frontiers | Frontiers in Sustainable Food Systems

TYPE Original Research
PUBLISHED 14 December 2023
DOI 10.3389/fsufs.2023.1307758

OPEN ACCESS

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RECEIVED 05 October 2023
ACCEPTED 28 November 2023
PUBLISHED 14 December 2023

CITATION
Cheikh Ismail L, Hashim M, Osaili TM, Faris ME, Naja F, Radwan H, Hasan F, Saleh ST, Al Rajaby R, Al Daour R, Stojanovska L, Al Dhaheri AS, Hasan H and Obaid RS (2023) Exploring sustainable food choices among adults in the United Arab Emirates: a cross-sectional study.
Front. Sustain. Food Syst. 7:1307758.
doi: 10.3389/fsufs.2023.1307758

Exploring sustainable food choices among adults in the United Arab Emirates: a cross-sectional study

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Introduction: Dietary choices serve as a vital and ongoing link between environmental sustainability and human health. This study aimed to assess the consumption behavior of people in the United Arab Emirates (UAE) concerning sustainability and determine factors that contribute to sustainable food choices.

Methods: A cross-sectional, web-based study was conducted among adults in the UAE ($n = 1{,}113$). Data on participants' sociodemographic characteristics, attitudes toward sustainable food choices, and reasons behind sustainable food choices were collected. Independent *t*-test and one-way ANOVA tests were used to investigate the differences in the level of agreement to nine statements about sustainable food choices among different sociodemographic groups on a scale of 1–5 ranging from strongly disagree to strongly agree. Participants' responses to open-ended questions were filtered and clustered into eight different categories and presented as counts and percentages.

Results and discussion: Participants agreed on trying new healthy and environmentally friendly foodstuff (3.57 ± 1.04). Females ($p=0.002$) and older adults (>50years; $p=0.001$) showed higher agreement with avoiding red meat. Older participants, and those with higher education ($p=0.020$ and $p<0.001$, respectively) showed higher agreement with favoring plant-based diets. 21.2% reported avoiding red meat and 23.1% preferred a plant-based diet. Of those who favored plant-based food the main reported reason was 'health and nutritive value' (66.5%), while of those who avoided red meat, preference was the most reported reason (41.9%). Although the study sample did not greatly adopt sustainable food choices, they leaned toward trying environmentally friendly foods. Females, older adults, and highly educated people aligned themselves with more sustainable food choices. Targeted policies and the integration of sustainability aspects within dietary guidelines to promote healthy, sustainable, and affordable diets are needed.

KEYWORDS

sustainable diets, sustainability, animal-based, plant-based, consumer behavior, dietary behavior

1 Introduction

The impact of human behavior on planet Earth has become of great interest to many researchers and environmental organizations. The Sustainable Development Goals (SDGs), set by the United Nations, focus on meeting the food requirements of the world population in a responsible and non–polluting manner (United Nations Environment Programme, 2022). Inevitably, due to urbanization and global population expansion, the earth's landscape has gradually changed from wild forests to systematically cultivated cash crops, making food production widely recognized as one of the most impactful drivers of environmental change (Myers et al., 2017). To a large extent, an unsustainable method of food production could be the very cause of food insecurity for future generations (Berry et al., 2015). Research shows that food systems are responsible for about one-quarter of global greenhouse gas (GHG) emissions and two-thirds of freshwater use compared to nonfood-related systems (Ritchie and Roser, 2020). In particular, human dietary choices and consequent consumption patterns are the main drivers of food production, and more importantly, these dietary choices serve as a vital and ongoing link between environmental sustainability and human health (Heller et al., 2013). With that in mind, dietary changes at a global level are needed to ensure the achievement of the SDGs (Chen et al., 2022).

Dietary choices are driven by numerous factors besides concerns about health and the environment. These include but are not limited to, availability and accessibility, personal preferences, and economic, social, and cultural factors which can have a far greater impact on people's food choices (United Nations, 2019). In line with international efforts to achieve the SDGs and lower harmful environmental impacts, sustainable diets have emerged as a pressing issue with a dual benefit for consumers and the environment (Berry et al., 2015). Sustainable diets refer to diets that have a low environmental impact and contribute to food security as well as the health of human beings, consequently contributing to achieving the targets of the SDGs (Burlingame and Dernini, 2010). The literature provides consistent evidence indicating that shifting to a sustainable diet that meets nutritional requirements for health while reducing the environmental impact of food such as lowering GHG emissions is possible and achievable (Hallström et al., 2015). In a broad context, both the vegetarian diet and the non-vegetarian diet contribute to the GHG burden, however, the burden of the latter is more than 2.5 times greater (4.2 vs. 1.6 kgCO2eq/day; Rabès et al., 2020). In other words, the overall environmental impact of non-vegetarian diets is higher than vegetarian diets by about 60% (Rabès et al., 2020; Hatjiathanassiadou et al., 2023). In that sense, available evidence indicated that a change in global diet patterns could result in up to a 50% reduction in GHG emissions (Hallström et al., 2015).

At present, there are numerous efforts to reduce the environmental burden via sustainable production throughout the agricultural spectra (Austgulen, 2014; Hallström et al., 2015). However, for sustainable food production and consumption to gain momentum, demand and awareness are needed at the consumer level. A recent systematic review indicated that consumers lack essential knowledge about food-related sustainability and that food choice factors such as price, taste, and health remain more important than sustainability (van Bussel et al., 2022). Moreover, while studies show that consumers may embrace certain aspects of sustainable diets, they remain reluctant to others (Culliford and Bradbury, 2020; Garcia-Gonzalez et al., 2020). Therefore, shifting to sustainable diets or more plant-based diets can be challenging and will require multiple actions to improve the food systems, increase awareness among populations, and subsequently encourage them to change their dietary habits.

The UAE is a country in the Middle East region with a population of around 10 million (Data Commons, 2020). The UAE recognizes the importance of sustainability and is a strong advocate of achieving the SDGs by launching initiatives and programs aimed at reaching each goal. It also places a significant emphasis on the consumption of healthy sustainable diets via sustainable food systems and is working aggressively toward achieving this goal (FAO, 2021). For instance, the UAE has established the National Food Security Strategy 2051 aiming to implement resilient agriculture practices that boost output and productivity while supporting ecosystem maintenance and overall achieving the SDG 'zero hunger' (UAE Government Portal, 2023). Although the UAE may not contribute greatly to the global ecological footprint directly via food production, consumption patterns and the attitudes of its population would indirectly impact the ecological food burdens of the countries it imports food from.

Keeping the above literature into perspective regarding food and its associated ecological footprint and in efforts to push toward more sustainable food production, it is imperative to determine the attitudes of the population toward the subject. Therefore, this study aimed to assess the consumption behavior of people in the United Arab Emirates (UAE) concerning sustainability and determine factors that contribute to sustainable food choices.

2 Materials and methods

2.1 Study design and participants

A cross-sectional web-based survey was conducted between March and June 2022 to investigate patterns of sustainable consumption behavior among people in the UAE. A convenient, snowball sampling method was used. The survey was disseminated on several social media platforms (Facebook™, Twitter™, WhatsApp™, Instagram™) and participants were encouraged to share the survey link with their contacts. Any participant aged 18 and above residing in any of the seven emirates of the UAE was considered eligible to take part in the study. The first page of the questionnaire contained a clear explanation of the objectives and purpose of the study. Participation in the study was completely voluntary and anonymous, and participants were free to withdraw from the study at any point. A consent form appeared below the information sheet and consenting participants were then directed to fill out the online survey. The study protocol obtained ethical approval from the Research Ethics Committee at the University of Sharjah (Number: REC-22-03-08-02-S). An electronic informed consent form was obtained from all participants.

The minimum sample size was calculated based on Cochran's formula for observational studies with a confidence interval of 99%:

$$N = z^2 \times P \times (1 - P) / e^2$$

Where z = 2.576; P = (estimated proportion of the population that presents the characteristic) = 0.5; e (margin of error) = 0.05; N (sample size) = 664 participants, plus 20% = approximately 797 participants.

2.2 Survey questionnaire

The survey questionnaire was adapted from previous similar research on sustainable food choices among consumers in Finland (Lehikoinen and Salonen, 2019). The original questionnaire was available in English and was translated into Arabic and back-translated to English by qualified translators to guarantee parallel-form reliability. Three bilingual experts compared the two versions for accuracy and consistency and any discrepancies were solved with mutual discussion. The final questionnaire (English and Arabic) was prepared using Google Forms to allow online dissemination. A pilot study was then performed on 15 individuals to evaluate response time and clarity and comments given for further improvement were taken into consideration. Data from the pilot testing was not included in the final analysis. The questionnaire took approximately 10 to 15 min to complete. The Alpha Cronbach factor was used to evaluate the reliability of the questionnaire which indicated good reliability (Cronbach's alpha coefficient = 0.87).

The survey was a semi-structured questionnaire and consisted of 19 items divided into three main sections. The first section was comprised of eight items related to socio-demographic characteristics including sex, nationality, emirate, age, marital status, employment status, household income, and educational level. The second section included nine items related to sustainable food choices. The participants were provided with nine statements in which they were asked to respond to a 5-point Likert scale (Response options: 1 = Strongly disagree; 2 = Disagree; 3 = Neutral; 4 = Agree; 5 = Strongly agree). The statements in this section focused on three broad categories related to sustainable food options; (United Nations Environment Programme, 2022) motivation for food consumption (Myers et al., 2017), environmental awareness of food choices, and (Berry et al., 2015) activity to influence food consumption. The last section comprised two questions to investigate the main reasons for avoiding the consumption of red meat and preferring plant-based diets (Lehikoinen and Salonen, 2019). Participants who responded "Yes" to any of the two statements were an open-ended question to provide the reason for their answer "If your answer was "yes" please state why."

2.3 Statistical analysis

Descriptive analyses were used to describe sociodemographic characteristics and statements related to sustainable food choices. These were presented using frequencies and percentages for categorical data and mean (standard deviation, SD) for continuous variables. Independent t-test and one-way ANOVA tests were used to investigate the differences in the level of agreement of the sustainable food statements among different sociodemographic groups (based on a 5-point Likert scale ranging from 1 to 5). For the open-ended questions, participants' answers were filtered and clustered into eight different categories; health and nutritive value, personal preferences (dislike, like, taste, texture), vegetarian, weight control, environmental and ethical concerns (climate, sustainability, animal welfare), diet diversity (balanced intake of different food groups), origin (food origin, organic), and meal replacement (replacing food item with alternatives). Data were analyzed using SPSS software, version 26.0 (SPSS, Chicago, IL, United States). A value of p of <0.05 was considered statistically significant.

3 Results

3.1 Participants profile

A total of 1,113 participants completed the survey. The general characteristics of the study population are presented in Table 1. The majority of the participants in this study were females (61.2%), single (60.4%), and expatriates (80.5%). About two-thirds of the participants aged 18–30 years (65.7%). About half of the participants were employed (50.2%) and the household income of around a third of the participants (37.1%) was less than 10,000 AED (2,722 USD). More than two-thirds of the participants either earned a diploma or a university degree (70.9%).

TABLE 1 Sociodemographic characteristics of participants (n = 1,113).

Characteristics	n	(%)
Sex		
Female	681	61.2
Male	432	38.8
Age (year)		
18–30	731	65.7
31–40	188	16.9
41–50	133	11.9
>50	61	5.5
Nationality		
Emirati	217	19.5
Non-Emirati Expatriate	896	80.5
Marital status		
Married	441	39.6
Single	672	60.4
Educational level		
High school or less	184	16.5
Diploma/university education	789	70.9
Higher education (Masters/Ph.D.)	140	12.6
Employment status		
Employed (full-time/part-time)	559	50.2
Unemployed (e.g., student or retired)	554	49.8
Household income (AED)[a]		
<10,000	413	37.1
10,000–<20,000	291	26.1
20,000–<30,000	184	16.6
≥30,000	225	20.2

AED, Arab Emirati Dirham. [a]1 USD = 3.67 AED.

3.2 Sustainable food choices among study participants

The mean (SD) for participants' agreement to the nine statements on sustainable food choices across three categories is shown in Table 2. These nine statements and their scores tackled sustainability in its multidimensional definition in terms of environmental friendliness, supporting local food production, concern about health impacts, and willingness to alter behavior.

Regarding motivation for personal food consumption, participants expressed a tendency toward trying new healthy and environmentally friendly foodstuffs (mean = 3.57 ± 1.04). However, there was a comparatively lower inclination and lack of agreement toward favoring plant-based foods (mean = 2.73 ± 1.07), and avoiding red meat consumption (mean = 2.39 ± 1.11). Regarding environmental awareness in food choices, the findings show a tendency toward favoring locally produced food and considering the origin of food while shopping (3.51 ± 0.95, and 3.45 ± 1.05 respectively). On the other hand, participants were neutral in terms of choosing a pro-climate meal (2.91 ± 1.00). For the last category concerning actively influencing food choices, participants showed slight agreement with the statements 'I change my eating habits as I get more information' (3.50 ± 0.99) and 'I actively influence what I eat' (3.30 ± 0.97), but were less in agreement with the statement 'I try to minimize the environmental cost of my diet' (3.19 ± 1.01).

3.3 Differences in sustainable food choices between groups

The scores for the preference for sustainable food choices differed significantly between certain sociodemographic groups as shown in Table 3. With regards to avoiding red meat, significant differences were observed among different sex and age groups. Females and older adults were significantly more likely to avoid red meat ($p = 0.002$ and $p = 0.001$ respectively). Favoring plant-based diets was significantly more evident among older participants (>50 years), and those with higher education levels ($p = 0.020$ and $p < 0.001$ respectively). Moreover, we observed that the interest in choosing a pro-climate meal increased significantly with age ($p < 0.001$), and education level ($p = 0.001$), and was more evident in married participants ($p = 0.004$). However, the interest decreased with increasing household income ($p = 0.022$). The participants' willingness to reduce the environmental impact of their diet increased significantly with age, however, decreased among participants who were above 50 years old ($p < 0.001$). Similarly, older adults were more active in influencing their diet and changing their diet upon receiving new information than other age groups ($p = 0.001$), while younger participants were more passive toward that. The origin of food was of most importance to older adults ($p = 0.001$), married participants ($p < 0.001$), as well as those with a higher educational level ($p = 0.039$). Favoring locally produced food differed significantly between all studied groups except for sex. Older adults ($p = 0.041$), local citizens ($p = 0.001$), married participants ($p = 0.014$), and those with higher education levels ($p = 0.001$) had a significantly higher preference for locally produced food. This was also more evident in participants with a moderate household income (10,000–<20,000 AED; $p = 0.042$). Regarding participants' willingness to try new healthy and environmentally friendly food, no statistically significant difference was observed between groups except for females ($p = 0.005$) and those with a higher education level ($p = 0.004$). In all nine statements regarding sustainable food choices, employment status did not have any significant impact among participants.

3.4 Food choices reasons

To further investigate the reasoning behind food choices among participants, two open-ended questions were asked concerning favoring plant-based meals and avoidance of red meat. Only one-fifth of the participants (21.2%) stated that they avoided red meat while a similar percentage (23.1%) stated that they preferred a plant-based diet (Figure 1). The participants' answers to the following question "Why?" were clustered into several themes as shown in Figure 2. The most common reasons stated by the participants to favor plant-based meals were related to 'health and nutritive value' (66.5%), followed by personal preference (11.9%) and environmental and ethical concerns (8.8%). Other less common reasons included weight control, being vegetarian, diet diversity, and the origin of food. As for avoidance of consuming red meat, personal preference was the most common reason (41.9%) followed by health and nutritive value (39.5%) and being vegetarian (8.3%). Other less common reasons included environmental and ethical concerns, meal replacement, and weight control.

Overall, the participants believed that red meat was harmful to their cardiovascular health, especially after a certain age (in comparison to white meat). On the other hand, based on participants'

TABLE 2 Mean scores of the participants to the nine statements related to sustainable food choices ($n = 1,113$).

Category	Statement	Mean	SD
Motivation for personal food consumption	1 I like to try new healthy and environmentally friendly foodstuff	3.57	1.04
	2 I favor a plant-based diet	2.74	1.07
	3 I avoid eating red meats	2.40	1.11
Environmental awareness in food choices	4 I favor locally-produced food	3.51	0.95
	5 I consider the origin of food while shopping	3.45	1.05
	6 I choose a pro-climate meal in a restaurant	2.91	1.00
Activity to influence food consumption	7 I change my eating habits as I get more information	3.50	0.99
	8 I actively influence what I eat	3.29	0.97
	9 I try to minimize the environmental cost of my diet	3.19	1.01

TABLE 3 Differences in sustainable food choices among different sociodemographic groups (n = 1,113).

Statement[a]	1	2	3	4	5	6	7	8	9
Variable									
Sex									
Female	2.5 ± 1.1	2.8 ± 1.0	2.9 ± 1.0	3.2 ± 1.0	3.3 ± 0.9	3.5 ± 1.0	3.5 ± 0.9	3.5 ± 0.9	3.6 ± 1.0
Male	2.3 ± 1.1	2.7 ± 1.1	2.9 ± 1.1	3.2 ± 1.1	3.3 ± 1.0	3.4 ± 1.1	3.4 ± 1.1	3.5 ± 1.0	3.5 ± 1.1
p-value[b]	0.002	0.332	0.759	0.213	0.296	0.284	0.173	0.543	0.005
Age (year)									
18–30	2.3 ± 1.1	2.7 ± 1.0	2.8 ± 1.0	3.1 ± 1.0	3.2 ± 1.0	3.3 ± 1.0	3.4 ± 1.0	3.5 ± 0.9	3.6 ± 1.0
31–40	2.4 ± 1.1	2.8 ± 1.1	3.0 ± 1.0	3.4 ± 1.1	3.3 ± 1.0	3.6 ± 1.0	3.5 ± 1.0	3.6 ± 1.0	3.5 ± 1.1
41–50	2.5 ± 1.1	2.8 ± 1.1	3.2 ± 1.0	3.4 ± 0.9	3.5 ± 0.9	3.8 ± 1.0	3.7 ± 0.9	3.7 ± 1.0	3.7 ± 1.0
>50	2.9 ± 1.2	3.1 ± 1.2	3.2 ± 1.2	3.3 ± 01	3.6 ± 1.1	3.7 ± 1.1	3.8 ± 1.2	3.7 ± 1.0	3.6 ± 1.2
p-value[c]	0.001	0.020	<0.001	<0.001	0.001	<0.001	0.001	0.041	0.240
Nationality									
Emirati	2.4 ± 1.2	2.7 ± 1.1	2.9 ± 1.0	3.2 ± 1.0	3.2 ± 1.0	3.5 ± 1.6	3.4 ± 1.0	3.7 ± 0.9	3.6 ± 1.0
Non-Emirati Expatriate	2.4 ± 1.1	2.8 ± 1.1	2.9 ± 1.0	3.2 ± 1.0	3.3 ± 1.0	3.4 ± 1.0	3.5 ± 1.0	3.5 ± 1.0	3.6 ± 1.0
p-value[b]	0.912	0.334	0.711	0.827	0.1998	0.195	0.237	0.001	0.794
Marital status									
Married	2.5 ± 1.1	2.8 ± 1.1	3.0 ± 1.0	3.2 ± 1.0	3.4 ± 1.0	3.6 ± 1.0	3.6 ± 1.0	3.6 ± 1.0	3.6 ± 1.0
Single	3.4 ± 1.1	2.7 ± 1.1	2.8 ± 1.0	3.2 ± 1.0	3.3 ± 1.0	3.4 ± 1.1	3.5 ± 1.0	3.5 ± 0.9	3.6 ± 1.0
p-value[b]	0.178	0.116	0.004	0.229	0.117	<0.001	0.057	0.041	0.897
Educational level									
High school or less	2.3 ± 1.4	2.7 ± 1.1	2.9 ± 1.0	3.2 ± 1.0	3.2 ± 0.9	3.5 ± 1.0	3.5 ± 1.0	3.6 ± 0.9	3.7 ± 1.1
Diploma/Bachelor's	2.4 ± 1.1	2.7 ± 1.1	2.9 ± 1.0	3.2 ± 1.0	3.3 ± 1.0	3.4 ± 1.1	3.5 ± 1.0	3.5 ± 1.0	3.5 ± 1.0
Higher education	2.6 ± 1.3	3.1 ± 1.1	3.2 ± 1.0	3.4 ± 1.1	3.4 ± 1.0	3.7 ± 1.1	3.7 ± 1.0	3.7 ± 1.1	3.8 ± 1.0
p-value[c]	0.104	<0.001	0.001	0.144	0.206	0.039	0.62	0.001	0.004
Household income (AED/month)									
<10,000	2.4 ± 1.0	2.8 ± 1.0	3.0 ± 1.0	3.3 ± 1.0	3.3 ± 0.9	3.5 ± 1.0	3.5 ± 0.9	3.5 ± 0.9	3.6 ± 1.0
10,000-20,000	2.4 ± 1.2	2.7 ± 1.2	2.8 ± 1.0	3.1 ± 1.1	3.2 ± 1.1	3.5 ± 1.1	3.6 ± 1.0	3.7 ± 1.0	3.6 ± 1.0
20,000-30,000	2.5 ± 1.2	2.8 ± 1.1	2.9 ± 1.0	3.2 ± 1.0	3.3 ± 1.0	3.4 ± 1.0	3.5 ± 1.0	3.4 ± 0.9	3.5 ± 1.0
≥30,000	2.4 ± 1.1	2.7 ± 1.1	2.8 ± 1.0	3.1 ± 1.0	3.3 ± 1.0	3.5 ± 1.0	3.4 ± 0.0	3.5 ± 1.0	3.6 ± 1.0
p-value[c]	0.598	0.324	0.022	0.315	0.646	0.825	0.301	0.042	0.625

[a]Statements; 1: I avoid eating red meats, 2: I favor a plant-based diet, 3: I choose a pro-climate meal in a restaurant, 4: I try to minimize the environmental cost of my diet, 5: I actively influence what I eat, 6: I consider the origin of food while shopping, 7: I change my eating habits as I get more information, 8: I favor locally produced food, 9: I like to try new healthy and environmentally friendly foodstuff. [b]p-value was based independent T-test at a 5% level. [c]p-value was based on a one-way ANOVA test at a 5% level.

responses to the open-ended questions, a plant-based diet is associated with more nutrients, a lower amount of energy and fat, and more fiber. Very few participants were concerned about the origin of food and the environment and ethics associated with red meat avoidance and adoption of a plant-based diet. Answers that were categorized under "origin" as the reason for avoiding red meat were "I prefer organic meat," "I prefer locally produced food," and "I do not trust the source of meat available in markets."

4 Discussion

This study aimed to assess the consumption behavior of people in the UAE regarding sustainability and investigate differences in their sustainable food choices. Overall, the findings indicate that the participants had a slight inclination toward positive specific behaviors (e.g., trying new healthy and environmentally friendly foodstuffs) while maintaining a neutral stance on others.

The demand for healthy, nutritious food is ever-increasing due to the surge in the global population over the last few decades and the growing awareness of consumers (Dwivedi et al., 2017; Bellamy et al., 2023). In the present study, willingness to try new healthy and environmentally friendly food, was most important to our participants, while, two of the core dietary factors in favor of sustainable diets were the least important according to our participants, that is avoiding red meats and favoring plant-based meals. This was in contrast to a similar study in Finland where favoring local food, actively influencing food choice and the

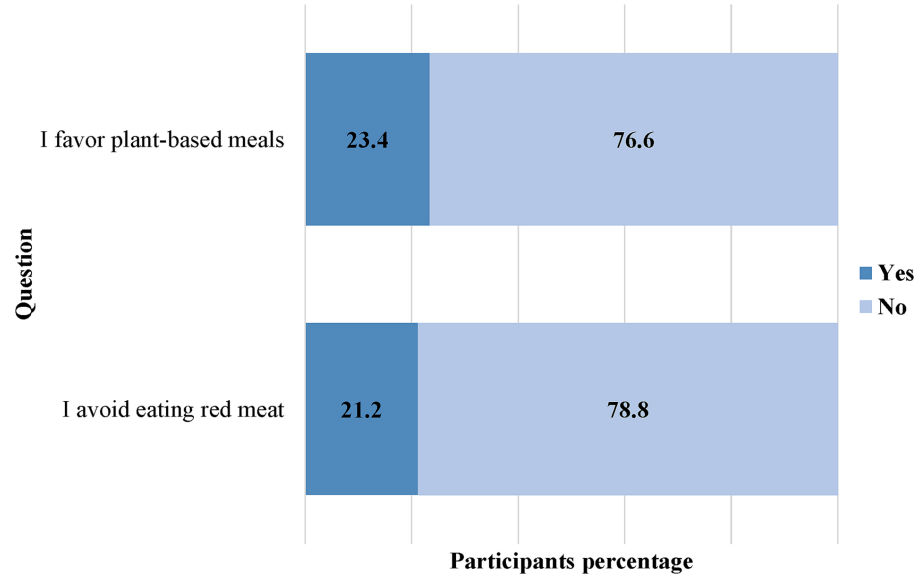

FIGURE 1
Proportion of participants answering "Yes" to "I avoid eating red meat" and "I favor plant-based meals".

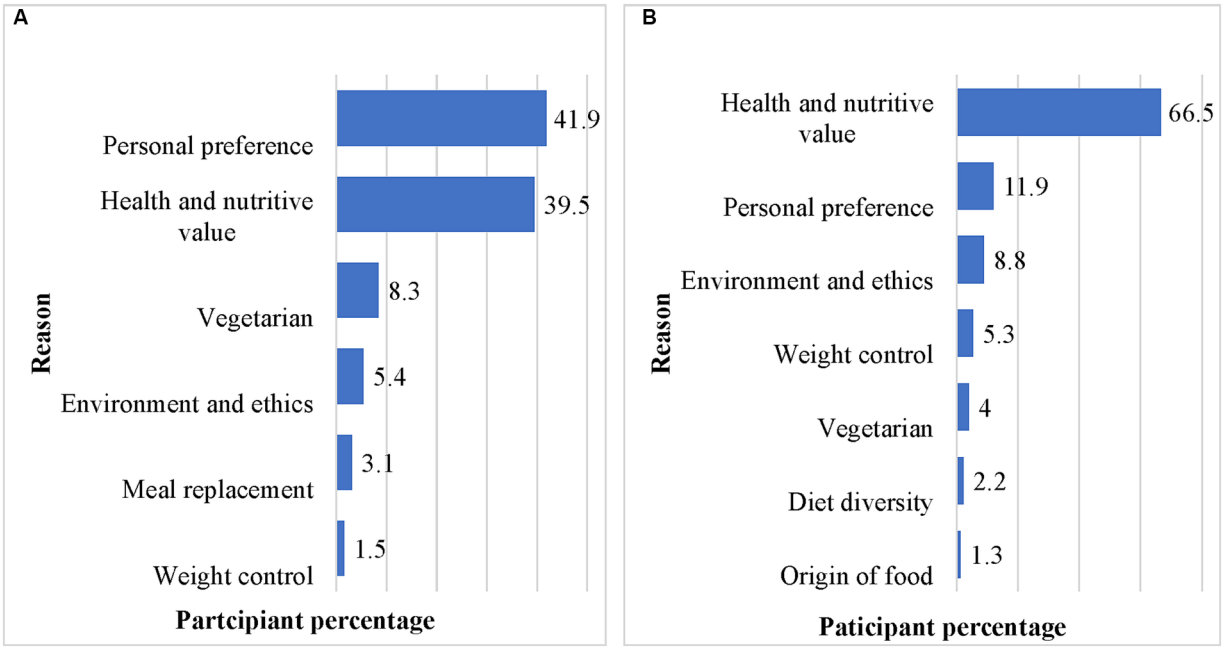

FIGURE 2
Main reasons for **(A)** avoiding eating red meat (n = 202) and **(B)** favoring plant-based diets (n = 232).

origin of food was most important to consumers (Lehikoinen and Salonen, 2019). Food consumption nowadays surpasses the sole need for survival as it comprises a person's preferences, choices, and attitudes toward food. Our findings suggest that while the participants may have positive attitudes toward environmental sustainability in terms of food consumption, a remarkable gap possibly exists between positive attitudes and actual sustainable behaviors. In addition, this may suggest limited awareness of the distinct association between food consumption and environmental consequences. This attitude-behavior gap has been discussed widely in available literature (van Dam and van Trijp, 2013; Aschemann-Witzel and Zielke, 2017; Eldesouky et al., 2020) and in a recent study among young adults in the UAE, where sustainable behaviors were not reflective of the favorable knowledge and attitudes toward sustainable diets (Hashim et al., 2023). This highlights the importance of taking serious measures to increase consumer awareness and adoption of more sustainable behaviors.

There is no doubt that food links human and environmental health; as unfavorable dietary habits are key contributors to the onset of several chronic diseases (Afshin et al., 2019), and that food production within the food systems is one of the main drivers of environmental change (Vermeulen et al., 2012). Meat is an essential component of Arab cuisine and available data from a study by the Ministry of Foreign Trade in the UAE indicated that meat consumption *per capita* in the country was 1.2 times higher than the global average in the year 2020 with an average of 78 kg compared to 63 kg globally (MOEC, 2021). Dietary habits are particularly difficult to alter as they are a core part of one's lifestyle and socio-cultural milieu (Sonestedt et al., 2005; Carrus et al., 2018), and are the most important to tackle to warrant a sustainable environment. Sustainable food choices require a gradual shift from animal-based protein sources to plant-based sources (Dwivedi et al., 2017) due to the greater environmental burden of meat (especially red meat) over plant-based sources (Helms, 2004). In the present study, we observed that females and older adults were significantly more likely to avoid eating red meat and willing to try new healthy and environmentally friendly food. These findings follow several studies indicating that women are generally more health-conscious and mindful when it comes to sustainable food purchasing decisions (von Meyer-Höfer et al., 2015; Hartmann and Siegrist, 2017; Lemken et al., 2019). Moreover, in a large prospective cohort study conducted in France, it was observed that older people were more likely to consume seafood rather than meat as compared to their younger counterparts (Touvier et al., 2010). This could be mainly due to the decline in appetite and the increasing concern for various diseases associated with aging. Hence, older people are more likely to choose healthy meat options (e.g.: seafood/white meat) as compared to red meat which is associated with various diseases like cancer, cardiovascular disease, etc. (Olsen, 2003; Lippi et al., 2015; Farvid et al., 2021; Fluitman et al., 2021).

In the present study, older adults were significantly more likely to favor plant-based meals than their counterparts. This contrasted with other studies which indicated that younger consumers are more willing to try and consume plant-based meals than older people (Vainio et al., 2016; Clark and Bogdan, 2019). Moreover, highly educated participants were also more likely to favor plant-based meals in the present study. Findings from a population-based cross-sectional survey in Switzerland showed that higher education levels are associated with a higher tendency toward vegetarianism and that the preference for a plant-based diet is most likely related to a higher awareness level (Wozniak et al., 2020). Consumers with higher education are therefore expected to be more aware of the health benefits and environmental impact of a plant-based diet as compared to less educated people (Lehikoinen and Salonen, 2019; Śmiglak-Krajewska et al., 2020).

Changing personal values through education and social influence may have a strong impact on changing behaviors (Vermeir and Verbeke, 2008; Warner et al., 2013). In a review article on effectively encouraging consumers to opt for sustainable food options, several promising interventions were discussed such as the use of environmentally specified labels on food and providing information to the public via text messages, pictures, or interactive quizzes (Abrahamse, 2020). These interventions along with other innovative ones should be explored to enhance consumers' awareness and facilitate behavior change.

Our data show that participants who were less than 30 years old were less interested in choosing pro-climate meals. This may indicate a lower level of awareness or interest concerning sustainability and the environmental impact of food consumption. This differs from other studies where young consumers were considered more environmentally conscious and more willing to adopt sustainable food behaviors (Fernández-Manzanal et al., 2007). This implies the need for wide-scale studies among young consumers in the UAE to investigate their level of environmental awareness and their attitude toward sustainable diets. Moreover, our findings indicated that married participants were more likely to be interested in purchasing pro-climate meals in a restaurant and that the origin of the food mattered to them. In a study in the United States, married participants were more likely to purchase sustainable foods compared to single ones, however, single participants had higher confidence in their ability to purchase them (Robinson and Smith, 2002). Furthermore, those with lower reported income in the present study were more interested in choosing pro-climate meals than their counterparts. Aside from environmental concerns, sustainable meals are generally more affordable (Hwalla et al., 2021). A recent study among Portuguese consumers found that non-vegetarian consumers spend almost 1 to 1.5 times more than other consumers who were pescatarians or vegans for example (Pais et al., 2022). Therefore, plant-based and pro-climate meals are not only healthy and sustainable, but they are also less expensive.

In the current study, older participants were more likely to influence what they eat and willing to reduce the environmental impact of their diet. Once again, beyond the sustainable diets paradigm, this could be because, with age, humans tend to become picky eaters (Nielsen et al., 2018), and their food choices evolve due to factors such as hygiene, nutrition, health, and flavor (Kim and Lee, 2016). Furthermore, the origin of food and locality mattered the most to older adults, married participants, and those with higher education levels. Locally produced food may be a more sustainable option compared to imported food due to the decreased transport-related greenhouse gas emissions (Shindelar, 2015). Previous studies suggest that consumers are usually willing to pay a higher price for quality local food that is produced sustainably (Annunziata and Vecchio, 2016; De-Magistris and Gracia, 2016). The local food preference in this study was greater than in a study conducted in Italy where about 23% of the population stated that it was important to them that the food is locally produced (Annunziata and Vecchio, 2016). One reason for the variation in the observation could be the trust placed by the public in the quality of locally produced foods. The UAE government encourages sustainable farming and ensures that the products and production strategies are in line with international standards (Al Qaydi, 2016). These observations should encourage local farmers in the UAE to adopt sustainable growing practices despite the challenges that may be posed by the harsh environmental conditions.

In light of understanding the impact of what people eat on their health as well as the environment, the Food and Agriculture Organization (FAO) together with the World Health Organization (WHO) revised dietary guidelines to include sustainability dimensions (FAO and WHO, 2019). Many countries including Germany, Netherlands, and Qatar have also made efforts to review their dietary guidelines to address the environmental impact of food consumption as per the local context (Seed, 2015; Brink et al., 2019; Schäfer et al., 2021). It has been suggested that the Mediterranean Diet (MD) with its emphasis on fruits and vegetables, more plant-based foods, and less red meat consumption, may have a lower impact on the environment compared to other Western or

high-protein diets (Grosso et al., 2020; Yacoub Bach et al., 2023). Moreover, a study in the UAE revealed an inverse association between the environmental footprint and adherence to the MD (Naja et al., 2022). With that in mind, promoting such diets should be considered as a strategy with dual benefits to human health and the environment.

To promote the projected sustainable transition, it is crucial to investigate the reasons behind dietary choices and why people eat what they eat. Understanding these factors especially those concerned with avoiding red meat and including more plant-based sources of food in one's diet is key to establishing interventional approaches and effective policies (Hielkema and Lund, 2021; Martinelli and De Canio, 2021). In the present study, we aimed to take a closer look into the reasons for the participants' choices in a fraction who stated that they avoided red meat and preferred plant-based meals. According to our results, it seems that adopting these behaviors is more related to health and personal preference rather than concerns about the environment. Healthiness in the context of nutritive value and health implications of food as seen in our results is a well-established reason for favoring plant-based foods among people (Miki et al., 2020). However, while ethical and environmental reasons and considerations of animal welfare can be other motivators for people to adopt more plant-based diets (Vainio, 2019; Estévez-Moreno et al., 2021), personal preference for meat due to its taste or its perceived naturalness remains a barrier as seen in the present study.

The reluctance to avoid red meat consumption was apparent in our study, where participants were not in agreement with the statement "I avoid eating red meat." A pivotal factor in shaping and transforming consumer behavior toward sustainable diets is an understanding of meat attachment, a notion that encompasses positive feelings about meat eating across dimensions such as hedonism, affinity, dependence, and entitlement (Graça et al., 2015). Studies examining diverse countries and behavior change phases, respectively, revealed a consistent pattern: higher levels of meat attachment correlate with a reluctance to reduce meat intake and a stronger inclination toward frequent meat consumption (Szczebyło et al., 2022; Gould et al., 2023). Moreover, recent research provided insight into the association of a higher level of meat attachment with a lower level of trust in substitute protein sources, which may hinder their uptake among consumers who have a strong meat attachment (Kühn et al., 2023). Neophobia is emerging as another pressing barrier in considering novel plant-based meat alternatives among consumers (Faria and Kang, 2022). Meat neophobia was found to predict consumers' willingness to try new foods, including insect-based snack bars. Moreover, the complexities of attitudes toward novel foods are highlighted by how food neophobia interacts with aspects of masculinity, animal empathy, as well as disgust sensitivity (Çınar et al., 2021). This means that tailored interventions and a deep understanding of individual preferences are needed to effectively promote sustainable dietary modifications.

There is no doubt that this study has several limitations. The present study followed a cross-sectional web-based methodology, and the nature of convenient sampling may have hindered the representativeness of the results to the whole population. Moreover, the nature of the items in the survey might have influenced the participants' real answers in terms of good or bad food choices in the items 'I avoid eating red meat' and 'I favor plant-based meals'. Given the self-administered nature of the questionnaire, there could have been a variance in the interpretation of certain questions terminology among the participants. Another limitation is that while the findings of the study enriched the literature with data on the promising sustainable shift, it did not venture real purchasing or consumption behavior among consumers. Despite its limitations, the present study provides key insights into the sustainable food consumption choices of consumers in the UAE and indicates the mere potential of adopting more sustainable diets. Moreover, this study is the first of its kind to assess sustainable food choices among consumers and the motives behind these choices in the UAE and the Arab region in general.

5 Conclusion

The present study identified several gaps in knowledge among the participants. Although the study sample did not greatly adopt sustainable food choices, there was an inclination toward exploring environmentally friendly dietary options. Sociodemographic factors such as income, sex, marital status, and age all had a significant impact on the choices related to sustainability. Overall, females, older adults, and highly educated people aligned themselves with more sustainable potential practices. Factors related to the avoidance of meat and preference for plant-based diets were mostly related to health and personal preference. However, the impact of food on the environment was not a very prominent driving factor in their food choice. Older age in the present study was significantly associated with almost all sustainable food choices.

6 Future considerations

Future nationwide research is essential to better understand sustainable food choices among consumers and the factors that would stimulate sustainable practices. Education and awareness programs are central to achieving a more sustainable future and investing in the youth sets the outline of the achievement of the SDGs in the country. The introduction of innovative syllabi at educational institutes that ingrain all aspects of sustainability is desperately needed. Providing sustainable options at affordable prices and good taste besides spreading awareness regarding sustainable food production would aid in wholesome environmental protection. We finally recommend that governments should develop policies and integrate sustainability aspects within dietary guidelines to promote healthy, sustainable, and affordable diets to enhance food security and evade health threats for the present and future generations. Strategic plans to modify dietary patterns therefore should not be limited to modifying consumer awareness and behavior alone but should engage all stakeholders involved in the operation of food systems.

Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Ethics statement

The studies involving humans were approved by the Research Ethics Committee at the University of Sharjah (Number: REC-22-03-08-02-S). The studies were conducted in accordance with the local

legislation and institutional requirements. The participants provided their written informed consent to participate in this study.

Author contributions

LCI: Conceptualization, Formal Analysis, Investigation, Writing – original draft, Writing – review & editing. MH: Conceptualization, Investigation, Writing – review & editing. TO: Writing – review & editing. MF: Writing – review & editing. FN: Writing – review & editing. HR: Writing – review & editing. FH: Writing – original draft. SS: Formal Analysis, Investigation, Writing – original draft. RR: Investigation, Writing – review & editing. RD: Investigation, Writing – review & editing. LS: Writing – review & editing. AD: Writing – review & editing. HH: Writing – review & editing. RO: Writing – review & editing.

Funding

The author(s) declare that no financial support was received for the research, authorship, and/or publication of this article.

Acknowledgments

The authors would like to thank the University of Sharjah for providing the necessary infrastructure and support to conduct the study.

Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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