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Cross-national differences in knowledge, attitudes and behaviors toward plant-based diets: A pilot study among Italian and Dutch adults

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ABSTRACT

Background: This study explored knowledge, attitudes, and behaviors regarding plant-based diets among participants from Italy and the Netherlands, with a focus on health and environmental sustainability. This pilot study lays the groundwork for broader research on how cultural, regional, and traditional background factors influence diet-related knowledge and behaviors.

Methods: A comparative study of eating habits in Italy and the Netherlands conducted through a 30-question KAB (Knowledge-Attitude-Behavior)-based survey, developed in English and translated into Italian via back-translation. An online questionnaire was administered in August–September 2024. A total of 884 adults (Italian and Dutch nationals) participated.

Results: Dutch participants were more aware than Italians of the environmental impact of dietary choices (69% vs 43%, $p<0.01$) and showed a higher prevalence of plant-based diets (47% vs 17%, $p<0.01$). While omnivores in both countries showed limited interest in fully embracing a plant-based diet, Dutch respondents were more open to increasing plant-based alternative products in the future than Italians ($p<0.01$). About a quarter of respondents in both countries reported having considered using dietary restrictions as a socially accepted form of eating control (17% Dutch; 24% Italians). Food selection criteria differed, with Dutch participants prioritizing price, organic quality, and taste, and Italians emphasized seasonality and origin.

Discussion: The study revealed differences in knowledge, attitudes, and behaviors toward plant-based diets between the two populations. As a pilot study, these findings offer initial insights and may inform future research

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with larger, multi-country samples to better explore the influence of cultural, regional, and traditional factors on dietary choices and perceptions related to plant-based diets and their links to health and sustainability.

Key words: plant-based diets, environmental sustainability, public health, Knowledge-Attitude-Behavior (KAB) model, plant-based eaters, omnivores.

Introduction

Food production is an activity that inevitably has an environmental impact since it produces various effects, including the reduction of biodiversity, pollution, soil erosion, landscape damage, depletion of water reserves, and greenhouse gas emissions (1). The consumer is the final link in the chain, responsible for purchasing, storing, and using food. Adequate information and comprehension enable consumers to play an active role, learn to read and interpret labels, understand the purchased product, the most suitable methods for its preservation, how to handle a product in the kitchen, and how to consume it to minimize any risks. (2) For this reason, there is an increasing interest by academics, communities, and decision makers in the sustainability of diets and a growing recognition of the need to focus attention on both human health and the health of the planet in formulating dietary guidelines (3). Internationally, the prevalence of people following a vegetarian diet varies by country, but it is generally estimated to be around 10% of the population (4). The term plant-based is used to refer to diets composed mainly of foods derived from plants, minimally processed like fruits, vegetables, whole grains, legumes, nuts and seeds, in which foods of animal origin are totally or mostly excluded. This definition includes vegetarian and non-vegetarian diets as long as the intake of animal products is low. (5) Currently, vegetarianism is often classified into flexitarian, pescetarian, ovolactovegetarian (lactovegetarian and ovovegetarian) and vegan (6) . In this study, the term "plant-based diet" is used as an umbrella definition to describe dietary patterns predominantly based on plant foods, including vegetarian, vegan and flexitarian diets, characterized by a reduced intake of animal-derived products rather than their complete exclusion. The adoption of a varied and balanced diet, that includes all nutrients in the adequate proportions, is one of the primary approaches in managing risk factors and provide health benefits for the prevention and treatment of diseases (7). In recent years, research has modified the perception of plant-based diets, highlighting their benefits for health, the environment, and animal welfare, making it a respected dietary choice adopted by an increasing number of people. Vegetarian and plant-based dietary patterns are generally considered healthful and sustainable (8). Although they exclude specific food groups, vegetarian and plant-based diets should not be regarded as restrictive per se (6); however, some studies suggest that, in a minority of cases, vegetarian dietary choices may be associated with orthorexic tendencies or used to legitimize restrictive eating behaviors in a socially acceptable way (9–11). World Health Organization recommends increasing the consumption of fruit and vegetables as part of a balanced and diversified dietary pattern. However, no official guideline currently recommends a fully vegetarian or vegan diet for the entire population, focusing instead on dietary diversity and moderation. According to a Position Paper by the Academy of Nutrition and Dietetics, accurately planned vegetarian and vegan diets may be healthful, nutritionally adequate for all stages of the life cycle, including pregnancy, lactation, infancy, childhood, adolescence, older adulthood, and for athletes (12). Recent evidence also indicates that consumption of a plant-based diet is associated with a reduced risk of cardiometabolic conditions, including cardiovascular disease, type 2 diabetes, and obesity (13). European countries develop their own food and dietary guidelines based on cultural traditions and context, prevailing health concerns, economic factors, and scientific evidence. Across Europe, prevalence of individuals following plant-based dietary patterns

varies notably between countries. In this study we focused on two European countries – Italy and the Netherlands – to compare similarities and differences in how plant-based diets are perceived and adopted. In Italy, in 2024, 7.2% of adults identified as vegetarian and 2.3% as vegan (14). In the Netherlands, in 2023, 2.3% of adults followed a fully vegetarian diet and 0.5% a fully plant-based (vegan) diet, with 25% of main meals being vegetarian and a large share of the population practicing flexitarian eating (15). Italy uses the graphical representation of the guidelines through the food pyramid. The triangular shape of the pyramid is effective in conveying the importance of including all food groups in the diet, albeit in varying quantities (16). In 2018 the Research Center for Food and Nutrition of CREA (Council for Agricultural Research and Economics) released the fourth edition of the Italian Dietary Guidelines (IDGs) for Healthy Eating (17). The IDGs are based on the principles of the Mediterranean Diet and are mainly aimed to prevent obesity and nutrition-related non-communicable diseases, which have a significant impact on the population's health, such as cardiovascular diseases, diabetes, and cancer (18). The Mediterranean dietary model represents a lifestyle-oriented dietary pattern characterized by moderate food consumption and regular physical activity, with a strong emphasis on plant-based foods such as fruits, vegetables, legumes, grains and nuts, alongside a limited intake of animal-derived products and the use of extra-virgin olive oil as the main source of fat (19). As the main dietary reference framework in Italy, this model provides an important cultural and nutritional background within which Italian consumers' perceptions and attitudes toward plant-based dietary patterns can be interpreted, and is therefore relevant for the cross-national comparison explored in the present study (20). In the Netherlands, the central theme of the advisory report about the Dutch dietary guidelines 2015 concerns a shift in the direction of a more plant-based and less animal-based dietary pattern (21). The Netherlands Nutrition Centre (Stichting Voedingscentrum Nederland) encourages and raises awareness among consumers to develop and maintain healthy and more sustainable eating habits, particularly concerning their role in the food chain, and urges the food industry to produce a more sustainable range of food products (22). Together, these national recommendations provide a relevant contextual background for interpreting Dutch consumers' attitudes toward plant-based dietary patterns in the present study. In the current context of increasing concern for human health and environmental impact, the present study explores the knowledge, attitudes, and behavior of Italian and Dutch nationals regarding plant-based diets using the Knowledge-Attitude-Behavior (KAB) model, which conceptualizes how knowledge may influence attitudes and, in turn, shape individual behaviors. The KAB approach has been widely applied in public health research and health promotion to investigate health-related behaviors and decision-making processes (23) and has also been adopted in nutrition-related studies focusing on dietary choices and diet-related behaviors (24,25). The aim of this study is to gain insight into what people know about plant-based diets, particularly whether perceived health and environmental considerations influence their views, as well as to assess their attitude towards transitioning to less animal-based diets.

Methods

Study design and setting

A comparative cross-sectional study between Italy and the Netherlands was conducted from August to September 2024 using an anonymous online survey. The study followed a priori procedures for questionnaire development, translation, data management, and analysis to enhance reproducibility.

Participants and eligibility criteria

The survey targeted adults aged ≥18 years currently residing in Italy or the Netherlands. In this study, respondents were categorized as "Italian" or "Dutch" based on their self-reported classification, as the questionnaire did not include questions on migration background. Eligibility required informed consent, completion of mandatory items, and unique submission (one response per device/account). No incentives were offered. A total of 884 adults residing in Italy or the Netherlands participated.

Recruitment and sampling strategy

A non-probabilistic snowball sampling strategy was used in this study. Participants were recruited through researchers' personal networks and social media channels (Instagram, Facebook, email and WhatsApp).

Questionnaire

The questionnaire was developed to gain insights into consumer knowledge of plant-based diets and their impact on health and sustainability, behaviors, and attitudes towards a possible shift to a more plant-based diet. It was based on the Knowledge-Attitude-Behavior (KAB) model and administered using Microsoft Forms. It consisted of four sections, including Knowledge-Awareness, Attitudes, Behavior and Demographics, for a total of 30 questions with open, closed and multiple-choice formats (see ANNEX - Questionnaire). Open-ended responses were qualitatively reviewed and categorized using inductive thematic grouping. Participants classified as plant-based eaters included individuals reporting vegetarian, vegan or flexitarian dietary patterns. At the end of the Knowledge-Awareness section, participants were directed to the Attitudes section according to their self-reported dietary pattern (plant-based eater/omnivorous), allowing stratification of the sample. The survey then converged, with all respondents completing Behavior and Demographics sections. The survey was first developed in English as it was the common working language of the research team. It was subsequently translated into Italian using a back-translation procedure to ensure conceptual equivalence. The Dutch sample completed the English version of the questionnaire, as English proficiency is generally high in the Netherlands and the research team considered the English version appropriate for data collection.

Statistical analysis

Demographic and survey data were summarized using descriptive statistics.

Where applicable, the chi-square test was performed using Microsoft Excel to identify differences between Italian and Dutch participants in relation to the survey outcomes. The statistical significance threshold was set at $p < 0.01$.

Results

The collected data is presented and analyzed section by section.

Demographics

This section presents information on the participants' age, gender, education level, nationality, and place of residence. For the purposes of the analysis, respondents were categorized as "Dutch" or "Italian" according to their self-reported classification. In the Netherlands, most participants were in the 18-34 age group, with a gradual decline in numbers as age increased, whereas in Italy, the majority fell into the 45+ age range. In both countries, most of the responses came from women. Regarding education, the Dutch sample primarily indicated university as the highest level of education, while in Italy, participants were mainly divided between university and secondary school. See Table 1 for details.

Knowledge-awareness

In both countries, respondents mainly identified a reduced risk of heart disease and a lower risk of certain cancers as the possible health benefits of a plant-based diet, while the main drawback they mentioned was nutrient deficiencies. The Dutch showed a higher awareness and confidence in the effect of a plant-based diet on reducing environmental impact, confirmed by the chi-square test (69% vs 43%, $p<0.01$; Table 2).

Attitudes of plant-based eaters

Among the Italian participants following a plant-based diet, the group was almost evenly distributed between vegetarians (30%), flexitarians (32%), and vegans (22%). In the Netherlands, almost half of the plant-based eaters reported being vegan (45%), followed by vegetarians (19%) and flexitarians (17%). It appears that plant-based

Table 1. Participants' demographic details.

Participants details		**Dutch**		**Italians**	
Participants number		136	**%**	748	**%**
Age group	18-24	37	27%	145	19%
	25-34	38	28%	97	13%
	35-44	25	18%	78	10%
	45-54	17	13%	141	19%
	55-64	13	10%	205	27%
	≥ 65	6	4%	82	11%
Gender	Male	42	31%	175	23%
	Female	91	67%	562	75%
	Prefer not to say	1	1%	8	1%
	Other	2	1%	3	0%
Higher level of education	Primary school	1	1%	47	6%
	Secondary school	5	4%	327	44%
	Professional Education	22	16%	27	4%
	University	108	79%	347	46%

eaters have been following that dietary pattern for over two years (see Table S1). The main motivation acknowledged by plant-based eaters for adopting a plant-based diet was ethical reasons (animal welfare), followed by health benefits. However, in the Netherlands, the environmental concerns also stood out significantly. The biggest challenge that the respondents acknowledged to face while following a plant-based diet was finding plant-based options when eating out or traveling. Half of plant-based eaters have household members following the same dietary pattern. Additionally, most reported that their diet had no significant impact on their social relationships (see Table S1). The question exploring a potential link between restrictive eating behaviors and plant-based diets revealed that about ¼ of plant-based eaters in both countries acknowledged this connection (17% in the Netherlands and 24% in Italy), often based on personal experience or direct knowledge. The chi-square test did not reveal significant differences between the two countries ($x^2(1) = 1.005$, $p > 0.05$; Table 2); a similar trend was observed. In both countries, the group following a plant-based diet reported paying attention to potential nutritional deficiencies by taking supplements.

Attitudes of omnivores

Dutch omnivores identified their primary reasons for not adopting a more plant-based pattern as taste preferences, the belief that a balanced diet should include animal products, and the preference for following a varied diet without excess. In contrast, Italian omnivores highlighted a preference for following a moderate varied diet as their main reason but also pointed out they had a lack of knowledge about plant-based diets. Both Dutch and Italian omnivores identified similar challenges to adopting a plant-based diet, including difficulties finding options when eating out or traveling, lack of variety and nutrient balance, and overcoming cravings for meat and animal products. Most omnivores in both countries reported that no one in their household follows a plant-based diet. Regarding the potential impact on social relationships, the majority felt that adopting a more plant-based pattern would not significantly affect their relations with others. Dutch participants showed greater confidence in the nutritional balance of a plant-based diet, with far fewer expressing uncertainty compared to their Italian counterparts (see Table S1). Additionally, Dutch omnivores reported

Table 2. Summary of key survey questions and statistical comparisons.

Questions	Sample	Answers options	Dutch	%	Italians	%	Chi-square	Significance
3. To what extent do you believe a plant-based diet can reduce environmental impact?	Plant-based and omnivores	Significantly	94	69%	319	43%	$x^2(3) = 33.986$	p<0.01
		Moderately	32	24%	276	36%		
		Slightly	7	5%	95	13%		
		Not at all	3	2%	58	8%		
4. Do you currently follow a plant-based diet?	Plant-based and omnivores	Yes	64	47%	125	17%	$x^2(1) = 63.051$	p<0.01
		No	72	53%	623	83%		
5. What dietary pattern are you currently following?	Plant-based	Vegetarian	12	19%	37	30%	$x^2(5) = 14.671$	ns
		Flexitarian	11	17%	40	32%		
		Pescetarian	9	14%	12	10%		
		Lactovegetarian	2	3%	5	4%		
		Ovovegetarian	1	2%	4	3%		
		Vegan	29	45%	27	22%		
11. Have you ever considered using a plant-based diet as a way to avoid certain foods to legitimize restrictive eating behaviors?	Plant-based	Yes	10	17%	23	24%	$x^2(1) = 1.005$	ns
		No	49	83%	74	76%		
18. Do you consume plant-based alternative products? (e.g., tofu, tempeh, soy or oat milk, ...)	Omnivores	Always	8	11%	11	2%	$x^2(3) = 86.176$	p<0.01
		Often	35	49%	83	13%		
		Sometimes	20	28%	262	42%		
		Never	9	13%	267	43%		
19. Would you consider adopting a plant-based diet?	Omnivores	Yes	18	25%	140	22%	$x^2(2) = 0.883$	ns
		Not now	37	51%	356	57%		
		No	17	24%	127	20%		
20. Do you think you will eat more plant-based alternative products in the next 5 years? (e.g., tofu, tempeh, soy or oat milk, ...)	Omnivores	More often than today	37	51%	144	23%	$x^2(4) = 51.008$	p<0.01
		With the same frequency	28	39%	148	24%		
		Less frequency than today	0	0%	11	2%		
		No consumption	4	6%	115	18%		
		I don't know	3	4%	205	33%		

Questions, reference sample, answers options, percentages of answers from Italians and Dutch, and chi-square test and p-value results for a selection of questions (3, 4, 5, 11, 18, 19, 20). See Table S1 for details about other questions.

consuming plant-based alternatives more frequently, whereas many Italians stated that they consume such products only occasionally or not at all; this difference was confirmed by the chi-square test (always/often: 60% vs 15%, $x^2(3) = 86.176$, $p < 0.01$; Table 2). When asked about the possibility of adopting a plant-based diet in the future, most omnivorous people in both countries expressed reluctance, indicating

that they are not ready for such a choice. In the Netherlands, there was a clear openness to increasing the consumption of plant-based alternatives over the next five years, with 51% reporting an intention to consume them more often, compared with 23% of Italian omnivores. Italian respondents more frequently reported uncertainty regarding future habits, with responses more evenly distributed across anticipated consumption levels. This difference was confirmed by the chi-square test ($x^2(4) = 51.008$, $p < 0.01$; Table 2).

Behavior

In both countries, the supermarket was the most common choice for grocery shopping. However, Dutch respondents preferred organic and farm shops as a secondary option, while Italians favored small shops. When choosing food, Dutch participants prioritized price, followed by seasonal products, nutritional properties, and taste. Italians, however, placed greater emphasis on the country or place of origin and seasonal products, viewing these as markers of quality and taste. Regarding nutrition labels, Dutch respondents focused on the ingredients list, followed by the expiry date and nutritional value. Italians, meanwhile, paid the most attention to the expiry date, alongside the country or place of origin and the ingredients list. When asked about adopting measures related to sustainable nutrition, most participants from both Italy and the Netherlands answered positively about reducing food waste, properly storing food, preferring local and seasonal foods, and limiting the consumption of highly processed and convenience foods. Italians showed more attention to organizing their pantries to prioritize expiring products and opting for bulk products over packaged ones, while the Dutch were more focused on limiting animal protein consumption, drinking tap water, and choosing organic products. However, at least half of the participants in both countries reported not using cooking methods that reduce electricity or gas consumption, suggesting a gap in sustainable practices related to energy use in the kitchen. See Table S1 for details.

Discussion

In this exploratory pilot study, the analysis of the survey revealed various aspects concerning the participants' knowledge, attitudes, and behaviors towards a plant-based diet. In both populations, similar factors were found regarding the perceptions of potential health benefits and negative aspects associated with plant-based diets. However, the Dutch participants showed greater sensitivity and awareness of environmental issues related to these dietary choices. Previous research in the Netherlands suggests that shifts toward more sustainable dietary patterns are ongoing but remain incremental, particularly with respect to reductions in animal-based food consumption (26-28). Among the Dutch participants with a plant-based diet, the motivations for following these dietary regimes were evenly divided between ethical and environmental reasons. In contrast, in Italy, ethical motivations prevailed, followed by health benefits but environmental reasons were poorly represented. Both groups reported similar challenges in adopting a plant-based diet, demonstrating that practical difficulties are common in both countries. These findings should be interpreted considering the exploratory nature of the study and the unbalanced sample sizes between countries. A potential link between restrictive eating behaviors and plant-based diets was acknowledged by a notable proportion of plant-based respondents in both countries, often based on personal experience or direct knowledge. This suggests that, among participants, some individuals perceive these dietary patterns as intersecting with food restriction practices. In our study, family environment plays an important role in adopting a plant-based diet, as having other family members following the same dietary pattern seems to facilitate meal sharing and reinforce the choice. In contrast, in predominantly omnivorous households, the absence of alternative dietary models may make change less likely, highlighting the influence of family habits on individual choices. Previous research has highlighted the role of social support and shared household practices in facilitating the adoption of plant-based dietary patterns (29-32). In both samples,

most plant-based eaters did not perceive a significant impact of their diet on their social relationships, suggesting a growing acceptance of this eating pattern. Similarly, both Italians and Dutch omnivores believe that adopting a plant-based diet would not affect their social interactions. This suggests that social dynamics are not a primary barrier to dietary change for the participants of this study, whereas existing literature has described social acceptability and relational factors as potential barriers to the adoption of plant-based diets, with variability across contexts (33-37). In the Dutch sample, the preference for an omnivorous diet is primarily associated with taste, possibly reflecting the challenge of giving up meat. In the Italian sample, the preference leans toward a varied and balanced diet that includes animal products, aligning with the principles of the Mediterranean diet. In both countries, participants reported difficulty maintaining a balanced plant-based diet due to the limited variety of options available, a more pronounced problem when traveling. Regarding the perception of a plant-based diet being nutritionally balanced, the Dutch showed greater confidence compared to Italians. As for the consumption of plant-based alternative products (e.g., tofu, tempeh, soy or oat milk), these ones are already widely integrated into Dutch diets (38,39), while in Italy their consumption is sporadic or non-existent, which may reflect a less developed market or lower familiarity with such alternatives (40,41). When asked about their willingness to adopt a plant-based diet in the future, most omnivores in both countries answered that they are not currently interested or not interested at all. However, in the Netherlands, many respondents indicated their intention to increase their consumption of plant-based alternative products or maintain their current levels, suggesting a more open attitude toward integrating plant-based elements into their diet over time, a pattern that has been described in previous research on consumer approaches to plant-based foods (42-45). Italians, on the other hand, demonstrated more uncertainty, reflecting hesitancy or a lack of clarity on the topic. The present study has some limitations. The use of a feasibility-oriented snowball sampling approach and the unbalanced size of the Italian and Dutch subsamples limit the generalizability of the findings and reduce cross-country comparability. Dutch respondents completed the English version of the questionnaire, and nationality was self-reported, which may have introduced minor measurement variation. The study design did not allow stratified analyses. These limitations are inherent to an exploratory pilot and will directly inform the design of a larger, representative follow-up study. Despite the mentioned limitations, the pilot still highlights a set of consistent cross-country patterns that are informative for subsequent research and practice. In conclusion, the Dutch participants in our sample exhibited greater confidence and decisiveness about plant-based diets, a broader general knowledge of the subject, and a higher level of awareness concerning environmental issues related to dietary choices. Social dynamics within households played a significant role in shaping dietary choices both for Italians and Dutch, and adopting a plant-based diet seems to not have a significant impact on social relationships, reflecting the growing acceptance and spread of this lifestyle. Individuals following a plant-based diet did not experience major social obstacles due to their dietary choices, and omnivores in both countries did not see social aspects as major obstacles to dietary change. While both omnivores' populations demonstrated limited interest in fully embracing a plant-based diet at present, the willingness of Dutch participants to incorporate more plant-based alternatives in the future was higher. The adoption of plant-based diets to mask restrictive eating behaviors was considered by roughly one-quarter of Dutch and Italians, suggesting its use as a socially acceptable method for managing food restriction. Lastly, the study revealed distinct differences in food selection criteria, highlighting cultural priorities in each country. Dutch prioritized price, organic quality and taste, reflecting a more pragmatic approach, while Italians focused more on seasonality and product origin, reflecting a stronger connection to local food traditions and quality. As a pilot study, these findings provide preliminary insights that may inform future research using larger and more balanced samples.

Ethic approval: This study was conducted according to the guidelines laid down in the Declaration of Helsinki. In accordance with the indications of the local ethics committee,

due to the anonymous nature of the data collection and the non-clinical, non-invasive design of the study, formal approval was not required.

Conflict of interest: Each author declares that he or she has no commercial associations (e.g. consultancies, stock ownership, equity interest, patent/licensing arrangement etc.) that might pose a conflict of interest in connection with the submitted article.

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Declaration on the use of AI: English language editing was supported by the Grammarly automated proofreading tool.

Consent for publication: Written informed consent for the publication of study results was obtained from all participants. Data confidentiality was ensured in accordance with applicable regulations.

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Supplementary files: Supplementary files (including Table S1) can be found online.

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