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"If I say sustainable diet": What are French consumers' social representations?

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ABSTRACT

The adoption of sustainable diets is essential to maintain our planet's ecosystem and the well-being of its inhabitants. Scientists characterize sustainable diets by four essential dimensions: respectful of the environment, of good nutritional quality, culturally acceptable, and economically fair. The 'sustainable diet' concept, however, can be challenging for consumers to understand. They might partially understand the concept or have representations of the concept that are not shared between individuals, which could result in difficulty putting the recommendations into practice. Our study investigated French consumers' social representations of sustainable diets, aiming more particularly to show if groups with different levels of education might have different representations. A free word association task was carried out by 273 participants aged between 20 and 60 years. Our results revealed common associations among the participants, including concepts such as ecology, health, environment, and locality. Sociocultural and economic dimensions were rarely mentioned, unlike the predominant environmental dimension. Segmentation analysis by education level revealed that participants in the higher education group had more multidimensional social representations. These results show that the 'sustainable diet' concept is not fully shared by French consumers. Clarifying the definition should improve consumer understanding, thus promoting the adoption of sustainable diet practices by all.

1. Introduction

According to the EAT-Lancet Commission, the adoption of healthy diets from sustainable food systems is the most powerful lever for optimizing human health and environmental sustainability (Willett et al., 2019). Current Western eating habits are associated with negative environmental consequences, contributing to resource depletion and climate change. They provoke diet-related non-communicable diseases such as obesity and type 2 diabetes (Springmann et al., 2022). For these reasons, a shift to more sustainable diets is increasingly urgent, and the interest in such diets has grown considerably in recent years (Portugal-Nunes et al., 2022). The definition of sustainable diets is complex and multidimensional (Macdiarmid, 2013) and can be difficult to understand for consumers. If this expression evokes a different concept for each consumer, following recommendations that urge consumers to adopt a more sustainable diet (European Commission, 2023; French Ministry of Health and Prevention, 2019) may be complicated. In 2010, the FAO established a definition of sustainable diets meant to be accessible to anyone. According to this definition, "Sustainable diets are 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, 2010). This definition distinguishes four main dimensions: (1) *Nutritional-Healthy*, (2) *Environmental*, (3) *Sociocultural*, and (4) *Socioeconomic* (Drewnowski et al., 2018). Consumers may not be aware of this definition and have their own representations of the 'sustainable diet' concept. It is therefore essential to investigate how consumers understand this concept.

Previous international studies have shown that Spanish, Hungarian, Brazilian and Canadian consumers spontaneously associate the 'sustainable diet' concept with the *Environmental* dimension, neglecting the *Sociocultural* and *Socioeconomic* dimensions (Barone, Nogueira, & Behrens, 2019; Mesías, Fernández, Horrillo, & Escribano, 2023; Simpson & Radford, 2012; Techio, Gonçalves, & Costa, 2016; László, 2021). The interpretation of this concept appears to be segmented according to the participant's level of education. People with higher education seem to

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be more concerned by the environment (Franzen & Vogl, 2013; Lassoued et al., 2023; Panzone et al., 2016) and food sustainability in general (Sánchez-Bravo et al., 2020; Van Loo et al., 2017). They appear to have better knowledge of the environmental impact of diet (Jain & Kaur, 2006) and of food sustainability (Sánchez-Bravo et al., 2020). They also mention social issues in association with sustainable diets (Barone et al., 2019).

To our knowledge in France, very few studies investigated the representation of a 'sustainable diet' Two interview-based studies (Rémésy et al., 2008: 70 participants; Mathe, 2009: 10 participants) have detected the predominance of the *Environmental* dimension. These results are contradicted by a much larger questionnaire-based pan-European study (European Commission, 2020), where 1,001 French participants placed the *Nutritional-Healthy* dimension in first place among the most important properties of sustainable diets. Interview-based studies imply smaller samples; questionnaires may recruit larger samples, but both item selection (Queirós et al., 2017) and social desirability (Fisher, 1993) may cause response bias. A study with a larger number of participants using another methodology is therefore necessary to clarify the social representations of sustainable diets for French consumers.

Social representations are the set of beliefs, opinions, attitudes, and information shared by a group about a given subject (Abric, 1994). They represent socially developed knowledge contributing to a shared reality. They evolve with time and context because they result from interactions between individuals and the society to which they belong. Therefore, studying social representations is a good way to study the acceptance of new subject, indicating the transition from "something disturbing and unknown" into "something familiar and known" (Wagner & Kronberger, 2001). Consequently, a social representations study might allow us to discover whether consumers share common definition of sustainable diets.

For many years, social psychologists have employed the structural approach, initially developed by Abric's (1976), to explore social representations. In this method, the understanding given by a social group to the subject of a social representation is articulated as a central core surrounded by peripheral elements (Lo Monaco & Lheureux, 2007). The elements that compose social representations are located in the central core and 1st periphery. The central elements evidenced by this analysis are those that are the most strongly associated with the concept. Other less shared elements are located in the contrasting zone and 2nd periphery, according to the importance attributed to these elements by respondents. These elements put the central meanings into perspective according to the diversity of contexts and individualities (Lo Monaco & Lheureux, 2007). The attitudes of respondents toward the elements present in the social representations can be analyzed using a polarity index (De rosa, 2002). If consumers rate a concept or object positively, their attitude toward it is positive, and its use or consumption may increase, while a negative rating may become a barrier to consumption (Bisconsin-Júnior et al., 2020; Erjansola et al., 2021; Petty et al., 2007).

In this study, we propose a free word association task to collect spontaneous verbatims as well as the importance French consumers attach to them. The free word association task has been used to conceptualize, from people's language, certain concepts that lack clarity or understanding (Rodrigues et al., 2015; Rojas-Rivas et al., 2022). Through this method, we should gain deeper insight into the French understanding of the 'sustainable diet' concept. Our first objective will be to determine whether 'sustainable diet' has a common meaning for French consumers, through a structural analysis of the social representations of this concept. The second objective will be to confirm our hypothesis that French consumers' social representations of sustainable diets differ from the FAO definition of 2010, hereafter 'the established definition'. Our third objective will be to identify potential differences in French consumers' social representations in relation to their level of education. Our hypothesis is that individuals with higher education level may have multidimensional social representations of sustainable diets that are closer to the established definition than individuals without higher education.

2. Methods

This study was conducted in accordance with the Declaration of Helsinki and was approved by the Institutional Review Board of INSERM (CEEI/IRB) (IRB00003888, IORG0003254, FWA00005831) on 10/01/2023.

The experiment was conducted between March and April 2023 at the Center for Taste and Feeding Behavior (CSGA), Dijon, France.

2.1. Participants

Using PanelSens, the internal participant database of the CSGA, 282 participants aged from 20 to 60 years were recruited in and around Dijon. During recruitment, care was taken to ensure that the population was balanced in terms of sex, age, and education level. The goal was to experimentally compare participants on these criteria, without seeking to represent the general French population. Data from nine participants were excluded because of technical problems. The final dataset therefore included 273 participants (142 females and 131 males).

2.2. Procedure

The experiment was performed on computers. The experimenter was present during the sessions to provide technical help if necessary and to ensure that participants did not search for information on Internet. After reading the information form upon arrival, participants gave their consent to participate in the study by activating the link to the form. LimeSurvey® (LimeSurvey GmbH, Hamburg, Germany) was used to collect participants' answers. The experiment lasted a maximum of 15 min.

2.2.1. Free word association task

Participants were asked to list five words in response to a stimulus; they then ranked their answers and rated their valency. To ensure spontaneity, participants had a maximum of 100 s to answer the question: "*What five words, expressions, or adjectives come spontaneously to your mind when I say 'sustainable diet'?*". Before the experiment, a trial with a neutral stimulus word '*tableau*' (a table, a chart, or a board, in French) was conducted to familiarize participants with the task. Once they had listed five evocations, participants were asked to rank them from 1 to 5: 1 for their most important evocation and 5 for the least important one. Participants also rated the valence of their evocations on semantic differential scale: very negative (1), negative (2), neutral (3), positive (4) and very positive (5).

2.2.2. Questionnaire on food choice motivations

The "Single Item Food Choice Questionnaire" (SI-FCQ) proposed by Onwezen and colleagues (2019) was used to indicate the importance of different motivations for food choices. In this questionnaire, participants are asked to indicate the level of importance they attach to 11 food motivations, on a 7-point semantic differential scale, from not at all important to very important. The 11 food motivations were health, mood, convenience, sensory appeal, natural content, price, weight control, familiarity, environmental protection, animal welfare, and ethical concerns (Appendix A).

2.2.3. Questionnaires on 'sustainable diet' knowledge

Participants completed two questionnaires about their knowledge of what a 'sustainable diet' is: one on their objective knowledge and the other on their subjective knowledge.

Objective knowledge. Participants were asked to check all the statements that apply to the 'sustainable diet' concept, in their opinion. The list of 24 statements included 6 characteristics from the established definition of sustainable diets (FAO, 2010), but also 18 distractors (Appendix B). The 6 characteristics stated that a sustainable diet: "is composed of foods that are good for health"; "contributes to the

preservation of the environment"; "is adapted to all food habits and cultures"; "is affordable"; "allows producers to receive adequate remuneration"; "must be easily accessible to all". The distractor statements were either the opposite of the 6 characteristics, or statements from the literature selected after a pre-test. Distractors stated, for example, that a sustainable diet: "is made up of foods with long expiry dates", "refers to well-identified brands", or "is suitable in times of crisis". The objective knowledge score (from 0 to +6) was based on the number of characteristics checked. Distractors were not included in this score because they were used to conceal the correct answers from a set of possible answers. The score therefore reflects how many characteristics from the established definition the participants could identify.

Subjective knowledge. Flynn and Goldsmith's questionnaire (1999), adapted to the 'sustainable diet' concept, was used to measure participants' self-assessment of their level of knowledge. Participants used a 5-point Likert scale (from strongly disagree to strongly agree) to rate statements such as: "I know a lot about sustainable diets" and "Compared to most other people, I know more about sustainable diets" (Appendix A).

2.2.4. Self-reported sustainable eating practices

The seven statements in a questionnaire on sustainable eating practices (Van Loo et al., 2017) were translated into French (Appendix A). Participants used a 5-point semantic differential scale, from "Does not apply to me at all" (1) to "Fully applies to me" (5), to indicate how much the seven statements applied to them: "I compost food waste at home", "I eat local products whenever possible", "I eat seasonal products", "I limit my meat consumption", "I regularly eat organic food products", "I limit the amount of food I waste" and "I regularly eat plant-based foods as an alternative to meat". The average of the set of seven responses was calculated to obtain the score, from 1 to 5, for each participant.

2.2.5. Socio-demographic questions

Participants answered questions about their age, level of education, sex, family situation, type of diet, and where they live and buy their food. A binary sex categorization (male/female) was used, which refers to the sex assigned at birth.

2.3. Analysis

Evocations were classified into categories for structural analysis, and dimensions for comparison with the established definition (see Table 2). Evocations were translated into English (see Appendix C for more details).

All analyses were performed on the full dataset of all participants and also on the two groups segmented by level of education. The group with higher education was composed of participants who had completed at least one year of higher education. The group without higher education was composed of participants who had not completed at least one year of higher education. The French definition of higher education includes all programs for which the "baccalauréat" is the minimum prerequisite (for more details see Chevaillier in Schwarz & Westerheijden, 2004, p. 164–165).

Data were analyzed using XLSTAT software (Addinsoft, France, version 2023-1) RStudio 2023.09.1 and R-4.2.1. The hypotheses were specified before the data were collected and the analytic plan was pre-specified.

2.3.1. Structural analysis

Categorization. All words or expressions evoked by participants during the free word association task were analyzed qualitatively. A thematic analysis was performed following the method of Braun and Clarke (2006): familiarization with the data, generation of initial codes, search for themes, examination of themes, and definition/naming of categories. Triangulation was used for this last step (Abric, 2003). Three researchers independently sorted the evocations according to meaning, and the final list of categories was validated by consensus. These category names were then translated into English (Appendix C). Participant evocations were sorted into categories. For a category to be included in structural analysis, at least 5 % of the participants must have mentioned an evocation in that category. This process was used to select relevant categories without losing too much information (Ares et al., 2014; Barone et al., 2020; de Andrade et al., 2016).

Structural Approach. The structural approach (Abric, 2001) was used to analyze each category, following the same methodology as Melendrez and colleagues (2020). The total frequency of occurrence was calculated from all evocations in the category. The importance of all evocations was averaged for the category. Cutoffs were defined for frequency and for importance. The cutoff for frequency was determined by halving the total frequency of occurrence of the category with the highest score. The cutoff for importance was calculated by averaging the mean importance scores of all categories. A representation map was created with four zones delineated by these cut-off points. Each category was assigned to one of these four zones on the representation map, as following:

The central core is defined by categories that are most frequently cited and most important.

The 1st periphery contains categories that are frequently cited, but with lower importance.

The contrasting zone represents categories less frequently cited, but with higher importance.

The 2nd periphery contains categories less frequently cited and considered less important.

Polarity Index. To evaluate the attitudes in the social representations, we calculated a polarity index (P) for each category (De rosa, 2002).

$$Polarity\ index(P) = \frac{Number\ of\ positive\ words\ in\ the\ category - Number\ of\ negative\ words\ in\ the\ category}{Total\ number\ of\ words\ in\ the\ category}$$

This index, ranging from −1 to +1, indicates the valence of the category. A P value between +0.05 and +1 indicates that most words in the category are connoted positively. A P value between −1 and −0.05 indicates that most words in the category are connoted negatively. If the P value is between −0.04 and +0.04, positive and negative words are equally balanced, reflecting a neutral attitude.

2.3.2. Analysis by dimensions

Dimensions. Three researchers independently sorted the evocations into the four dimensions mentioned in the established definition of a sustainable diet: *Environmental, Nutritional-Healthy, Socioeconomic,* and *Sociocultural* (Chaire ANCA, 2010). After comparing the resulting sets, the final list of evocations for each dimension was validated by consensus. The evocations that could not be assigned to any of these four dimensions were classified as a fifth dimension: "*Other*". As participants were allowed to produce fewer than five evocations, the number of missing responses was identified under "No answer".

2.3.3. Statistical comparison of educational groups

The Chi2 test was used to compare the low and high level of education groups in terms of (1) socio-demographics and (2) frequency of

dimension citations. The non-parametric Mann-Whitney *U* test was used to compare knowledge (subjective and objective), food choice motivation (by using the Food Choice Questionnaire, FCQ), and self-reported sustainable eating between these two groups. All statistical tests used a significance threshold of $p < 0.05$.

3. Results

3.1. Socio-demographic characterization of participants

Participant characteristics (n = 273) are presented in Table 1. There were 161 participants in the group with higher education; the group without higher education had 112 participants. A Chi square test showed that there was no significant difference in the composition of the two groups, except for place of residence. This factor could depend on level of education: work opportunities for people with higher education are mostly in urban areas.

3.2. Results of the free word association task for all participants

Out of a potential total of 1365 (n = 273*5), the participants produced 1269 evocations, among which 281 were cited only once, whereas 126 were cited more than once. The most frequent evocation "*écologie*" (ecology) was cited 109 times. A table showing the frequency of evocations in French by dimension is provided in the Supplementary data (Appendix C). Evocations were classified into categories for structural analysis and into dimensions for comparison with the established definition (Table 2).

3.2.1. Structural analysis of social representations for all participants

A structural analysis was used to determine whether common social representations of the 'sustainable diet' concept exist in France, based on the entire dataset of participant evocations (Fig. 1). The central core comprised four categories: *ecological attitude*, *health*, *environment*, and *local*. These four pillars form the shared foundation of the 'sustainable diet' concept among the 273 participants. The most frequently cited and most important category, *ecological attitude*, is therefore considered to be the most firmly established. The 1st periphery contains only one category: *organic*. The contrasting zone comprises seven categories: *ethical values, plant-based products*, *planet protection*, *resources*, *rational*, *food waste reduction*, and *positive*. The 2nd periphery comprises eleven categories: *food and meals, quality, food preservation, duration, agriculture, social economy, future, price, hedonic*, and *protein intake*. The valence of the evocations is also shown in Fig. 1, grouped by category. Most evocations about sustainable diets were positive. The only category with a negative polarity index was *price*.

3.2.2. Comparison between the social representations of sustainable diets and the established definition

We segmented participants' social representations by classifying the 1269 evocations according to the four dimensions usually proposed (Fig. 2).

The *Environmental* dimension (42.6 % of the evocations) was much more prominent in the social representations of the participants than the other three dimensions: *Nutritional-Healthy* (20.1 %), *Sociocultural* (10.2 %), and *Socioeconomic* (13.4 %). Participants also mentioned concepts unrelated to the four dimensions of the established definition, classified as *Other* (13.7 % of evocations). Many of the evocations in this fifth dimension are related to the following evocations: *quality, vegetable, fruit, cereal and, time*.

Table 1
Demographic characteristics of participants (n = 273).

Characteristics (Chi2 results p-values)	Number of participants (%*)		
	Group without higher education	Group with higher education	Total
Sex (0.123)			
Female	52 (46.4)	90 (55.9)	142 (52.0)
Male	60 (53.6)	71 (44.1)	131 (48.0)
Age (0.997)			
20–30	27 (24.1)	38 (23.6)	65 (23.8)
31–40	28 (25.0)	42 (26.1)	70 (25.6)
41–50	27 (24.1)	39 (24.2)	66 (24.2)
51–60	30 (26.8)	42 (26.1)	72 (26.4)
Residence (0.004)			
Countryside	28 (25.0)	19 (11.8)	47 (17.2)
Periphery	27 (24.1)	31 (19.3)	58 (21.2)
City	57 (50.9)	111 (68.9)	168 (61.6)
Diet (0.637)			
Omnivore	56 (50.0)	72 (44.7)	128 (46.9)
Flexitarian	46 (41.0)	78 (48.4)	124 (45.4)
Pescetarian	7 (6.3)	7 (4.3)	14 (5.1)
Vegetarian	3 (2.7)	3 (2.0)	6 (2.2)
Vegan	0 (0)	1 (0.6)	1 (0.4)
Number of adults living with the participant (0.748)			
0	3 (2.7)	4 (2.5)	7 (2.6)
1	33 (29.5)	50 (31.1)	83 (30.4)
2	55 (49.1)	83 (51.5)	138 (50.5)
3 and more	21 (18.7)	24 (14.9)	45 (16.5)
Number of children (0.311)			
0	70 (62.5)	101 (62.7)	171 (62.6)
1	22 (19.6)	27 (16.8)	49 (17.9)
2	15 (13.4)	27 (16.8)	42 (15.4)
3 and more	5 (4.5)	6 (3.7)	11 (4.1)
Total **	112 (41.1)	161 (58.9)	273 (100)

p-values < 0.05.
* The percentage was calculated on the basis of the group's size.
** The percentage was calculated on the total number of participants.

Table 2
Evocations (central column) classified into categories for structural analysis (left), and into dimensions of the established definition (right).

Categories for structural analysis (% of participants)	Citation ranking of categories	Evocations translated in English (from most to least cited)	Dimensions (% of participants)
Agriculture (19.0)	2.9	agriculture, land, cultivation, farmer, grower, production, agricultural, small farming, environmentally friendly agriculture, countryside, field, growing conditions, farm, family farm, peasant farmer, plantation, plant	
Ecological attitude (48.0)	1.9	ecology, ecological, green, eco-responsible, eco-friendly, ecological impact	
Environment (30.4)	2.9	environment, planet, nature, climate, biodiversity, diversity, ecosystem	
Future (11.7)	3.7	future*, future, generations to come, 2030, tomorrow, secure future, generation, our future, goal, future solution, survival of the Earth	
Organic (39.6)	2.5	organic, natural, pesticide-free, organic farming, organic*, organic food, GMO-free, additive-free, preservative-free	Environmental (86.8)
Planet Protection (12.5)	2.7	respect for the environment, protection, good for the planet, well-being of the environment, well-being of the planet, better for nature, less pollution, no crops/fallow land*, taking care of nature, preservation, environmental preservation, soil preservation, planet preservation, preserve, planet protection, environmental protection, reforestation, safeguard	
Rational (7.7)	3.3	rational, permaculture, integrated agriculture, agroecology, rational food intake*, integrated production, reason, to rationalize, reasonable	
Resources (8.4)	3.5	resource, water, energy, resource management, carbon cost/footprint*, water conservation, resource conservation, energy-related, food resources, inexhaustible source, self-sufficiency, overexploitation	
Seasonal (4.0)	3.6	season, seasonal, seasonal worker, seasonal eating, seasonal vegetable, seasonal product	
Food and Meals (10.6)	2.9	food, foodstuff, eating, food*, 4 p.m, plate, drink, composition, edible, consumption, snack, the evening meal, meal, morning meal, lunch	
Food Preservation (7.7)	2.7	conservation, dry product, frozen, can, freezer, preservative, long shelf life, canned food, store your food, expiration date, long shelf life, long date, non-perishable foodstuff, expiry date for consumption, optimal use-by-date, non-perishable, expiration, dehydrated product, non-perishable*, refrigerator, no expiration date, no use-by date, dry, storable	Nutritional-Healthy (59.3)
Healthy (41.4)	3.0	healthy, health, well-being, balance, healthy diet, balanced, good for health, nutrition, good health, healthy eating, healthy food, healthy product, dietary, balanced diet, healthy mind in a healthy body, eat better, healthy nutrition, nutritional quality, consumer health, varied	
Industrialized (4.4)	4.0	pesticide, additive, agri-food, industrial, modified, non-industrial, unprocessed, GMO, ready meal, without processing	
Protein Intake (8.4)	2.8	meat, vegan, vegetarian, insect, protein, plant-based, little meat, flexitarian, fish, vegetable protein, not too much meat	
Animal Welfare (1.5)	3.0	animal welfare, animal protection, respect for animals, respect for animal welfare	

(*continued on next page*)

Table 2 (*continued*)

Ethical Values (14.3)	3.0	respect, responsible, respectful, responsibility, ethics, sharing, socially responsible, help, altruism, common sense, responsible consumption, ethical approach, mutual aid, generous, collective responsibility, social responsibility, supportive, worth	Sociocultural (33.3)
Hedonic (8.4)	3.2	good, taste, delicious, gustatory, not very tasty, pleasure, very good	
Necessary (4.8)	2.9	important, indispensable, necessity, beneficial, need, necessary, which concerns us all, nevertheless useful, useful, vital	
Negative (2.6)	3.7	anxiety, sensitive, critic, harsh reality, is it really possible, greenwashing, petit bourgeois, a little ironic, or even contradictory	
Positive (5.1)	3.5	eat well, correct, joy, freedom, optimistic, positive, simple, simplicity, care, virtuous	
Transition (1.8)	4.3	change, evolution, eating habits to change, awareness, ecological transition	
Trending (3.7)	3.0	fashion, all the rage, news, new, new fashion, trend	
Food waste reduction (6.6)	3.0	anti-wastage, recycling, waste reduction, biodegradable, waste, wastage, less wastage, zero waste, food waste sorting, maximum use of the product	
Local (23.1)	3.0	local, proximity, short supply chain, garden, locavore, gardening, nearby, self-sufficiency, autonomy, food autonomy, France, French origin, French heritage, vegetable garden, near home, local production, locally sourced/as close as possible, provenance, regional	
Meat Production (2.2)	3.3	animal husbandry, animal, stockbreeder, fishing, free-range	Socioeconomic (46.9)
Price (6.7)	3.8	price, expensive, economical, costly, more expensive, cost, budgetary economy, higher price, rich	
Regulations (2.2)	3.4	specifications, food certification, label, labelling, standard, regulated, traceability	
Social Economy (11.7)	3.2	economy, equitable, fair trade, society, trade, societal challenge, sustainable economy, equality, fair pay, non-exploitation of people, fair share product, remuneration	
Supply (4.4)	3.4	small producer, market, artisan, shopping, direct from the producer, grocery store, shop, market gardener, producer, supermarket	
Duration (10.3)	2.8	time, duration, long term, longevity, perennity, that lasts over time, food that lasts over time, food that lasts a long time, how long, duration over time, infinite, long, perpetual, that endures, to feed oneself as long as possible, stable	
Learning (2.6)	3.4	studies, training, INRAE, lack of knowledge, research, reflection, know-how	
Life (3.7)	3.1	life, living, biology, biologist, good for humans and the environment, human, integration into life, population	Other (45.8)
Plant-based products (12.5)	3.2	vegetable, fruit, cereal, flour, pasta, potato, carrot, starchy foods, fruit and vegetable, Heirloom vegetable, legume, radish, rice, salad, soya, tomato	
Quality (12.1)	3.3	quality, quality food, good product, good food, good quality, freshness, freshness of food, best, quality product, qualitative	
Quantity (2.6)	3.1	weight, large quantity, parsimony, quantity, reduction, yield, inexhaustible	
Sustainable (2.2)	3.0	sustainable development, sustainability, sustainable agriculture	
Unclassified (9.5)	2.8	choice, pollution, soluble food, candy, good hydration, chocolate, substantial, define this expression, development, hunger, impact, line, marginal, marketing, globalization, no packaging, foreign country, protectionism, advertising, daily, diet, sugar-free, variable, varies	

Categories in gray were not included in the structural analysis, as they were cited by under 5% of participants. The percentage of participants with at least one evocation classified in the category or dimension was indicated.
An asterisk* after a word in the column "Evocations translated in English" indicates that in English there is only one translation for two different French evocations.
NB. No answer = 19.8 %.

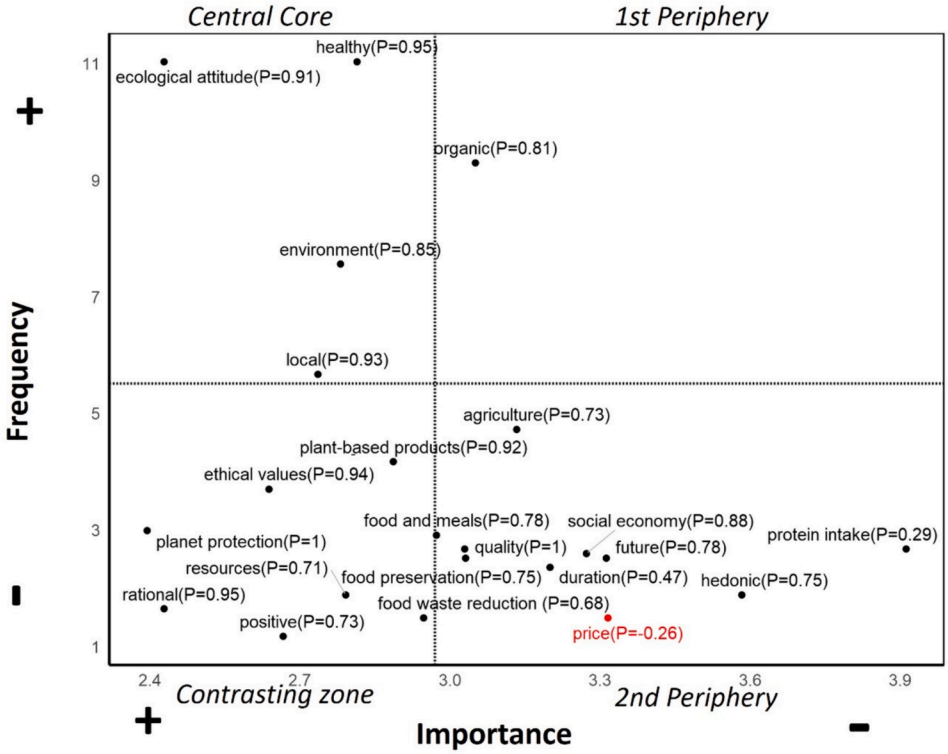

Fig. 1. Map representing the social representation of the 'sustainable diet' concept. P = Polarity index. Categories considered positive are in black font color; categories considered negative are in red font color. (For interpretation of the references to color in this figure legend, the reader is referred to the web version of this article.)

3.3. Differences in social representations in relation to level of education

Our hypothesis was the group with higher education would have more multidimensional social representations of sustainable diets than the group without higher education. We therefore compared the social representations of the two groups.

3.3.1. Comparison of knowledge, motivations, and sustainable dietary practices

There was no significant difference between the two groups, whatever their level of education, in terms of objective or subjective knowledge and sustainable dietary practices (Table 3). Their food choice motivations were broadly similar, except for animal welfare and ethical concerns, where the motivations for the group without higher education were significantly higher (Table 3).

3.3.2. Structural analysis of social representations by education level

Social representations for the two groups are shown in Fig. 3. The central core for the group without higher education comprised two elements, while that of the group with higher education comprised four elements. The common categories were *ecological attitude* and *healthy*. The central core of the group with higher education also included the categories *environment* and *local*, which were in the contrasting zone for the group without higher education. The difference was based on evocation frequency: the *environment* and *local* categories were important for both groups, but evocations were much more frequent in the group with higher education. For the group with higher education, *environment* and *local* categories were anchored in their social representations of sustainable diets, but were in a zone of potential change for the group without higher education. The *organic* category was in the 1st periphery for both groups, with frequent evocations, but with a lower level of importance. The evocations for the *plant-based products* category were more frequent for the group without higher education, but more important for the group with higher education. For both groups, the only category with a negative polarity index was the *price* (Fig. 3). In the group with higher education, there were more negative evocations for the *price* category.

3.3.3. Comparison of social representations, by dimension and by level of education

The evocations for the group without higher education were classified in six dimensions, in the following order of frequency: *Environmental* (34.3 %), *Nutritional-Healthy* (21.1 %), *Other* (15 %), *No answer* (11.6 %), *Socioeconomic* (10.7 %), and *Sociocultural* (7.3 %). The order of frequency for the group with higher education was: *Environmental* (43.2 %), *Nutritional-Healthy* (17 %), *Socioeconomic* (13.7 %), *Other* (11.2 %), *Sociocultural* (11.1 %), and *No answer* (3.9 %). The differences in evocation frequency between the two groups were not significant for the *Nutritional-Healthy* and *Socioeconomic* dimensions. The *Other* dimension was significantly higher for the group without higher education, which also produced fewer evocations, resulting in a significantly higher percentage of the *No answer* dimension than for the group with higher education. The *Environmental* and *Sociocultural* dimensions were significantly higher for the group with higher education than for the group without higher education (See Fig. 4).

4. Discussion

The objectives of our study were to determine whether 'sustainable diet' has a common meaning for French people, and if this meaning corresponds to the definition proposed by the FAO. Another goal was to determine whether there is a difference in social representations in relation to level of education.

4.1. The components of the social representations of sustainable diets

Participants in our study had social representations of sustainable diets based on a central core comprising four categories: *ecological*

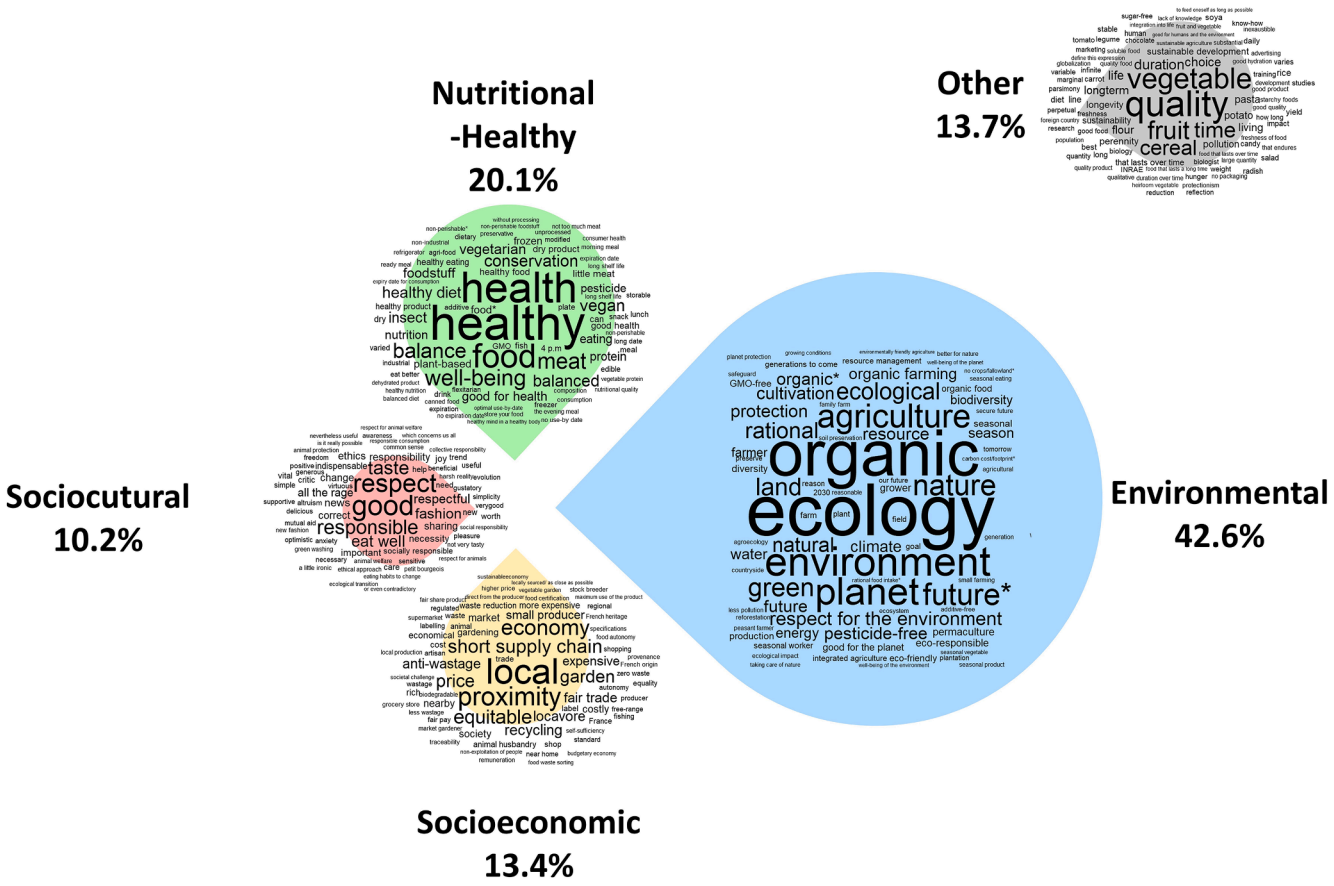

Fig. 2. Petal diagram of social representations (273 participants). Each petal represents a component of the FAO definition and contains the participants' evocations that relate to this component. The area of the petals represents the percentage of the dimension identified in all evocations. Category font size corresponds to frequency of evocation. (For interpretation of the references to color in this figure legend, the reader is referred to the web version of this article.)

attitude, *healthy*, *environment*, and *local*. The central core represents the shared basis of social representations, emerging from the collective memory and the system of norms to which a group refers (Abric, 2001). Our results prove the existence of a common core within the social representations of sustainable diets in France. The next step was to determine the segmentation of these social representations according to the dimensions of sustainable diets. Participant evocations covered each of the four dimensions of the FAO's definition of sustainable diets, but their distribution was not equally balanced. The *Environmental* dimension largely predominated, with multiple evocations of *ecology*, *environment*, and *organic*. It was twice as frequent as the *Nutritional-Healthy* dimension, with many evocations of *healthy* and *health*. There were few evocations for the *Socioeconomic* dimension and even fewer for the *Sociocultural* dimension. Our hypothesis that consumers' social representations would be different from the established definition was thus validated. Our results are consistent with previous European studies

Table 3
Comparison of knowledge, motivations and sustainable dietary practices by level of education.

Characteristics	Participants withouthigher education			Participants withhigher education			Difference
	Median	Mean	SD	Median	Mean	SD	Mann Whitneyp values
Objective knowledge score(from 0 to 6)	4.0	3.86	1.17	4.0	3.76	1.27	0.638
Subjective knowledge score (from 1 to 5)	2.6	2.54	0.68	2.6	2.67	0.68	0.174
Sustainable eating score (from 1 to 5)	3.4	3.40	0.75	3.6	3.46	0.72	0.412
FCQ (from 1 to 7)							
Health	6	6.07	1.12	6	6.22	0.84	0.456
Mood	5	4.96	1.55	5	4.60	1.63	0.078
Convenience	5	4.69	1.68	5	4.49	1.54	0.262
Sensory Appeal	6	6.20	0.80	7	6.26	0.89	0.304
Natural Content	6	5.81	1.20	6	5.74	1.05	0.313
Price	5	5.15	1.48	5	5.11	1.33	0.675
Weight control	5	4.84	1.69	5	4.76	1.54	0.511
Familiarity	5	4.76	1.45	5	4.53	1.46	0.205
Environmental protection	6	5.84	1.15	6	5.75	1.02	0.423
Animal welfare	6	5.85	1.23	6	5.42	1.52	0.026*
Ethical concerns	5	4.81	1.36	4	4.29	1.41	0.003*

* p-value < 0.05.

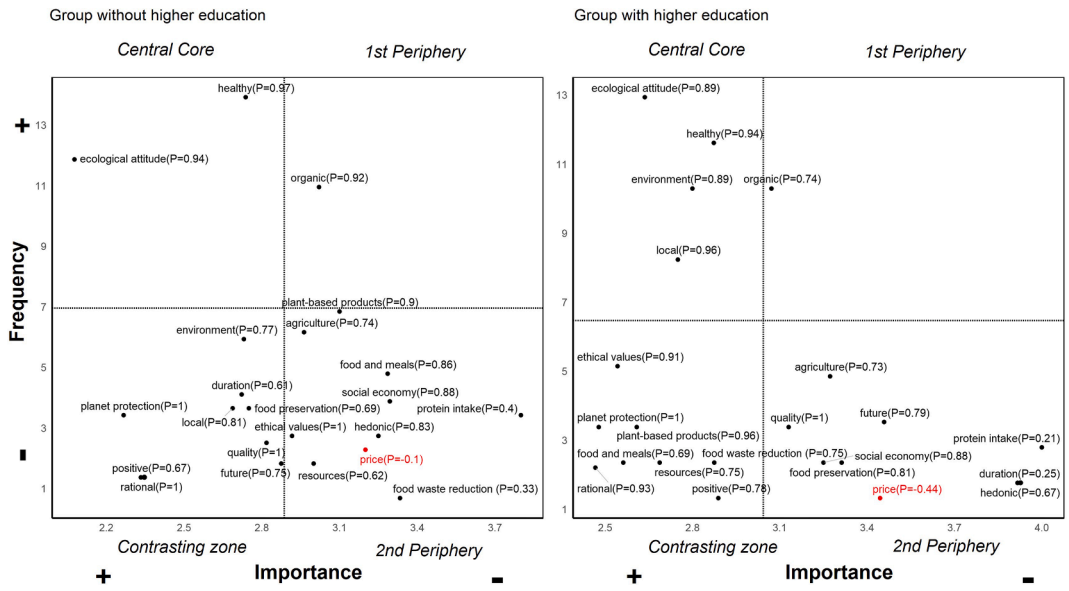

Fig. 3. Social representation maps of sustainable diets by education level. P = Polarity index. The black font color indicates that most of the words in the category have a positive connotation and the red font color indicates that most of the words in the category have a negative connotation. (For interpretation of the references to color in this figure legend, the reader is referred to the web version of this article.)

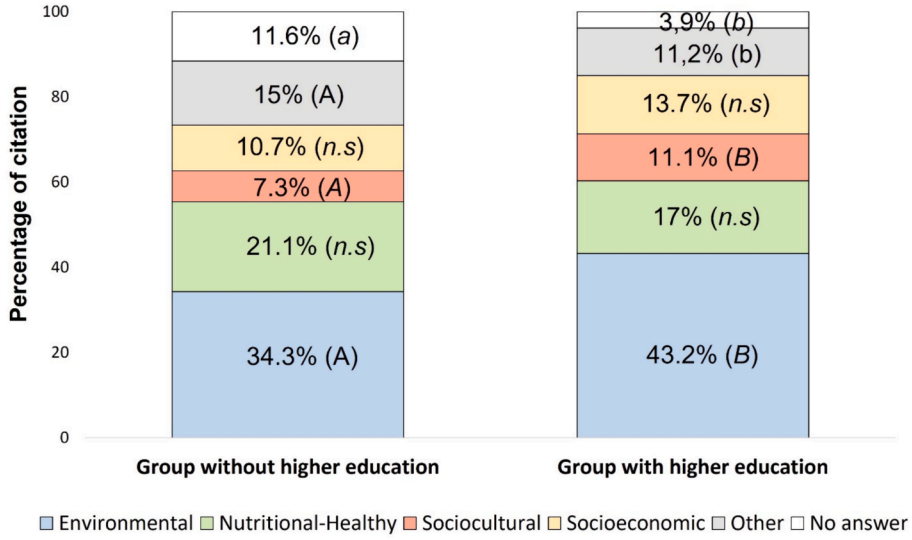

Fig. 4. Comparison of evocations by level of education, based on the 4 dimensions in the established definition. The frequency of quotation by dimension is indicated. Letters in brackets represent the results of the Chi2 Test: different letters indicate that the number of evocations for the dimension was significantly different between the two groups; n.s indicates that there was no significant difference between the two groups. (For interpretation of the references to color in this figure legend, the reader is referred to the web version of this article.)

using free word association tasks, in which the predominant notion was the environment (László, 2021: Hungary; Mesías et al., 2023: Spain). In contrast, a free word association task conducted in Brazil found that health was the predominant notion (Barone et al., 2019), which could perhaps be due to intercontinental cultural differences. Our results also confirm the conclusions of an interview-based study conducted in France (Rémésy et al., 2008), in which the key notions were the environment, strongly associated with ecology, while social aspects were less frequently mentioned. An interview-based study also concluded that the key notion was the environment, strongly associated with the term 'organic', while ethical and social aspects were less frequently mentioned (Mathe, 2009).

Our results contrast strongly with those of a large-scale, pan-European questionnaire (European Commission, 2020), in which the chief characteristics of sustainable diets for French participants were, in order of importance: "nutritious and healthy"; "with little or no pesticide use"; "accessible to all"; the notion of environmental impact was ranked far behind, in eighth place. These differences in outcomes could be due to the use of different methodologies. The European Commission questionnaire asked participants to rank a series of specific pre-defined answers, which did not necessarily correspond to what participants would have spontaneously proposed. Interviews and free word association tasks involve the generation of spontaneous verbatims that more directly reflect participants' representations. Free word association tasks and questionnaires involve cognitive resources related to two different systems: 'System 1 thinking' and 'System 2 thinking' (Kahneman, 2011). System 1 is driven by instinct and experiences. It is based on familiarity and associative memory, and happens automatically, intuitively, and

with little effort. System 2 thinking is conscious, logical, and requires more effort, which makes it slower than System 1. Interviews and free word association tasks may mainly involve the use of System 1, while System 2 may more often be used for tasks such as ranking items in a questionnaire. This difference could explain why different methodologies may elicit different predominant notions.

Another difference with the established definition emerged from participant evocations related to price. While most of the evoked categories about the 'sustainable diet' concept were perceived very positively by participants, the *price* category was perceived negatively. Several studies have found that sustainable diets are perceived as expensive (van Bussel et al., 2022; Campbell et al., 2015; Żakowska-Biemans et al., 2019). This perception contrasts with the established definition, which includes the affordability of sustainable diets (FAO, 2010). A comparative study of sustainable grocery baskets showed that the average cost is the same as for the average standard basket for the French (WWF & ECO2 Initiative, 2017). Yet price is one of the most important determinants of food choices in Europe (European Commission, 2020). This discrepancy between consumer perception and the established definition may well be a significant barrier to the adoption of sustainable diets.

4.2. Practices contributing to sustainable diets

Several categories built from participant evocations refer to dietary practices (26.4 % of the total number of evocations). In order of evocation frequency, these categories were: *organic, local, plant-based product, protein intake, food waste reduction*. For the participants in our study, sustainable diets preserve the environment, so the practices they most often mentioned may be those that they identify as good for the environment. Their representations of the practices that are good for the environment might well be different from scientific evidence. The *local* category was located in the central core, with *organic* in the 1st periphery, while *plant-based products* and *food waste reduction* were in the contrasting zone, and *protein intake* was in the 2nd periphery. Organic production uses more land and energy than conventional production (Redlingshöfer, 2006). Local production does not necessarily reduce the carbon footprint (Stein & Santini, 2022). Focusing on organic and local produce may not be the most effective strategy for environmental protection. Instead, the most important lever is reducing meat consumption, especially that of red meat. In fact, 57 % of the global food industry's greenhouse gas emissions are related to the production of animal-based food, with 25 % specifically for beef (Xu et al., 2021). Thus, our results suggest that consumers do not spontaneously associate reduced meat consumption with environmental sustainability. This might be due to a lack of knowledge, or difficulty identifying efficient practices (Baur et al., 2022; Lea & Worsley, 2008), or a lack of motivation. However, 45 % of the participants in our study self-identified as flexitarians, which seems quite a high proportion. It should be noted that there is often a gap between self-reporting of sustainable practices and their implementation (Mcguire & Beattie, 2018; Steiner et al., 2018). According to France AgriMer, a public administrative institution under the supervision of the French Ministry of Agriculture, 29 % of flexitarians consume meat daily (Morio et al., 2023). Their motivation for reducing meat consumption may be based on economic, or health, or animal welfare considerations, rather than on environmental concerns. Among those limiting or excluding meat, 52 % do so for economic or health reasons, or as part of dietary adjustment (Morio et al., 2023). Our results confirm the need to question participants' environmental concerns and their implementation of such intentions.

4.3. Grouping participants by level of education

4.3.1. Social representations of sustainable diets

The third objective of our study was to examine whether the social representations of sustainable diet differed in relation to level of education. We found that the central core for participants with a higher level of education comprised four categories, while the central core for participants with a lower level of education comprised only two categories. For both groups of participants, *ecological attitude* and *healthy* were in the central core, while *environment and local* were specific to the group with higher education. For participants with higher education, the central of social representations encompasses three dimensions: *Environmental, Nutritional-Healthy* and *Socioeconomic,* whereas the central core for the representations of participants without higher education focused only on two dimensions: *Environmental and Nutritional-Healthy*. The *Socioeconomic* and *Sociocultural* dimensions were neglected for both groups with few citations. Individuals with a higher level of education paid more attention to the *Sociocultural* and *Environmental* dimensions, mentioning fewer terms that were not part of the established definition (*Other* dimension*)*. Our hypothesis according to which the group with higher education level would have more multidimensional social representations of sustainable diets than the group without higher education, was therefore validated. These findings agree with other studies, both in Europe and further afield. In a pan-European study, people with higher education referred more frequently to low environmental and climate impact, the preservation of natural resources, and social issues (European Commission, 2020). In Brazil, people without higher education referred more frequently to health and plant-based foods (Barone et al., 2019). Overall, younger, more highly educated people are more likely to associate sustainability with other pillars, such as the social and economic dimensions (Barone et al., 2020).

4.3.2. The causes and consequences of these different social representations

As a higher level of education is a key factor in the social representations of sustainable diets in our study, we now draw upon the literature for the potential causes and consequences of this difference. One explanation was a potential difference in knowledge, due to a better understanding of the environmental impacts and sustainability of food among individuals with higher education (Jain & Kaur, 2006; Sánchez-Bravo et al., 2020). Our results did not confirm this hypothesis, as there was no significant difference in objective and subjective knowledge in relation to level of education.

The difference in social representations is particularly noticeable in the central core. The presence of only two categories in the central core for participants without higher education might be related to a lower level of agreement about the definition of sustainable diets in this group. Despite a comparable level of knowledge, participants in the group without higher education appeared less able to form shared social representations. Moscovici (1961) identifies two fundamental processes that enable the elaboration of social representations: objectification and anchoring. Objectification constitutes knowledge, while anchoring integrates this new knowledge into the representational system. Anchoring reflects the appropriation by groups of an emerging social representation. Our results showed a higher number of evocations corresponding to the dimension *Other* among participants without higher education. As a group, these participants must therefore have appropriated fewer shared elements from the established definition of sustainable diets.

Another possible explanation is a difference in knowledge activation. People without higher education could have the same level of procedural knowledge as people with higher education, but with differences in semantic memory. Semantic memory is the basis of general knowledge; it is a type of declarative memory (Tulving, 1972). People with higher education generally have better semantic memory than people with a lower level of education (Barea & Mansur, 2007). This could be because semantic memory is trained during studies or because knowledge activation is a recurrent task. Thus, people with higher education would more easily reactivate their knowledge of sustainable diets at the level of evocation, which would be reflected in their citations. In our study, participants without higher education were three times as likely to be unable to produce a full set of five evocations (i.e. *No answer*

dimension). This result could indicate that even when these participants have sufficient knowledge, they cannot readily activate it.

In social representation studies, attitudes are revealed by the elements that appear in the central core (Rateau et al., 2012). In our study, the differences between the central cores for the two groups could reveal differences in attitude related to level of education. Even though *ecological attitude* was in the central core for both groups, its meaning might be interpreted differently in the presence of other categories in the central core. The central core for the group with higher education also contained the category *environment,* thus indication a stronger association between the more abstract *ecological attitude* (e.g. eco-responsible, ecological, and green) and the more concrete *environment* in the minds of participants with a higher level of education (e.g. climate, biodiversity, and nature). This strong association suggests that the group with higher education would be more likely to engage in sustainable practices, but no such link exists for the group with a lower level of education.

The differences in social representations according to educational level could induce different behaviors. Previous studies have found that individuals with higher education are more motivated by sustainability (Schösler et al., 2014) and adopt more sustainable consumption behaviors (Panzone et al., 2016; Verain et al., 2012). In our study, there was no significant difference in self-declared motivation for food choices and sustainable eating practices between the two groups. Our findings even contradict prior studies by observing a higher level of motivation for animal welfare and ethical concerns among the group without higher education. A plausible explanation could be found in the Theory of Planned Behavior (TPB; Ajzen, 1985), which proposes that an individual's decision to engage in a specific behavior can be predicted by their intention to engage in that behavior. According to the TPB, attitudes towards an action, together with subjective norms and perceived behavioral control, indirectly influence behavior (Ajzen, 1991). Our study only allows us indirect access to attitudes, so it is impossible to draw firm conclusions on this point. Nevertheless, our study suggests that multidimensional social representations of sustainable diets do not necessarily lead to more sustainable eating behaviors.

4.4. Interpretation of the 'sustainable diet' concept

4.4.1. The semantical specificity of the French expression for a sustainable diet

In our results, the multiple evocations in the *Other* dimension indicate that the 'sustainable diet' concept is ill-defined in the minds of many French consumers. The French translation of sustainable is "*durable*", defined as "lasting by nature for a long time" (Larousse). For some participants, "*durable*" activated a network of ideas semantically linked to the activation of concepts of duration or conservation, which are not overtly mentioned in the established definition. In the spreading activation theory, the activation of a semantic memory node propagates along bidirectional associative links to other associated nodes (Collins & Loftus, 1975).

The translation-related ambiguity corresponding to evocations in the *duration* category in our study can also be identified in a French interview-based study of sustainable diets: "A sustainable diet… sustainable is something that lasts over time, like sustainable development, to protect future generations, the land, and biodiversity" (Rémésy et al., 2008, p.70). In a questionnaire by Damico and colleagues, 20 % of the participants also associated sustainable diets with persistence over time (2023).

The translation-related ambiguity corresponding to evocations in the *food preservation* category in our study was also found in another French interview-based study, where a sustainable food product was defined as "can be kept as long as possible" (Mathe, 2009, p. 58). Thus, our results highlight a possible misinterpretation of the French translation of sustainable ("durable"), linked to its semantics.

4.4.2. Classifying multidimensional concept

The classification into dimensions may give rise to discussion for certain words notably those related to *organic* and *local*. Organic production is perceived as beneficial both for health (*Nutritional-Healthy* dimension) and for the environment (*Environmental* dimension). *Local* production and food can be perceived both as supporting the local economy (*Socioeconomic* dimension) and as having a lower carbon footprint (*Environmental* dimension). Our classification was based on French consumer perceptions drawn from the literature, as participants evocations in our study were not contextualized. For instance, the words related to *organic production* were classified in the *Environmental* dimension because organic agriculture was perceived as helping to preserve the environment by 87 % of respondents and as beneficial to health by 82 % of respondents (Agence Bio, 2022). Words related to *local* were classified in the *Socioeconomic* dimension, because *local* was perceived as supporting the local economy by 95 % of respondents and as respecting the environment by 70 % of respondents (Bonnal et al., 2019). If words related to *organic* had been classified in the *Nutritional-Healthy* dimension and those related to *local* in the *Environmental* dimension, the most frequent dimension in the evocations would still have been *Environmental* at 38.9 %, followed by *Nutritional-Healthy* at 29.4 %, with much lower frequencies for *Sociocultural* at 10.2 % and *Socioeconomic* at 7.7 %. The choices made by the research team did not negatively affect the results, thus confirming the validity of our methodology.

4.5. Strengths and limitations of the study

This is the first study with a significant number of participants (balanced in terms of age and sex) to examine French consumers' social representations of sustainable diets. The use of a free word association was essential to faithfully capture consumer perceptions of sustainable diets. Given the complexity and ambiguity of the 'sustainable diet' concept, this method proved to be particularly suitable in overcoming consumers' reluctance to communicate their own definitions (Mesías et al., 2023). However, the sample is not representative of French consumers, as the participants all lived near Dijon in order to be able to attend the sessions in person. Besides, it should be noted that the free word association task may have favored people with a higher level of education, as they are more accustomed to situations in which they have to express their knowledge. In our study, participants with a lower level of education were more likely to produce fewer evocations. Nevertheless, these differences did not bias our results because the differences between the two groups were not proportional to the number of evocations, but rather reflected true differences in the proportion of evocations across different dimensions.

5. Conclusion

According to the FAO definition, sustainable diets should be respectful of the environment, of good nutritional quality, culturally acceptable, and economically fair. In our study, French consumers' social representations of sustainable diets did not correspond well to this definition. Most participants did not have a balanced view of the four dimensions in this definition. Social representations within the population segmented by education level were shown to be significantly different. It would be interesting in future studies to explore other segmentation criteria, such as age or place of residence. Analysis of social representations in this study did not provide a strong basis for predicting sustainable eating behavior. It thus remains essential to further clarify the 'sustainable diet' concept, to promote more sustainable food choices. Clearer information should be provided to encourage more appropriate dietary practices among French consumers. Further investigation of the relationship between knowledge of sustainable diets and behavior should lead to better understanding, thus encouraging the transition toward sustainable diets.

Author contributions

OC, SC, and GA conceptualized the research questions. OC, SC, GA and LD contributed to the design of the study and data analysis. OC carried out the collection and curation of the data, and wrote the first draft. SC and GA contributed to the final version. All authors proofread the final version. Funding acquisition: SC.

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Ethical statement

This study was conducted in accordance with the Declaration of Helsinki and was approved by the Institutional Review Board of INSERM (CEEI/IRB) (IRB00003888, IORG0003254, FWA00005831) on 10/01/2023.

After reading the information form upon arrival, participants gave their consent to participate in the study by activating the link to the form.

CRediT authorship contribution statement

Oriane Chene: Writing – original draft, Visualization, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Gaëlle Arvisenet:** Writing – review & editing, Validation, Supervision, Resources, Project administration, Methodology, Funding acquisition, Conceptualization. **Laurence Dujourdy:** Writing – review & editing, Validation. **Stéphanie Chambaron:** Writing – review & editing, Validation, Supervision, Resources, Project administration, Methodology, Funding acquisition, Conceptualization.

Declaration of competing interest

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

Data availability

Data will be made available on request.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.foodqual.2024.105224.

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