a social space: lower plate waste was associated with higher neophilia, stronger ethical–environmental values, greater enjoyment of eating socially with peers,

and openness to tasting classmates' food, while higher waste was associated with hedonic and energy-driven preferences for sweets and snacks. By contrast, family control, cooking with parents, food sharing per se, and strict adherence to family food rules showed no significant effect on acceptance or rejection.

Taken together, these results suggest that family food habitus shapes the conditions for acceptance without being simply reproduced in the canteen: taste is instead renegotiated there through peer-oriented relations, in line with a logic of singularization proper to pre-teen social life. Acceptance is thus co-produced: family food habitus provides the dispositional substrate—the tastes, values, and practices brought into the canteen—while the canteen itself functions as a second normative arena where those dispositions are exposed to peer scrutiny, partially renegotiated according to their peculiar socialization dynamics, and selectively reinforced or revised. Neither context alone determines the outcome; it is their interaction that shapes what children ultimately eat or leave on the plate. The relatively low, though consequential, levels of ethical–environmental awareness further indicate that sustainability-oriented values are not yet fully internalized among children, but already make a measurable difference where present, pointing to a role for educational interventions that engage children as active moral agents rather than passive recipients of information.

The available follow-up evidence is consistent with this interpretation: plate waste is not reducible to the sensory or nutritional properties of the recipe alone, and acceptance is not a matter of individual choice, but is shaped by children's food dispositions, peer dynamics, and the broader cultural conditions of the school meal.

5.1. Practical Takeaways

Being exploratory in design, this study does not warrant prescriptive guidance, though its findings suggest several takeaways that the actors involved in school food provision may find worthwhile to consider.

Polymakers: The decentralized protocol adopted here—locally adapted recipes constrained by shared sustainability principles rather than a standardized menu—appears to be a promising preliminary strategy, consistent with the observed weight of national context. Procurement frameworks may therefore benefit from retaining local discretion for gastronomic adaptation, provided this is not turned into a normative or nationalistic assertion of tradition. The conditions of conviviality—mealtime duration, seating arrangements, trained canteen staff—also warrant consideration as substantive components of school food policy rather than logistical residuals, as does the regulation of food promotion directed at children, given the asymmetric competition with the marketing of sweet and energy-dense products.

Educators: Ethical–environmental values recorded low endorsement yet a significant association with reduced waste: an underdeveloped but potentially consequential resource. Food education may thus be most promising where it engages children as active moral agents rather than recipients of nutritional information, and where it draws on peer modeling and socially embedded exposure rather than instruction or compliance [44].

Schools: Canteens may be more effectively designed around sociability, curiosity, and openness to novelty—cultivated at home and reinforced at school—together with ethical and environmental food values, rather than around rigid rules or tradition-bound patterns. Since the frequency of attendance carried no independent predictive weight, exposure alone does not appear sufficient: what seems to matter is the relational quality of the meal. Involving local cooks and canteen staff—and, in several countries, parents—in adapting recipes to regional culinary patterns may support alignment between school and family food cultures. Since plate waste was higher among pre-teens (9–13) than among 15-year-

olds—consistent with the pre-teen years as the period in which adult-referenced norms are still being renegotiated into peer-referenced acceptance—closer attention to this age group may be warranted.

Families: Engaging families in food education pathways that foster continuity between home and canteen, while making food patterns more flexible, could also help reduce food-related and nutritional awareness gaps within the family sphere. Continuity, however, is not replication, nor is alignment with the family table a guarantee of inclusion in itself. What travels from home to canteen is not the instructional dimension of family food socialization—neither cooking together with parents nor compliance with family food rules showed any association with acceptance—but its relational one: what children bring from home is a resource to be renegotiated in the shared socialization mode proper to the canteen. Family-oriented interventions might therefore gain from reproducing convivial conditions: meals served family-style rather than portioned individually; mealtimes framed as occasions for interaction rather than compliance; repeated exposure to unfamiliar foods embedded in these conditions; and adult modeling of curiosity toward new tastes rather than prescription. In this respect, the broader SF4C intervention includes a dedicated toolkit—the “Vademecum for the School Canteen Day” [42]—outlining structured moments of informal food education that directly engage families and other relevant actors across the food supply chain. These include, among others: a convivial, shared-experience event centered on tasting; sessions in which a dietitian and the canteen cook support families in planning evening menus, in continuity with the home–canteen link discussed above—a continuity that, consistently with our findings, is not a matter of replicating family food patterns as such, but of rendering them flexible enough for children to renegotiate and integrate within the canteen’s own socialization dynamics; and guided tasting sessions aimed at reducing meat consumption, consistent with our finding that food neophilia is the strongest predictor of acceptance.

Taken together, these suggestions point to school canteens as potentially strategic sites for advancing sustainable food systems and democratic forms of gastro-citizenship.

5.2. Limitations of This Study

Follow-up data were not collected as a systematic longitudinal evaluation across all participating units, but were available only for a subset of cities and geographical areas; these findings should therefore be treated as complementary rather than conclusive evidence. While they strengthen the plausibility of the socio-cultural framework advanced here, future research should examine whether reductions in plate waste are sustained over time and whether their magnitude is consistent with the socio-cultural food orientations identified across countries. Consistent with this, findings reflect associations observed at a single, “kick-off” time point, rather than confirmed causal effects or durable change: verifying such change would require following social transitions over a longer period than the project’s timeline allowed, which is why no post-intervention evaluation was possible. Finally, it is worth noting that, as part of a Horizon 2020 project, the study covered EU partner countries; consequently, findings cannot be assumed to generalize to developing regions. Moreover, a specific focus on ethnic minorities as an analytical category within countries with dense immigrant presence was not part of the project scope, although the singularization model adopted proved particularly inclusive, overcoming the limitations of more standardized or gastro-nationalistic approaches to planetary-healthy diets. Explicitly addressing ethnic minorities as a distinct dimension—which would further test the goodness of the implemented model—nonetheless remains a valuable direction for future research.

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Data Availability Statement: The original data upon which the analysis presented in this article is based belong to the SF4C Consortium and are subject to restrictions due to ethical, legal, and privacy issues. Data may be made available upon request, as far as compliant with the above-mentioned restrictions.

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Abbreviation

SF4C School Food for Change

Appendix A

This section presents the structure of the socio-cultural component of the questionnaire, comprising the 12 items used to explore the value-based food orientations of the children participating in the study. The questionnaire was structured around a combination of statements and illustrations designed to facilitate children's understanding and support the projective process (consistent with Schwartz's model). This projective approach elicited responses framed as identification with what was depicted, recorded on a 5-point Likert scale, with each point supported by an emoticon.



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SECTION 2.2 – FOOD CONSUMPTION IN THE DAILY LIFE

DO YOU EXPERIENCE THE SAME SITUATION AS THE CHILDREN IN THE FOLLOWING DRAWINGS?

■ These kids like to try dishes that are different from the ones they usually eat at home




Not at all
like me
○


Only a little
like me
○


Somewhat
like me
○


Largely
like me
○


Exactly
like me
○

■ These children choose the groceries themselves when they go shopping with their parents




Not at all
like me
○


Only a little
like me
○


Somewhat
like me
○


Largely
like me
○


Exactly
like me
○

■ These kids usually cook with their parents or with their friends.




Not at all
like me
○


Only a little
like me
○


Somewhat
like me
○


Largely
like me
○


Exactly
like me
○

■ These children love foods made only with vegetable ingredients




Not at all
like me
○


Only a little
like me
○


Somewhat
like me
○


Largely
like me
○


Exactly
like me
○

■ These children like sharing their food with classmates.




Not at all
like me
○


Only a little
like me
○


Somewhat
like me
○


Largely
like me
○


Exactly
like me
○

■ These children enjoy to have lunch with classmates in the school canteen during the week




Not at all
like me
○


Only a little
like me
○


Somewhat
like me
○


Largely
like me
○


Exactly
like me
○


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Figure A1. *Cont.*

■ This child likes to taste the food offered by classmates.



Not at all like me ☐ Only a little like me ☐ Somewhat like me ☐ Largely like me ☐ Exactly like me ☐

■ These children eat only food prepared by their family members.



Not at all like me ☐ Only a little like me ☐ Somewhat like me ☐ Largely like me ☐ Exactly like me ☐

■ These kids only eat foods that are allowed by their parents.



Not at all like me ☐ Only a little like me ☐ Somewhat like me ☐ Largely like me ☐ Exactly like me ☐

■ This child prefers sweetened products (with added sugar) because they give them energy.



Not at all like me ☐ Only a little like me ☐ Somewhat like me ☐ Largely like me ☐ Exactly like me ☐

■ These children eat many desserts, cakes or crisps because they taste delicious.



Not at all like me ☐ Only a little like me ☐ Somewhat like me ☐ Largely like me ☐ Exactly like me ☐

■ This child decides which leftover food from previous family meals stored in the refrigerator will be part of dinner.



Not at all like me ☐ Only a little like me ☐ Somewhat like me ☐ Largely like me ☐ Exactly like me ☐

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Figure A1. Socio-cultural section of the questionnaire exploring the value-based orientations guiding children's acceptance of the new planetary-healthy dish.

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