The link between people's social perceptions of cultivated meat eaters and their acceptance of cultivated meat

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Abstract

Low consumer acceptance emerges as one important barrier to the introduction of cultivated meat, a novel food which offers an opportunity for more sustainable and ethical meat production. Due to the motives for impression management and self-esteem, one factor that could contribute to people's acceptance of cultivated meat is their perceptions of other individuals who consume cultivated meat. In the current research, two online survey studies with 393 Singaporean undergraduate students and 401 American adults were conducted to explore the perceptions of cultivated meat eaters. In both studies, participants were randomly assigned to read one of three profiles that described a cultivated meat eater, a conventional meat eater, and a vegetarian. Then they rated the target on a list of traits. In Study 1, cultivated meat eaters were evaluated as more eco-friendly than conventional meat eaters, and less pure than vegetarians. In Study 2, cultivated meat eaters were perceived as more eco-friendly than conventional meat eaters, and less healthy than vegetarians; further, the participants tended to believe that others' general perception of cultivated meat eaters is slightly negative, and their belief about others' perception was strongly correlated with their acceptance of cultivated meat. Practical implications and future directions were discussed.

Keywords: Conventional meat, cultivated meat, dietary choices, social perceptions

1. Introduction

Human's heavy meat consumption raises concerns about food sustainability, climate change, and public health (Aiking, 2011; Tilman & Clark, 2014; Tomiyama et al., 2020; Van Loo et al., 2020; Willett et al., 2019). Despite these concerns, annual global meat consumption continues to rise (Bogueva et al., 2020; Possidónio et al., 2021). Cultivated meat is an emerging technology that poses an exciting opportunity to address these challenges. This novel technology involves forming a structured meat, such as hamburgers, meatballs, and steak, by means of multiplying muscle stem cells extracted from an adult animal (Bhat et al., 2015; Chodkowska et al., 2022; Silva & Semprebon, 2021). Cultivated meat provides a means to more sustainable food production because it uses less land, water, and energy in the production process (Silva & Semprebon, 2021). Theoretically, a single muscle biopsy from one living cow could cultivate 1 billion beef burgers in 1.5 months whereas the same number of beef burgers produced by conventional methods would require 0.5 million cows over the course of 18 months (Tomiyama et al., 2020). In addition, cultivated meat can be produced without slaughtering animals, and hence circumvent the ethical and animal welfare issues inherent in conventional meat production (Bryant et al., 2019). Another outstanding advantage of cultivated meat is that its production may allow greater food security. Whereas conventional meat production involves the use of pesticides and antibiotics, cultivated meat can be produced without using these harmful chemicals (Bhat et al., 2015).

Despite the aforementioned advantages that might be provided by cultivated meat, Chriki and Hocquette (2020) noted some possible drawbacks of cultivated meat, including dysregulation of cell lines that may happen with high levels of cell multiplication (as happened in cancer cells), the lack of transparency regarding the control of cultivated meat's nutritional composition, as well as the ethical issue of rearing animals to harvest cells so as to produce cultivated meat. Moreover, technical challenges to large-scale production of cultivated meat and low customer acceptance emerge as potential barriers to promoting the consumption of cultivated meat (Bodiou et al., 2020; Chriki & Hocquette, 2020).

To enable transitions towards more sustainable, ethical, and healthier food consumption, it is important to overcome technical challenges to ensure safety and nutritional value of cultivated meat and to enable large-scale production. In the meantime, it is also imperative to understand the factors that influence consumer acceptance of cultivated meat. Recent studies have examined the relationship between people's perceptions or beliefs about cultivated meat and their acceptance of it. For example, perceived naturalness of cultivated meat was positively correlated with its acceptance (Bryant & Dillard, 2019). Besides, the provision of positive information about cultivated meat's properties, such as its quality and flavour and its similarities to conventional meat, increased the acceptance of cultivated meat (Bryant & Dillard, 2019; Rolland et al., 2020). However, stereotypical perceptions about people who consume cultivated meat have not been empirically studied, even though such perceptions could play an important role in the acceptance of cultivated meat given the motives for achieving a desired social image (Chong et al., 2022). To fill this gap in the literature, the current research set out to examine the stereotypical perceptions of people who consume cultivated meat. In addition, people's beliefs about how others perceive cultivated meat eaters were explored. We argue that such beliefs about others' perception of cultivated meat eaters may differ from one's own perception of cultivated meat eaters and might independently contribute to the acceptance of cultivated meat.

1.1 | Diet-based social perceptions

Prior research has well established that food consumption has important implications for social perception (Thomas, 2016). In many cultures, the type of food a person consumes bears symbolic values that can reflect, communicate, and reaffirm his/her identity, gender roles, and social status (Barker et al., 1999; Vartanian et al., 2007). Specifically, people's meat-related dietary choices can be a pertinent factor affecting social judgements. Most previous studies on stereotypes associated with meat consumption asked participants to rate vegetarian and omnivore targets on a predetermined list of traits (Branković & Budžak, 2021). For example, Ruby and Heine (2011) contrasted stereotypical perceptions of vegetarians and omnivores (i.e., individuals who consume both vegetables and meat) in terms of moral virtue and masculinity. They found that vegetarians were rated as more virtuous and less masculine than omnivores. Another study also found vegetarians to be viewed as healthier, purer, and more physically attractive than omnivores (Ruby, 2008). More recently, it was found that vegetarians (vs. omnivores) were stereotypically perceived as more moralistic and eccentric, which predicted lower perceived social attractiveness (De Groeve et al., 2021). A few studies also examined stereotypes about vegetarians in an open-ended manner. Minson and Monin (2012) asked non-vegetarian participants to generate three word associations about vegetarians. They found that vegetarians tended to be associated with negative psychosocial characteristics (e.g., self-righteous, annoying, crazy), especially among participants who anticipated more moral reproach from vegetarians. Branković and Budžak (2021) assessed stereotypical contents about vegetarians using the same paradigm (i.e., free association task) and found ambivalent stereotypes about vegetarians. Vegetarians were associated with both good and poor health, being moral, and being moralistic/judgemental. Whereas previous research found that vegetarians were perceived as less masculine than omnivores, few participants explicitly associated vegetarians with a lack of masculinity (Branković & Budžak, 2021).

Notably, these studies only focused on social perceptions of people who consume conventional meat or not (i.e., vegetarians or vegans), whereas the perceptions of people who consume *cultivated meat* have not been studied. To our knowledge, the current investigation is the first to examine the stereotypical perceptions of cultivated meat eaters. Specifically, we aimed to examine stereotypical perceptions on dimensions of moral virtue, eco-friendliness, masculinity, purity, healthiness, physical attractiveness, eccentricity, and sociability.

1.1.1 | Stereotypical perceptions of cultivated meat eaters

As introduced earlier, the production process of cultivated meat allegedly causes significantly less severe environmental problems and animal suffering than conventional meat production. In this light, cultivated meat eaters might be thought to base their dietary choice on these pro-environmental and moral considerations, thus signalling themselves as being more virtuous and pro-environmental compared to conventional meat eaters.

Meat-eating is also relevant for evaluations of masculinity. Whereas meat stands as a symbol of manhood across many cultures (Adams, 1994; Twigg, 1979), meat cultivated in the laboratory may not be associated with

an equivalent level of masculinity. It was posited that the masculine value of meat is at least partly derived from the killing and subjugation of animals (Rosenfeld, 2020; Salmen & Dhont, 2023), yet the production of cultivated meat does not require slaughtering animals. Therefore, it is possible that cultivated meat eaters would be stereotypically perceived as less masculine than conventional meat eaters.

Perceived purity can be negatively influenced by the consumption of cultivated meat. 'You are what you eat' is a common belief across cultures. If people think negatively about a certain food, they tend to believe that the bad properties of this food can be passed onto its consumers (Stein & Nemeroff, 1995). There is consistent evidence showing that cultivated meat tends to be perceived as unnatural (Wilks et al., 2021). A well-documented lay belief about naturalness is that natural things are good whereas unnatural things are bad (Bryant et al., 2019). In this light, people who consume cultivated meat might be perceived as less pure because they are 'contaminated' by the 'unnatural essence' of cultivated meat.

The stereotypical perception of healthiness might be influenced by competing mechanisms. On the one hand, cultivated meat (vs. conventional meat) can be produced using fewer chemicals, and therefore it might be perceived to be better for health. On the other hand, perceived unnaturalness of cultivated meat can lead to the inference that cultivated meat is unsafe and detrimental to human health (Bryant et al., 2019). Therefore, it is unclear whether cultivated meat eaters tend to be perceived as more or less healthy compared to conventional meat eaters. The current research can empirically address this question.

Importantly, cultivated meat eaters might be stereotypically viewed as more eccentric and less sociable compared to conventional meat eaters. De Groeve et al. (2021) argued that vegetarians violate the mainstream ideologies and practices that normalize animal-based consumption as natural and necessary and that their deviance from established norms may detract from their social appeal. Corroborating these arguments, they found that vegetarians and vegans tended to be perceived as more eccentric and less sociable compared to omnivores. In a similar vein, it is possible that cultivated meat eaters (vs. conventional meat eaters) would be perceived as more eccentric and less sociable because their consumption of cultivated meat might be perceived as signalling their deviance from the established social norm of consuming butchered animal meat (Hyers, 2006).

Lastly, it might be fruitful to explore the stereotypical perception of cultivated meat eaters in terms of physical attractiveness. It has been found that people eating a healthy (vs. non-healthy) diet tended to be viewed as more physically attractive (Stein & Nemeroff, 1995). Considering that cultivated meat eaters may differ from conventional meat eaters and vegetarians in terms of perceived healthiness of their diet, the three groups may differ in terms of perceived physical attractiveness.

RQ1: What are people's perceptions of cultivated meat eaters in terms of moral virtue, eco-friendliness, masculinity, purity, healthiness, physical attractiveness, eccentricity, and sociability?

Of note, at the current time, cultivated meat is not a mainstream product and many people may not be familiar with cultivated meat. More importantly, most people may not have any actual experience of interacting with cultivated meat eaters, and thus how they perceive cultivated meat eaters could be largely based on their personal beliefs, intuitions, or peer influences. Nonetheless, it would still be meaningful to explore people's general perceptions or impressions of cultivated meat eaters as consumer acceptance towards cultivated meat could be affected by such perceptions.

1.2 | Motives for desired self-image and social image

As discussed earlier, consuming cultivated meat could have implications on how the consumers are stereotypically perceived on several dimensions. To help inform efforts to promote consumer acceptance of cultivated meat, it would be important to examine not only people's own stereotypical perceptions but also their beliefs of others' stereotypical perceptions of cultivated meat eaters. These perceptions could act in concert or act independently to impact people's willingness to consume cultivated meat.

Vartanian et al. (2007) highlighted the crucial role played by food-consumption stereotypes (i.e., perceptions of others based on their food intake) in food choice, and proposed two psychological pathways whereby food-consumption stereotypes can potentially exert its influence. First, as eating is oftentimes a social activity, people may exploit food-consumption stereotypes for impression management – they may eat in a particular way with a view to presenting a desirable social image. Second, internalized food-consumption stereotypes play a role in self-evaluations. Eating behaviour thus is shaped by these stereotypes to establish and maintain a desired self-image. Supporting these arguments, empirical evidence suggests that people are motivated to eat in a way that satisfies social expectations about their gender roles. Relative to men, women were more concerned about eating lightly when on a date (Laner & Ventrone, 2000), possibly because eating a small amount of food is associated with perceived femininity. Moreover, it is well established that self-image congruence contributes to consumer behaviour (Hosany & Martin, 2012). For example, teenagers reported greater intentions to smoke when their ideal self-image was aligned with their perceptions of the typical smoker (Barton et al., 1982).

In this light, if an individual perceives cultivated meat eaters as possessing socially desirable traits or traits that are congruent to his/her ideal self-image, this individual may show greater acceptance of cultivated meat. For instance, if cultivated meat eaters are perceived to be more eco-friendly than conventional meat eaters, people for whom environmentalism is a central aspect of their self-concept may consume cultivated meat as a way of achieving their desired self-image.

On the other hand, it would be informative to explore people's beliefs about others' perceptions of cultivated meat eaters. Due to the motive for positive social image, people will probably infer others' view of cultivated meat eaters when they make dietary decisions. If an individual believes that others tend to view cultivated meat eaters negatively, he/she may reject cultivated meat as a way of avoiding negative social evaluations. Literature on pluralistic ignorance showed that one's beliefs about what others think can be inaccurate (Fields & Schuman, 1976). This means that the beliefs about others' perceptions of cultivated meat eaters may be discrepant from the actual public perceptions of cultivated meat eaters. Therefore, aside from examining people's perceptions of cultivated meat eaters' specific traits, the current study also explored people's subjective beliefs regarding whether others perceive cultivated meat eaters positively or negatively.

> RQ2: What are people's beliefs about whether others hold positive or negative general perceptions of cultivated meat eaters?[1]

1.3 | Rationale for the selection of stereotype dimensions

As noted earlier, we selected moral virtue, eco-friendliness, masculinity, purity, healthiness, physical attractiveness, eccentricity, and sociability as the stereotype dimensions to examine in the current research. In this section, we explain why examining stereotype contents on these dimensions would help inform future efforts to promote consumer acceptance of cultivated meat (among the general public and among specific groups).

1.3.1 | Morality and sociability

Morality and sociability represent two major dimensions of universal stereotypical contents, with each dimension associated with distinct functions and traits (De Groeve et al., 2021; Goodwin et al., 2014). Stereotypes regarding morality capture a target's helpful or harmful intentions and are generally considered as the most important dimension in global evaluations of real and hypothetical others, while stereotypes regarding sociability capture a target's tendency to connect and affiliate with others (De Groeve et al., 2021; Goodwin et al., 2014). We examined stereotypical perceptions of morality and sociability because both dimensions were found to positively predict perceived social attractiveness of targets, although the effect of morality was more dominant (De Groeve et al., 2021). Due to the motive for impression management, people may show greater acceptance of cultivated meat if cultivated meat eaters are perceived to be moral and sociable.

Stereotypical perceptions of eccentricity and purity were examined because they can respectively predict one's perceived sociability and morality. People judged as eccentric were perceived as less sociable, even if their eccentricity was benign in nature (see De Groeve et al., 2021, for a review), while perception of impurity was found to negatively predict perception of morality (Stein & Nemeroff, 1995).

1.3.2 | Physical attractiveness and healthiness

We examined the stereotypical perceptions of physical attractiveness and healthiness because these perceptions tend to influence judgements regarding social attractiveness (De Groeve et al., 2021; Palmer & Peterson, 2021; Vartanian et al., 2007).

1.3.3 | Masculinity

We also studied the stereotypical perception of masculinity because people tend to be socialized to conform to their gender roles, such that perceived masculinity of cultivated meat eaters (or lack thereof) may largely affect the acceptance of cultivated meat among male individuals.

1.3.4 | Eco-friendliness

Finally, we chose to examine the stereotypical perception regarding eco-friendliness because cultivated meat poses a potential benefit in reducing the environmental impact of meat consumption and thus appears appealing to environmentalists. Therefore, the acceptance of cultivated meat among environmentalists may not only be determined by the instrumental value of consuming cultivated meat but also its social image value – whether consuming cultivated meat would be seen as pro-environmental by others.

2 | STUDY 1

Aiming to explore RQ1, Study 1 examined for the first time the stereotypical perceptions of cultivated meat

eaters among a Singaporean undergraduate student sample. The stereotypical perceptions of cultivated meat eaters were contrasted to the stereotypical perceptions of vegetarians and conventional meat eaters.

2.1 | Methods

2.1.1 | Participants

A total of 393 Singaporean undergraduate students enrolled in psychology courses (M_{age}=21.89, SD_{age}=1.71) were recruited via the subject pool system of a university (305 females, 82 males, 3 non-binary individuals, and 3 individuals who did not disclose their gender). Each participant either received one course credit or SGD3 for participation.

The sample size was determined based on the practical availability of the student pool. Sensitivity power analysis (α=0.05, $1-\beta$=0.8, N=393) conducted by G*Power suggested that the minimum effect size required to detect a significant group difference was f=0.16 (i.e., a small to medium effect) based on the current sample size.

2.1.2 | Procedure

The study (and the next study) was approved by the university's research ethics board. After providing informed consent, the participants were randomly allocated to one of the three conditions (131 participants in each condition), such that each participant read one of the three profiles describing a hypothetical individual (vegetarian, conventional meat eater, cultivated meat eater), and then rated this individual on a list of traits. Gender and age were reported at the end of the survey. The online survey was hosted by Qualtrics. In the survey flow, a randomizer feature was added to randomly present the three profiles to the participants an equal number of times.

The sample profile of a cultivated meat eater is as follows (adapted from Fries & Croyle, 1993; Ruby & Heine, 2011):

'Person A is a university student. He/she is 20 years old, a sophomore, and earns Bs in most of his/her classes. He/she lives near campus. When there is free time, Person A enjoys listening to good music, going to movies, and being around his/her friends. The foods he/she eats most regularly are lamb, lean beef, salad, whole wheat bread, and burgers made of cultivated meat (i.e., genuine animal meat that is produced by growing animal cells in the laboratory).'

Targets in the other two conditions (i.e., vegetarian and conventional meat eater) were described in identical terms, except that the foods the vegetarian eats most regularly are tofu, vegetable tempura, salad, whole wheat bread, and lentils; the foods the conventional meat eater eats most regularly are lamb, lean beef, salad, whole wheat bread, and chicken burgers. Of note, cultivated meat eater was described as also eating conventional meat because very few people purely eat cultivated meat. Cultivated meat is a novel food and yet to be introduced to a wide market, thus describing cultivated meat eaters in the vignette as eating both conventional and cultivated meat is more consistent with the reality at the current time. Nevertheless, it is possible that some people will purely eat cultivated meat in the future, suggesting that the description of a prototypical cultivated meat eater's diet could possibly change over time.

2.1.3 | Measures

Trait attributions

Participants rated the target along 26 traits on a 7-point Likert scale (1=*not at all* to 7=*extremely*). The measured traits include moral virtue (tolerant of others, ethical, kind-hearted, considerate, virtuous, concerned; α=0.89), eco-friendliness (environmentally aware, eco-friendly; α=0.95), masculinity (masculine), purity (clean, tainted, pure, polluted; α=0.60), healthiness (healthy, fit; α=0.61), physical attractiveness (attractive, good-looking; α=0.84), sociability (friendly, sociable, warm, gregarious, happy, extroverted; α=0.87), and eccentricity (eccentric, odd, unconventional; α=0.78). Measures of perceived moral virtue, masculinity, physical attractiveness, and purity were adapted from scales developed by Stein and Nemeroff (1995); measures of perceived eccentricity and healthiness were developed by De Groeve et al. (2022); the measure of perceived sociability was derived from Goodwin et al. (2014); the measure of perceived eco-friendliness was created by authors of the current research. A composite score of each measure was computed by averaging the scores of scale items. Two items in the purity scale (i.e., tainted, polluted) were reversely scored before computing the composite score of purity.

Dietary pattern

Dietary pattern was measured by a single item adapted from Mullee et al. (2017): 'Please indicate which of the following best describes your dietary pattern?' Participants chose from a list of seven responses: (1) Eating meat or fish almost every day or not intentionally abstaining from meat or fish, (2) Intentionally limiting meat or fish to a few times a week, (3) Eating meat or fish no more than once a week, (4) No meat but eating fish, (5) No meat or fish, (6) No animal products, and (7) Other (please specify) with a textbox. Participants who chose options (3), (4), (5), or (6) and who indicated those dietary patterns in the textbox were considered as consuming a semi-vegetarian/vegetarian diet because they seldom/never consume meat. Dietary pattern was recoded into two categories: non-vegetarian=0, semi-vegetarian/strict-vegetarian=1.

Demographic information

Participants were asked to indicate their gender and age. Gender was dummy coded, with female being the reference category. Age was reported in years.

2.2 | Results

2.2.1 | Demographic comparison

All analyses in this and the following study were performed using IBM SPSS Statistics 29. A one-way ANOVA showed that there was no significant difference in participants' age between the three conditions, $F(2, 390) = 1.20$, $p = 0.30$. A chi-square test of independence revealed that the proportion of males did not significantly differ between the three conditions, $\chi^2(2) = 1.59$, $p = 0.45$. This confirmed no demographic differences in participants between the three dietary profile conditions.

2.2.2 | Comparisons of target perceptions

To examine differences in perceptions of vegetarians, conventional meat eaters, and cultivated meat eaters as described by the three profiles, one-way ANOVAs were performed, with perceived moral virtue, eco-friendliness, masculinity, purity, healthiness, physical attractiveness, sociability, and eccentricity as dependent variables. Post-hoc pairwise comparisons were conducted with Bonferroni corrections, using an adjusted alpha level of 0.006 (0.05/8) to assess significance. Results are shown in Table 1.

The results revealed several significant effects of the targets' dietary choices on participants' perceptions of the targets' traits. The vegetarian was seen as more eco-friendly, healthy, pure, and moral ($ps < 0.001$), and less masculine ($p < 0.001$) than the conventional meat eater. Importantly, it was also shown that the cultivated meat eater was seen as more eco-friendly ($p < 0.001$) than the conventional meat eater, and less pure ($p < 0.006$) than the vegetarian. Additionally, the vegetarian was perceived as more eccentric ($p < 0.05$) than the conventional meat eater; the cultivated meat eater was seen as healthier ($p < 0.05$) than the conventional meat eater and more masculine ($p < 0.05$) than the vegetarian. These differences were significant at the alpha level of 0.05, which gave some weak indication against the null hypotheses.

Considering that people's diet type may affect their perceptions of different dietary groups, we reran the group comparisons after excluding a small group of participants who consumed a semi-vegetarian/strict-vegetarian diet ($n = 35$). Consistent with prior results, it was shown that the vegetarian was seen as more eco-friendly, healthy, pure, and moral ($ps < 0.001$), and less masculine ($p < 0.001$) than the conventional meat eater; the cultivated meat eater was seen as more eco-friendly ($p < 0.001$) and healthier ($p < 0.05$) than the conventional meat eater, and more masculine ($p < 0.05$) and less pure ($p < 0.05$) than the vegetarian. On the other hand, the cultivated meat eater was also seen as more moral and eccentric ($ps < 0.05$) than the conventional meat eater.

3 | STUDY 2

After exploring the stereotypical perceptions of cultivated meat eaters among an undergraduate sample, Study 2 recruited a community sample to examine the replicability of the results about people's perceptions of cultivated meat eaters found in Study 1. In addition, Study 2 aimed to build on Study 1 by exploring RQ2, that is, people's beliefs about others' general perceptions of cultivated meat eaters.

3.1 | Method

3.1.1 | Participants

A total of 401 Americans were recruited from CloudResearch ($M_{age} = 39.06$, $SD_{age} = 12.03$; 227 males, 169 females, 2 non-binary individuals, 1 post-gender individual, and 2 individuals who did not disclose their gender). Each participant received a payment of USD1.3.

Sample size estimate was based on a small-to-medium effect size ($f = 0.16$, $\alpha = 0.05$, $1 - \beta = 0.8$). A priori power analysis by G*Power ($f = 0.16$, $\alpha = 0.05$, $1 - \beta = 0.8$) recommended a sample size of 381. As participants were allowed to skip sensitive items such as willingness to eat or buy cultivated meat, we oversampled participants to buffer for missing data. After removing responses with missing data for focal variables, we had a final sample of 396 participants.

3.1.2 | Procedure

Participants completed an online survey hosted by Qualtrics. Each participant was randomly assigned to read one of the three profiles presented in Study 1, and then rated this target on a list of traits. As per Study 1, random assignment of the participants was enabled by the randomizer feature in the survey flow. There were 133 participants in the vegetarian target condition, and 134 participants in each of the other two target conditions. Following this task, all participants indicated their beliefs about others' general perception of cultivated meat eaters and their acceptance of cultivated meat. At the end of the survey, participants indicated their dietary pattern, gender, age, and religion.

TABLE 1 Comparison of the perceptions of the targets (vegetarian, conventional meat eater, cultivated meat eater) in Study 1.

	1. Vegetarian		2. Conventional meat eater		3. Cultivated meat eater				Post-hoc test (Bonferroni)	
Perception dimension	***M***	***SD***	***M***	***SD***	***M***	***SD***	***F*(2, 390)**	**η^2**	**Group comparison**	***p***
Moral virtue	5.06_{a}	0.92	4.66_{b}	0.77	4.89_{ab}	0.80	7.77***	0.04	1 vs. 3	0.26
									2 vs. 3	0.08
									1 vs. 2	<0.001
Eco-friendliness	5.12_{a}	1.15	3.68_{b}	1.18	4.89_{a}	1.30	53.77***	0.22	1 vs. 3	0.40
									2 vs. 3	<0.001
									1 vs. 2	<0.001
Masculinity	3.77_{a}	1.09	4.30_{b}	1.02	4.11_{ab}	0.89	8.26***	0.05	1 vs. 3	0.02
									2 vs. 3	0.29
									1 vs. 2	<0.001
Purity	4.97_{a}	0.84	4.57_{b}	0.69	4.65_{b}	0.70	10.54***	0.05	1 vs. 3	0.002
									2 vs. 3	1.00
									1 vs. 2	<0.001
Healthiness	5.08_{a}	0.96	4.53_{b}	0.97	4.84_{ab}	0.93	10.79***	0.05	1 vs. 3	0.13
									2 vs. 3	0.03
									1 vs. 2	<0.001
Physical attractiveness	4.46_{a}	0.96	4.52_{a}	0.87	4.32_{a}	0.81	1.61	0.01		
Sociability	5.04_{a}	0.80	5.15_{a}	0.75	5.05_{a}	0.73	0.78	0.004		
Eccentricity	3.48_{a}	1.07	3.16_{a}	1.03	3.42_{a}	1.02	3.51*	0.02	1 vs. 3	1.00
									2 vs. 3	0.12
									1 vs. 2	0.04

Note: Means within the same row that do not share a subscript differ significantly at the adjusted alpha level of 0.006 in pairwise post-hoc comparisons with a Bonferroni correction. Because Levene's test of homogeneity of variance was significant for perceived masculinity, Welch's *F* was reported, with adjusted degrees of freedom: *F*(2, 258). Pairwise comparisons were conducted based on the Tamhane test.

*$p<0.05$; ***$p<0.001$.

After removing responses with missing data, there were 131 participants in the vegetarian target condition, 133 participants in the conventional meat eater target condition, and 132 participants in the cultivated meat eater target condition.

3.1.3 | Measures

Trait rating

As per Study 1, participants rated the target along the same 26 traits. Measured scales include moral virtue ($\alpha = 0.89$), eco-friendliness ($\alpha = 0.94$), masculinity, purity ($\alpha = 0.66$), healthiness ($\alpha = 0.72$), physical attractiveness ($\alpha = 0.86$), sociability ($\alpha = 0.83$), and eccentricity ($\alpha = 0.76$).

Beliefs about others' general perception of cultivated meat eaters

Beliefs about others' general perception of cultivated meat eaters was measured by two items: 'How positively do you think Americans generally perceive cultivated meat eaters?'; 'How positively do you think people in your neighbourhood generally perceive cultivated meat eaters?' These items were rated on a 7-point scale (1 = *very negatively* to 7 = *very positively*). A composite score was computed by averaging these two items, with a higher score indicating beliefs about a more positive perception.

Acceptance of cultivated meat

Acceptance of cultivated meat was measured by five items on a 5-point scale (1 = *not favourable at all/ definitely no* to 5 = *very favourable/ definitely yes*). These items assessed participants' attitude towards cultivated meat, willingness to try cultivated meat, willingness to buy cultivated meat, willingness to eat cultivated meat as a replacement for conventionally produced meat, and willingness to eat cultivated meat compared to plant-based meat substitutes (Chong et al., 2022; adapted from Bryant & Dillard, 2019; Wilks & Phillips, 2017). A composite score was calculated by averaging these five items, with a higher score indicating greater acceptance.

Dietary pattern

As per Study 1, dietary pattern was measured by a single item adapted from Mullee et al. (2017): 'Please indicate which of the following best describes your dietary pattern?', followed by a list of seven choices.

Socio-demographic information

Participants reported their gender, age, and religion. Gender was dummy coded, with female being the reference category. Age was reported in years. Religion was recoded into three categories: Abrahamic (Christian, Islam, Jewish), Dharmic (Buddhist, Hindu), and none/agnostic/atheist/others.

3.2 | Results

3.2.1 | Demographic comparison

A one-way ANOVA revealed that there was no significant difference in age between the three conditions, $F(2, 391) = 1.10$, $p = 0.33$. A chi-square test of independence also showed that the proportion of males did not significantly differ between conditions, $\chi^2(2) = 4.48$, $p = 0.11$.

3.2.2 | Comparisons of target perceptions

One-way ANOVAs were conducted to examine differences between the perceptions of vegetarians, conventional meat eaters, and cultivated meat eaters on dimensions of moral virtue, eco-friendliness, masculinity, purity, healthiness, physical attractiveness, sociability, and eccentricity. Post-hoc pairwise comparisons were conducted with Bonferroni corrections, and significance was based on adjusted alpha levels of 0.006 (0.05/8). The results are summarized in Table 2.

The analyses suggested that the vegetarian target was perceived as more moral ($p < 0.006$), eco-friendly ($p < 0.001$), and healthy ($p < 0.006$) than the conventional meat eater. Importantly, it was shown that the cultivated meat eater was perceived as more eco-friendly than the conventional meat eater ($p < 0.001$), and less healthy than the vegetarian ($p < 0.001$).

As there was only a small group of participants ($n = 50$) consuming a semi-vegetarian/strict-vegetarian diet, we did not test the interaction between diet type and target condition. If excluding participants consuming a semi-vegetarian/strict-vegetarian diet, the vegetarian was perceived as more eco-friendly ($p < 0.001$), heathier ($p < 0.05$), more eccentric ($p < 0.05$), yet not different in morality compared to the conventional meat eater; the cultivated meat eater was perceived as more eco-friendly ($p < 0.001$) than the conventional meat eater, and less healthy ($p < 0.006$) than the vegetarian.

3.2.3 | Interaction between religion and target condition

To recall, religion was recoded into three categories: Abrahamic, Dharmic, and none/agnostic/atheist/others. There were 232 participants in the Abrahamic category, and 155 participants in the category of none/agnostic/atheist/others, whereas only 9 participants were in the Dharmic category. Therefore, we only examined the interaction between Abrahamic religion (vs. none/agnostic/atheist/others) and target condition. Two-way ANOVAs showed a significant interaction effect on perception of eco-friendliness, $F(2, 381) = 7.04$, $p < 0.001$, but not on other perception dimensions. Among individuals not

TABLE 2 Comparison of the perceptions of the targets (vegetarian, conventional meat eater, cultivated meat eater) in Study 2.

	1. Vegetarian		2. Conventional meat eater		3. Cultivated meat eater				Post-hoc test (Bonferroni)	
Perception dimension	***M***	***SD***	***M***	***SD***	***M***	***SD***	***F*(2, 393)**	**η^2**	**Group comparison**	***p***
Moral virtue	5.35_{a}	0.89	5.02_{b}	0.87	5.21_{ab}	0.86	4.92**	0.03	1 vs. 3	0.60
									2 vs. 3	0.20
									1 vs. 2	0.006
Eco-friendliness	5.53_{a}	1.14	4.48_{b}	1.22	5.28_{a}	1.14	29.52***	0.13	1 vs. 3	0.24
									2 vs. 3	<0.001
									1 vs. 2	<0.001
Masculinity	3.79_{a}	1.38	4.11_{a}	1.14	4.06_{a}	1.18	2.64	0.01		
Purity	5.27_{a}	0.96	5.01_{a}	0.94	5.11_{a}	0.91	2.49	0.01		
Healthiness	5.47_{a}	0.92	5.08_{b}	0.93	5.05_{b}	0.89	8.78***	0.04	1 vs. 3	<0.001
									2 vs. 3	1.00
									1 vs. 2	0.002
Physical attractiveness	4.70_{a}	1.04	4.76_{a}	0.92	4.66_{a}	0.88	0.40	0.002		
Sociability	5.21_{a}	0.87	5.22_{a}	0.72	5.13_{a}	0.83	0.56	0.003		
Eccentricity	3.59_{a}	1.21	3.26_{a}	1.13	3.55_{a}	1.19	3.17*	0.02	1 vs. 3	1.00
									2 vs. 3	0.12
									1 vs. 2	0.07

Note: Means within the same row that do not share a subscript differ significantly at the adjusted alpha level of 0.006 in pairwise post-hoc comparisons with a Bonferroni correction. Because Levene's test of homogeneity of variance was significant for perceived masculinity, Welch's *F* was reported, with adjusted degrees of freedom: *F*(2, 260). Pairwise comparisons were conducted based on the Tamhane test.

*$p<0.05$; **$p<0.01$; ***$p<0.001$.

from an Abrahamic religion, the vegetarian ($M = 5.83$, $SE = 0.16$) was perceived as more eco-friendly than the cultivated meat eater ($M = 5.11$, $SE = 0.15$), $p < 0.006$, and the conventional meat eater ($M = 4.16$, $SE = 0.17$), $p < 0.001$; the cultivated meat eater was perceived as more eco-friendly than the conventional meat eater, $p < 0.001$. Among individuals from an Abrahamic religion, the conventional meat eater ($M = 4.67$, $SE = 0.13$) was perceived as less eco-friendly than the cultivated meat eater ($M = 5.46$, $SE = 0.14$) and the vegetarian ($M = 5.32$, $SE = 0.13$), $ps < 0.001$, whereas there was no difference in the perception of the cultivated meat eater and vegetarian.

3.2.4 | Correlation between participants' belief about others' general perception of cultivated meat eaters and their acceptance of cultivated meat

Descriptive statistics were computed for the belief about others' general perception of cultivated meat eaters ($M = 3.76$, $SD = 1.44$) and the acceptance of cultivated meat ($M = 3.12$, $SD = 1.18$). Pearson's correlation showed that the belief about others' perception of cultivated meat eaters and the acceptance of cultivated meat was strongly positively correlated, $r(394) = 0.57$, $p < 0.001$.

Partial correlation controlling for gender, age, and religion was also examined, given that these sociodemographic characteristics may affect people's belief about others' general perception of cultivated meat eaters and their acceptance of cultivated meat. It was shown that the belief about others' general perception of cultivated meat eaters was also strongly correlated with the acceptance of cultivated meat after controlling for covariates, $r(383) = 0.58$, $p < 0.001$.

Considering that people who seldom/never eat meat may show lower acceptance of cultivated meat regardless of their perceptions of cultivated meat eaters, the same analyses were conducted excluding participants consuming a semi-vegetarian/strict-vegetarian diet. After removing this group, descriptive statistics were computed for the belief about others' general perception of cultivated meat eaters ($M = 3.71$, $SD = 1.46$) and the acceptance of cultivated meat ($M = 3.10$, $SD = 1.18$). Pearson's correlation indicated a strong positive correlation between the two variables, $r(344) = 0.60$, $p < 0.001$. Partial correlation also indicated a strong positive correlation after controlling for covariates, $r(335) = 0.61$, $p < 0.001$.

3.2.5 | Comparisons between two samples in age, gender, and diet type

A one-way ANOVA revealed that American participants ($M = 39.11$, $SD = 12.09$) were significantly older than Singaporean participants ($M = 21.89$, $SD = 1.71$), $F(1, 783) = 774.68$, $p < 0.001$. A chi-square test of independence suggested that the proportion of males was significantly higher in the American sample (57.5%) than in the Singapore sample (21.2%), $\chi^2(1) = 107.61$, $p < 0.001$. However, a chi-square test of independence suggested that the proportion of individuals consuming a semi-vegetarian/strict-vegetarian (vs. a non-vegetarian) diet was not significantly different between the American sample (12.6%) and the Singaporean sample (8.9%), $\chi^2(1) = 2.84$, $p = 0.09$. This suggests that the two samples did not significantly differ in diet type despite the demographic differences.

3.2.6 | Interaction between culture and target condition on trait perceptions

Two-way ANCOVAs controlling for age, gender, and diet type showed that target condition and culture did not have a significant interaction effect on any perception dimensions.

4 | DISCUSSION

4.1 | Theoretical contributions

The current research contributes to the understanding of people's stereotypical perceptions of cultivated meat eaters, an emerging dietary group, in Singapore and the United States. Across two studies, it was consistently shown that cultivated meat eaters were judged as more eco-friendly and equivalently masculine compared to conventional meat eaters. Additionally, whereas past research found that cultivated meat tended to be perceived as unnatural, cultivated meat eaters did not differ from conventional meat eaters in terms of perceived purity in both samples. Importantly, as stated earlier, considering that cultivated meat is an unconventional food that deviates from the normative practice of animal exploitation, cultivated meat eaters could be considered as deviating from mainstream ideologies and behaviours, and thus are perceived to be more eccentric and less sociable. However, the results indicated that cultivated meat eaters were perceived as not different from conventional meat eaters in terms of eccentricity and sociability among American participants. On the other hand, among Singaporean participants who consumed an omnivore diet, cultivated meat eaters were seen as more eccentric ($p < 0.05$) than conventional meat eaters, which gave some weak indication against the null hypothesis. As there is no strong evidence supporting this perceived difference, future research can examine and compare perceived eccentricity of conventional meat eaters and cultivated meat eaters among a larger sample of omnivores in Singapore and test whether the result can be replicated.

Importantly, the current research also examined Americans' beliefs about other people's perceptions of cultivated meat eaters. Despite having positive perceptions of cultivated meat eaters on the dimensions examined in this research, American participants tended to believe that others' general perception of cultivated meat eaters is slightly negative (M=3.77 on a 7-point scale), and their belief was strongly correlated with their acceptance of cultivated meat. In light of these findings, American participants' belief about others' general perception of cultivated meat eaters appeared to be misaligned with their own perceptions. One possibility for this mismatch is pluralistic ignorance, such that people hold misbeliefs about others' actual perception of cultivated meat eaters. Given the finding that individuals' belief about others' perception of cultivated meat eaters was strongly correlated with their acceptance of cultivated meat, one factor that may contribute to some people's lower acceptance of cultivated meat is perhaps their misbelief that other people would think negatively of cultivated meat eaters. In this case, informing the public about the positive social perceptions of cultivated meat eaters would be important for enhancing their acceptance of cultivated meat. Another possible reason for the misalignment is that American participants' belief about others' perception is accurate, but our American sample is generally more open to cultivated meat than an average American. To address this issue, future research can apply quota sampling to ensure that sample characteristics (e.g., gender, age, education level) are representative of the characteristics of the general population.

In addition, this research might be useful for identifying prospective consumers of cultivated meat. A major barrier to plant-based dietary choices among men is the general perception of vegetarianism as 'unmanly' (Bogueva et al., 2020). If cultivated meat eaters tend to be viewed as less masculine than conventional meat eaters, cultivated meat may similarly provoke non-acceptance among men. The finding that cultivated meat eaters were viewed as equivalently masculine as conventional meat eaters thus has important practical implications, as it signals that cultivated meat is potentially appealing to male individuals. Another important finding is that cultivated meat eaters were viewed as eco-friendly. As discussed earlier, people are motivated to eat in a way that helps them establish and maintain their ideal self-image. Narrative psychology has shown that consumer choices are driven by the motivation to manage and express their self-identity (e.g., as an environmentalist) (Schmitt, 2012). In particular, food consumption behaviour can be a means by which individuals create and present stories about the self. It was posited that the self is created through constantly monitoring and controlling one's self-narrative, which can be reflected in his or her consumption practices or dietary choices (Schembri et al., 2010). From this perspective, consumers do not just buy goods or services but rather 'buy' the ability or licence to tell a story about themselves – i.e. to express, explore, and affirm their identities (e.g., Polkinghorne, 2022). Given these considerations, cultivated meat may be particularly appealing to individuals for whom their environmentalist identity is a central aspect of their self-concept. In addition, for conventional meat eaters, eating cultivated meat may seem more feasible than converting to vegetarianism. Therefore, meat eaters might more easily reap an ecological image by means of eating cultivated meat.

4.2 | Study limitations

While the current research is the first to explore the stereotypical and social image perceptions of cultivated meat eaters and to offer a novel perspective on studying consumer acceptance of cultivated meat, it has several limitations. First, the current research is exploratory in nature as we did not formulate specific hypotheses for testing, and the exploration of the stereotypical perceptions of cultivated meat eaters was confined by the quantitative design of the study, such that it might omit important stereotype content dimensions that can contribute to positive or negative global evaluation. Future research can consider qualitative or semi-qualitative methods (e.g., free association task, open-ended items) to further explore stereotypical perceptions of cultivated meat eaters.

Second, as discussed earlier, it is unclear whether the discrepancy between American participants' own perceptions of cultivated meat eaters and their beliefs about others' perceptions is due to pluralistic ignorance or due to our sample being biased towards individuals with a more open attitude towards cultivated meat. Future research can address this discrepancy by seeking to recruit a representative sample in the research.

Third, cultivated meat is a novel food and people may not have a lot of social interactions with cultivated meat eaters. Study 2 was conducted in May 2023. At that time, cultivated meat had not yet been approved in the United States. Most American participants thereby may not have any prior experiences interacting with cultivated meat eaters and may not even be aware of this food, meaning that their perceptions of cultivated meat eaters could be largely based on their personal beliefs or intuitions. Although cultivated meat had been approved in Singapore when Study 1 was conducted, we did not collect information about participants' awareness of cultivated meat or whether they have prior interactions with cultivated meat eaters. Therefore, it remains to be tested whether the findings of the current research would remain the same among people who have real-world social interactions with cultivated meat eaters.

4.3 | Future directions

Although the current research indicated that people tend to believe that others' general perception of cultivated

meat eaters is slightly negative, it remains unexplored why people hold such belief. It is possible that there are unexamined negative stereotypical contents about cultivated meat eaters. For example, people may perceive cultivated meat eaters as moralistic (e.g. preachy, imposing one's own moral standards on others), and this negative perception could in turn contribute to their belief that others would evaluate cultivated meat eaters negatively. Future research can examine stereotypical contents about cultivated meat eaters in an open-ended manner to possibly capture a wider range of stereotypical perceptions. It is also possible that while people tend to perceive cultivated meat eaters positively, they do not believe that others would perceive cultivated meat eaters as positively as they do. Future research can first examine whether participants think that others' perception of cultivated meat eaters would be positive/negative/neutral, and then ask them to specify why they think that others would perceive cultivated meat eaters positively or negatively.

The results revealed some differences in stereotypical perceptions of cultivated meat eaters between the Singaporean and the American samples. Conventional meat eaters were perceived as less healthy than vegetarians in both samples. However, whereas cultivated meat eaters were perceived as equivalently healthy as vegetarians among Singaporean undergraduate students, cultivated meat eaters were perceived to be less healthy than vegetarians among the American community sample. We speculate that this difference in healthiness perception could be due to difference in knowledge and beliefs about cultivated meat. On the one hand, given that cultivated meat had been approved in Singapore (but not in the United States) at the time the research was conducted, the Singaporean sample might be more knowledgeable about the health benefits of cultivated meat. On the other hand, there exist notable value differences between the Singaporean culture and the American culture (e.g., cultural tightness, collectivism/individualism; (Gelfand et al., 2011; Hofstede, 2001)). These cultural differences may strengthen people's adherence to norms, thus rendering Singaporeans more receptive of the alleged conceptions of novel food technologies (e.g., being healthy and nutritious), as well as potentially affecting their stereotypical perceptions of cultivated meat eaters on other dimensions. Future research can explore the cultural factors that influence stereotypical perceptions of cultivated meat eaters.

Notably, a strong correlation between belief about others' general perception of cultivated meat eaters and acceptance of cultivated meat does not imply causation in a particular direction. Perceived social image could inform acceptance, but people might also project their own (low) acceptance of cultivated meat onto the generalized others when making inference about others' perception of cultivated meat eaters. Future research can employ an experimental design and examine whether manipulating people's belief about others' perception of cultivated meat eaters would affect their acceptance of cultivated meat. Taking into consideration the divergence between consumer behaviour in public and private contexts (Silva & Semprebon, 2021), future research can also explore how (beliefs about others') perception of cultivated meat eaters may affect consumer acceptance of cultivated meat in public and private contexts.

5 | CONCLUSION

Given sustainability concerns regarding the environment and conventional meat production, promoting the prevalence of cultivated meat consumption presents an important opportunity to address these challenges facing many developed and developing countries. Thus, it becomes very timely to empirically investigate the factors that contribute to the acceptance of this novel food source. The current research oriented itself as the first exploration of the social perceptions of cultivated meat eaters and how these perceptions may motivate a less or more favourable attitude towards acceptance of cultivated meat. This research is deemed an important first step to motivate further research on the dynamics of perceptions of cultivated meat consumption and its acceptance.

AUTHOR CONTRIBUTIONS

Xiaoyu Dai: Conceptualization; formal analysis; investigation; methodology; writing – original draft. **Angela K.-y. Leung:** Conceptualization; funding acquisition; methodology; supervision; writing – review and editing. **Mark Chong:** Methodology; writing – review and editing.

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CONFLICT OF INTEREST STATEMENT

None of the authors have any conflict of interest to disclose.

OPEN RESEARCH BADGES

This article has earned an Open Data badge for making publicly available the digitally-shareable data necessary to reproduce the reported results. The data is available at https://data.mendeley.com/datasets/9czvysbwy5/2.

DATA AVAILABILITY STATEMENT

The data and code for this research can be accessed at: https://data.mendeley.com/datasets/9czvysbwy5/2.

ETHICS STATEMENT

All participants gave informed consent before they participated. All procedures of the research were approved by the ethics board of Singapore Management University (IRB-23-023-A019-M1(523)).

RESEARCH MATERIALS AVAILABILITY STATEMENT

All research materials can be found in the Supporting Information.

PRE-REGISTRATION STATEMENT

The studies conducted in this research were not preregistered.

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ENDNOTE

[1] RQ2 was formed after an initial examination of the stereotypical perceptions of cultivated meat eaters. After discovering positive perceptions of cultivated meat eaters despite the relatively low consumer acceptance of cultivated meat found in previous research, we speculated that people may assume others to view cultivated meat eaters negatively, thus impacting their acceptance of cultivated meat. To extend the prior findings, we conducted a subsequent study exploring people's beliefs about others' perceptions.

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Additional supporting information can be found online in the Supporting Information section at the end of this article.