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Sustainable nutrition perceptions and professional recommendations of Turkish nutrition and dietetics students: a qualitative focus group study

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Abstract

Background Nutrition and dietetics students are instrumental in fostering sustainable eating behaviors at both individual and community levels. Addressing knowledge gaps and strengthening their role as change agents is essential to promote a sustainable future. This qualitative study aimed to explore nutrition and dietetics students' perceptions of sustainable nutrition and their professional recommendations for enhancing social awareness.

Methods Using a qualitative research design, data were collected through focus group interviews conducted between September and October 2022. A purposive sampling strategy was used to ensure representation of diverse views by selecting 20 students from various classes in the nutrition and dietetics program who had not been previously educated in sustainable nutrition. Focus group interviews lasting 60–80 min were conducted, and content analysis was used to identify the main themes.

Results Three primary themes emerged from the analysis: Conceptual Meaning (mentioned 24 times), Determinants: Environmental Health (mentioned 31 times), and the Role of Dietitians (mentioned 27 times). Although students demonstrated awareness of sustainable nutrition, many perceptions were surface level, highlighting the need for enhanced curriculum focus on this topic.

Conclusions As future dietitians, these students are uniquely positioned to influence individual and collective dietary habits, fostering improvements in both human and planetary health. This research identifies gaps in their understanding and underscores the critical role of dietitians in advocating for sustainable practices. By addressing these gaps, the study contributes to the development of effective educational interventions. The findings provide valuable insights into future dietitians' attitudes toward sustainable diets, which may guide public health strategies that integrate environmental and nutritional perspectives, as well as inform curriculum development and professional training programs.

Keywords Focus groups, Higher education institutions (HEIs), Student, Sustainable nutrition, Qualitative study

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Introduction

Background

Climate change is a significant threat to human health. Disasters due to adverse weather conditions alone have increased by 46% since 2000, with the most severe impacts observed among vulnerable populations in underdeveloped and developing countries [32]. These effects are driven by both direct mechanisms, such as the health consequences of extreme heat, and indirect mechanisms, including disruptions to food production and economic systems, and shifts in the distribution of vector-borne diseases [14, 32]. According to projections by the World Health Organization (WHO), climate change could cause approximately 250,000 additional deaths per year between 2030 and 2050. Particularly at-risk groups include children and older adults, who face increased susceptibility to heat-related illnesses, diarrheal diseases, malaria, and malnutrition [33].

The world's food supply is changing rapidly, driven by advances in industrial systems and technological innovation. However, with these advances come significant environmental challenges. Food systems contribute up to 30% of global greenhouse gas emissions, considering various factors such as food production, safety measures, packaging, and transportation [31]. Notably, the most significant source of carbon emissions within the food industry is animal production and associated agricultural activities [25]. As the global population is projected to grow, the demand for food is expected to increase accordingly. This growth raises concerns about the expansion of agricultural activities into forested areas and the proliferation of new enterprises aimed at increasing food production, both of which are likely to exacerbate carbon emissions and further contribute to climate change [26]. In addition, the global prevalence of overweight and obesity affects approximately two billion people and represents a significant public health challenge [22]. This condition is associated with increased risk of cardiovascular disease, type 2 diabetes, certain cancers, and musculoskeletal disorders [6]. However, in addition to overnutrition, issues of hunger and micronutrient deficiencies persist, with similar implications for human health. Addressing these multifaceted challenges therefore requires comprehensive approaches that prioritize environmental sustainability and public health outcomes. In light of these facts, it becomes evident that individuals'dietary choices not only impact their own health but also have significant implications for the health of the planet [13].

In 2015, UN member states also adopted the 2030 Agenda for Sustainable Development. A comprehensive global action plan with 17 Sustainable Development Goals (SDGs) and 169 targets to be achieved by 2030, including SDG13 on climate action [29]. Despite the endorsement of 193 UN Member States, global progress toward achieving the SDGs remains below expectations [30]. Therefore, it is emphasized that all organizations should implement a set of skills, knowledge, and mindsets—referred to as"Education for Sustainable Development Goals"(ESDG)—to tackle the challenges posed by the Sustainable Development Goals (SDGs) and drive the necessary transformations in society [17].

In addition to working as clinical dietitians, graduates from nutrition and dietetics programs influence the food system through various roles such as public health nutritionists, educators within healthcare systems, food service managers, and professionals involved in product development and innovation in the food industry [5]. Their activities range from providing nutrition education to communities, designing sustainable menus in institutional foodservice settings, and contributing to developing sustainable food products and policies. Recognizing this diverse range of career paths highlights the critical impact that nutrition and dietetics students will have on shaping future sustainable food systems [12].

Sustainable nutrition is a concept that underscores the importance of adopting dietary patterns that have low environmental impacts while promoting food and nutrient security for both current and future generations [11]. A landmark report published by the EAT-Lancet Commission in 2019 provided comprehensive guidance on achieving a sustainable and healthy diet. The report emphasized the importance of increasing consumption of fruits, vegetables, legumes, and whole grains, while advocating for moderate intake of seafood and poultry as sources of protein [34]. Conversely, it recommended reducing consumption of red meat, refined grains, added sugar, and starchy vegetables [34]. Subsequently, many countries have begun to align their nutrition guidelines with principles of sustainability and health [8]. Although these updates at the policy level are significant, it remains necessary to strengthen individual-level education, particularly in nutrition and dietetics programs, to ensure that future professionals can fully implement and advocate for sustainable nutrition practices in their communities. For instance, in 2022, Türkiye incorporated a chapter on sustainable nutrition into its updated national nutrition guidelines, emphasizing environmentally friendly dietary practices alongside health considerations [8]. This shift towards promoting sustainable and healthy diets not only benefits individual health but also contributes to broader environmental sustainability efforts. By encouraging consumption patterns that prioritize plant-based foods and minimize the consumption of resource-intensive animal products and processed foods, these

guidelines aim to mitigate the adverse environmental impacts associated with food production and consumption. Thus, adopting sustainable nutrition practices represents a crucial step towards safeguarding both human health and the health of the planet for generations to come. However, despite the increasing popularity of sustainable nutrition in recent years, it is apparent that nutrition and dietetics professionals in our country lack sufficient knowledge and awareness on this issue. In particular, only 61.7% demonstrated the knowledge and willingness to recommend reducing meat consumption as a strategy to mitigate climate change [23].

Nutrition and dietetics education must be updated to reflect new developments and structured to safeguard not only human health but also the health of the planet, with dietitians playing a pivotal role in guiding policymakers [1]. In this context, it is important to understand future dietitians'understanding and definition of sustainable nutrition, their perceptions regarding the determinants of sustainable nutrition, and their views on how societal changes can promote sustainable nutrition. Therefore, the aim of this study was to explore the perceptions of nutrition and dietetics program students about sustainable nutrition and to examine their professional and vocational recommendations for enhancing social awareness.

Materials and methods

Design and sampling

This qualitative study was conducted in university students enrolled in the nutrition and dietetics program. Focus group discussions were used to gather data. Focus groups are an interactive process among a group of participants interested in addressing a specific topic or research question [20, 24].

This study was conducted at Erciyes University, a well-established university in Türkiye. Erciyes University Nutrition and Dietetics program is the second program providing nutrition and dietetics education in Türkiye. This nutrition and dietetics program, which educates future professional dietitians, holds an accreditation certificate from the Health Sciences Education Programs Evaluation and Accreditation Association, an independent organization that evaluates health education programs [15] and the number of students studying in the program is 462 [28]. The quota occupancy rate of the program is 100%. In the nutrition and dietetics program curriculum, professional courses consist of both theoretical knowledge and clinical practice.

Nutrition and dietetics students are required to have 132 h of theoretical courses and 86 h of clinical practice with a focus on human nutrition. During this period, each nutrition and dietetics program student is provided with the opportunity to practice in the field/clinic/field for 4 days (24 h)."Sustainable Nutrition" was added to the curriculum as an elective course in the 2022–2023 academic year within the scope of the project titled" Assessment and development of an educational plan for dietitian candidates to promote sustainable nutrition in society" supported by the Scientific and Technological Research Council of Türkiye (TUBITAK), which is also related to the data of this study. The data of the study was collected before the start of the semester courses. Therefore, the students who participated in the study had not taken any courses on sustainable nutrition during their nutrition and dietetics education.

In this study, the purposive sampling method, which is a type of criterion sampling, was used to select participants. Purposive sampling involves intentionally selecting individuals who meet specific criteria relevant to the research objectives. The inclusion criteria were as follows: being over 18 years of age, being enrolled in the nutrition and dietetics program, and not having participated in elective or mandatory courses or training related to sustainable nutrition. Participants were required to be able to answer questions clearly, demonstrate openness to communication and cooperation, have no known memory issues, and voluntarily agree to participate. Participation was entirely voluntary, and the decision not to participate did not affect the academic success of the students. This approach ensured that the selected participants aligned with the study's goals and characteristics.

Research questions

The following research questions were formulated to determine the aim of this study:

RQ 1. What is sustainable food or sustainable nutrition in human nutrition?
RQ 2. What are the determinants for sustainable food or sustainable nutrition? Environmental or external factors (climate change, awareness trend, social media, COVID-19, etc.), personal factors and motivational factors, etc.)
RQ 3. How can change towards sustainable food/nutrition in society be increased or sustained? (for students and dietitians)

Procedure and focus group interviews

Participants were selected from students in different grades of the nutrition and dietetics program to ensure a diversity of views. The aim was to include four to six students in each focus group session [10]. After obtaining permission from the dean's administration, the

researchers prepared informative invitations for program students interested in participating in the study. These invitations were shared on student notice boards and through student groups to maximize awareness. The selection of volunteers was conducted in a systematic manner to ensure fair and diverse representation:

Encouraging participation across all grades was successfully achieved. All students, regardless of grade level, were encouraged to volunteer for the study. Balanced representation was targeted. From the pool of volunteers, participants were chosen to maintain an equal representation across different grades. This approach ensured that no single grade dominated the discussions. A strategic process was implemented to ensure diversity. The final selection process prioritized demographic and viewpoint diversity to align with the study's objectives. This ensured robust discussions and valuable insights from participants. As a result of this structured approach, each focus group session successfully included four to six participants from various grades, fulfilling the goal of representing a range of views and experiences.

All focus groups were conducted from September 2022 to October 2022. Focus group interview is a data collection technique carried out with a group participants with similar characteristics and accompanied by a moderator. It was an interaction process that was carried out with a group of people selected from among the individuals who were interested in the subject by addressing a specific topic and emerging about the research topic [10]. Students from the same grade and academic year (e.g., first-year or second-year students) were placed in the same focus groups. Participants came from similar or different social backgrounds, which include factors such as socioeconomic status, cultural influences, and family environment. No other criteria were used to organize participants into focus groups.

Participants received an information sheet and a consent form prior to the focus group interview sessions. At the beginning of each session, the purpose of the study, as well as an overview of the focus group process, were explained. Participants were informed that they could leave the focus group at any time during the session if they wished. Permission to record the interviews was obtained using an audio/video recorder (DJI Pocket 2 Creator Combo Gimbal camera, Dà-Jiāng Innovations Science and Technology Co. Ltd., Shenzhen, China). Participants were assured that the recordings would only be accessed by the researchers, participation was entirely voluntary, and they could withdraw from the study at any time without providing a reason. At the end of each session, students completed a questionnaire to collect demographic data. Anonymity was maintained by ensuring no personal information that could identify participants was collected. Each focus group lasted between 60 to 80 min. Facilitation was carried out by (Authors HD, AB, and EKA), who handled audio recording, and (Author NO), who asked questions and took notes during the sessions.

Focus group design questions

The questions in the semi-structured interview guide (Table 1), designed to address the research questions of this study, were developed within the framework of sustainability and behavioral change theories. Specifically, the theoretical foundation was derived from the Theory of Planned Behavior [2] and the Social Cognitive Theory [3], which provide insights into attitudes, beliefs, and social influences affecting sustainable nutrition practices. After welcoming the participants, an opening (and warm-up) on the topic was made, followed by introductory and transitional ice-breaker questions to facilitate engagement. The main questions were designed to elicit detailed discussions on sustainability perceptions, professional recommendations, and behaviors. The questions were developed using relevant literature [9, 35] and consultation with five experts from the fields of public health, nutrition, and sociology. To ensure the validity and clarity of the interview guide, the questions were tested in a pilot session with four participants. These pilot participants were randomly selected from among the first students who responded to the participation announcement, although two first-year students who applied were excluded from the main study. Since no modifications were deemed necessary after the pilot session, the data collected during this session were included in the analysis, adhering to the accepted approach for utilizing pilot data [21].

The questions consisted of an introductory question (icebreaker) to start the conversation and a transitional question more related to the topic of the study to steer the group discussions towards the purpose of the study. There were four main questions and most of the time was spent on these questions. The moderator followed the question guide in each session and asked probe questions where needed. Main questions had alternatives (probes). The probe questions allowed students to share and elaborate on their ideas. At the end of the focus groups,

Table 1 The main questions in the focus group guide source

1. What are the meanings of the word "sustainable" and "unsustainable" food / nutrition for you?
2. How would you define sustainable nutrition in human food consumption?
3. What are the determinants of sustainable food/nutrition in today's world? Environmental health, external factors, personal determinants, etc.
4. What can be done for social awareness on sustainable food/nutrition (in terms of students, dietitians)?

participants were asked to complete a short questionnaire collecting demographic information. The questionnaire was completed anonymously. There were seven questions related to age, gender, accommodation status, parental education, interest in the professional field, academic average and income. This information was used to better understand the sample and was not used for further analyses.

Data saturation is the point at which no new information or themes emerge from gathering additional data [35]. In our study, we continued conducting focus-group interviews until no novel codes appeared in two consecutive sessions, ensuring comprehensive coverage of participants' perspectives. This approach strengthens the credibility of our thematic analysis by demonstrating that further data collection would not have added meaningful insights. When the data started to be repeated, saturation was determined in the 4th focus group interview. At this point, the number of mention counts under the codes was quite sufficient and no new code was created. It was decided that data saturation was reached, and the sample of the study consisted of 20 participants.

Data analysis and trustworthiness

The data obtained from the questionnaire were analyzed using Microsoft Excel software (Microsoft Corporation, the United States), and descriptive statistics related to participant characteristics were calculated. After the completion of the focus group interviews, audio recordings were listened to within 24 h, and the raw data were transferred to the computer and converted into Microsoft Word documents (Microsoft Corporation, the United States). The recordings were transcribed verbatim, cleaned, and checked for accuracy.

Content analysis was conducted to organize and interpret similar data within the scope of specific concepts and themes. This process included preliminary reading, coding qualitative data, reaching themes, organizing data, interpretation, and reporting [10]. Hand coding was used for the data analysis. A list of codes (33 codes) was created and systematically grouped into the phenomenon of sustainable nutrition under three main categories: Conceptual meaning, Determinants: Environmental impact, and Role of dietitians.

To ensure the reliability of the coding process, two researchers independently coded a randomly selected interview transcript. They compared their results and resolved any discrepancies through discussion until consensus was reached. Following this preliminary process, one researcher coded the remaining transcripts. Subsequently, all codes across the dataset were reviewed and compared collaboratively by both researchers. Any inconsistencies or disagreements were addressed through discussion until full agreement was achieved. Finally, the agreed-upon codes were subjected to content analysis, resulting in the identification of three overarching themes. The finalized codes were then used to thematically code all focus group data using Microsoft Excel. For each identified factor, supporting quotes and the frequency (f) of mentions were presented in the findings section. The letter"P"was used to represent participant numbers. The frequency counts (f) of each factor are provided in brackets.

To ensure the trustworthiness of the data, the quality criteria for qualitative research—credibility, transferability, dependability, and confirmability—were employed [10]. Credibility was established through transparency and the use of a reflective dialogue approach during data collection and analysis. This approach involved several key steps: (1) participants were allowed to review the initial themes generated from their responses to ensure accuracy and relevance,(2) moderators engaged in reflective discussions on the notes taken during focus groups, allowing for deeper analysis and refinement of themes; and (3) honesty, truth, and proving self were emphasized by creating an open environment where participants felt comfortable expressing their perspectives without fear of judgment. The importance of the study was explained to the participants to encourage active engagement. All researchers, except for one, were academics working at the same university as the students, fostering familiarity and trust during the data collection process.

The research team consisted of individuals from diverse disciplines, including Nutrition and Dietetics, Public Health, Public Health Nursing, and Nursing Education. Validity was assessed based on the involvement of the two researchers who collected the data (from Nutrition and Dietetics and Public Health Nursing departments) and all authors who contributed to data analysis. One of the researchers (Author [AC]) held a qualitative data analysis certificate, ensuring further rigor. Throughout the interviews, issues of honesty, truthfulness, and self-reflection were emphasized by the authors.

Ethical considerations

This study was carried out as a part of TUBITAK project number 122G123. The ethics committee approval, which is required for conducting studies related to the project, was granted by the Social and Human Sciences Ethics Committee of Erciyes University [Date: 15.09.2022/Approval No: 402 (ethical approval taken for the execution of the project) and Date: 30.07.2024/Approval No: 317 (ethical approval taken for the execution of the study)] and the procedures followed were in accordance

with the Helsinki Declaration. Written informed consent was provided.

Results

The students were between the ages of 18–22 years, and all but one student was female ($n=19$). Among the students of the nutrition and dietetics program, 25% of them were 1st year, 25% of them were 2nd year, 25% of them were 3rd year and 25% of them were 4th year students. The students included in the study did not take any course related to sustainable nutrition or any training related to sustainable nutrition during their education life and did not participate in any seminar program. Other descriptive characteristics about the students included in the focus group interview were shown in Table 2.

The results are presented according to the research questions of the study. The first section addresses the participants' conceptual understanding and definitions of sustainable food/nutrition. The second section discusses the determinants of sustainable food/nutrition, focusing on perceptions of environmental impact. The third section explores the roles of dietitians in raising students' social awareness of sustainable nutrition. We recorded the mention counts each theme received to gauge its prominence. Figure 1 illustrates the conceptual structure of three theme labels that explain the perceptions of sustainable nutrition and suggestions for awareness. In Fig. 1, which visually presents the themes, the box sizes are proportional to the number of mentions: Theme 2 received 37.8% of the mention counts, Theme 3 received 32.9%, and Theme 1 received 29.3%. Figure 2 presents the themes and subthemes explaining the phenomenon of sustainable nutrition.

Theme 1. Conceptual Meaning: Repeated use, economically affordable, healthy, and safe

In focus group discussions, students provided conceptual definitions of sustainable food/nutrition. They emphasized that sustainable nutrition should involve"repeated use, economically affordable, healthy, and safe." Table 3 presents the Conceptual Meaning theme and related sub-themes associated with the phenomenon of sustainable nutrition.

The most cited subcategory was 'Continuity, repetition, cycle, sustainability and renewability of food', while the others were 'Healthy, safe, integrated into life', 'Preventing waste, economic', 'Accessible nutrition' and 'Useful use

Table 2 Other descriptive characteristics about the students included in the focus group interview

Participant code	Gender	Age	Grade	Wanting/liking the profession	Uni. GPA	Parental education (Mother\Father)	Income status [1, 2, 3]
P1	F	18	1	Yes	-*	High sch. \ Uni.	2
P2	M	18	1	Yes	-*	High sch. \ Uni.	2
P3	F	18	1	No	-*	Uni.\Uni.	2
P4	F	19	1	Yes	-*	Uni.\Uni.	2
P5	F	19	1	Yes	-*	Uni.\Uni.	3
P6	F	19	2	Yes	2.76	High sch. \ Uni.	2
P7	F	20	2	No	3.15	High sch. \ Uni.	1
P8	F	20	2	Yes	3.41	Uni.\Uni.	2
P9	F	20	2	Yes	2.96	High sch. \ Uni.	2
P10	F	20	2	Yes	3.49	High sch. \ Uni.	3
P11	F	21	3	Yes	3.55	Uni.\Uni.	2
P12	F	22	3	Yes	2.61	Uni.\Uni.	2
P13	F	21	3	Yes	3.57	Uni.\Uni.	2
P14	F	21	3	Yes	3.11	High sch. \ Uni.	1
P15	F	21	3	Yes	3.34	High sch. \ Uni.	2
P16	F	22	4	Yes	2.35	High sch. \ Uni.	2
P17	F	22	4	Yes	3.47	High sch. \ Uni.	1
P18	F	22	4	Yes	2.89	Uni.\Uni.	2
P19	F	22	4	Yes	3.35	Uni.\Uni.	2
P20	F	22	4	Yes	3.21	Uni.\Uni.	2

F Female, *M* Male, *Uni* University, *GPA* Grade point average (The highest is 4.), *High sch* High school, *Income status 1* Income less than expenditure, *Income status 2* Income equals expenditure, *Income status, 3* Income more than expenditure

* The 1st year students' University grade point average has not yet been calculated

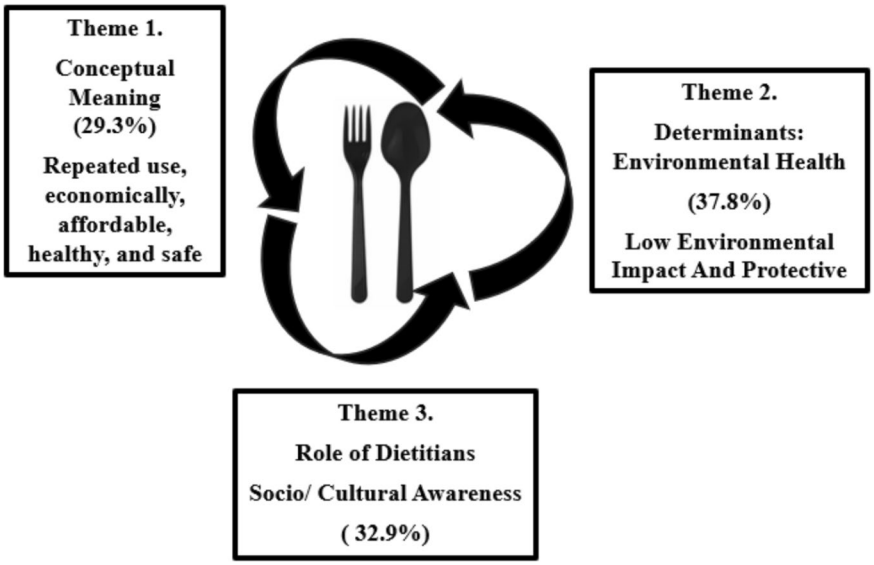

Fig. 1 Conceptual presentation of theme labels including perceptions of sustainable nutrition ($n = 20$)

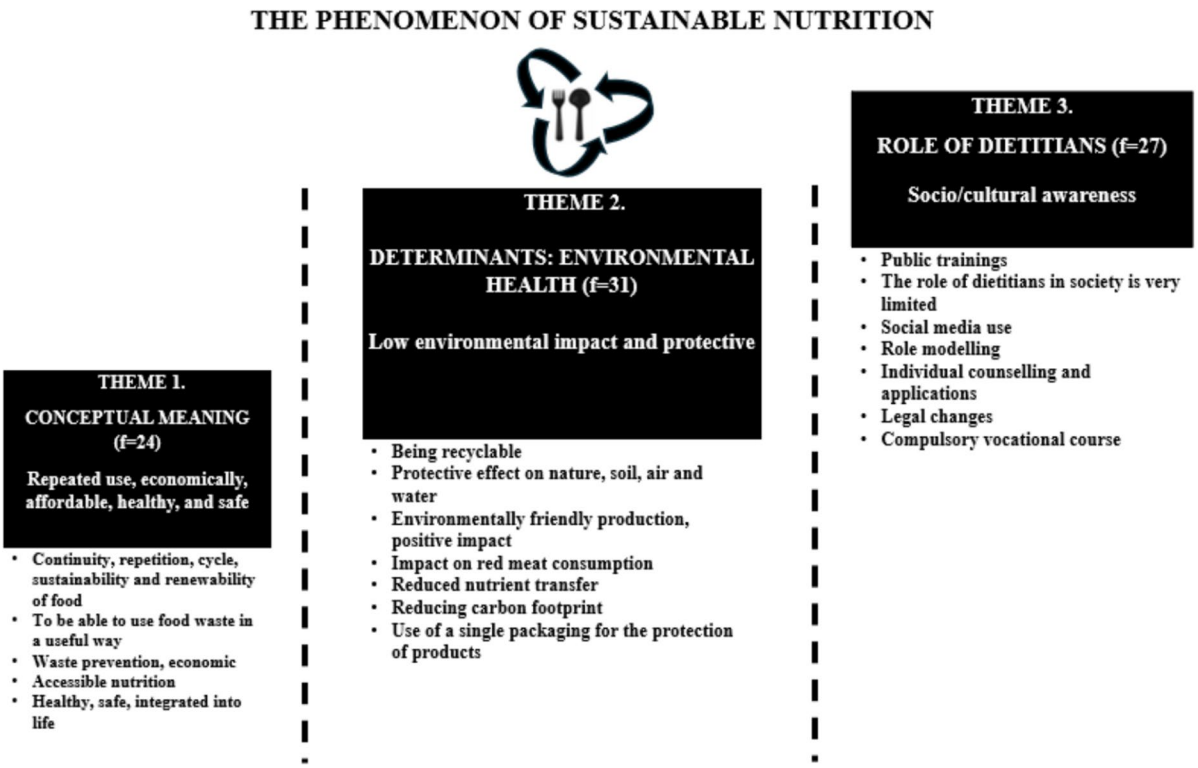

Fig. 2 Theme labels (frequency counts) and sub-theme labels explaining the phenomenon of sustainable nutrition ($n = 20$)

of food waste' in order from the most to the least cited. P17 stated that she had no idea. Some quotations for this theme are presented below:

'What comes to my mind when I think of sustainable nutrition is to transform it into a reusable form without wasting' (P3, Female, 1st Grade).

Table 3 Conceptual Meaning theme and related sub-themes

Theme	Sub-themes	Participants
Conceptual Meaning (f = 24)	Continuity, repetition, cycle, sustainability and renewability of food	P1, P4, P12, P11, P7, P8, P9, P14, P18, P6, P16, P19
	Healthy, safe, integrated into life	P10, P14, P13, P15, P19, P20, P18
	Waste prevention, economic	P1, P3, P5
	Accessible nutrition	P13
	To be able to use food waste in a useful way	P2

'... sustainable in my eyes means that something, nutrition, order is sustainable. It is not eating a lot one day and eating less the next. To continue our lives as normal. In a certain diet, in a certain meal. There is also waste, but the first thing that comes first is the sustainability of nutrition' (P11, Female, 3rd Grade).

'Ensuring continuity, at the same time respecting the things we welcome. Like reducing the consumption of animals more. Respect for them too. We aim to increase soil fertility. Likewise, the continuity of this work without harming the ecology' (P18, Female, 4rd Grade).

Theme 2. Determinants: Environmental Health: Low environmental impact, protective

The students of the nutrition and dietetics program highlighted the relationship between sustainable nutrition and environmental health, underlining low environmental impact and preventive measures. Table 4 presents the Determinants: Environmental Health theme and related sub-themes about the phenomenon of sustainable nutrition. This theme, which received the most mention counts from participants, includes seven sub-themes.

Under this theme, 13 codes were identified. All the students stated that there is a positive relationship between sustainable nutrition and environmental health. Some quotations related to the theme are presented below:

'Reducing red meat consumption all over the world will be of great benefit to the environment' (P2, Male, 1st Grade).

'Nature is getting worse and worse with industrialization and increasing air pollution. The increase in artificial fertilizers and pesticides is making nature worse. I think sustainability is necessary to turn this into a better situation.' (P9, Female, 2nd Grade).

'In addition to taking the food directly, I think there are such things as production, transport, production, transport, packaging, packaging, packaging, packaging until it reaches our hands, and after it reaches our hands, let's say a package of plastic, what will be the damage of that package to the environment, what kind of effects it will have, I think there are such things.' (P14, Female, 3rd Grade).

Theme 3. Role of Dietitians: Socio/cultural awareness

In the focus group interviews, 19 of the 20 students in the nutrition and dietetics program emphasized the role of dietitians in promoting and raising awareness of sustainable nutrition in society. The frequently emphasized role of dietitians in this context is their responsibility to conduct public trainings to fulfill their educational role. Sixteen students believed that dietitians could play a significant role in disseminating sustainable nutrition in society, three students felt they would, and one student disagreed. Table 5 presents the Role of Dietitians theme and sub-themes about the phenomenon of sustainable nutrition.

Regarding the addition of a course on sustainable nutrition to the undergraduate curriculum, all participants

Table 4 Determinants: Environmental Health theme and related sub-themes

Theme	Sub-themes	Participants
Determinants: Environmental Health (f=31)	Being recyclable	P1, P3, P4, P14, P5,P17, P10, P11, P15
	Protective effect on nature, soil, air and water	P5, P12, P11, P3, P16, P9, P15
	Environmentally friendly production, positive impact	P18, P7, P8, P17, P20
	Impact on red meat consumption	P2, P13, P19, P4
	Reduced nutrient transfer	P6, P12, P14
	Reducing carbon footprint	P11, P13
	Use of a single packaging for the protection of products	P15

Table 5 Role of Dietitians theme and sub-themes

Theme	Sub-themes	Participants
Role of Dietitians (f=27)	Public trainings	P4, P5, P8, P10, P12, P13, P14, P16, P18, P19
	The role of dietitians in society is very limited	P3, P7, P18, P19
	Social media use	P6, P9, P11, P19
	Role modelling	P11, P13, P15
	Individual counselling and applications	P1, P2, P20
	Legal changes	P2, P20
	Compulsory vocational course	P17

expressed a desire to take such a course. They unanimously agreed that it should be a compulsory part of the curriculum and suggested that students in other departments should be able to take it as an elective. Some students mentioned that taking this course would be beneficial on an individual, social, and environmental level, highlighting its relevance given the increasing population, resource depletion, and the broad scope of the subject. There were seven codes in the code list for this theme. Some quotations related to this theme are presented below:

"I think social media will help raise awareness if dietitians actively share studies on sustainable nutrition.". (P6, Female, 2nd Grade).

"Yes, dietitians have a role. It is important to educate dietitians first so they can raise awareness in society, especially those working in community nutrition.". (P17, Female, 4rd Grade).

"Dietitians can influence individuals, but broader changes in sustainable nutrition require state and agricultural sector involvement.". (P20, Female, 4rd Grade).

Discussion

The aim of this study was to explore the current perceptions of nutrition and dietetics program students regarding sustainable nutrition and to examine their professional/vocational recommendations for social awareness of sustainable nutrition. The results obtained from this study make an important contribution to the literature by examining the current perceptions of nutrition and dietetics students regarding sustainable nutrition and their professional recommendations for social awareness on sustainable nutrition.

Previous studies have highlighted a scarcity of qualitative research in the field of nutrition and dietetics [27]. Although there has been an increase in research using mixed-methods designs in health sciences generally [37], qualitative studies focusing specifically on nutrition and dietetics remain limited. Qualitative research provides important insights into personal experiences, social contexts, and perceptions, making it particularly valuable for exploring complex topics such as sustainable nutrition [4]. This study contributes to filling this gap by capturing diverse student perspectives through qualitative inquiry.

Burkhart et al. [7], who examined Australian nutrition and dietetics students'perceptions of sustainability through a cohort study, found that nutrition and dietetics students were familiar with the environmental aspects of sustainability and that sustainability was seen as an important issue for nutrition and dietetics practice. Again, another qualitative study on the future of the dietetic profession in Australia and New Zealand emphasized the need for nutrition and dietetics professionals who can advocate and build sustainable and healthy food systems and identified this situation as a learning opportunity [4].

In this study, three main themes were identified based on the frequency with which they were mentioned by the participants: Conceptual Meaning (29.3%), Determinants: Environmental Health (37.8%), and the Role of Dietitians (32.9%). These themes reflect the perceptions of nutrition and dietetics students regarding the phenomenon of sustainable nutrition. Especially in recent years, the issue of sustainability has been given more attention both in daily life and in social media. Even though this issue is mentioned in some of the nutrition guidelines of the countries, it is still seen as missing in some of them [16]. Türkiye has drawn attention to the importance of the issue by including a chapter on sustainable nutrition in its updated national nutrition guideline in 2022. When all these are evaluated, it is expected that students will have heard about this issue from the environment, future colleagues, and academicians. In addition, the findings obtained from this study provide more in-depth findings on nutrition and dietetics education and profession regarding the theme of sustainable nutrition and overlap

with some studies in the literature on the future of the dietetic profession [4, 7] and show that dietitians have a clear professional identity in terms of sustainable nutrition and climate action.

Sustainable and healthy nutrition is a multifaceted and complex concept. It includes avoiding food waste, preferring, or consuming local and seasonal foods. In addition, animal welfare, healthy and balanced nutrition, consumption of low-fat foods and reducing meat consumption are also issues related to healthy nutrition within the scope of sustainable and healthy nutrition [36]. When the students'evaluations about sustainable nutrition are considered as a whole, it is seen that they have knowledge in line with the actuality of the subject. In this case, it is possible that students may be displaying knowledge from pre-university education. The fact that nutrition and dietetics students hear the concept of sustainable nutrition and have positive statements about its environmental effects has an important potential to build on discipline-specific content and competence development and individual interest. According to Mintz and Tal [19], motivation as an outcome of learning is related to how students actively advocate and participate in sustainability in their personal and professional lives. These findings emphasize the importance of deepening students'understanding and awareness of the relationship between sustainable nutrition and environmental health. They also highlight the critical role of nutrition and dietetics education in promoting sustainable nutrition and fostering students'motivation. Furthermore, academics teaching in the field of nutrition and dietetics should be encouraged to include sustainability-related links in their course content and learning activities. As an important result of this study, it is noteworthy that there are points that need to be improved in students'knowledge and thoughts about sustainable nutrition. Specifically, only three participants expressed, it is seen that only three participants expressed preventing waste and reducing meat consumption, which is a very important concept in sustainable nutrition.

Despite a basic understanding and awareness about the importance of sustainable nutrition, this awareness appeared to be superficial, as it decreased when more detailed and specific aspects or dimensions of sustainable nutrition were questioned. This finding indicates that students have basic values about the importance of sustainable nutrition. From this point of view, it is a valuable opportunity for the development of both theoretical and practical applications of sustainable nutrition to be integrated into the nutrition and dietetics education curriculum, in order to increase students'knowledge and skills regarding more detailed and specific aspects or dimensions of sustainable nutrition. In this study, Determinants: Environmental Health and Role of Dietitians themes point to the importance of dietitians informing the society through trainings.

The first step in popularizing sustainable nutrition in the society is to increase educational activities. However, in this study, some of the students reported that the role of the dietitian in the society is limited. However, nutrition and dietetics students are important advocates for the dissemination of sustainable nutrition.

Therefore, a more detailed examination of this perception in nutrition and dietetics students is a topic worthy of further research. Dietitians should approach medical nutrition therapy with consideration of sustainable nutrition principles in both client and community education. Therefore, it is important to include a sustainable nutrition course in the core curriculum of nutrition and dietetics departments that includes practical educational techniques for the individual and community to promote sustainable nutrition [18].

Conclusion

This study provides a new and holistic overview of how sustainable nutrition/sustainable foods are perceived among university students and identifies determinants for sustainable nutrition awareness. Particularly from the perspective of future dietitians and food service professionals, this study helps to identify opportunities to promote awareness and community promotion of sustainable nutrition among university students and to design/implement informed interventions and policies aimed at improving sustainable food consumption behaviours.

Students had different perceptions of what constitutes sustainable nutrition, some of which were superficial. Various environmental (macro, micro and social) factors were most frequently mentioned as factors associated with sustainable diets. Although participants recognized the importance of sustainable nutrition, their awareness appeared superficial when probed for specific dimensions. This suggests a need for deeper theoretical and practical integration of sustainable nutrition in the curriculum. Although nutrition and dietetics students made positive statements about sustainable nutrition, it is noteworthy that there are points that need to be improved in their knowledge and thoughts about sustainable nutrition.

This study is not without limitations. Foreign students were excluded from the focus-group interviews due to anticipated language and cultural barriers, which may limit the transferability of our findings to the international student population. Additionally, only one male student took part in this study; while nutrition and dietetics programs are predominantly female—possibly

explaining this imbalance—it may nonetheless bias gender-related perspectives. Finally, although we made every effort to preserve the cultural and linguistic features of participants' responses when translating from Turkish into English, this process may have introduced interpretive limitations.

Abbreviations

WHO	World Health Organization
SDG	Sustainable Development Goal
SDGs	Sustainable Development Goals
UN	United Nations
ESDG	Education for Sustainable Development Goals
HEIs	Higher Education Institutions
TUBITAK	The Scientific and Technological Research Council of Türkiye
GPA	Grade Point Average
SABAK	Health Sciences Education Programs Evaluation and Accreditation Association
FCRN	Food Climate Research Network

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Authors' contributions
NÖ: conceptualization, formal analysis, investigation, project administration, and writing – original draft, and supervision. AÇ: conceptualization, formal analysis, data analyse, writing – review and editing, and supervision. HD: conceptualization, data analyse, writing – review and editing, and supervision. EKA: Investigation, data analyse, writing – review. YYF: Investigation, data analyse, writing – review. AB: conceptualization, writing – review and editing, and supervision, corresponding.

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Data availability
The datasets used and/or analyzed during the current study are available from the corresponding author on responsible request.

Declarations

Ethics approval and consent to participate
Ethics committee approval was obtained for this study from Erciyes University the Social and Human Sciences Ethics Committee [Date: 15.09.2022/Approval No: 402 (ethical approval taken for the execution of the project) and Date: 30.07.2024/Approval No: 317 (ethical approval taken for the execution of the study)]. The procedures followed were according to the ethical standards of the responsible institutional ethics committee and the Helsinki Declaration. Participants were informed about the purpose of the study, provided verbal informed consent.

Consent for publication
Not applicable.

Competing interests
The authors declare no competing interests.

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