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Are Emirati consumers in United Arab Emirates open to alternative proteins? Insights into their attitudes and willingness to replace animal protein sources

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Introduction: Replacing animal protein with alternative sources is gaining popularity for sustainable food systems and reducing greenhouse gas emissions. Understanding consumers' views on alternative proteins is crucial for widespread adoption. Research shows acceptance and preferences vary across cultures, but there is no data for the United Arab Emirates (UAE). This study investigates the influence of dietary habits, objective knowledge, attitudes, subjective norms, and perceived behavioral control on willingness to replace meat with alternatives by Emiratis. Further, the factors that drive willingness to replace meat are investigated.

Methods: An online survey with 1,666 native UAE nationals assessed their knowledge, attitudes, and acceptance of plant-based proteins, microalgae, edible insects, and cultured meat. In the study, Emirati citizens between the ages of 18 and 65, who have resided in the UAE for most of their lives, were selected. A total of 1,666 out of 2,600 individuals who expressed interest participated in the study. Data was analyzed using Pearson Chi-square to correlate two demographic variables and linear regression to identify predictors that influence the participants to shift toward alternative proteins.

Results: About 51.2% of Emiratis were familiar with alternative proteins, with 74% preferring plant-based options. Using linear regression model, the following were factors influencing willingness to replace meat: (i) meat, dairy and cereal attachment, (ii) sustainability awareness, (iii) awareness of alternative proteins, (iv) nutrition consciousness, (v) availability of alternative proteins, (vi) taste of alternative proteins products, and (vii) advertisement. Sustainability concerns alone did not drive purchases, but focusing on sensory qualities and advertising could lead to a shift.

Discussion: Our findings bring insights on the knowledge, attitude, and determinants of willingness of native Emiratis toward the purchase and replacement of meat with "alternative proteins-based" food products. The successful shift to alternative proteins will depend on enhancing consumer sensory satisfaction, cost, doubts, health, and cultural significance. This study indicates that Emiratis consume animal proteins on a regular basis, leading us to classify them as individuals with a high meat intake. Incorporating plant-based

proteins into food design shows promise for promoting sustainable diets in the UAE and beyond.

KEYWORDS

sustainable diets, alternative proteins, theory of planned behavior, willingness, attitudes, meat replacement

1 Introduction

Food security (FS) is a concern worldwide because of its impact on economies, population health, and quality of life (Manikas et al., 2022). Food security is achieved when its delivery is through modus that preserves the environment, economic and social bases of future generations (Nguyen, 2018; Fischbach, 2018). In the Middle East and United Arab Emirates (UAE) included, FS is adversely affected by, among others the scarcity of freshwater, harsh environment, rising temperatures and import restrictions (Fischbach, 2018; El Bilali and Ben Hassen, 2020). Even though, the UAE is regarded as food secure owing to its economic and political stability, it still must address sustainability and food security challenges in the face of climate change (Fischbach, 2018). Moreover, the reliance on international markets for 80–90% of its increased food needs (even at high costs) results in sustainability sourcing challenges, hence persistent food insecurity (El Bilali and Ben Hassen, 2020; Holden et al., 2018).

The growing demand for food in the UAE is attributed to the overall population growth due to the influx of tourists and expatriates, therefore, strategic policies to promote long-term food security are required (Fischbach, 2018). Adoption of healthy and sustainable diets is one such strategy, characterized by consumption of less animal-derived and increased plant-based foods (e.g., alternative proteins) (Fanzo, 2019; Biasini et al., 2021). In addition, poor dietary habits in the region have played a significant role in the prevalence of diet-related non-communicable diseases, straining healthcare systems and diminishing the wellbeing of many individuals (Bahn et al., 2019; Al-Jawaldeh et al., 2020). This is evidenced by the excessive intake of processed meat, red meat, trans fats, sugary drinks, and sodium, along with inadequate consumption of fruits, vegetables, legumes, nuts, whole grains, and omega-3 fatty acids from seafood which are considered beneficial to health. Furthermore, Bahn et al. (2019) analyzed the impact of current and recommended consumption levels on the environment and nutrition in 17 Middle East and North Africa (MENA) countries. By calculating the footprints of different food groups, it was found that reducing red-meat consumption would lead to savings in all four footprints. On the other hand, increasing the consumption of vegetables/beans, nuts/seeds, and fruits would result in net expenditure in those footprints. Thus, animal protein (i.e., meat, eggs, fish, and dairy) replacement with alternative sources (e.g., plant-based, micro algae, edible insects, and cultured meat) (Hartmann and Siegrist, 2017; van der Weele et al., 2019) is encouraged. Unfortunately, animal protein accounts for the large proportion of the total protein consumption across the globe compared to the smaller portion of plant-based protein (Lemken et al., 2019). Conveniently, the benefits of alternative protein sources have been investigated (Hartmann and Siegrist, 2017; van der Weele et al., 2019) and, nutritionally, some of these outperform animal-based protein, though with slightly lower protein quality (Parodi et al., 2018; Floret et al., 2023). In addition, some trends toward eating less meat have been observed in western

populations and they are labeled as meat-reduced diet, flexitarians, semi-vegetarianism and conscious omnivores (Gómez-Luciano et al., 2019).

To enhance the consumption of meat substitutes, it is imperative to gather comprehensive information on the factors that drive and hinder various consumer groups from using these products. This will enable the generation of valuable input for the development and promotion strategies associated with product innovation.

2 Literature review

2.1 Knowledge and theoretical framework

The theory of planned behavior (TPB) has emerged as a highly influential theory in understanding human behavior since its inception (Ajzen, 2011). The fundamental principle of the TPB is a theoretical framework that proposes that consumer behavior is directly influenced by an individual's attitudes toward a specific behavior. The TPB explains how behavior, attitude, subjective norms, and behavioral control influence behavioral intentions (Ajzen, 1991). These attitudes can be either positive or negative evaluations of one's own performance in relation to that behavior. Additionally, the theory suggests that subjective norms, which refer to an individual's response to social pressure or the influence of significant others, play a significant role in shaping behavior. Furthermore, TPB emphasizes the concept of perceived behavioral control, which encompasses an individual's belief in their ability to perform the desired behavior (referred to as self-efficacy) as well as their perception of the ease or difficulty in engaging in that behavior.

This theory has found application in elucidating consumers' dietary choices, encompassing aspects such as plant based yogurt (Pandey et al., 2021), cultured meat adoption (Kouarfaté and Durif, 2023) and plant based meat alternatives (Bakr et al., 2023). In the realm of meat alternatives, the TPB provides insights into the perception and attitudes toward these diets and possible adoption. To illustrate, an individual's motivation or intention to reduce meat consumption may be influenced by their inclination toward environmental sustainability, as determined by societal values or the opinions of significant others regarding the avoidance of damage to the environment.

2.2 Transition toward sustainable alternative protein diets

According to Biasini et al. (2021), understanding consumers' behaviors is crucial for developing strategies necessary to influence transition toward sustainable diets at the individual and population level. Several studies have reported consumer perception, attitudes, and

acceptance of alternative protein products (Siddiqui et al., 2022; Anusha Siddiqui et al., 2022; Tso et al., 2020; Hartmann and Siegrist, 2017; Grasso et al., 2019; Gómez-Luciano et al., 2019). Chen and Antonelli (2020) summarized factors influencing food choices as food-related, individual differences, and society-related features. Additionally, the degree of acceptance of alternative proteins is dependent on preconceptions toward vegetarian diets, familiarity with meat substitutes, consumer awareness to sustainability and food insecurity, food fussiness, food neophobia and disgusts (*viz.* insect-based proteins), gender, social (economic) group, education, and motives of sensory quality (Gómez-Luciano et al., 2019; Collier et al., 2021; Birch et al., 2018; Lemken et al., 2019; Smith et al., 2017). Well-educated people had positive attitudes for meat alternatives (Hoek et al., 2011) and women had higher preference for alternative sources of protein than men (de Boer and Aiking, 2011). The influence of population's social norms and familiarity is evident in the study by Bryant and Sanctorum (2021) who reported a significant increase in the proportion of Belgians consuming already existing plant-based meat consecutively in 2 years. Similarly, plant-based protein was most accepted among other protein alternative sources through a consumer survey in five European Union countries (Grasso et al., 2019). In contrast, a large cluster of consumers drawn from New Zealand and Germany stated that they will not consider replacing meat with plant-based products (Halkjaer et al., 2009). The influence of economic class and sensorial attributes was evident in a three-way study in UK, Brazil and Spain, whereby higher economic groups indicated readiness to replace traditional meats (Gómez-Luciano et al., 2019). Comparable sensorial attributes were the most crucial factor influencing willingness to purchase alternative proteins rather than sustainability and health.

Since the transition toward meat replacement varies among consumers at individual and population level (Biasini et al., 2021; Onwezen et al., 2019; Gómez-Luciano et al., 2019), it is therefore necessary to investigate the context of native Emiratis in the UAE. This study therefore evaluates the knowledge, attitudes, and willingness of native Emiratis to substitute meat with four alternative proteins (*i.e.*, plant-based, micro algae, edible insects, and cultured meat). Based on the TPB assumptions and literature review, this study intended to examine the influence of dietary habits, objective knowledge, attitudes, subjective norms, and perceived behavioral control (self-efficacy on—willingness to replace meat with alternatives). Further, the factors that drive willingness to replace meat are investigated. This study is of

significance as to the best of our knowledge is the first study in the UAE, thus it adds to the body of existing knowledge. Moreover, knowledge on consumer requirements is key to apprehend opportunities for protein ingredients selection in food product design contributing to protein transition of Emirati consumers, the Middle East and beyond. Findings from this study will identify priorities for various stakeholders in the alternative protein value chain.

3 Materials and methods

3.1 Study design and participants sampling

A cross-sectional self-administered online survey of native UAE nationals representing the seven Emirates (Abu Dhabi, Ajman, Dubai, Fujairah, Ras Al Khaimah, Sharjah, and Umm Al Quwain) of UAE (Siemund et al., 2021) was conducted from January to April 2022. The study received ethical approval from the UAE University's Social Science Ethical Committee (ERS-2021-8445). Participants were recruited randomly through emails and social media (Facebook and WhatsApp groups) (Etikan et al., 2016). Online written consent was filled by the participants for their volunteer participation in this survey. Quotas such as age, gender, and nationality, were pre-set to ensure that the general population was represented. Emirati nationals aged 18–65 years, currently living and lived most of their life within UAE were included in the study. Out of 2,600 interested participants, 1,666 respondents were included in the study and they entirely completed the survey.

3.2 Survey tool and data collection

A structured questionnaire was created on Google Forms in English and Arabic based on the objectives of the study (Supplementary material 1). The questionnaire consisted of sections (Table 1) developed based on the study by Estell et al. (2021). The questionnaire included participant's socio-demographic data, dietary habits (*viz.* food fussiness and neophobia, motives of food choice and green eating behavior), knowledge, attitudes, and willingness to accept alternative protein sources (plant-based proteins, edible insects, algae and lab [cultured] meat). The questionnaire was piloted to 15

TABLE 1 Type of data collected using the structured questionnaire.

Activity	Description
Introduction	Introduction to survey and consent
Socio-demographic characteristics of participants	Marital status, gender, monthly income, education level and location
Dietary habits and motive of food choices of the participants	General consumer information on frequency and reasons for consumption of different foods, dietary regime possibility of constantly trying new foods, health and sustainability consideration when choosing food products
Knowledge, attitude, and willingness to accept alternative protein-based food products	Meaning of "Alternative proteins." Knowledge, attitude, and willingness to accept alternative protein-based food products. Knowledge of alternative proteins, familiarity with the four different types listed (plant-based, micro algae, edible insects, and cultured meat). Alternative protein preference, alternative protein consumption history, knowledge of the availability for sale in the UAE market
Factors that's affect purchasing habits	Opinion on role of alternative proteins in achieving food security in the UAE, risk perception, final comments on alternative protein-based food products

respondents to validate appropriateness of study aims, clarity of questions and presence of errors, and display of questionnaire in various devices. Feedback obtained was useful in improving the tool.

Prior to the survey, participants were informed of research intentions and that the survey data will be used for research purposes only. Moreover, the participants were assured that their participation would be kept confidential, and they had the freedom to withdraw from the study at any given point in time. All participants used a checkbox on the questionnaire to indicate their informed consent ([Supplementary material 2](#)). No reward was given for participation in the survey.

3.3 Data handling and statistical analyses

The data obtained from the study was imported from Google survey into excel and statistically analyzed using IBM SPSS statistics version 28 (SPSS Inc., Chicago, IL, USA). Cross tabulations and Pearson Chi-square test were performed to correlate two demographic variables and determine their independence from each other, respectively. Statistical significance was tested at the 5% level. The influence of each independent variable, i.e., demographic, dietary habit, knowledge, attitudes, and willingness on various dependent variables was analyzed using Pearson Chi-square analysis. In this study, the dependent variables were (i) which alternative protein-based food product are they willing to eat, (ii) probability of participants replacing animal-based protein with alternative proteins, (iii) awareness of the availability of alternative proteins-based food products, and (iv) intention to increase or decrease the consumption of meat and chicken.

Moreover, linear regression analysis was conducted to identify the significant predictors out of fifteen (15) variables that influence the participants' (i) decision to replace animal-based proteins with alternative protein and (ii) decision to purchase alternative protein products. Tested predictors were (a) educational level, (b) how often do you eat meat?, (c) how often do you eat dairy?, (d) how often do you eat cereals?, (e) health consideration, (f) awareness of sustainability, (g) awareness of alternative proteins, (h) following a dietary regime, (i) food neophobia, (j) nutrition, (k) family influence, (l) cost of alternative protein products, (m) ease of purchasing alternative protein products, (n) taste of alternative protein products, and (o) impact of advertisement.

4 Results

4.1 Demographic characteristics of respondents

The socio-demographic characteristics of the respondents are presented in [Table 2](#). Of the 1,666 respondents included in the study, the majority (80.9%) were female and 19.1% were male. The respondents aged between 18 and 24 yr. represented almost three-quarters (75.9%) of the survey respondents, showing that older people were underrepresented in this study. Of the seven Emirates, about half (45.6%) of survey respondents were from Abu Dhabi, followed by Ras Al Khaimah (19.9%) and Sharjah (12.7%). The education level of respondents varied from no education (0.6%), primary education

(0.5%), high school (39.1%), technical qualification/diploma (7.6%), college/undergraduate (47.4%), and postgraduate (4.9%), thus 99% of respondents were educated. Respondents comprised of different marital status, however, most of the participants (84.3%) were single. Approximately two-thirds of the respondents earned less than 5,000 AED (US\$ 1,361) monthly representing early career respondents.

4.2 Dietary habits of respondents

The dietary habits of respondents are presented in [Table 3](#) and [Figures 1A,B](#). The frequency of consumption of various food categories, i.e., meat and chicken, egg and dairy, fish and other seafood, vegetables, cereal, and legumes among the local Emiratis are presented in [Table 3](#). Over half of the respondents (49.2%) consume vegetables once a day, while 45.1% consume egg and dairy products, and 38.9% consume meat and chicken once a day indicating animal protein consumption daily. Additionally, 31 and 28% of respondents reported consuming fish and other seafood and cereals and legumes once a week, respectively. On following any dietary routine, 36% of respondents indicated not following any, 32.8% sometimes do, while 3.8% of the respondents frequently did ([Figure 1A](#)). Furthermore, respondents' perception of trying new foods (neophilia) is shown in [Figure 1A](#). Result showed that 9% of the respondents frequently tried new foods, while the majority (41%) sometimes tried new foods. [Figure 1B](#) reports on motivating factors for food choices. Accordingly, 36.7% of the respondents reported neutral views with respect to sustainability and environment whilst 34.5% indicated health as the motivating factor for their food choices.

4.3 Knowledge and attitude toward alternative proteins

[Figure 2A](#) shows respondent's familiarity and preferred alternative proteins. About half of the respondents (52%) had prior knowledge (awareness) of alternative proteins. Most respondents (59%) were familiar with plant-based proteins, followed by cultured meat (17%) and (12% had previously heard of both insects and micro algae protein-based products). A comparable trend was observed on the alternative protein-based products respondents would prefer to consume. Plant-based proteins were highly preferred (74%), followed by cultured meat (12%), and micro algae proteins (9%). Insect-based proteins were the least preferred (5%). More than half of the respondents (57.7%) did not know if any of the alternative proteins were available in UAE markets.

[Figure 2B](#) shows plant-based alternative proteins as highly ranked among the four alternative proteins investigated. Nearly half of the respondents (42%) would recommend plant-based proteins to their friends and family. Fifty-five percent were willing to buy if available on the market, and (53%) reviewed them as healthy and safe for consumption. High proportion of respondents mentioned that they will consume plant-based proteins if all the four-alternative protein-based products are available, tasty, and affordable at grocery store and supermarkets. [Figure 2C](#) shows (30.7%) would moderately like to consume plant-based proteins, and 26.3% were extremely likely. However, 27.3 and 28.4% of the respondents showed

TABLE 2 Demographic characteristics of surveyed respondents (% of respondents).

Demographic characteristics		% (N = 1,666)
Gender	Female	80.9
	Male	19.1
Age (years)	18–24	75.9
	25–34	17.2
	35–44	4.6
	45–54	1.9
	54–65	0.4
	Emirate	Abu Dhabi
	Ajman	3.8
	Dubai	10.0
	Fujairah	6.7
	Ras Al Khaimah	19.9
	Sharjah	12.7
	Umm Al Quwain	1.4
Marital status	Single	84.3
	Married	14.3
	Divorced	1.3
	Widow	0.1
Education	No education	0.6
	Primary education	0.5
	High school	39.1
	Technical qualification/Trade Certificate/Diploma	7.6
	College or undergraduate degree (Bachelors)	47.4
	Postgraduate degree (Masters/PhD/Professional Degree)	4.9
Monthly income (Monthly) (AED)	Less than 5,000	66.6
	5,000–9,999	9.2
	10,000–19,999	9.1
	20,000–29,999	8.1
	More than 30,000	7.0

moderate likeness to consume cultured meat and micro algae, respectively. Overall, half of the respondents (49.9%) were not likely to consume the insect-based protein. Figure 2D shows consumers' intentions to either increase or decrease the consumption of animal products (chicken, dairy, and meat) in the next 1 year. The participants responses indicated chicken (50.2%), dairy (42.5%), and meat (46.3%).

4.3.1 Determinants of respondent's attitude and willingness to transition toward alternative proteins

Using the Pearson Chi-square analysis, the influence of each independent variable: (a) demographic, (b) dietary habit, (c) knowledge, (d) attitudes, and (e) willingness on the dependent variables: (i) which alternative protein-based food product are they willing to eat, (ii) probability of participants replacing animal-based proteins with alternative proteins, (iii) awareness of the availability of alternative

proteins-based food products, and (iv) intention to increase or decrease the consumption of meat and chicken was conducted.

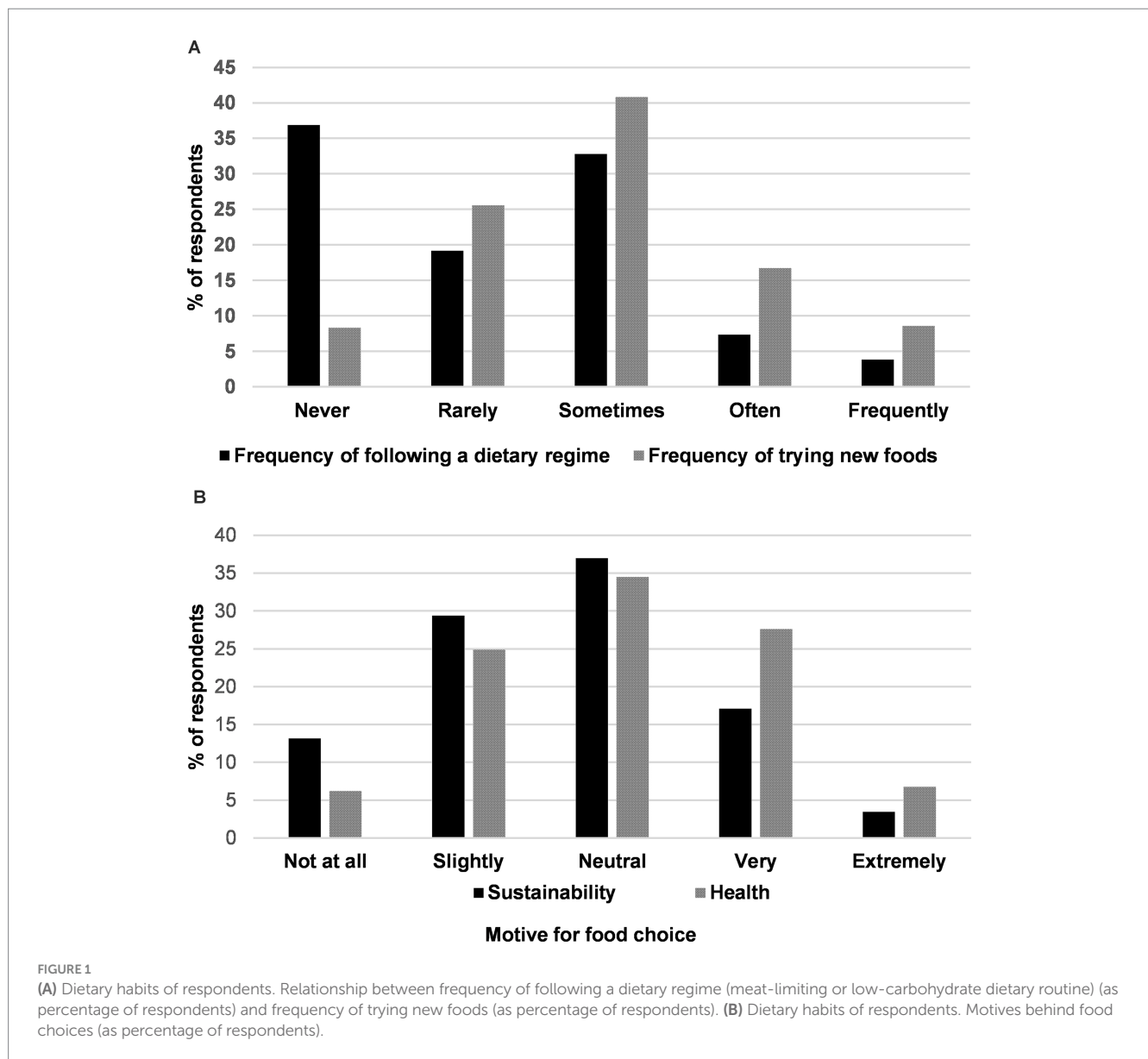
Most respondents (85.2%) regardless of their location indicated preference for plant-based protein products (Supplementary Table 1). Moreover, the educational level of the respondents had no significant effect (Chi-square p -value = 0.419) on the participants' overall awareness of the existence of alternative protein-based products (Supplementary Table 2). Similarly, the respondents' food neophobia did not hinder their willingness to try new foods or stir their preference toward a specific alternative protein (Chi-square p -value = 0.130). Nevertheless, the majority of respondents (85.2%) showed more readiness to try plant-based protein products (Supplementary Table 3). It can be observed from the presented data that there is a clear winner out of the surveyed four alternative proteins which is plant-based protein.

The cost of the alternative protein food products is a key factor (Chi-square p -value = 0.001) to persuade the UAE nationals to both

TABLE 3 Consumption frequency of food products (% of respondents).

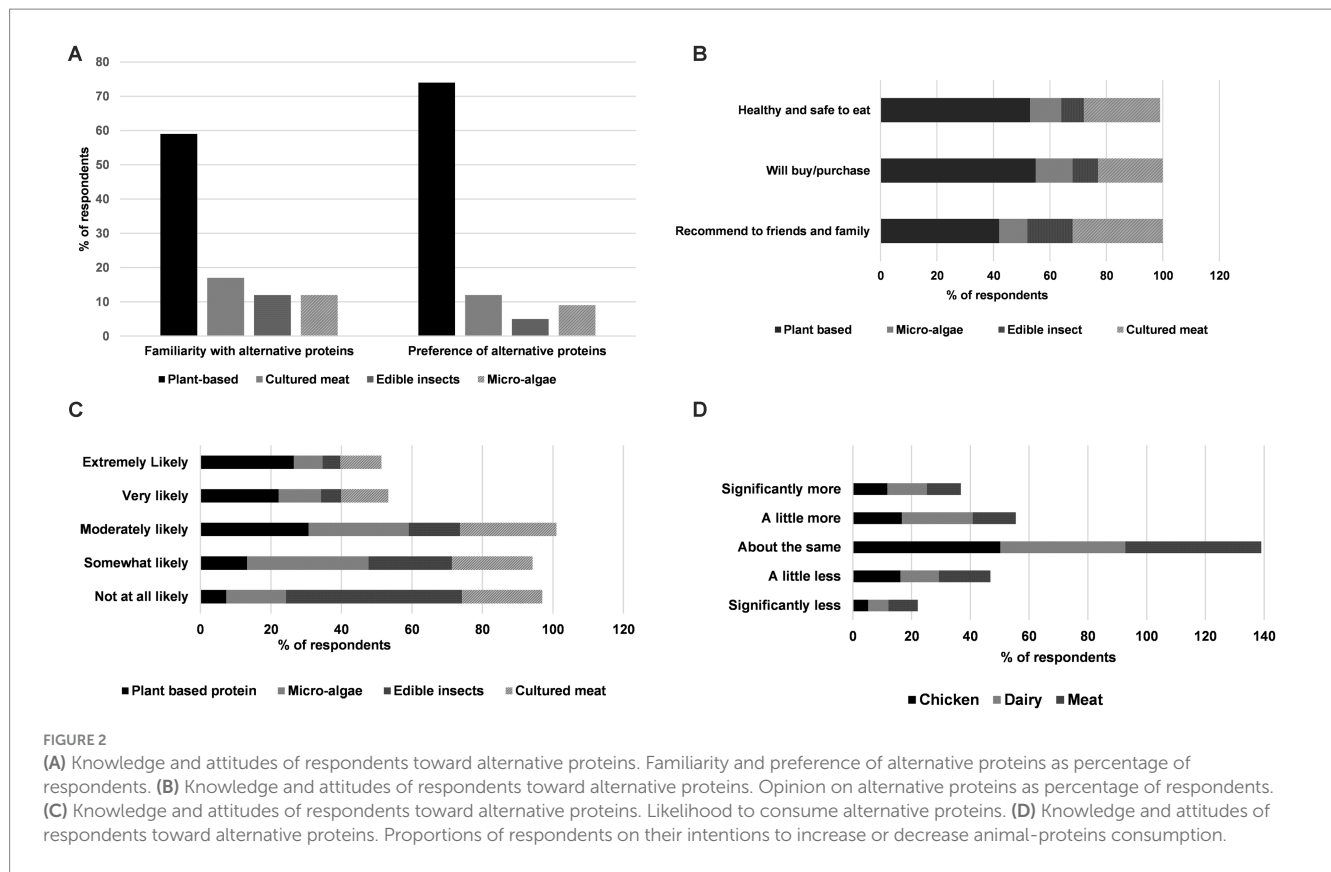
Consumption frequency	Meat and chicken	Egg and dairy product	Fish and other seafood	Vegetables	Cereal and legumes
%					
Once a day	38.96	45.20	6.42	49.28	23.59
2–4 times a week	37.21	33.19	18.97	26.17	23.89
Once a week	14.35	15.61	30.79	14.77	28.33
2–3 times a month	2.28	0.90	6.18	1.92	3.24
Once a month	3.42	2.46	20.95	4.68	12.36
Rarely	1.81	1.98	6.54	2.10	5.28
I do not eat this	1.97	0.66	10.14	1.10	3.30

Bold values indicate the highest consumption frequency found for each food category.



accept and replace the animal-based proteins products with alternative protein products (Supplementary Table 4). A combined percentage of 76.6% of the participants highlighted the importance

of the alternative protein's cost and around 39.7% of participants have refused to replace animal-based proteins with alternative protein regardless of the price.



Supplementary Table 5 shows that 39 and 37.2% of respondents either eat meat and/or chicken once a day or 2–4 times a week, respectively. This high attachment to meat and chicken had a significant effect (Chi-square p -value = 0.000) on their willingness to replace animal-based proteins and reflected a reluctance to replace animal-based proteins (39.7%). Conversely, 9 and 21.4% of participants have partially agreed and fully agreed to replace animal-based proteins with alternative proteins, respectively, which keeps the hope of introducing such products to the UAE market alive. Finally, the correlation between the respondents’ awareness of the current global food security and sustainability issues and their willingness to replace or reduce animal-based products with alternative protein was analyzed (Supplementary Tables 6, 7). Respondents’ awareness of the current global food security and sustainability issues was shown to have a significant effect (Chi-square p -value = 0.000 for both models) and positive correlation with the respondents’ willingness to replace and/or reduce the consumption of animal-based protein. This positive finding highlights the importance of increasing awareness and marketing as key factors for the potential success of alternative proteins in the UAE market. However, some respondents have indicated that they extremely and very much consider sustainability and chose not to replace or reduce animal-based products.

4.4 Factors that influence transition to alternative proteins-based food products

Figure 3 shows that the most ‘extremely important’ influencing factor influencing the purchase of alternative proteins-based food

products was sensory attributes (41.7%), followed by ease of purchase and cooking (30.4%), and advertisement was ‘somewhat important’ (29.3%). A high proportion (43.3%) indicated that health benefits/nutrition were not at all important. Moreover, (29.3%) indicated that cost/price and family influence (29.7%) were ‘not at all important’.

Table 4 shows the results of linear regression analysis used to determine the main factors/variables that influence the respondents’ decision to purchase alternative proteins. The regression model included fifteen (15) independent factors which were: (a) education level, (b) meat attachment, (c) dairy attachment, (d) cereals attachment, (e) health, (f) sustainability, (g) awareness of alternative proteins, (h) dietary routine, (i) food neophobia, (j) nutrition, (k) family influence, (l) cost of alternative proteins, (m) availability of alternative proteins, (n) taste of alternative proteins products, and (o) effect of advertisement.

The model showed that the respondents’ educational level had a significant effect ($p < 0.05$) indicating that more educated participants were more willing to purchase alternative proteins when compared to others. Even though meat attachment was very high among the surveyed respondents’ and generally in UAE, the model showed that this factor generated positive predictive values ($p < 0.05$) revealing that regardless of the respondents’ meat attachment level they are likely to purchase alternative proteins. Conversely, the respondents’ attachment to dairy products and cereal did not have a significant effect ($p > 0.05$) on the response factor and displayed negative predictive values which highlighted the indirect relationship between the mentioned two independent factors and the response factor. The analysis showed that respondents that consider their health when buying food items are more likely to purchase alternative proteins especially plant-based proteins. However, concerns related to sustainability and environment did not

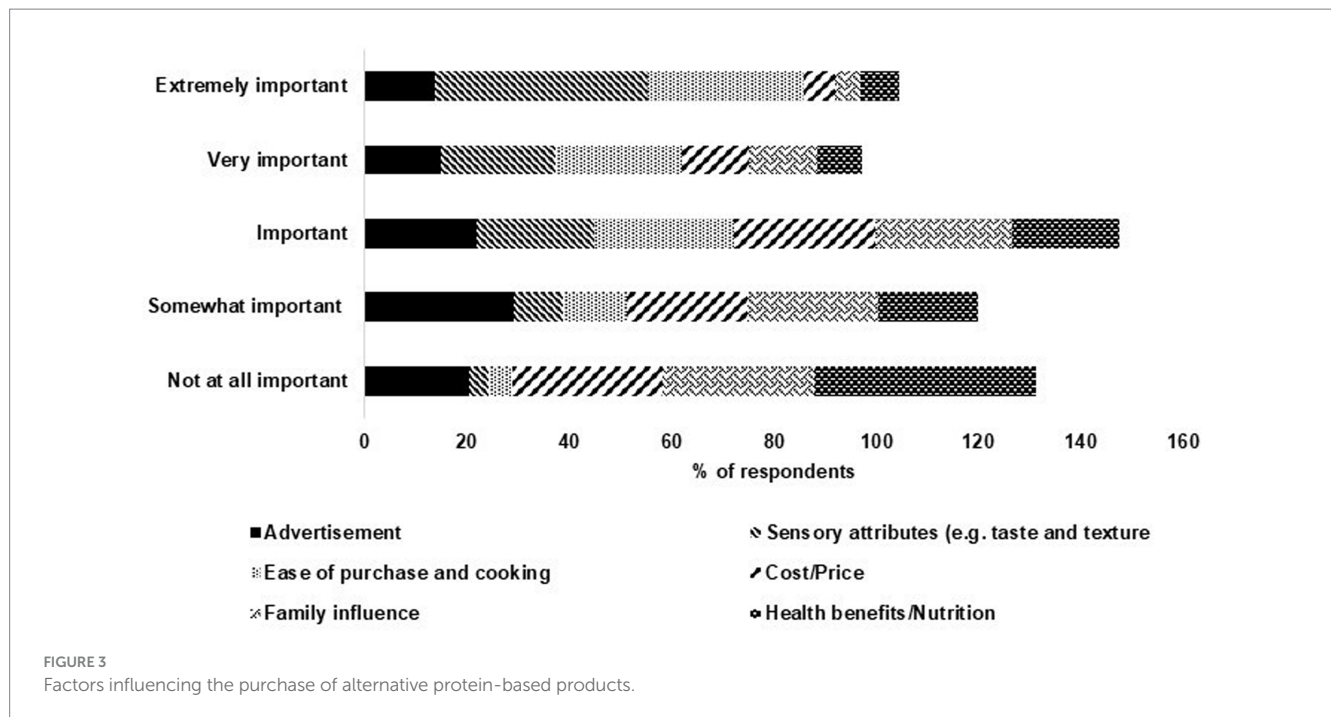


TABLE 4 Regression model showing factors affecting the respondents' decision to purchase alternative proteins (AltP).

Model's $R^2 = 0.111$ and Adjusted $R^2 = 0.0744$; Model's p -value = 0.000		
Variable	β	p -value
Educational level	0.0935	0.025
How often do you eat meat	-0.0897	0.009
How often do you eat dairy	0.0622	0.117
How often do you eat cereals	-0.0098	0.724
Do you consider Health	0.1634	0.001
Do you consider sustainability	-0.0619	0.203
Have you heard of AltP	-0.0204	0.819
Do you follow any dietary regime	-0.0906	0.031
Food neophobia	-0.1001	0.021
Attitude-Nutrition	0.0034	0.946
Attitude-Family influence	-0.0507	0.262
Cost of AltP products	-0.0424	0.373
Ease of Purchase of AltP	0.1251	0.020
Attitude-Taste of AltP products	0.2164	0.000
Advertisement will help your choice to buy AltP	-0.2530	0.000

have a significant effect as factors to convince participants to purchase alternative proteins. Similarly, the respondents' awareness of alternative proteins did not positively influence respondents' decision.

Table 4 shows that respondents with lower food neophobia and normal dietary regimes are more likely to purchase alternative proteins. The cost of the alternative proteins had an insignificant effect on the respondents' decision to buy alternative proteins, however, the taste and availability of alternative protein products in the UAE market were two important factors considered by the respondents. Finally, proper advertisement of alternative proteins would play a significant role

($p < 0.05$) in increasing the acceptance of alternative proteins and subsequently its purchase as indicated by the respondents.

4.5 Factors that influence willingness to replace animal-based proteins with alternative proteins-based food products

Table 5 shows the results of linear regression analysis used to determine the main factors/variables that influenced the respondents'

TABLE 5 Regression model showing factors affecting the respondents' decision to replace animal-based proteins with alternative proteins (AltP).

Model's $R^2 = 0.137$ and Adjusted $R^2 = 0.103$; Model's p -value = 0.000		
Variable	β	p -value
Educational level	-0.0224	0.508
How often do you eat meat	-0.1325	0.000
How often do you eat dairy	-0.1413	0.000
How often do you eat cereals	0.0600	0.008
Do you consider Health	0.0384	0.348
Do you consider sustainability	0.1146	0.004
Have you heard of AltP	0.3468	0.000
Do you follow any dietary regime	0.0551	0.108
Food neophobia	-0.0147	0.677
Attitude-Nutrition	0.0893	0.027
Attitude-Family influence	-0.0159	0.667
Cost of AltP products	0.0139	0.722
Ease of Purchase of AltP	0.0832	0.059
Attitude-Taste of AltP products	-0.1433	0.000
Advertisement will help your choice to buy AltP	0.1510	0.000

decision to replace animal-based proteins with alternative proteins. The models included fifteen independent factors mentioned in section 3.5. For this model, seven independent variables (education level, health, dietary habit, food neophobia, family influence, cost of alternative proteins, and availability of alternative proteins) had an insignificant effect ($p > 0.05$) on the response factors. For the significant factors, the respondents' meat attachment had a negative predictive value demonstrating that respondents who are highly attached to meat are unlikely to replace animal-based proteins. A similar trend was served for the participants with attachment to dairy products and cereals. Around 40% of respondents indicated that they do not consider sustainability and environmental impact when purchasing food items which was reflected in the negative predictive value of sustainability as an independent factor indicating that regardless of the current global sustainability concerns most of the surveyed UAE population were unwilling to replace animal-based products. Moreover, around 52% of respondents were aware or heard of alternative proteins and around 87% do consider nutrition when purchasing foods items again, they were against replacing animal-based proteins. Although the taste and texture of the alternative protein products were a crucial factor for respondents to purchase such products, it was not enough for respondents to replace animal-based proteins. However, positive predictive value was obtained for the influence of advertisement in persuading the respondents to replace animal-based proteins.

5 Discussion

5.1 Demographic characteristics and dietary habits of respondents

Our findings on the native Emirati's dietary habits show frequent consumption of animal proteins from eggs, meat and dairy sources. This

aligns with traditional Emirati cuisine, which emphasizes staples like grilled meats, stemming from a historical dependence on animal meat from camel, goat, and sheep (Mphepo, 2024; UAEGovernment, n.d.). The frequent meat consumption suggests their classification as high meat consumers (meat lovers). This category aligns with a report from the UAE Ministry of Foreign Trade, which found that per-capita meat consumption in the UAE was 85.1 kg, 18 times higher than the global average (Yagoub et al., 2022). However, these figures likely include UAE nationals, expatriates, and tourists, who together make up 80% of the population, as such, not a true reflection of meat consumption among the Emiratis. However, this survey still aligns with previous research that believed that people in the UAE consume more poultry (39%) and red meat (37%) than seafood (24%) (Yagoub et al., 2022).

The differences in dietary habits among respondents may be influenced by various factors which include cultural, social and religious factors (Enriquez and Archila-Godinez, 2022), as well as educational level, health status, age, and gender (Chen and Antonelli, 2020; Neumark-Sztainer et al., 1999). The UAE, which is known for its wealth and blend of traditional and modern aspects, displays dietary habits that reflect its rich cultural background and the impact of swift economic development (Mphepo, 2024; Ozoral, 2024). High per-capita income was suggested as a key factor in the high meat consumption (Parlasca and Qaim, 2022; Milford et al., 2019). The UAE ranks seventh globally in per capita income (World Bank), but most of the respondents (66.6%) in this study reported a Low/Medium household income range (0–5,000 AED monthly), highlighting potential individual self-reported data (Aamir and Nashar, 2023).

Nonetheless, according to Basarir (2013), higher income influences the meat choices of Emiratis, as Emirati income rises, beef consumption declines while goat meat consumption rises. Additionally, an increase in income for UAE households in the future will likely lead them to spend a larger portion of their earnings on fish, camel, goat, and lamb. Lusk and Tonsor (2016) showed that in the United States of America, the demand for meat products is non-linear,

indicating that it becomes less responsive to price changes as prices increase. Additionally, high-income consumers generally show less sensitivity to changes in their own prices and are more affected by changes in the prices of related goods compared to lower-income consumers. In view of this, while cost influences dietary transitions, making substitutes for animal products more affordable is crucial, despite respondents' strong buying power. Therefore, it is crucial to understand how the pricing of alternative protein products and availability of affordable options affect the cultural preferences and consumption habits to promote healthier and more sustainable dietary choices among Emiratis.

Even though this study's demographics show the underrepresentation of older age groups among respondents, nevertheless, given the cultural significance in the Emirati context, the respondents' perspectives can be reflective of their households. Parents significantly impact their children's eating habits by shaping both their genetic predispositions and their environment. They affect children's food preferences and eating patterns by choosing which foods to offer and by demonstrating their own eating behaviors (Savage et al., 2007; Sohail et al., 2024). Emirati families are characterized by common cultural principles (Al Hameli and Arnuco, 2023), whereby family serves a crucial function in shaping the cultural identity and perceptions of the children (Ozoral, 2024; Sohail et al., 2024). On the other hand Emiratis with non-Emirati lineage may have experienced and been influenced by diverse cultural practices and norms derived from their non-Emirati ancestors, especially maternal figures, which in turn can affect their dietary preferences (Al Hameli and Arnuco, 2023; Savage et al., 2007). Overall, the variations in dietary habits may be influenced by the extent to which families have embraced cultural diversities. To determine how the Emirati location influences dietary habits, a new sampling strategy is needed to ensure sufficient representative samples.

5.2 Knowledge, attitudes and willingness to transition toward alternative proteins

Gavin et al. (2011) found that healthcare information can lead to behavior changes, varying by gender and race. Although awareness of sustainability issues does not always translate to attitude changes, a survey by Dator et al. (2018) showed that 28% of Emirati adolescents meet the recommended daily intake of fruits and vegetables, reflecting growing health awareness. Neutral views on sustainability may stem from geography and local diets (Aboussaleh et al., 2017). In Germany, environmental and nutritional benefits motivate food choices (Orsi et al., 2019), while people in Poland and Belgium also consider environmental impacts (Kostecka et al., 2017; Schiemer et al., 2018). Educating young people, pseudo-flexitarians, and those on restricted meat diets could yield long-term benefits (Derbyshire, 2017).

Consumers' attitudes toward alternative proteins were significantly associated with their motivation to recommend to friends and family, and purchase decisions. Apart from the meat-loving dietary habits pointing toward an unwillingness to replace meat (Yagoub et al., 2022), the partial willingness of respondents, could be attributed to the high percentage of young age group of respondents. This agrees with the findings of an online consumer survey on the replacement of meat with meat substitutes that reported that younger consumers are more flexible and positive about meat substitution (Spadafore, 2020).

Education may impact the attitudes and readiness to substitute animal protein, particularly when considering the respondents' status. Respondents preferring replacement of animal proteins with plant-based protein products, ahead of culture meat, and microalgae implies that plant-based products are more attractive and acceptable since they are already part of the diet. Moreover, these positive perceptions could be attributed to the recent popularity of plant proteins in the media and academic settings (Lonnie and Johnstone, 2020). This is also consistent with the study by Bryant and Sanctorum (2021), which showed a willingness to replace animal products with plant-based proteins and cultured meat. Similarly, cultured meat is the second most accepted product, and this could be because consumers perceive it to possess the same attributes as conventional meat, making it appealing. A lower level of acceptance for edible insects among the respondents could be attributed to food disgust and neophobia that have been associated with edible insects (Dupont and Fiebelkorn, 2020). The low preference for insect consumption is consistent with previous studies (Modlinska et al., 2020; Orkusz et al., 2020; Orsi et al., 2019).

Consumers' interest and curiosity have been identified as crucial factors for accepting new food products (Wendin and Nyberg, 2021). According to Smith et al. (2017), food fussiness is the propensity to extremely select foods one is willing to eat and emerges in early childhood. Food neophobia, though a closely related characteristic, refers to the rejection of unfamiliar novel food (Hazley et al., 2022). Some of the respondent's less inclination to trying or testing new food products, agree with a study by Tan et al. (2016) that reported a habitual dislike of testing new foods especially when consumers have minimum knowledge about the food products. Importantly, understanding consumer predisposition will assist optimal food design of alternative protein-based foods, e.g., me-too products which can mimic meat-based products. Moreover, utilizing familiar raw materials, mostly plant sources that are acceptable to a population, e.g., the use of date seeds as ingredients in hybrid meat products and meat analogs processing (Munoz-Tebar et al., 2023). Respondent's limited knowledge of locally available alternative protein-based food products indicates that these resources are not regular food, though they might be available and consumed by expatriates from the West. Nonetheless, policies on sensitization, importing, and/or local processing of alternative proteins are required.

The reluctance to reduce animal protein consumption in the next one-year points toward barriers toward transition. Collier et al. (2021) report that barriers to decreasing meat consumption include uncertainty (sensory experience, familiarity and expectations, practicalities, and price) skepticism, health, and identity. This agrees with current survey findings which reveal that sensory attributes such as taste, and texture are extremely important motivators to buying and consuming these protein sources. In previous studies, comparable taste and texture to animal protein sources were reported to be key drivers that influenced the acceptance of plant-based food products (Beacom et al., 2021). Thus, working on improving the taste and reducing the cost of the alternative protein products to increase the probability of their success on the UAE market is required. In addition, in view of the barriers to uptake of alternative proteins, with proper advertisement and awareness campaigns the prospective and meat attachment of UAE nationals can be changed which can result to more acceptance of alternative proteins (Collier et al., 2021).

The current study indicates that consumer's attitudes are a strong predictor of their willingness to recommend, try and purchase alternative proteins. As such, respondents with lower food neophobia and normal dietary routines are more likely to purchase alternative proteins. Therefore, if the concept of alternative proteins is introduced to the UAE nationals it will be better to start with plant-based products. Thus, knowledge of acceptable plant protein sources in the context of Emirati consumers is required for further food design.

6 Conclusion

Our findings bring insights into the knowledge, attitude, and determinants of the willingness of native Emiratis toward the purchase and replacement of meat with "alternative protein-based" food products. The partial agreement by half of the surveyed respondents to replace animal-based proteins with alternative proteins keeps the hope of introducing such products to UAE market alive. If this concept is to be introduced to the UAE nationals, it will be better to start with plant-based products and cultured meat because of their higher ranking as compared to insects and micro-algae. Also, the cost of the preferred alternative protein food products is an important factor in persuading UAE nationals to both accept and replace animal-based proteins. Even though nationals were shown to have high meat attachment, the importance of advertisement and marketing required for the success of alternative protein products in the UAE cannot be overlooked. Even though sustainability and environmental concerns did not convince respondents to purchase or replace animal proteins, education about the subject can contribute to long-term changes. Overall, a successful transition to alternative proteins will be based on optimizing consumer sensory experience, price, skepticism, health, and identity. This necessitates food product design using selected plant-based proteins and evaluating their sensorial and nutritional quality, consumer acceptance and life cycle assessment. Overall, knowledge sharing, education, building from existing strategies and applied research are essential interventions for improving food and nutrition security through alternative proteins. Public health messaging should be persistent in the UAE to discourage the voracious consumption of animal-based proteins and emphasize the health, sustainability and environmental benefits of alternative proteins.

Data availability statement

The original contributions presented in the study are included in the article/[Supplementary material](#), further inquiries can be directed to the corresponding author.

Ethics statement

The studies involving humans were approved by United Arab University's Social Science Ethical Committee (ERS-2021-8445). 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

SM: Conceptualization, Formal analysis, Funding acquisition, Investigation, Methodology, Project administration, Supervision, Writing – original draft, Writing – review & editing, Data curation, Resources. FA: Formal analysis, Investigation, Methodology, Writing – original draft, Writing – review & editing, Data curation. HM: Data curation, Formal analysis, Methodology, Writing – review & editing. KL: Conceptualization, Formal analysis, Investigation, Methodology, Writing – original draft, Data curation. JM: Data curation, Formal analysis, Investigation, Methodology, Writing – review & editing. NA: Data curation, Formal analysis, Investigation, Methodology, Writing – review & editing. MaA: Data curation, Formal analysis, Investigation, Methodology, Writing – review & editing. MeA: Data curation, Formal analysis, Investigation, Methodology, Writing – review & editing.

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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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Supplementary material

The Supplementary material for this article can be found online at: <https://www.frontiersin.org/articles/10.3389/fsufs.2025.1446790/full#supplementary-material>

References

- Aamir, M., and Nashar, K. (2023). UAE's per capita income continues to rise, ranks 7th globally. *Emirates News Agency*.
- Aboussaleh, Y., Capone, R., and El Bilali, H. (2017). Mediterranean food consumption patterns: low environmental impacts and significant health–nutrition benefits. *Proc Nutr Soc.*, 76, 543–548.
- Ajzen, I. (1991). The theory of planned behavior. *Organ. Behav. Human Decis. Process.* 50, 179–211. doi: 10.1016/0749-5978(91)90020-T
- Ajzen, I. (2011). The theory of planned behaviour: reactions and reflections. *Psychol. Health* 26, 1113–1127. doi: 10.1080/08870446.2011.613995
- Al Hameli, A., and Arnucu, M. (2023). Exploring the nuances of Emirati identity: a study of dual identities and hybridity in the post-oil United Arab Emirates. *Soc. Sci.* 12:598. doi: 10.3390/socsci12110598
- Al-Jawaldeh, A., Taktouk, M., and Nasreddine, L. (2020). Food consumption patterns and nutrient intakes of children and adolescents in the eastern Mediterranean region: a call for policy action. *Nutrients* 12:3345. doi: 10.3390/nu12113345
- Anusha Siddiqui, S., Bahmid, N. A., Mahmud, C. M., Boukid, F., Lamri, M., and Gagaoua, M. (2022). Consumer acceptability of plant-, seaweed-, and insect-based foods as alternatives to meat: a critical compilation of a decade of research. *Crit. Rev. Food Sci. Nutr.* 63, 1–22. doi: 10.1080/10408398.2022.2036096
- Bahn, R., El Labban, S., and Hwalla, N. (2019). Impacts of shifting to healthier food consumption patterns on environmental sustainability in Mena countries. *Sustain. Sci.* 14, 1131–1146. doi: 10.1007/s11625-018-0600-3
- Bakr, Y., Al-Bloushi, H., and Mostafa, M. J. (2023). Consumer intention to buy plant-based meat alternatives: a cross-cultural analysis. *J. Int. Consum. Market.* 35, 420–435. doi: 10.1080/08961530.2022.2122103
- Basarir, A. (2013). An almost ideal demand system analysis of meat demand in UAE. *Bulgarian J. Agric. Sci.* 19, 32–39.
- Beacom, E., Bogue, J., and Repar, L. (2021). Market-oriented development of plant-based food and beverage products: a usage segmentation approach. *J. Food Prod. Mark.* 27, 204–222. doi: 10.1080/10454446.2021.1955799
- Biasini, B., Rosi, A., Giopp, F., Turgut, R., Scazzino, F., and Menozzi, D. (2021). Understanding, promoting and predicting sustainable diets: a systematic review. *Trends Food Sci. Technol.* 111, 191–207. doi: 10.1016/j.tifs.2021.02.062
- Birch, D., Skallerud, K., and Paul, N. (2018). Who eats seaweed? An Australian perspective. *J. Int. Food Agribus. Mark.* 31, 329–351. doi: 10.1080/08974438.2018.1520182
- Bryant, C., and Sanctorem, H. (2021). Alternative proteins, evolving attitudes: comparing consumer attitudes to plant-based and cultured meat in Belgium in two consecutive years. *Appetite* 161:105161. doi: 10.1016/j.appet.2021.105161
- Chen, P. J., and Antonelli, M. (2020). Conceptual models of food choice: influential factors related to foods, individual differences, and society. *Food Secur.* 9:1898. doi: 10.3390/foods9121898
- Collier, E. S., Oberrauter, L. M., Normann, A., Norman, C., Svensson, M., Niimi, J., et al. (2021). Identifying barriers to decreasing meat consumption and increasing acceptance of meat substitutes among Swedish consumers. *Appetite* 167:105643. doi: 10.1016/j.appet.2021.105643
- Dator, W., Abunab, H., and Dao-Ayen, N. (2018). Health challenges and access to health care among Syrian refugees in Jordan: a review. *Eastern Mediterranean Health Journal*, 24, 680–686.
- De Boer, J., and Aiking, H. (2011). On the merits of plant-based proteins for global food security: marrying macro and micro perspectives. *Ecol. Econ.* 70, 1259–1265. doi: 10.1016/j.ecolecon.2011.03.001
- Derbyshire, E. (2017). Flexitarian diets and health: a review of the evidence-based literature. *Frontiers in Nutrition*, 3, 55.
- Dupont, J., and Fiebelkorn, F. (2020). Attitudes and acceptance of young people toward the consumption of insects and cultured meat in Germany. *Food Qual. Prefer.* 85:103983. doi: 10.1016/j.foodqual.2020.103983
- El Bilali, H., and Ben Hassen, T. (2020). Food waste in the countries of the gulf cooperation council: a systematic review. *Food Secur.* 9:463. doi: 10.3390/foods9040463
- Enriquez, J. P., and Archila-Godinez, J. C. (2022). Social and cultural influences on food choices: a review. *Crit. Rev. Food Sci.* 62, 3698–3704. doi: 10.1080/10408398.2020.1870434
- Estell, M., Hughes, J., and Grafenauer, S. (2021). Plant protein and plant-based meat alternatives: consumer and nutrition professional attitudes and perceptions. *Sustain. For.* 13:1478. doi: 10.3390/su13031478
- Etikan, I., Musa, S. A., and Alkassim, R. S. (2016). Comparison of convenience sampling and purposive sampling. *Am. J. Theor. Appl. Stat.* 5, 1–4. doi: 10.11648/j.ajtas.20160501.11
- Fanzo, J. (2019). Healthy and sustainable diets and food systems: the key to achieving sustainable development goal 2? *Food Ethics* 4, 159–174. doi: 10.1007/s41055-019-00052-6
- Fischbach, T. (2018). Advancing food security in the UAE. Policy paper. Mohammed Bin Rashid School of Government. Available at: https://mbrsg.ae/documents/d/MBRSG/EN_ADVANCING-FOOD-SECURITY-IN-THE-UAE
- Floret, C., Monnet, A.-F., Micard, V., Walrand, S., and Michon, C. J. (2023). Replacement of animal proteins in food: how to take advantage of nutritional and gelling properties of alternative protein sources. *Crit. Rev. Food Sci. Nutr.* 63, 920–946. doi: 10.1080/10408398.2021.1956426
- Gavin, J. R., Fox, K. M., and Grandy, S. (2011). Race/Ethnicity and gender differences in health intentions and behaviors regarding exercise and diet for adults with type 2 diabetes: A cross-sectional analysis. *BMC Public Health*, 11, 1–8.
- Gómez-Luciano, C. A., De Aguiar, L. K., Vrieskoop, F., and Urbano, B. (2019). Consumers' willingness to purchase three alternatives to meat proteins in the United Kingdom, Spain, Brazil and the Dominican Republic. *Food Qual. Prefer.* 78:103732. doi: 10.1016/j.foodqual.2019.103732
- Grasso, A. C., Hung, Y., Olthof, M. R., Verbeke, W., and Brouwer, I. A. (2019). Older consumers' readiness to accept alternative, more sustainable protein sources in the European Union. *Nutrients* 11:1904. doi: 10.3390/nu11081904
- Halkjaer, J., Olsen, A., Bjerregaard, L., Deharveng, G., Tjønneland, A., Welch, A., et al. (2009). Intake of total, animal and plant proteins, and their food sources in 10 countries in the European prospective investigation into cancer and nutrition. *Eur. J. Clin. Nutr.* 63, S16–S36. doi: 10.1038/ejcn.2009.73
- Hartmann, C., and Siegrist, M. (2017). Consumer perception and behaviour regarding sustainable protein consumption: a systematic review. *Trends Food Sci. Technol.* 61, 11–25. doi: 10.1016/j.tifs.2016.12.006
- Hazley, D., Stack, M., Walton, J., McNulty, B. A., and Kearney, J. M. (2022). Food neophobia across the life course: pooling data from five national cross-sectional surveys in Ireland. *Appetite* 171:105941. doi: 10.1016/j.appet.2022.105941
- Hoek, A. C., Luning, P. A., Weijzen, P., Engels, W., Kok, F. J., and De Graaf, C. (2011). Replacement of meat by meat substitutes. A survey on person- and product-related factors in consumer acceptance. *Appetite* 56, 662–673. doi: 10.1016/j.appet.2011.02.001
- Holden, N. M., White, E. P., Lange, M. C., and Oldfield, T. L. (2018). Review of the sustainability of food systems and transition using the internet of food. *Npj Sci. Food* 2:18. doi: 10.1038/s41538-018-0027-3
- Kouarfáté, B. B., and Durif, F. N. (2023). A systematic review of determinants of cultured meat adoption: impacts and guiding insights. *Br. Food J.* 125, 2737–2763. doi: 10.1108/BFJ-06-2022-0513
- Kostecka, J., Konieczna, K., and Cunha, L. (2017). Evaluation of Insect-Based Food Acceptance by Representatives of Polish Consumers in the Context of Natural.
- Lemken, D., Spiller, A., and Schulze-Ehlers, B. (2019). More room for legume - consumer acceptance of meat substitution with classic, processed and meat-resembling legume products. *Appetite* 143:104412. doi: 10.1016/j.appet.2019.104412
- Lonnig, M., and Johnstone, A. M. (2020). The public health rationale for promoting plant protein as an important part of a sustainable and healthy diet. *Nutr. Bull.* 45, 281–293. doi: 10.1111/mbu.12453
- Lusk, J. L., and Tonsor, G. T. (2016). How meat demand elasticities vary with price, income, and product category. *Appl. Econ. Perspect. Policy* 38, 673–711. doi: 10.1093/aep/ppv050
- Manikas, I., Sundarakani, B., Aanstasiadis, F. and Ali, B. (2022). A Framework for Food Security via Resilient Agri-Food Supply Chains: The Case of UAE. *Sustainability*, 14.
- Milford, A. B., Le Mouél, C., Bodirsky, B. L., and Rolinski, S. (2019). Drivers of meat consumption. *Appetite* 141:104313. doi: 10.1016/j.appet.2019.06.005
- Modlinska, K., Adamczyk, D., Goncikowska, K., Maison, D., and Pisula, W. (2020). The effect of labelling and visual properties on the acceptance of foods containing insects. *Nutrients* 12:2498. doi: 10.3390/nu12092498
- Mphepo, E. (2024). Re: cultural influences on eating habits: a comparison between the UAE, UK, and Malawi. The Sparkle Foundation. Available at: <https://www.thesparklefoundation.org/>
- Munoz-Tebar, N., Viuda-Martos, M., Lorenzo, J. M., Fernandez-Lopez, J., and Perez-Alvarez, J. A. (2023). Strategies for the valorization of date fruit and its co-products: a new ingredient in the development of value-added foods. *Food Secur.* 12:1456. doi: 10.3390/foods12071456
- Neumark-Sztainer, D., Story, M., Perry, C., and Casey, M. A. (1999). Factors influencing food choices of adolescents: findings from focus-group discussions with adolescents. *J. Am. Diet. Assoc.* 99, 929–937. doi: 10.1016/S0002-8223(99)00222-9
- Nguyen, H. (2018). "Sustainable food systems. Concept and framework" in Food and Agriculture Organization of the United Nations. ed. D. Neven. Available at: <https://www.fao.org/sustainable-food-value-chains/en/>
- Onwezen, M. C., Van Den Puttelaar, J., Verain, M. C. D., and Veldkamp, T. (2019). Consumer acceptance of insects as food and feed: the relevance of affective factors. *Food Qual. Prefer.* 77, 51–63. doi: 10.1016/j.foodqual.2019.04.011
- Orkusz, A., Wolanska, W., Harasym, J., Piwowar, A., and Kapelko, M. (2020). Consumers' attitudes facing entomophagy: polish case perspectives. *Int. J. Environ. Res. Public Health* 17:2427. doi: 10.3390/ijerph17072427

- Orsi, L., Voegelé, L. L., and Stranieri, S. (2019). Eating edible insects as sustainable food? Exploring the determinants of consumer acceptance in Germany. *Food Res. Int.* 125:108573. doi: 10.1016/j.foodres.2019.108573
- Ozoral, B. (2024). "Fostering a cultural melting pot: the UAE's approach to multicultural integration and heritage preservation" in Globalization and Sustainability - Ecological, Social and Cultural Perspectives. doi: 10.5772/intechopen.1005194
- Pandey, S., Ritz, C., and Perez-Cueto, F. J. A. (2021). An application of the theory of planned behaviour to predict intention to consume plant-based yogurt alternatives. *Foods* 10:148. doi: 10.3390/foods10010148
- Parlasca, M. C., and Qaim, M. (2022). Meat consumption and sustainability. *Ann. Rev. Resour. Econ.* 14, 17–41. doi: 10.1146/annurev-resource-111820-032340
- Parodi, A., Leip, A., De Boer, I. J. M., Slegers, P. M., Ziegler, F., Temme, E. H. M., et al. (2018). The potential of future foods for sustainable and healthy diets. *Nat. Sustain.* 1, 782–789. doi: 10.1038/s41893-018-0189-7
- Savage, J. S., Fisher, J. O., and Birch, L. L. (2007). Parental influence on eating behavior: conception to adolescence. *J. Law Med. Ethics* 35, 22–34. doi: 10.1111/j.1748-720X.2007.00111.x
- Schiemer, C., Halloran, A., Jespersen, K., and Kaukua, P. (2018). Marketing Insects: Superfood or Solution-Food? *Edible Insects in Sustainable Food Systems*.
- Siddiqui, S. A., Alvi, T., Sameen, A., Khan, S., Blinov, A. V., Nagdalian, A. A., et al. (2022). Consumer acceptance of alternative proteins: a systematic review of current alternative protein sources and interventions adapted to increase their acceptability. *Sustain. For.* 14:15370. doi: 10.3390/su142215370
- Siemund, P., Al-Issa, A., and Leimgruber, J. R. (2021). Multilingualism and the role of English in the United Arab Emirates. *World Englishes* 40, 191–204. doi: 10.1111/weng.12507
- Smith, A. D., Herle, M., Fildes, A., Cooke, L., Steinsbekk, S., and Llewellyn, C. H. (2017). Food fussiness and food neophobia share a common etiology in early childhood. *J. Child Psychol. Psychiatry* 58, 189–196. doi: 10.1111/jcpp.12647
- Sohail, R., Hasan, H., Saqan, R., Barakji, A., Khan, A., Sadiq, F., et al. (2024). The influence of the home food environment on the eating behaviors, family meals, and academic achievement of adolescents in schools in the Uae. *Int. J. Environ. Res. Public Health* 21:1187. doi: 10.3390/ijerph21091187
- Spadafore, B. (2020). Reducing meat consumption: Dr reducing meat consumption: drawing on Participatory action research to explore ways of engaging in a process of meat consumption reduction: Wilfrid Laurier University.
- Tan, H. S. G., Van Den Berg, E., and Stieger, M. (2016). The influence of product preparation, familiarity and individual traits on the consumer acceptance of insects as food. *Food Qual. Prefer.* 52, 222–231. doi: 10.1016/j.foodqual.2016.05.003
- Tso, R., Lim, A. J., and Forde, C. G. (2020). A critical appraisal of the evidence supporting consumer motivations for alternative proteins. *Food Secur.* 10:24. doi: 10.3390/foods10010024
- UAE Government. (n.d.). Food. Available at: <https://u.ae/en/about-the-uae/culture/food>
- Van Der Weele, C., Feindt, P., Jan Van Der Goot, A., Van Mierlo, B., and Van Boekel, M. (2019). Meat alternatives: an integrative comparison. *Trends Food Sci. Technol.* 88, 505–512. doi: 10.1016/j.tifs.2019.04.018
- Wendin, K. M. E., and Nyberg, M. E. (2021). Factors influencing consumer perception and acceptability of insect-based foods. *Curr. Opin. Food Sci.* 40, 67–71. doi: 10.1016/j.cofs.2021.01.007
- Yagoub, M. M., Al Hosani, N., Alsumaiti, T., Kortbi, O., Alshehhi, A. A., Aldhanhani, S. R., et al. (2022). University students' perceptions of food waste in the UAE. *Sustain. For.* 14:11196. doi: 10.3390/su141811196