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Is cultured meat a promising consumer alternative? Exploring key factors determining consumer's willingness to try, buy and pay a premium for cultured meat

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ABSTRACT

Cultured meat is a relatively new product, enjoying consumer appreciation as a more sustainable meat option. The present study builds on a sample from a diverse set of countries and continents, including China, the US, the UK, France, Spain, Netherlands, New Zealand, Brazil, and the Dominican Republic and uses partial least square structural equation modelling. The proposed conceptual model identified key factors driving and inhibiting consumer willingness to try, buy, and pay a price premium for cultured meat. Results relate to the overall sample of 3091 respondents and two sub-sample comparisons based on gender and meat consumption behaviour. Food neophobia, having food allergies, being a locavore, and having concerns about food technology were found to be inhibiting factors towards willingness to try, buy, and pay a price premium for cultured meat. Food curiosity, meat importance, and a consumer's perception of cultured meat as a realistic alternative to regular meat were found to be important drivers that positively impacted consumers' willingness to try, buy and pay more. Best practice recommendations address issues facing marketing managers in food retail and gastronomy.

1. Introduction

In the past decade, the world population has seen vast growth. It is anticipated that by 2050, agricultural production systems will need to accommodate the needs of over nine billion people, accounting for an increase in food production of 70% (Béné et al., 2015; Bir, Davis, et al., 2019). Feeding the world is only one of many consumer concerns in western societies, which demand affordable, ethical, and environmental-friendly produced food. Consumer awareness and lifestyle changes toward vegetarian, vegan, and flexitarian diets (Kemper & White, 2021; Kerslake et al., 2022; Kwasny et al., 2022), alongside public debates on meat production, consumption, and animal welfare, that outline the negative externalities associated with livestock production (Bonnet et al., 2020; Mathur et al., 2021; De Boer & Aiking, 2022).

These externalities include water depletion, climate change, disruption of nutrient cycles, and adverse effects on biodiversity (Michel et al., 2021). The recent body of literature emphasizes that consumers are well informed about animal cruelty and issues of welfare and perceive in particularly factory farming and slaughtering unethically and unjustified. However, they are not to the same extent knowledgeable about the environmental externalities (Michel et al., 2021; Siegrist Hartmann &, 2020). Regardless, a desire to counteract animal cruelty and environmental externalities are often cited as examples of pro-social consumer motivation toward meat-reduced lifestyle changes (Onwezen et al., 2021). Pro-social refers to motivations that extend beyond a

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consumer's self-interests and focus on the interests of others, which may be animals, society, or the world (Rosenfeld & Burrow, 2017). Motivations can also arise from personal or moral grounds (Rosenfeld & Burrow, 2017). Personal motivations, such as improved health or lifestyle, can lead to a meat-reduced or meat-free diet and moral motivations stem from belief systems and norms that attach a right or wrong aspect to consumer choices (Rosenfeld & Burrow, 2017).

Across most countries, changes related to meat alternatives can be found in consumer motivation, increased demand, and publicity, as well as food production technological and legislative developments (Bir, Davis, et al., 2019; Gravely & Fraser, 2018; Michel et al., 2021; Morton et al., 2018; Onwezen et al., 2021; Van Loo et al., 2020).

One of the greatest technological advances in food production is cellular agriculture and the development of cultured meat (Aschemann-Witzel et al., 2019; Seah et al., 2022; Slade, 2018; Treich, 2021). Cultured meat is procured through a muscle biopsy where starter cells are taken from a living animal (Post, 2014; Pakseresht et al., 2022). Starter cells are undifferentiated cells that can be seen as an organism's raw material from which all other cells with specialized functions are generated (Allan et al., 2019; Bodiou et al., 2020; Seah et al., 2022). In-vitro, these starter cells begin a growing and dividing process (cell proliferation) and subsequently differentiate into the desired skeletal muscle cells. The skeletal muscle cells are preserved until they reach maturity and are afterwards harvested and assembled to obtain cultured meat products (Seah et al., 2022).

In many countries, the specific technology to produce cultured meat is primarily used for research purposes, given that production is in its earlier stages and is prohibitively costly (Mancini & Antonioli, 2019; Pakseresht et al., 2022). However, the market and availability of meat alternatives are steadily increasing. Supermarkets and restaurants are offering a wider variety of plant-based and fungal-based meat alternatives. According to Baum et al. (2021), the standout leader is Singapore, where various new startups and well-established businesses are striving for market leadership in the alternative protein market. The startup "Just Foods" obtained legal permission to serve their cultured meat chicken nuggets for $50 at a popular restaurant in Singapore, making Singapore the first country to have commercially available cultured meat (Baum et al., 2021).

This development provides clear evidence that consumers are interested in cultured meat and various studies have explored consumer acceptance of cultured meat or willingness to try it (Verbeke, Sans, & Van Loo, 2015,b; Bryant & Dillard, 2019; Bryant et al., 2020; Rolland et al., 2020; Weinrich et al., 2020; Boereboom et al., 2022; Motoki et al., 2022). Only a few studies have been dedicated to consumer willingness to pay for cultured meat (Asioli et al., 2018; Arora et al., 2020; Kantor & Kantor, 2021, Asioli, Bazzani, & Nayga, 2021,b). Thus, the key factors driving willingness to try, buy and pay a price premium for cultured meat deserve further attention. While some factors such as food neophobia, and concerns about biotechnology, food quality aspects, as well as environmental benefits, are well explored and validated (De Koning et al., 2020), concepts such as food curiosity, importance dedicated to meat in a cultural context, local food consumption and dietary requirements such as food allergies and sensitivities, could complement the more widely explored factors. The present paper addresses these research gaps and proposes a conceptual model to generate a more complete picture of the driving forces of consumers' willingness to try, buy and pay a price premium. Therefore, the relevant factors are presented in the following section of the paper.

2. Conceptual review and hypotheses

2.1. Food curiosity

A food-curious consumer is one with a keen interest in food and wants to explore all aspects of food production, processing, and consumption (Hwang et al., 2020; Stone et al., 2022). Respectively, food curiosity is motivated by feelings that trigger a need to seek information to fill knowledge gaps related to food. Per se, curiosity is an important driver of any exploratory behaviour such as trying and buying cultured meat (House et al., 2016; Piochi et al., 2022). To satisfy their curiosity, consumers are willing to obtain information, even if this incurs costs or produces adverse effects. Following Van der Weele and Driessen (2013), genuine interest or a wow effect are the initial reactions of consumers towards cultured meat. Other studies emphasize disgust as a common negative consumer reaction, which often counteracts positive consumer reactions like willingness to try new products. However, curiosity and interest in product and production processes are often able to overcome disgust reactions (Stone et al., 2022). Overall, various consumer studies on products like cultured meat, namely plant-based and insect-based meat alternatives, have found that food curiosity and the influence of social circles are the most important drivers of the purchase and consumption of new meat alternatives (Estelle et al., 2021; Liu et al., 2021; Sogari, 2015). Hence, the following hypothesis is proposed:

Hypothesis H1. Food curiosity will positively affect willingness to a) try b) buy and c) pay a price premium for cultured meat.

2.2. Concerns about food technology

Cultured meat is a form of cellular agriculture, where meat is produced in-vitro, with the assistance of a culture medium and a bioreactor (Arshad et al., 2017; Seah et al., 2022). The food technology involved in the process assists in imitating the natural processes inside an animal's body in terms of cell development (Arshad et al., 2017). However, consumers are not necessarily familiar with the processes and technologies, and they may have reservations about biotechnology as a part of modern food production (De Koning et al., 2020). Risks to human health, adverse environmental effects, and unknown long-term effects are common consumer concerns (Hwang et al., 2020). Similarly, tissue engineering and in-vitro production are often subject to ethical discussion. The technology involved in cultured meat production could be considered desirable and morally superior because tissue engineering closely follows natural processes and avoids slaughter and animal cruelty (Mancini & Antonioli, 2019; Chriki & Hocquette, 2020; Weinrich et al., 2020). In turn, the technology could be considered questionable because it may be seen as artificial and unnatural, as the meat is constructed in a laboratory (Varela et al., 2022). Since various consumer studies have shown distrust and concerns toward biotechnology the following hypotheses are proposed:

Hypothesis H2. Concern for food technology will negatively affect willingness to a) try b) buy and c) pay a price premium for cultured meat.

2.3. Food neophobia

Food neophobia is defined as a reluctance to eat new food items or avoidance due to the fear of an unpleasant sensory experience (Guiotto Nai Fovino, 2019; Siegrist & Hartmann, 2020; Verbeke, Sans, & Van Loo, 2015; Faccio &). It is a consumer personality trait, rooted in consumer values, with the intent to avoid the risk associated with unfamiliar food products (Siegrist & Hartmann, 2020; Elzerman et al., 2021; Onwezen et al., 2021). Familiarity and the extent of consumption impact the degree of food neophobia. Consumers who have never eaten any form of alternative meat tend to have higher levels of food neophobia compared with consumers who have consumption experience (De Koning et al., 2020; Hwang et al., 2020; Siegrist & Hartmann, 2020). Age is also positively associated with food neophobia (Siegrist & Hartmann, 2020). Studies report older consumers are more likely to experience food neophobia than younger consumers, especially those living in bigger cities (Hwang et al., 2020; Siegrist & Hartmann, 2020). Food neophobia in older consumers is often associated with dental or gastrointestinal problems (Faccio & Guiotto Nai Fovino, 2019). Concerning gender and

food neophobia, there is no consensus in the recent body of literature. While some studies suggest that men are more neophobic than women, other studies find no significant differences. It is suggested that women tend to be less food neophobic as they are often involved in food purchase and preparation (Meiselman, King, & Gillette, 2020; Siegrist et al., 2013; Faccio & Guiotto Nai Fovino, 2019). This may not apply to cultured meat as it is a new meat product and not available in many food retail outlets. (Hwang et al., 2020; Pakseresht et al., 2022). Respectively the following hypotheses are proposed:

Hypothesis 3 H3. Food neophobia negatively affects consumers' willingness to a) try, b) buy, and c) pay a price premium for cultured meat

2.4. Meat importance and the suitability of cultured meat as an alternative to regular meat

Cardiovascular disease, high cholesterol, cancer, and other illnesses are associated with meat over-consumption. (Schweiggert-Weisz et al., 2020). However, when eaten in moderation, meat is a valuable source of protein. The value of meat for the human body stems from its amino-acid composition and digestibility. In addition, some meat types provide the human body with iron, zinc, vitamin A and vitamin B (Schweiggert--Weisz et al., 2020). Many consumers in western societies consider meat consumption to be an important part of their food culture and dietary acculturation in line with their self-identity (Bogueva et al., 2022; Bonne et al., 2007; Lueders et al., 2022). Personal values, religion, and ethics often determine whether consumers perceive cultured meat as a suitable alternative to regular meat (Treich, 2021). When buying or eating meat, consumers consider intrinsic meat attributes such as freshness, tenderness, leanness, flavour/taste, texture, and smell (Mancini & Antonioli, 2019; Slade, 2018). Taste, texture, and smell are essential to the sensory consumption experience of meat products including meat alternatives and consumer willingness to try cultured meat. (Siegrist & Sütterlin, 2017; Wilks et al., 2021). Some plant-based meat products try to imitate the taste and texture of meat, creating analogs to these sensory characteristics of regular meat, but cultured meat is an identical substitute where such imitation is not required (Pakseresht et al., 2022). An example of such imitation is a burger patty made of plant-based proteins, mostly beets and peas, which imitate bleeding (Slade, 2018; Wilks et al., 2021). Thus, the following hypotheses are proposed:

Hypothesis 4. **(H4).** Meat importance positively affects consumers' willingness to a*) try,* b*)* buy, and c*)* pay a price premium for cultured meat

Hypothesis 5. **(H5).** Meat importance positively affects the consumer's perception of cultured meat as a suitable alternative to regular meat

Hypothesis 6. **(H6).** The consumer's perception of cultured meat as a suitable alternative to regular meat positively affects consumers' willingness to a*) try,* b*)* buy, and c*)* pay a price premium for cultured meat.

2.5. Food allergies

Many consumers suffer from food allergies or sensitivities which require them to follow strict diets (Handral et al., 2022). These consumers rely on food substitutes and are attentive to ingredients (Lipton, 2017). Various plant, fungal and insect-based foods contain allergens (Sadler, 2004), however, whether this is the case for cultured meat is yet to be explored (Hadi & Brightwell, 2021). The recent body of literature lacks information about food allergies and assessments concerning food safety risks related to cultured meat (Hadi & Brightwell, 2021). Amidst this background, the following hypotheses are proposed.

Hypothesis 7. **(H7).** Food allergies affect consumers' willingness to a*) try,* b*)* buy, and c*)* pay a price premium for cultured meat.

2.6. Locavore

Following Bir, Lai, et al. (2019) the term locavore refers to a person whose diet consists only of locally grown or produced food. Locavoring requires rather traditional buying such as from farmers' markets, at the farm gate, from community-supported agriculture, and nearby shops, as it is assumed that food procured from these distribution channels has been produced nearby (Bir, Lai, et al., 2019). Some consumer associations with local food are superior quality, organically or more sustainably produced, and livestock for meat being raised in an area within a certain radius measured in km or driving hours (Bailey et al., 2022; Hempel & Hamm, 2016; Witzling & Shaw, 2019). Naturalness, transparency, insights into food production systems, trust, and a more personal relationship with farmers are other drivers that make local food attractive to consumers (Feldmann & Hamm, 2015; De Boer et al., 2016). Given that cultured meat and how it is produced is unlikely to be viewed as traditional or local food, the following hypothesis is proposed:

Hypothesis 8. **(H8).** Being a locavore negatively affects consumers' willingness to a) try, b) buy, and c) pay a price premium for cultured meat.

2.7. Conceptual model

A conceptual model suggesting that consumers' willingness to try, buy and pay a price premium for cultured meat is the result of a combination of different predictors is proposed (see Fig. 1). This includes attitudinal factors such as food curiosity, food neophobia, concerns towards food technology, factors related to lifestyle, e.g., importance dedicated to local food and meat, the perception of cultured meat as a realistic alternative to regular meat, as well as factors referring to a consumers' background, such as suffering from food allergies. In addition, views and empirical findings have suggested that attitudes towards cultured meat are not universal, and likely to be varied by gender or meat consumption. For example, some research suggests that cultured meat has a greater appeal for men (Bryant & Barnett, 2020; Gomez-Luciano et al., 2019; Slade, 2018) while other findings conclude that the appeal is greater for women (Bryant et al., 2019; Heidemann et al., 2020; Hocquette et al., 2015). Likewise, some researchers consider cultured meat to be a vegetarian product (Chriki & Hocquette, 2020) and suggest that cultured meat could have widespread appeal for no-meat eaters (Caldwell, 2015; Hicks et al., 2018), while others conclude that cultured meat will be more appealing to meat eaters (Franceković et al., 2021; Bryant & Barnett, 2020; Bryant et al., 2019; Valente et al., 2019). Therefore, once the proposed model is examined, the relationships found in the global sample will be examined to see whether they apply to both males and females, as well as the no-meat and meat-eating sub-groups (see Fig. 2).

3. Materials and methods

3.1. Survey instrument and data collection

A globally distributed online survey about plant-based meat alternatives and cultured meat was conducted in nine different countries, spanning all the continents except Africa, in 2018/2019. The survey was distributed via social media and email, but upon request survey participants also had the option to fill out a printed version. Given budget constraints and the diversity within meat-reduced or meat-free diets, and the controversial nature of discussions related to cultured meat and meat/non-meat consumption, sampling via social media platforms were considered suitable for the present study. Social media platforms are cost-effective and allow researchers to access personal contacts, which are directly linked to them, and members of special interest groups that connect with other users throughout the social media networks (Schneider & Harknett, 2022). Such groups are classified as online

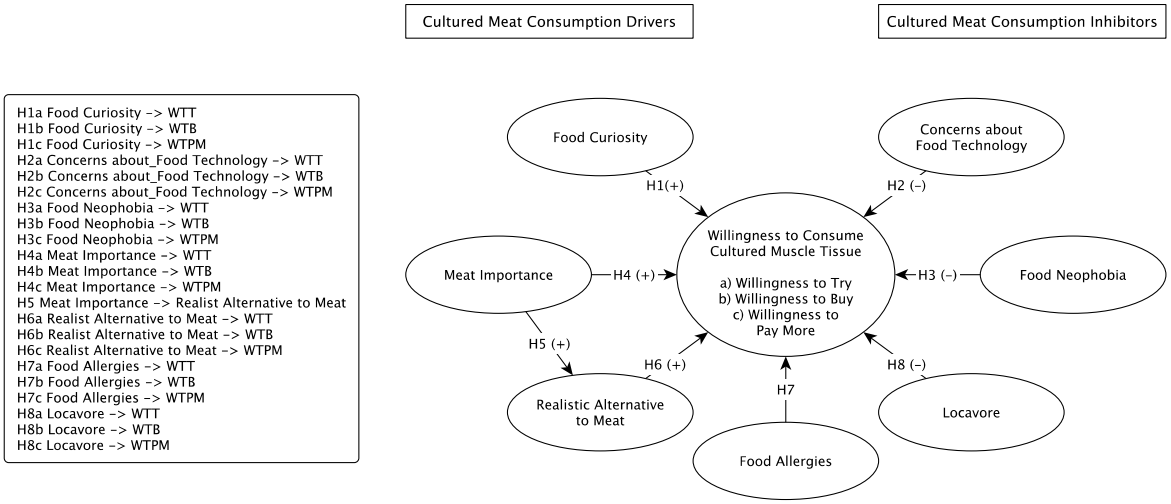

Fig. 1. Proposed conceptual model.

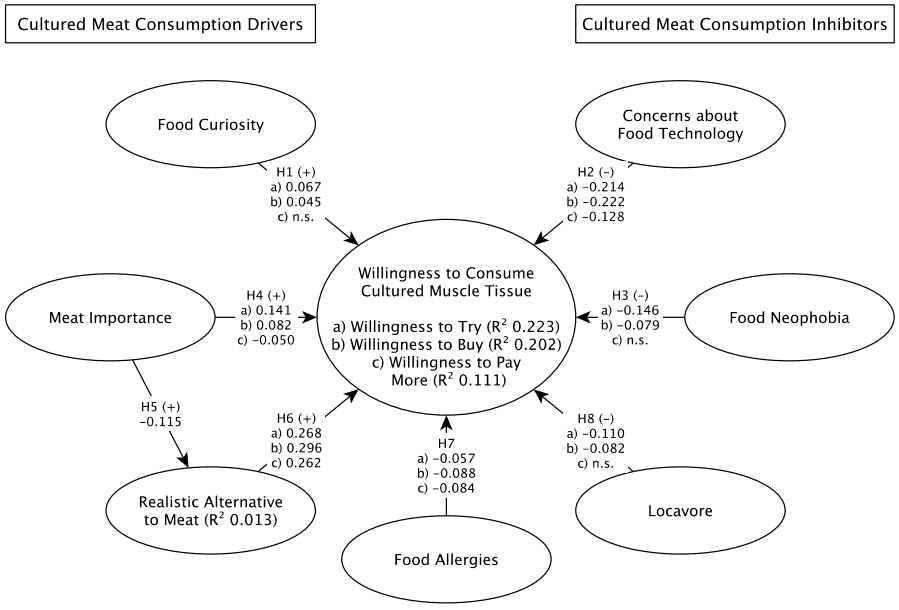

Fig. 2. Conceptual model results.

communities connecting members with shared interests, attitudes, and in the case of this study's context, consumption habits. Such a multi-referral sampling approach somewhat overcomes the risk of one-dimensional information (Schneider & Harknett, 2022).

A total of 3091 responses were complete and appropriate for data analysis. The sample included 571 respondents from China, 539 from the USA 484 from France, 366 from the United Kingdom, 268 from New Zealand, 231 from the Netherlands, 216 from Brazil, 210 from Spain, and 206 from the Dominican Republic. All participants had to be of legal age to take part in the survey, to make sure they could give informed consent themselves (Singer, 2004). Given the cultural diversity of the investigation, the survey was initially designed in English and then translated into other languages. The translation work included grammatical and colloquial adjustments for the English-speaking countries, and for other countries, the respective co-authors translated the survey. All researchers involved in the translation are fluent in English with advanced language proficiency, and native speakers in their respective mother tongues. This way of proceeding assured cultural appropriateness of the translation and translation accuracy (Lee et al., 1999). The corresponding author facilitated a centralized data collection ensuring data safety and consistency. The Human Ethics Committee at Harper Adams University (HAU) in the United Kingdom approved the research design and survey instrument. The survey instrument required all survey participants to provide their informed consent. The survey included closed-end questions related to meat consumption behaviour, willingness to try, buy and pay a price premium for novel food products such as cultured meat, as well as attitudes dedicated to local food and food technology. The study further explored socio-demographic information and personality traits such as food neophobia and food curiosity and included various multi-item scales that were constructed following the extant literature (see Table 2). The two items related to food neophobia and four items related to food curiosity were adapted from Pliner and Hobden (1992), and the items related to food technology concerns (4 items) stem from Cox and Evans (2008). The five items related to meat

Table 1
Sample description.

Country	n	Demographics			Meat Eating Behaviour		
		Male	Female	Age (Mean)	None	Moderate	Heavy
China	571	38.0%	60.8%	31.2	3.7%	85.6%	10.7%
USA	539	24.6%	75.4%	44.1	16.7%	70.1%	13.2%
France	484	59.9%	31.8%	29.0	9.7%	79.1%	11.2%
UK	366	23.8%	76.2%	32.0	18.0%	92.8%	19.1%
New Zealand	268	46.8%	53.2%	37.9	10.4%	68.3%	21.3%
Netherlands	231	37.7%	62.3%	29.6	16.0%	68.4%	15.6%
Brazil	216	43.1%	56.9%	38.3	5.6%	65.3%	29.2%
Spain	210	49.5%	48.1%	35.1	4.8%	63.3%	31.9%
Dominican Republic	206	32.5%	66.0%	26.2	4.4%	68.4%	27.2%
Total	3091	38.9%	59.3%	34.1	10.4%	72.3%	17.3%

Table 2
Descriptive statistics for single-item measures.

Scale/Item	Full Sample		No Meat		Moderate		Heavy	
	Mean	StDev	Mean	StDev	Mean	StDev	Mean	StDev
Locavore (1 = Strongly Disagree to 5 = Strongly Agree)								
I often get my food from traditional and/or local sources.	3.66	0.95	3.61	0.97	3.70	0.93	3.52	1.04
Realistic Alternative to Meat (1 = No, 2 = Possible in distant future, 3 = Possible in near future, 4 = Yes, now.								
Do you think that dietary cultured muscle protein provides a realistic alternative to offset a growing demand for animal based proteins?	2.31	1.01	2.51	1.02	2.30	1.01	2.21	1.00
Food Allergies (1 = No, 2 = Yes)								
Do you have food allergies or sensitivities?	1.31	0.46	1.29	0.46	1.32	0.47	1.26	0.44
Willingness To Consume (1 = No, 2 = Possible, 3 = Yes)								
Willingness to Try Cultured Muscle	2.01	0.82	1.67	0.83	2.02	0.80	2.19	0.82
Willingness to Buy Cultured Muscle	1.73	0.74	1.55	0.78	1.75	0.72	1.79	0.75
Willingness to Pay More for Cultured Muscle	1.39	0.60	1.46	0.71	1.40	0.59	1.31	0.55

importance followed Roininen et al. (1999). All of these statements presented in the survey asked respondents to indicate their agreement on a five-point Likert scale ranging from "strongly disagree (1)" to "strongly agree (5)". Their meat consumption was measured using a single item where they reported either "I consume a moderate amount of meat", "I consume large amounts of meat", or "I do not consume meat."

Two methods were employed to analyze the data. Descriptive analyses were performed, using SPSS, to describe the sample, and PLS-SEM was employed, using SmartPLS, to examine the research model and test the proposed hypotheses. PLS-SEM is suitable for estimating complex causal dependencies between latent variables within explorative models (Chin, 1998; Henseler et al., 2015). It was especially appropriate in the current research as it does not require data to be normally distributed and can accommodate models with multi-item and single-item measures. Further, SEM models can test models where constructs are considered independent for some relationships and dependent for others; unlike methods like regression, where constructs are either independent or dependent (Hair et al., 2022).

The first step in PLS-SEM is to examine the measurement or outer model, focusing on the relationships between items and construct scales. Factor loadings (>0.4) indicate that items contribute to scales and average variance extracted or AVE (>0.5) indicates that scales sufficiently capture item variance. Reliability via Chronbach's Alpha and composite reliability (>0.6 in exploratory studies) confirm the internal consistency of the scale items. Together, these tests confirm convergent validity (Hair et al., 2022). Discriminant validity confirms that scales are measuring conceptually distinct constructs, and this is confirmed with the Fornell-Larker criterion (cross-loadings less than the square root of AVE) and Heterotrait-Monotrait or HTMT (<0.9) (Hair et al., 2022; Fornell & Larker, 1982).

The second step in the PLS-SEM is to assess the inner or structural model, focusing on model fit, explanatory power, and predictive relevance. Model fit in PLS-SEM is somewhat problematic and should be used with caution (Hair et al., 2022), but Goodness of Fit scores and Normed Fit Indices are often reported and higher scores indicate better fit. Standardized Root Mean Square Residual (SRMR) scores can be problematic (>0.10) or acceptable (<0.08). Explanatory power (R^2) measures the model's ability to explain the variance of the dependent variables and can be classified as weak (~0.25), moderate (~.50), or substantial (~0.75). Q^2 values indicate the predictive relevance of a model and can be classified as adequate (>0), medium (~0.25), and strong (~0.50) (Hair et al., 2022). Once both steps have been successful, the model is appropriate for hypothesis testing.

3.2. Data analysis

Table 1 provides insight into the demographics of the survey. Frequencies are also reported for gender and meat-eating habit sub-groups. The sample consisted of 59.3% women and 38.9% men, with the remaining 1.2% preferring not to reveal their gender identity. The mean age of the sample was 34 years old. While 10.4% of the survey participants indicated they eat no meat, 72.3% stated they eat meat in moderation, and 17.3% classified themselves as heavy meat eaters. Overall, Spain, Brazil, and the Dominican Republic had the highest percentage of heavy meat eaters, whereas the UK, the US, and the Netherlands had the highest percentage of non-meat eaters. The inclusion of non-meat eaters in the sample builds on the following assumption. Some non-meat eaters would enjoy eating meat but choose not to because of religious beliefs or otherwise disapprove due to animal husbandry, animal cruelty, or other ethical reasons. Given that cultured meat could overcome these issues, it may provide these consumers with an authentic and ethical meat alternative (Chriki & Hocquette, 2020; Van der Weele & Driessen, 2013). Table 2 reports the means, minima, maxima, and standard deviations for the single-item measures in the model.

3.3. Measurement model

Following Hair et al. (2022), the assessment of the model's measurement was conducted to check for reliability and validity. Table 3 shows that the Cronbach Alpha indicators were above 0.7 except for Food Neophobia. This low Cronbach Alpha is somewhat mitigated by satisfactory composite reliability indicators for all scales (>0.7). Support for scale convergent validity was found with average variance extracted (AVE) scores above 0.5 and item factor loadings above 0.6. with exception of one food neophobia item (Some foods look too weird to eat.). With all but one indicator within appropriate ranges, the requirements of construct reliability and convergent validity were deemed to have been satisfied (Hair et al., 2011, 2022).

After accessing construct reliability and validity, evaluating the discriminant validity of the constructs via Fornell–Larcker criterion and Heterotrait Multitrait (HTMT) ratio was performed. As displayed in Table 4, the discriminant validity requirements were fulfilled for all constructs. All HTMT ratios are below 0.90 and for the Fornell-Lacker criterion, the cross-loadings are less than the diagonal values (Fornell & Larcker, 1981; Hair et al., 2022; Henseler et al., 2015). Finally, tests for the presence of collinearity were performed. The averaged variance inflation factor (VIF) score was used to determine if collinearity occurred among the constructs (Hair et al., 2019). The VIF scores ranged from 1.000 to 1.155 with an average VIF score of 1.085, indicating that collinearity was not an issue within the proposed model. Hair et al. (2019) suggest that VIF scores should not be greater than 5, and ideal values are below 3.

Table 3
Scale loadings, reliabilities, and convergent validity.

Scales and Items	Factor Loadings	Cronbach's Alpha	Composite Reliability	AVE
Food Curiosity (1 = Strongly Disagree to 5 = Strongly Agree)		0.740	0.837	0.563
I am constantly sampling new and different foods	**0.729**			
I like foods from different countries	**0.748**			
At dinner parties I will try a new food	**0.702**			
I like to try new foods from all over the world	**0.818**			
Food Neophobia (1 = Strongly Disagree to 5 = Strongly Agree)		**0.360**	**0.730**	**0.590**
If I do not know what is in a food, I will not eat it	**0.933**			
Some foods look too weird to eat	**0.556**			
Concerns about Food Technology (1 = Strongly Disagree to 5 = Strongly Agree)		**0.744**	**0.839**	**0.566**
There are plenty of tasty foods around so that we do not need to use new food technologies to produce more	**0.709**			
New food technologies decrease the natural quality of foods	**0.726**			
New products using new food technologies can help people have a balanced diet	**0.779**			
Innovations in food technology can help us produce foods in a sustainable manner	**0.791**			
Meat Importance (1 = Strongly Disagree to 5 = Strongly Agree)		**0.909**	**0.933**	**0.737**
Eating meat is necessary for obtaining beneficial nutrients	**0.738**			
Meat is an important part of a healthy and balanced diet	**0.835**			
The taste of meat is important to me	**0.920**			
The texture of meat is important to me	**0.912**			
The smell of meat is important to me	**0.875**			

Table 4
Fornell–larcker criterion and heterotrait multitrait ratio.

Fornell-Larker Criterion	Concerns about Food Technology	Food Curiosity	Food Neophobia	Meat Importance
Concerns about Food Technology	0.752			
Food Curiosity	−0.178	0.750		
Food Neophobia	0.038	−0.302	0.768	
Meat Importance	−0.017	−0.044	−0.048	0.859
Heterotrait-Monotrait Ratio				
Food Curiosity	0.238			
Food Neophobia	0.100	0.604		
Meat Importance	0.031	0.095	0.311	

3.4. Structural model

The proposed structural model was tested resulting in a goodness of fit (GoF) of 0.370, a normal fit index (NFI) of 0.805, and a standardized root mean square residual (SRMR) of 0.063 for the overall sample. This indicates adequate model fit, considering a satisfactory SRMR less than 0.08 and greater than 0.10 is considered problematic, as suggested by Hair et al. (2022).

The model fit scores for all the analyzed sub-samples were also adequate, with 0.381 (GoF), 0.777 (NFI), and 0.068 (SRMR) for the female sub-sample and 0.378 (GoF), 0.723 (NFI), 0.069 (SRMR) for the male sub-sample. The no-meat eating sub-sample was 0.466 (GoF), 0.740 (NFI), and 0.088 (SRMR) and the heavy meat eating sub-sample was 0.391 (GoF), 0.597 (NFI), and 0.081 (SRMR).

For explanatory power, the model's constructs contributed to an R^2 for willingness to try cultured meat of 0.223, for willingness to buy cultured meat of 0.202, and willingness to pay a price premium of 0.111. The R^2 for cultured meat as a realistic alternative to regular meat of 0.013, but meat importance was the only predictor. Deducing from the R^2 values, it is clear that the model's constructs are better suited to explain future behaviour that represents a lower level of commitment. Willingness to try something represents a low level of commitment, buying a slightly higher level, and the highest commitment would be to pay a premium for something. This model explained 22.3% of the variance of willingness to try cultured meat (low commitment), explained 20.2% of willingness to buy cultured meat (slightly higher commitment), and only 11.1% of willingness to pay a price premium for cultured meat (highest commitment). Overall, the R^2 values would be classified as weak, but considering the exploratory nature of the research, the results do provide sufficient explanatory power.

3.5. Multigroup analysis

To examine the generality of the model, its structure was tested on sub-groups of the sample. Two sets of sub-groups were chosen: male vs. female, and no-meat vs. heavy meat eaters. The choice of no-meat vs heavy meat eaters was predicated on the fact that over 70% of the sample were moderate meat eaters and the model tests were unlikely to differ from the overall sample. Thus, a model comparison of extremes (no-meat vs heavy meat eaters) was the most likely to yield differences. The first step of the model comparisons was to test the structural model for each of the sub-groups and examine any variations from the

complete sample. This was followed by a partial least squares multi-group analysis, which tested whether the observed sub-group differences were statistically significant. Following Hair et al. (2018) and Henseler et al. (2009), this type of analysis relies on non-parametric significance testing for the difference of group-specific results that, like hypotheses testing, rely on a bootstrapping technique. Hair et al. (2018) state that results are significant at the 5% level if the p-value is less than 0.05. When the MGA approach is employed while comparing sub-group models, it can confirm the significance of sub-group variations.

4. Results

The results from hypothesis testing are presented in Table 5. This includes the overall sample as well as the sub-samples. Results from the multigroup analysis are displayed in Table 6.

In the overall sample, food curiosity positively influenced willingness to try and buy cultured meat, supporting hypotheses H1a/b. However, no significance was found for hypothesis H1c, where food curiosity was used as a predictor of consumers' willingness to pay a price premium for cultured meat (see Table 5). Comparisons between sub-groups (see Table 5) and the multi-group analyses (see Table 6) confirmed two differences in the sub-groups, namely that H1a and H1b were supported in the male sub-group but not supported in the female sub-group. While the meat subgroups did not support H1a or H1b, the MGA did not find significant differences between them.

Concerns about food technology seem to have a negative effect on consumers' willingness to try, buy and pay a price premium for cultured meat, supporting hypotheses H2a/b/c in the overall sample (see Table 5). In male-female sub-samples, H2a/b/c was supported for both men and women, although the relationship towards willingness to buy was significantly stronger for men (see Table 6). Across the heavy meat-no meat sub-samples, H2a/b were supported and H2c was supported for no-meat eaters. The relationship between food technology and willingness to pay a price premium was not significant for heavy meat eaters and this difference was confirmed in the MGA. (see Table 6).

Food neophobia negatively affected consumers' willingness to try and buy cultured meat, therefore supporting H3a/b in the overall sample (see Table 5). H3c was not supported as food neophobia was not found to be a significant predictor of willingness to pay a price premium for cultured meat. In the male-female sub-sample comparisons, the only significant difference was that the path between food neophobia and willingness to try was stronger for men (Table 6). No significant differences in path relationships were found in the no-meat - heavy meat sub-samples (see Table 6).

In the overall sample, meat importance positively affects consumer willingness to try & buy, but negatively affects willingness to pay a price premium and negatively impacts the perception of cultured meat as a suitable alternative to regular meat. These results support hypotheses H4a/b but are opposite to what was predicted for H4c and H5 (see Table 5). When comparing the male and female sub-samples, the relationships between meat importance and willingness to try and buy, were significantly more positive for women (see Table 6). When examining the sub-samples, women had more positive (less negative for H4c) relationships between meat importance and willingness to consume. Interestingly, all the hypotheses involving meat importance, H4a/b/c and H5, were supported for the no meat sub-group, and all the relationships were significantly more positive compared with the heavy meat group (see Table 6).

Cultured meat may be seen as a realistic alternative to regular meat, and this influences their willingness to consume, supporting hypotheses H6 a/b/c in the overall sample (see Table 5). This was found to be significantly stronger among females for willingness to try and buy cultured meat (see Table 6).

Those with locavore tendencies are less willing to try and buy cultured meat, with women locavores also willing to pay a price premium. This supports hypotheses H8a/b for the total sample and H8c for women (see Tables 5 and 6).

For the present study, significant negative relationships have been found between having food allergies and willingness to try, buy, and pay more for cultured meat, supporting hypotheses H7a/b/c (see Table 5). Comparing the sub-samples, males had stronger negative relationships between food allergies and willingness to try and buy, and heavy meat eaters had a weaker negative relationship between food allergies and willingness to pay more for cultured meat (see Table 6).

5. Discussion

The results related to food curiosity and consumers' willingness to try and buy cultured meat confirm recent studies. Food curiosity is a strong predictor, positively impacting consumers' willingness to try alternative meat products including cultured meat (Hwang et al., 2020). The non-significant relationship between food curiosity and willingness to pay a price premium can be explained as follows: According to Gomez-Luciano et al. (2019) and Kantor and Kantor (2021), cultured meat is already more widely known in various countries e.g., the UK, Spain, Brazil, and the Dominican Republic, through media coverage. Hence, societal familiarity with cultured meat may have dampened food curiosity. In addition, cultured meat is not yet widely commercially available in food retail and gastronomy (Pakseresht et al., 2022), which may limit the overall willingness to pay a price premium, even though consumers may be food curious. For the sub-samples, these results are in line with previous studies, which found that men find cultured meat to be an attractive product (Bryant & Sanctorum, 2021; Onwezen et al., 2021; Slade, 2018) which is in part related to product attributes as well as environmental impacts (Kantor & Kantor, 2021). Compared to women, men tend to have an overall higher interest and willingness to pay for cultured meat (Kantor & Kantor, 2021; Mancini & Antonioli, 2019).

The food technology results for the overall sample can be explained by the fact that the sample spans various countries, including European countries, where consumers have strong preferences towards the naturalness of food and reservations toward cellular agriculture (Kantor & Kantor, 2021). Bryant (2020) and Baum et al. (2022) indicate that societal stakeholders such as media and farming lobbyists contribute their fair share to the negative perception of food technology by framing their reporting, so consumers disapprove. Moreover, the use of food technology to produce cultured meat is concerning for some consumers, as they disapprove of the increased reliance on technology which causes a disconnection from nature and inhibits social change in this direction (Bryant, 2020; Dilworth & McGregor, 2015). Another reason for concerns about food technology relates to personal values and moral opinions toward cellular agriculture and tissue engineering (Ryynänen & Toivanen, 2022). Previous studies show that heavy meat eaters and non-meat eaters share favourable attitudes toward cultured meat (Franceković et al., 2021). These usually stem from the perceived sustainability benefits of the product, allowing to overcome adverse effects on the environment. However, the food technology involved the production of cultured meat and may be a barrier to paying premium prices. Asioli, Bazzani, and Nayga (2021) indicate that emphasis on technology in the context of cultured meat is not beneficial to buying. Verbeke, Sans, and Van Loo (2015) indicate that "artificial", "from the laboratory", and "unnatural" are common consumer perceptions who either fear or feel concerned about the technology used for cultured meat production.

Food neophobia alongside distrust and disgust is one of the strongest attitudinal predictors inhibiting consumers' willingness to accept meat alternatives and their willingness to pay for cultured meat. (Bryant et al., 2019a, b; Wilks et al., 2019; Siegrist & Hartmann, 2020; Hwang,2020; Onwezen et al., 2021). In the context of cultured meat, food neophobia and concerns about food technology seem to be closely linked, and this can be attributed to the nature and production process of cultured meat.

Table 5
Path coefficients.

	Complete Sample			Female Sub-group			Male Sub-group			No Meat Sub-group			Heavy Meat Sub-group		
Hypothesised Path Relationship	**Coef-ficient**	**t-Stat**	**P Value**	**Coef-ficient**	**t-Stat**	**P Value**	**Coef-ficient**	**t-Stat**	**P Value**	**Coef-ficient**	**t-Stat**	**P Value**	**Coef-ficient**	**t-Stat**	**P Value**
H1a Food Curiosity - > WTT	**0.067**	3.990	0.000	0.035	1.659	0.097	**0.133**	4.574	0.000	0.078	0.804	0.422	0.075	1.762	0.078
H1b Food Curiosity - > WTB	**0.045**	2.678	0.007	0.010	0.482	0.630	**0.101**	3.647	0.000	0.056	0.524	0.6	0.057	1.348	0.178
H1c Food Curiosity - > WTPM	0.028	1.548	0.122	0.007	0.300	0.764	**0.069**	2.473	0.013	0.043	0.543	0.587	0.062	1.301	0.193
H2a Concerns about_Food Technology - > WTT	**−0.214**	13.097	0.000	**−0.194**	9.286	0.000	**−0.233**	8.369	0.000	**−0.185**	3.495	0	**−0.256**	6.676	0
H2b Concerns about_Food Technology - > WTB	**−0.222**	13.473	0.000	**−0.188**	8.773	0.000	**−0.258**	9.813	0.000	**−0.205**	4.247	0	**−0.205**	5.445	0
H2c Concerns about_Food Technology - > WTPM	**−0.128**	7.088	0.000	**−0.118**	4.985	0.000	**−0.127**	4.512	0.000	**−0.207**	4.314	0	−0.024	0.61	0.542
H3a Food Neophobia - > WTT	**−0.146**	8.763	0.000	**−0.176**	8.242	0.000	**−0.106**	3.720	0.000	**−0.17**	3.433	0.001	**−0.178**	4.451	0
H3b Food Neophobia - > WTB	**−0.079**	4.752	0.000	**−0.101**	4.762	0.000	**−0.064**	2.264	0.024	**−0.123**	2.386	0.017	−0.067	1.681	0.093
H3c Food Neophobia - > WTPM	0.003	0.163	0.871	−0.002	0.071	0.944	0.005	0.158	0.874	−0.064	1.245	0.213	0.024	0.475	0.634
H4a Meat Importance - > WTT	**0.141**	7.719	0.000	**0.175**	8.285	0.000	0.014	0.422	0.673	**0.312**	6.271	0	0	0.01	0.992
H4b Meat Importance - > WTB	**0.082**	4.464	0.000	**0.113**	5.062	0.000	−0.031	1.020	0.308	**0.27**	4.837	0	−0.055	1.246	0.213
H4c Meat Importance - > WTPM	**−0.050**	2.715	0.007	−0.017	0.713	0.476	**−0.165**	5.691	0.000	**0.218**	4.163	0	**−0.12**	2.431	0.015
H5 Meat Importance - > Realist Alternative to Meat	**−0.115**	5.455	0.000	**−0.155**	6.166	0.000	**−0.130**	4.676	0.000	**0.204**	3.981	0	**−0.168**	3.413	0.001
H6a Realist Alternative to Meat - > WTT	**0.268**	16.174	0.000	**0.302**	14.110	0.000	**0.223**	8.071	0.000	**0.194**	3.997	0	**0.296**	7.754	0
H6b Realist Alternative to Meat - > WTB	**0.296**	18.643	0.000	**0.341**	16.724	0.000	**0.232**	8.826	0.000	**0.227**	5.052	0	**0.324**	8.444	0
H6c Realist Alternative to Meat - > WTPM	**0.262**	16.415	0.000	**0.282**	13.699	0.000	**0.229**	8.895	0.000	**0.234**	5.407	0	**0.253**	5.877	0
H7a Food Allergies - > WTT	**−0.057**	3.502	0.000	−0.018	0.840	0.401	**−0.103**	3.941	0.000	−0.089	1.892	0.058	−0.062	1.666	0.096
H7b Food Allergies - > WTB	**−0.088**	5.241	0.000	**−0.044**	2.050	0.040	**−0.140**	5.321	0.000	**−0.129**	2.742	0.006	−0.051	1.289	0.198
H7c Food Allergies - > WTPM	**−0.084**	4.938	0.000	**−0.059**	2.715	0.007	**−0.105**	3.955	0.000	**−0.169**	3.954	0	−0.027	0.665	0.506
H8a Locavore - > WTT	**−0.110**	6.728	0.000	**−0.113**	5.312	0.000	**−0.110**	4.163	0.000	−0.066	1.244	0.214	**−0.128**	3.619	0
H8b Locavore - > WTB	**−0.082**	4.961	0.000	**−0.097**	4.427	0.000	**−0.057**	2.144	0.032	−0.06	1.13	0.259	**−0.087**	2.303	0.021
H8c Locavore - > WTPM	−0.030	1.603	0.109	**−0.051**	2.136	0.033	0.014	0.483	0.629	−0.096	1.792	0.073	0.009	0.208	0.835
Significant at p ≥ 0.05	Bold														

(*continued on next page*)

Table 5 (*continued*)

Complete Sample	Female Sub-group	Male Sub-group	No Meat Sub-group	Heavy Meat Sub-group
Significant in complete sample, n.s. in sub-sample				
Significant in sub-sample, n. s. in complete sample				
Significant but opposite sign to Hypothesised				

Table 6
Multigroup analysis results.

	Female - Male			Sub-group	Heavy Meat -No Meat			Sub-group
Hypothesised Path Relationship	**Coefficient**	**t-Stat**	**P Value**	**Path Change**	**Coefficient**	**t-Stat**	**P Value**	**Path Change**
H1a Food Curiosity - > WTT	**−0.098**	0.997	0.005	Female n.s.	−0.003	0.587	0.826	
H1b Food Curiosity - > WTB	**−0.091**	0.996	0.008	Female n.s.	0.001	0.559	0.882	
H1c Food Curiosity - > WTPM	−0.062	0.952	0.095		0.018	0.462	0.924	
H2a Concerns about_Food Technology - > WTT	0.039	0.131	0.262		−0.071	0.860	0.279	
H2b Concerns about_Food Technology - > WTB	**0.069**	0.021	0.041		0.000	0.500	0.999	
H2c Concerns about_Food Technology - > WTPM	0.009	0.398	0.795		**0.183**	0.002	0.004	Heavy Meat n.s.
H3a Food Neophobia - > WTT	**−0.070**	0.977	0.046		−0.008	0.545	0.911	
H3b Food Neophobia - > WTB	−0.038	0.858	0.284		0.056	0.193	0.387	
H3c Food Neophobia - > WTPM	−0.006	0.563	0.874		0.088	0.112	0.225	
H4a Meat Importance - > WTT	**0.161**	0.000	0.000		**−0.312**	1.000	0.000	Heavy Meat n.s.
H4b Meat Importance - > WTB	**0.143**	0.000	0.001		**−0.325**	1.000	0.000	Heavy Meat n.s.
H4c Meat Importance - > WTPM	**0.149**	0.000	0.000	Female n.s.	**−0.338**	1.000	0.000	No Meat Reverse
H5 Meat Importance - > Realist Alternative to Meat	−0.025	0.751	0.498		**−0.372**	1.000	0.001	No Meat Reverse
H6a Realist Alternative to Meat - > WTT	**0.079**	0.011	0.022		0.103	0.050	0.100	
H6b Realist Alternative to Meat - > WTB	**0.109**	0.001	0.001		0.097	0.053	0.105	
H6c Realist Alternative to Meat - > WTPM	0.053	0.053	0.106		0.019	0.375	0.750	
H7a Food Allergies - > WTT	**0.085**	0.006	0.012	Female n.s.	0.027	0.323	0.645	
H7b Food Allergies - > WTB	**0.096**	0.003	0.005		0.078	0.100	0.200	
H7c Food Allergies - > WTPM	0.045	0.092	0.185		**0.143**	0.008	0.015	Heavy Meat n.s.
H8a Locavore - > WTT	−0.003	0.537	0.925		−0.062	0.830	0.340	
H8b Locavore - > WTB	−0.039	0.872	0.255		−0.027	0.660	0.680	
H8c Locavore - > WTPM	**−0.065**	0.960	0.080	Female Sig	0.105	0.064	0.129	
Significant sub-samples difference ($p \leq 0.05$)	**Bold**							
Significant in complete sample, n.s. in sub-sample								
Significant in sub-sample, n.s. in complete sample								
Significant but opposite sign to complete sample								

Note: Coefficients are the differences between the groups. For example, a positive score indicates that Female > Male or Heavy Meat > No Meat.

A consumer's willingness to try new food products stems from their system of norms and values, which often relates to both the product itself and the associated technology involved in the production (De Koning et al., 2020). The differences between the male and female sub-sample are consistent with some research reporting that men tend to be more food neophobic than women (Faccio & Guiotto Nai Fovino, 2019; Siegrist et al., 2013).

Meat importance refers to intrinsic attributes such as meat taste, texture, smell and nutritional importance, which are essential product characteristics for consumers when it comes to meat purchase and consumption (Schouteten et al., 2016; Meiselman, King, & Gillette, 2020). In contrast to other plant-based meat alternate natives, the sensory and nutritional features are the same as regular meat (Pakseresht et al., 2022). The insignificant or opposite results for the sub-sample of heavy meat eaters may be due to their eating behaviour. Changing meat-eating behaviour involves self-regulation and executive function and overcoming pre-existing habits (Tomiyama et al., 2020) or believing that cultured meat may not be as healthy as regular meat (Bryant & Barnett, 2020).

The significant findings for the non-meat eaters may appear, at first glance, surprising. However, the reasons for not eating meat and the motivations to consume meat are quite diverse. Rosenbaum and Burrow (2017) report that motivations, aversions, and constraints are the major reasons why consumers follow a meat-reduced or meat-free diet. While meat aversion is not a likely explanation for these findings, motivations and social reasons may explain these results. Cultured meat alleviates some of the negatively viewed practices associated with meat production, such as factory farming and animal cruelty, which are among the pro-social and moral motivations for people choosing not to eat meat. In addition, consumers who are restrained from meat consumption by their social circles, including family and friends, may view cultured meat as an acceptable food choice. A posthoc analysis highlighting the diversity of possible motivations for the non-meat eaters in the sample can be found in Table A1 (appendix). The frequencies of a selection of questionnaire items indicate agreement with pro-social ideas such as locavorism (63% agreement) and sustainability concerns (81.3%). Evidence of personal motivations is also present with the importance of personal health (76.2% agreement) and disagreement with the nutritional necessity of meat (91.9% disagreement) and affinity towards the sensory experience of meat-eating (79.7% disagreement). Tomiyama (2020) also explains some of the significant differences between the male and female sub-samples, claiming that men are less inclined to eat a plant-based diet but are more willing to try and buy cultured meat.

Overall, cultured meat appears to be a realistic alternative to traditional meat, and is very appealing to socially conscious consumers. These types of consumers are aware of the problems associated with

meat production and consumption. Cultured meat allows consumers to continue eating meat without supporting the negative externalities or being worried about food safety as the meat stems from a sterile environment (Verbeke, Marcu, et al., 2015; Gómez-Luciano et al., 2019; Van Der Weele & Driessen, 2019; Weinrich et al., 2019). The potentially high price-point of cultured meat could be a factor contributing to consumers' evaluation of whether it is a realistic alternative to traditional meat, and this deserves critical attention. The existing body of literature shows that other meat substitutes products targeting consumers following a meat-free or meat-reduced diet are often more expensive than traditional meat products (Apostolidis & McLeay, 2016), which could explain why consumers are willing to pay a price premium. In the long term, the price point needs to be reduced for cultured meat to be accessible to consumers at all income levels.

Food allergies influence the food consumption habits and purchase decisions of many consumers. While various plant and fungal-based proteins contain allergens, whether or not cultured meat contains allergens remains unclear (Hadi & Brightwell, 2021). The negative relationships suggest that consumers with food allergies are less willing to consume cultured meat, or perhaps their allergies temper their willingness to try, buy and pay a price premium for any new foods with the potential to cause allergic reactions.

The findings concerning locavores may be because the beliefs and values underpinning locavorism conflict with the notion of cultured meat. Local food is often associated with traditional farming methods, affordability and community (Caspi et al., 2012), which is inconsistent with laboratory-grown meat, even if the laboratory is nearby.

6. Managerial implications

The present study focused on key factors driving consumer willingness to try, buy, and pay a price premium for cultured meat. The study highlighted food neophobia, having food allergies, being a locavore, and having concerns about food technology as inhibiting factors towards willingness to try, buy and pay a price premium for this meat alternative. Food curiosity, meat importance, and a consumer's perception of cultured meat as a realistic alternative to regular meat were important drivers that positively impacted consumers' willingness to try, buy and pay more. These findings are of relevance to marketing managers in food retail and gastronomy. Once cultured meat is more widely commercially available, and offered at commercially viable prices, familiarizing consumers with the products and making production processes transparent and understandable will be crucial to wider acceptance. The use of appropriate terminology is also key, and avoiding terminology related to the technical process and association with laboratory conditions is best avoided. Instead, marketing campaigns should focus on the benefits of cultured meat for the environment, animal welfare, and any hypo-allergenic characteristics. In addition, marketers and policymakers need to price cultured meat at a level that is commensurate with its benefits. While novelty may command unrealistic prices in the short term, it is hoped that the price point will settle to a reasonable level so it has a chance to be a viable alternative to meat and other meat substitutes. Often there is a price premium for meat substitutes, which may be morally justifiable, but fair access including consumers with low income should be considered. Concerns about food technology can be mitigated through trustworthy food system actors. Food retailers and regulators should be called to assess, assure, and communicate the safety of the products and the technology employed in the production of all meat alternatives.

To foster food curiosity towards cultured meat as a new product, the sensory product attributes of cultured meat should be highlighted and adjusted to the needs, wants and value systems of different consumer groups. To generate consumer acceptance for cultured meat, targeting meat lovers and socially conscious consumers who enjoy the taste of meat but have refrained from meat consumption due to the adverse effects on the environment and animals are likely to be beneficial, as cultured meat corresponds to their lifestyle and values.

7. Suggestions for future research

Future research could examine consumer attitudes in Singapore where cultured meat, in the form of "Just Food's Good Meat Chicken Nuggets", is already commercially available. Research at the point of sale could overcome any discrepancies between behavioural intention and actual consumer behaviour. The study would uncover whether cultured meat is a realistic opportunity for Asian consumers. With the potential of more countries following the example of Singapore, future research should focus on how to target consumers, following the work of Asioli, Bazzani, and Nayga (2021) and Baum et al. (2022). In addition, employing a best-worst methodology could be a suitable approach to studying consumer preferences towards product attributes. The approach allows understanding the underlying trade-offs when consumers consider the bundle of cultured meat attributes.

Empirical studies dedicated to cultured meat should target vegan and vegetarian consumers and build on the work of Rosenbaum and Burrow (2017). Such work would add to the extant literature and could distinguish pro-social, personal, and moral motivations alongside aversion and constraints as important predictors in PLS-SEM studies. Lastly, in a cultured meat consumption context, the relationship between food neophobia and disgust could be extended. Aversion of uncleanliness and micro-organisms could be included as mediators in the model.

8. Limitation

In terms of limitations, a few methodological aspects deserve critical attention. In the present study, respondents self-reported their meat consumption habits and classified themselves as non-meat eaters, moderate meat eaters, or heavy meat eaters. The survey participants had no numerical references for this classification which could have led to socially desirable answers and underreporting of consumption. In future investigations, the authors aim to address this issue by measuring portion sizes and frequencies of consumption as well as incorporating cheap talk (from game theory) to experimental designs to overcome this potential problem. A further limitation concerns the non-meat eaters specifically. Their reasons for abstaining from meat consumption did not consider reasons such as aversions, motivations, and constraints. In upcoming investigations, the authors will consider these aspects and aim to contribute a finer-grained analysis of why consumers avoid meat, are opposed to cultured meat, and are willing to try and buy cultured meat. Lastly, the sampling approach of the present study is likely to have affected the sample. The perspective of elderly consumers may have been under-represented given the investigation through social media. Recruitment through dietary organizations or opt-panel providers in the future could overcome this drawback.

Author contribution

David Dean: data analysis and interpretation; editing manuscript; Meike Rombach: writing manuscript and data interpretation; Frank Vriesekoop: project manager, research design, research supervision, data curation, Wim de Koning: research design and research supervision; Luis Kluwe Aguiar: researcher; Martin Anderson: researcher supervision; Philippe Mongondry: research supervision; Mark Oppong-Gyamfi: researcher; Beatriz Urbano: researcher; Cristino Alberto Gómez Luciano: researcher; Bin Jiang: researcher; Wendy Hao: researcher; Emma Eastwick: researcher; Zheng (Virgil) Jiang: researcher; Anouk Boereboom: researcher.

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Institutional review board statement

The study was conducted in accordance with the Declaration of Helsinki, and the protocol was approved by the Human Ethics Committee at HAU, United Kingdom.

Informed consent

All participants gave their informed consent for inclusion before they participated in the study.

Declaration of competing interest

The authors declare no conflict of interest in the context of this publication. The funders had no role in the design of the study; in the collection, analyses, or interpretation of data; in the writing of the manuscript or in the decision to publish the results.

Data availability

Data will be made available on request.

Appendix

Table A1
Selected Item Frequencies for No Meat Sub-group

Individual Questionnaire Items (No meat: N = 320)	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Total
Locavore: I often get my food from traditional and/or local sources	2.2%	13.2%	21.0%	48.6%	15.0%	100%
Health: I am very particular about the healthiness of the food I eat	0.7%	5.9%	17.2%	40.9%	35.3%	100%
Sustainability: I am worried about humankind's ability to provide the nutritional needs for all people living on earth now	2.1%	5.3%	11.3%	36.9%	44.4%	100%
Meat Nutrition: Meat is an important part of a healthy and balanced diet	71.3%	20.6%	5.9%	0.9%	1.3%	100%
Meat Appreciation: The taste of meat is important to me	65.9%	13.8%	11.3%	6.9%	2.1%	100%

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