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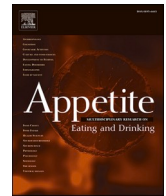
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Higher well-being individuals are more receptive to cultivated meat: An investigation of their reasoning for consuming cultivated meat

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ABSTRACT

It is evident that over-consumption of meat can contribute to the emission of hazardous greenhouse gases. One viable way to address such climate impact is to make people become more aware of more sustainable diet options, such as cultivated meat. However, it is challenging to instigate change in people's meat-eating habit, and empirical works have been examining the psychological factors that are related to consumers' willingness to consume cultivated meat. Research has suggested that psychological well-being can play a role in the meaning-making of food consumption, with higher well-being individuals showing more recognition of other sociocultural benefits of consuming food beyond just fulfilling their sustenance needs. As existing works have yet to understand the link between well-being and consumption of novel foods, the current research set out to fill this gap by examining the relationship between people's psychological well-being and their willingness to consume cultivated meat via different reasons (mediators) for consuming cultivated meat. We recruited a representative sample of 948 adults in Singapore to complete an online survey. The study offered the first evidence that there is a positive relationship between people's psychological well-being and their willingness to consume cultivated meat. Further, results revealed that their higher willingness can be motivated by the perception that cultivated meat is as healthy and nutritious, as safe as, and has the same sensory quality as real meat, and is beneficial to the society. This investigation adds to the growing literature on consumer acceptance of cultivated meat by showing the novel finding that well-being and receptivity to cultivated meat is positively linked, and such a positive link can be explained by people's better recognition of the prospective benefits offered by this alternative food.

1. Introduction

The world is facing pressing environmental degradation and sustainability challenges. Based on the Intergovernmental Panel on Climate Change (IPCC, 2014), human activities, including their food consumption, have contributed to global warming since pre-industrial times. Alarmed by the climate's fast-approaching Point of No Return, the Paris Agreement was signed by 195 nations in 2015 to chart social and economic initiatives to limit the global temperature increase to 1.5 °C. However, the current emission levels and the energy policies pursued by most governments make it difficult to reduce humanity's carbon footprint and achieve the Paris Agreement's temperature target (Climate Action Tracker, 2020).

It is reasonable to argue that people tend to identify intensive economic activities, infrastructure development, resource extraction, deforestation and the like to be the major contributors to greenhouse gas emissions. It may be less likely for people to recognize that over-

production and over-consumption of meat is a significant contributor to emitting hazardous greenhouse gases (Harguess et al., 2020; Sanchez-Sabate & Sabaté, 2019). The world now produces more than four times as much meat as compared to the 1960s (Food and Agriculture Organization, 2022). Producing meat requires arable land, such that clearing land for grazing and ranching can cause forest fires and deforestation, with the downstream consequences of upsetting the ecosystem, endangering wildlife, and causing new infectious diseases. Also of import, the COVID-19 pandemic has exposed the food import dependency and disruptions in global food supply chain facing many countries, particularly those with limited resources and food-growing capacities (e.g., Singapore).

Considering the adverse environmental impacts of meat consumption and food supply challenges, it is believed that one viable solution is to change people's meat-eating habits (Harguess et al., 2020). To achieve a more sustainable diet, one way that has been proposed is to substitute conventional meat with alternative proteins such as cultivated

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meat (Onwezen et al., 2021). For small island states that are faced with limited land, fresh water and labor (e.g. Singapore), the self-production of alternative proteins such as cultivated meat has the potential to boost food security and nutrition self-sufficiency (Teng, 2020). Cultivated meat is produced by the technology that allows in-vitro extraction and cultivation of animal cells by growing these stem cells into muscle tissues in a sterile laboratory setting (Post et al., 2020). Therefore, the process does not involve raising animals and slaughtering them for harvesting the meat (Datar & Betti, 2010).

Given that cultivated meat is produced in a laboratory, previous research has suggested that people often raise concerns such as food safety (e.g., Gomez-Luciano et al., 2019; Ronteltap et al., 2007), lack of naturalness (Roman et al., 2017), and food neophobia (Birch et al., 2019) as deterrents to trying out such novel food. To understand and motivate consumer acceptance of cultivated meat, empirical research and meta-analytical reviews have sought to examine the key factors that explain why some individuals show greater acceptance than others. For instance, in a recent systematic review on consumer acceptance of alternative proteins, Onwezen et al. (2021) summarized some categories of factors evident from prior research that can impact people's acceptance of cultivated meat. These include product-related attributes such as food security (e.g., Verbeke et al., 2015) and taste (e.g., Bryant & Barnett, 2018; Tucker, 2014), external attributes such as distrust in science and political conservatism (e.g., Wilks et al., 2019), and psychological factors such as disgust sensitivity (e.g., Wilks et al., 2019) and attitudes toward the environment (e.g., Slade, 2018). Another meta-analysis by Pakseresht et al. (2022) also revealed that risk perception, naturalness concerns, and public awareness play an important role in affecting consumer acceptance of cultivated meat. Research also suggested that people pay much attention to the similarity of cultivated meat to traditional meat, thus perceived naturalness, food neophobia, and disgust sensitivity evoked by cultivated meat tend to influence their acceptance of this novel food (Siegrist and Hartmann, 2020a, 2020b).

Although existing works have examined some psychological factors that are related to individuals' acceptance of cultivated meat, to our knowledge no research has studied individuals' sense of well-being as a psychological factor that may be related to their acceptance of novel foods. The study of people's psychological well-being and their perception of novel foods is an important research direction because prior empirical works have suggested that people with lower well-being are more likely to perceive food as a means for ensuring survival, whereas those with higher well-being are more likely to recognize other sociocultural benefits of consuming food beyond just fulfilling their sustenance or utilitarian needs. These benefits include socializing (Brown et al., 2010; Khoo-Lattimore et al., 2016), seeking novelty or comfort (Chang et al., 2022; Ji et al., 2016), and improving personal well-being (Goetzke et al., 2014). Therefore, the current study set out to add to the growing literature on consumer acceptance of cultivated meat by studying for the first time whether people with higher levels of psychological well-being would be more receptive to cultivated meat – because they can better recognize the potential benefits that cultivated meat can offer.

1.1. Psychological well-being and consumption of food

Research revealed that happier people tend to have healthier diets. For instance, they were more likely to consume more fruits and vegetables (Blanchflower et al., 2013; Ding et al., 2014; Grant et al., 2009; Kelloniemi et al., 2005). People's emotional well-being had also been shown to be positively associated with the consumption of functional food, that is, healthy food that reduces the impact of health problems or the risk of diseases (Goetzke et al., 2014; Schnettler et al., 2015). Another study similarly found that students with higher levels of life satisfaction were more likely to eat fruits and control their fat intake (Grant et al., 2009). More recently, Boehm et al. (2018) found a

longitudinal relationship between psychological well-being and consuming fruits and vegetables among individuals aged 50 and above over the span of seven years. Interestingly, an experimental study showed that under the induction of a sad mood, individuals had a higher likelihood of consuming hedonic food (e.g., buttered popcorn and M&Ms), as compared to fruits (De Neve et al., 2013; Garg et al., 2007). It is evident that healthier food consumption by individuals with higher levels of well-being can be partly explained by their more effective self-regulation towards the goal of healthy eating (Boehm et al., 2018; DeSteno, 2009; Rasmussen et al., 2006).

Besides a positive relationship between a sense of well-being and healthier eating, research also suggested that higher well-being individuals tend to be more satisfied with food-related aspects of their life – they derive greater pleasure from and see more positive meaning in food – compared to their lower well-being counterparts (Dean et al., 2008; Grunert et al., 2007). In a previous study, a positive relationship between well-being and enthusiasm about food was found (Gong et al., 2020). It is plausible that having a passion for food could be related to having a passion for other areas of life, thus explaining a link between a positive attitude towards food and a sense of well-being (Gong et al., 2020; Philippe et al., 2009).

1.2. Psychological well-being and acceptance of cultivated meat

Although existing works have offered some robust evidence that people with higher well-being are more likely to derive positive meanings from food consumption and to consume healthier diets, research has yet to study if these findings are applicable to the receptiveness to novel food such as cultivated meat. The current research sought to examine for the first time the relationship between psychological well-being and acceptance of cultivated meat. We contend that such a relationship is a positive one because cultivated meat can bring about benefits that align with the motives and characteristics of higher well-being individuals.

1.2.1. Health and pro-environmental motives

As discussed, there is evidence that people with a higher sense of well-being show a stronger health motive (Gong et al., 2020). To the extent that cultivated meat is perceived to be healthy and nutritious and is free of undesirable elements, then people with higher psychological well-being may be more motivated to consume or accept cultivated meat.

Another motive that can drive higher well-being individuals' food choice is the ethical motive, which can attest to their moral and environmental concerns (Lim et al., 2022; Steptoe et al., 1995). In one study, it was shown that happy individuals display more pro-environmental behaviors because they tend to possess intrinsically oriented values such as personal worth, relationship building, and community involvement (Brown & Kasser, 2005). Other research also consistently supported a positive link between psychological well-being and pro-environmental engagement. For example, in developed and Sub-Saharan African countries, happier individuals are more inclined to sacrifice a portion of their income and be willing to contribute more taxes if the tax money is spent on reducing environmental pollution (Sulemana, 2016). Likewise, individuals with higher subjective well-being are more likely to engage in pro-environmental actions such as opting for environmentally friendly household goods, recycling, contributing money to environmental charities, and signing a petition for or taking part in a meeting about conserving the environment (Duroy, 2008; Maccagnan et al., 2019). Another study found that the subjective and objective well-being of people residing in rural areas of China was positively associated with their choice of environmentally friendly cooking fuels (Liang et al., 2020). Related to food choice, there is evidence that environmentally concerned people are more likely to purchase organic food (Honkanen et al., 2006; Saleki et al., 2019) and cultivated meat (Slade, 2018). Together, empirical works have

established some reliable evidence that higher well-being individuals are more motivated to engage in environmentally responsible behaviors. Thus, it is reasonable to contend that they may choose to consume cultivated meat for environmentally friendly reasons.

1.2.2. Lower food neophobia

Food neophobia is defined as people's trait aversion to novel foods that they are unfamiliar with (Pliner & Hobden, 1992), such as food manufactured with new technology or food from another culture. Food neophobia can be an adaptive, defensive mechanism, which prevents people from trying foods that may cause illness or disease (Santisi et al., 2021). Unsurprisingly, recent studies have found a negative relationship between food neophobia and willingness to accept cultivated meat (Hwang et al., 2020; Siegrist and Hartmann, 2020a, 2020b; Wilks et al., 2019).

Research has suggested a negative relationship between subjective well-being and food neophobia (Pourfakhimi, Nadim, Prayag, & Mulcahy, 2021; Schnettler et al., 2013). Lower well-being is associated with the experience of negative emotional states, and negative emotions such as anxiety and acute fear have been found to discourage people from tasting novel foods. Therefore, lower (vs. higher) well-being individuals may be more likely to exhibit food neophobia (Pliner et al., 1993, 1995). According to the optimal level of arousal theories (Hebb, 1955), when levels of arousal rise above the optimal level, such as when people experience high-arousal states (e.g., anxiety), they would display a higher preference for familiar foods and thus food neophobia. In contrast, low-arousal states (e.g., contentment) would buffer people from exhibiting food neophobic tendencies.

The Broaden-and-Build theory of positive emotions (Fredrickson, 2004) provides another theoretical account for explaining the negative relationship between psychological well-being and food neophobia. Based on the theory, positive emotions can broaden one's cognitive and behavioral repertoires, thereby promoting diversity of thoughts and actions (Gallagher & Lopez, 2007). Therefore, this can account for the observation that individuals with higher subjective well-being or more positive emotions may display less food neophobic tendencies through increased curiosity. Together, it is reasonable to predict that higher well-being individuals are more receptive to consuming cultivated meat due to their lower likelihood of showing food neophobia.

1.2.3. Compassion towards animals

As discussed, the production of cultivated meat does not involve raising and slaughtering animals. This can be particularly appealing to people who show compassion towards animals. We argue that the positive link between psychological well-being and compassion towards animals can be in part explained by higher well-being individuals' greater empathy (Gómez-Leal et al., 2021; Martins et al., 2010). Further, drawing from research examining the relation between psychological well-being and personality traits, findings supported that higher well-being people may have a stronger compassion for animals because they tend to have higher trait agreeableness (Soto, 2015), which is a disposition correlated with a favorable attitude towards animals (Furnham et al., 2003; Hopwood et al., 2022). This evidence suggests that those with higher levels of psychological well-being may be more compassionate towards animals, which can drive a greater acceptance of cultivated meat – a more animal-friendly source of meat without animal slaughter.

1.2.4. Forward thinking orientation

Research has shown that happier individuals are more likely to pursue long-term goals, even when they entail short-term sacrifices. For instance, they were found to save more and spend less than others, show higher optimism about the future, and expect themselves to live longer or perceive higher life expectancies (Güven, 2012). Relatedly, happier individuals tend to keep in mind the future implications of their present decisions (De Neve et al., 2013). Exercising restraint or delaying

gratification has been shown to be more characteristic of individuals with higher (vs. lower) levels of positive affect (De Neve et al., 2013; Ifcher & Zarghamee, 2011; Pyone & Isen, 2011).

To reiterate, the aforementioned studies showed that positive affect is linked to a future-oriented time perspective. Those who have higher well-being or experience more positive emotions could be more forward thinking, thus they may be more prepared for the diet shift to novel foods and consider the prospective societal benefits of cultivated meat, such as it being a sustainable source of meat in the future.

Together, drawing from prior works showing that higher well-being individuals tend to have stronger health and pro-environmental motives, lower food neophobia, stronger compassion for animals, and more future-oriented thinking, we posit a positive relationship between psychological well-being and acceptance of cultivated meat. The present research set out to conduct the first empirical test of this relationship. In addition, to examine the underlying mechanisms why higher well-being individuals may be more receptive to cultivated meat, we asked participants to indicate what reasons for consuming cultivated meat would apply to them. Two reasons pertain to health considerations (cultivated meat is "healthy and nutritious" and "free of undesirable elements, such as foodborne diseases and growth hormones"); one reason pertains to pro-environmental considerations (cultivated meat is "environmentally friendly"); one reason pertains to compassion towards animals (cultivated meat is "animal friendly"); and one reason pertains to their future-oriented thinking for contributing to the society (cultivated meat "has benefits for society"). We also included two other reasons that are common considerations for consuming cultivated meat (cultivated meat is "as safe as real meat" and "has the same sensory quality as real meat"). We examined the relationship between psychological well-being and acceptance of cultivated meat by testing the seven reasons as the mediators.

2. Methods

2.1. Participants

A total of 1451 Singaporeans who are 18 years old or above were recruited for an online survey through the market research company InVeritas Research. To ensure that the ethnic composition of the sample approximately reflects Singapore's population (Singapore Department of Statistics, 2021), ethnicity quotas were set to recruit Chinese (75%), Malays (13%), Indians (10%), and other ethnicity participants (2%). Gender quota was also imposed to recruit approximately 50% males and 50% females in the sample. As we tried to ensure achieving gender balance and the unique ethnic composition of the Singaporean population in the sample, we did not further set an age quota given time and funding constraints. However, following closely the gender and ethnicity quotas had ensured a reasonably representative sample for this research. To enhance data quality, participants who were not comfortable with communicating in English ($n = 19$), failed the honesty check ($n = 14$) or the attention check ($n = 353$), and duplicated responses ($n = 28$) were excluded. Additionally, participants who gave meaningless responses to an open-ended question asking them to indicate their occupation ($n = 11$) and response outliers (>2 SD of mean duration) in terms of the time taken to complete the survey ($n = 12$) were excluded. This resulted in a final sample of 948 participants (see Table 1 for descriptive statistics).

2.2. Procedure

An online survey was administered as a means of data collection. The survey, which took about 9 min to complete, was approved by the university's Institutional Review Board. Participants were briefed that the study examined people's perceptions of cultivated meat. After informed consent was obtained, participants were asked to indicate their ethnicity to ensure that they met the quota requirements to continue. To

Table 1
Participants' demographic characteristics.

	Total Sample Size N = 948 n (%)
Gender	
Male	492 (51.9%)
Female	452 (47.7%)
Prefer not to say	4 (0.4%)
Ethnicity	
Chinese	711 (75.0%)
Non-Chinese (Malay, Indian, Others)	237 (25.0%)
Age group	
18–29	307 (32.4%)
30–39	281 (29.6%)
40–49	225 (23.7%)
50–59	106 (11.2%)
60–69	29 (3.1%)
Religion	
Abrahamic (Christian, Islam, Jewish)	373 (39.3%)
Dharmic (Buddhist, Hindu)	358 (37.8%)
None, Agnostic, Atheist, Taoist, Others	217 (22.9%)
Educational level	
Vocational certificate (Diploma, NITEC, ITE, associate degree, professional certificate)	175 (18.5%)
Academic degree (Bachelors, Masters, Doctorate)	590 (62.2%)
No tertiary (Secondary school, PSLE, A levels, undergraduate, others)	183 (19.3%)
Annual household income	
SGD15,000 or less	91 (9.6%)
SGD15,001 - SGD25,000	63 (6.6%)
SGD25,001 - SGD35,000	64 (6.8%)
SGD35,001 - SGD50,000	104 (11.0%)
SGD50,001 - SGD75,000	164 (17.3%)
SGD75,001 - SGD100,000	172 (18.1%)
SGD100,001 - SGD150,000	191 (20.1%)
More than SGD150,000	99 (10.4%)

ensure that participants had the same understanding of cultivated meat, the definition was given:

Cultivated meat is real meat which is grown in a sterile, controlled environment from a single animal cell, removing the need to raise animals.

Cultivated meat should not be confused with plant-based meats such as Impossible and Beyond. Since it is real animal meat, it has similar taste, texture, and the same or better nutritional content as conventionally produced meat.

After reading the definition and some information about cultivated meat,¹ the participants completed several scales measuring their willingness and reasons to consume cultivated meat (see Measures section below) and some demographic questions. Participants who completed the survey were compensated based on the market rate determined by InVeritas Research.

2.3. Measures

2.3.1. Willingness to eat cultivated meat

Participants rated their willingness to: eat cultivated meat, buy cultivated meat regularly, eat cultivated meat as a replacement for conventionally produced meat, eat cultivated meat as a supplement to conventionally produced meat, and eat cultivated meat instead of plant-based meat substitutes (adapted from Bryant & Dillard, 2019; Wilks & Phillips, 2017). These items were rated on a seven-point scale (1 =

¹ The study also explored if presenting participants certain benefits about cultivated meat would be associated with their willingness to try cultivated meat. Results showed that messages presenting different benefits of cultivated meat (e.g., benefits to health, animal, the environment) did not have any significant effects on the variables measured in this research. We reported the detailed analyses of this part of the findings in the Supplementary Material.

definitely no, 7 = definitely yes). The scores of all five items were aggregated to form a composite measure, where higher scores indicate a greater willingness to consume cultivated meat ($\alpha = 0.94$).

2.3.2. Reasons to consume cultivated meat

To find out the dominant reason why participants might consider consuming cultivated meat (even if they do not consume it now), they were asked to imagine that cultivated meat has become a common food source in the near future and that while people still consume more conventional meat than cultivated meat, sometimes they also choose to consume cultivated meat for some reasons. Participants rated on seven statements on how likely the reason applied to them: I eat cultivated meat because it is ... "healthy and nutritious", "free of undesirable elements, such as foodborne diseases and growth hormones", "as safe as real meat", "has the same sensory quality as real meat", "environmentally friendly", "has benefits for society" and "animal friendly" (1 = not at all applies to me, 7 = very much applies to me). ($\alpha = 0.96$).

2.3.3. Mental health continuum short form (MHC-SF) scale

Participants answered the 14-item MHC-SF scale (Keyes, 2005; Keyes et al., 2008) which measures individuals' psychological well-being. Participants were asked to rate their feelings in the past month (sample items: "that you had something important to contribute to society", "that you liked most parts of your personality") on a six-point scale (never, once or twice a month, about once a week, two or three times a week, almost every day, every day). The scores of all items were aggregated to form a composite measure, with higher scores indicating higher levels of psychological well-being ($\alpha = 0.96$).

2.3.4. Demographic covariates

Demographic variables (gender, ethnicity, age, religion, highest educational qualification, and household income levels) were included as covariates in the analyses. Gender was dummy coded with males/prefer not to say as the reference category and ethnicity was dummy coded with the minority race (i.e., non-Chinese) as the reference category. Religion was re-coded into three main categories: Abrahamic, Dharmic, and 'no religion/Agnostic/Atheist/others' as the reference category. As for the highest educational qualification, the responses were also re-coded into three main categories: Vocational certificate, academic degree, and 'no tertiary/primary or secondary school/junior college/others' as the reference category. Age was reported in years and annual household income was measured on an eight-point scale (1 = SGD 15,000 or less, 8 = More than SGD 150,000).

2.4. Analytical methods

We conducted parallel mediation analyses (Table 4) using the SPSS PROCESS macro (Model 4; Hayes, 2017) in IBM SPSS Statistics 28.0. In the mediation model, psychological well-being was specified as the predictor variable and willingness to eat cultivated meat as the outcome variable. The seven reasons for consuming cultivated meat (i.e., healthy and nutritious, free of undesirable elements, as safe as real meat, same sensory quality as real meat, environmentally friendly, has societal benefits, animal friendly) were all entered as parallel mediators in the model. In the first step of the analysis, the seven reasons to consume cultivated meat were regressed on psychological well-being; in the second step, the willingness to consume cultivated meat was regressed on the seven reasons to consume cultivated meat and psychological well-being. Demographic variables (age, gender, ethnicity, income, religion, education) were entered as covariates for all regressions in the mediation model. Therefore, the indirect relationships between psychological well-being and willingness to consume cultivated meat via the seven reasons for consuming cultivated meat (i.e. seven parallel mediators) were tested after controlling for the measured demographic variables.

The Spearman bivariate correlation table for all variables measured

in the study is presented in Table 2, and means and standard deviations of the key variables are presented in Table 3. The hypothesis that psychological well-being would be positively associated with the acceptance of cultivated meat was specified before the data were collected. The analytic plans of carrying out correlational and regression analyses were also pre-specified and thus not data-driven. The dataset and SPSS syntax files can be found in https://researchbox.org/954&PEER_REVIEW_passcode=GKOVDE.

3. Results

3.1. Psychological well-being and willingness to consume cultivated meat: different consumption reasons as the mediators

As expected, participants' psychological well-being was positively associated with their willingness to consume cultivated meat ($r = .34, p < .001$). Further, regression analyses revealed that psychological well-being was positively associated with all seven reasons for consuming cultivated meat. Specifically, participants with higher levels of psychological well-being were more likely to consume cultivated meat because it is healthy and nutritious ($\beta = 0.27, SE = 0.04, p < .001$); is free of undesirable elements ($\beta = 0.19, SE = 0.04, p < .001$); is as safe as real meat ($\beta = 0.21, SE = 0.04, p < .001$); has the same sensory quality as real meat ($\beta = 0.26, SE = 0.04, p < .001$); is environmentally friendly ($\beta = 0.21, SE = 0.05, p < .001$); has societal benefits ($\beta = 0.22, SE = 0.05, p < .001$); and is animal friendly ($\beta = 0.19, SE = 0.05, p < .001$).

Regression analyses further showed that the participants' endorsement of four reasons for consuming cultivated meat was in turn positively associated with their willingness to eat cultivated meat. These

Table 3
Perceptions of cultivated meat and psychological well-being scores.

	Total N = 948 M (SD)
Willingness to consume cultivated meat	
Composite score (Mean)	4.32 (1.37)
Eat cultivated meat	4.68 (1.47)
Buy cultivated meat regularly	4.09 (1.53)
Eat cultivated meat as a replacement for conventionally produced meat	4.10 (1.58)
Eat cultivated meat as a supplement to conventionally produced meat	4.34 (1.52)
Eat cultivated meat instead of plant-based meat substitutes	4.40 (1.55)
Reasons for consuming cultivated meat	
Healthy and nutritious	4.42 (1.54)
Free of undesirable elements	4.65 (1.54)
As safe as real meat	4.57 (1.57)
Same sensory quality as real meat	4.45 (1.57)
Environmentally friendly	4.83 (1.59)
Has societal benefits	4.69 (1.59)
Animal friendly	4.85 (1.60)
Mental Health Continuum Short Form (MHC-SF) scale	
Composite score (Mean)	3.84 (1.16)

four reasons are: because it is healthy and nutritious ($\beta = 0.26, SE = 0.03, p < .001$); because it is as safe as real meat ($\beta = 0.14, SE = 0.03, p < .001$); because it has the same sensory quality as real meat ($\beta = 0.18, SE = 0.03, p < .001$), and because it has societal benefits ($\beta = 0.16, SE = 0.04, p < .001$). However, three reasons to consume cultivated meat – i. e., because it is free of undesirable elements ($\beta = 0.06, SE = 0.03, p = .059$); because it is environmentally friendly ($\beta = 0.04, SE = 0.03, p =$

Table 2
Spearman bivariate correlations of all variables measured in the study (N = 948).

	α	1	2	3	4	5	6	7	8
1. Age		–							
2. Gender (Female)		–0.04	–						
3. Income		0.19***	–0.05	–					
4. Ethnicity (Chinese)		0.03	–0.05	0.20***	–				
5. Religion: Abrahamic		0.08*	0.13***	–0.03	–0.35***	–			
6. Religion: Dharmic		–0.01	–0.08*	–0.03	0.15***	–0.63***	–		
7. Education: Vocational		–0.11**	0.04	–0.23***	–0.10**	0.04	0.01	–	
8. Education: Academic		0.10**	–0.08*	0.42***	0.17***	–0.09**	0.05	–0.61***	–
9. Willingness to eat cultivated meat	0.94	–0.03	–0.13***	0.11***	–0.03	0.02	–0.05	–0.06	0.16***
10. Reasons - Healthy and nutritious		–0.01	–0.07*	0.12***	–0.01	0.02	–0.02	–0.09**	0.17***
11. Reasons - Free of undesirable elements		–0.03	–0.06	0.14***	0.02	0.01	–0.00	–0.08*	0.14***
12. Reasons - As safe as real meat		–0.04	–0.05	0.11***	–0.03	0.03	–0.03	–0.06	0.14***
13. Reasons - Same sensory quality as real meat		–0.05	–0.06	0.08*	–0.04	–0.01	–0.00	–0.03	0.12***
14. Reasons - Environmentally friendly		–0.07*	–0.04	0.10**	0.01	0.01	–0.04	–0.04	0.10**
15. Reasons - Has societal benefits		–0.07*	–0.04	0.09**	0.01	–0.02	–0.01	–0.06	0.11***
16. Reasons - Animal friendly		–0.04	–0.04	0.09**	0.01	–0.01	–0.02	–0.05	0.10**
17. Psychological well-being	0.96	0.14***	–0.06	0.16***	–0.15***	0.13***	–0.03	–0.09**	0.16***
		9	10	11	12	13	14	15	16
1. Age	–								
2. Gender (Female)	–								
3. Income	–								
4. Ethnicity (Chinese)	–								
5. Religion: Abrahamic	–								
6. Religion: Dharmic	–								
7. Education: Vocational	–								
8. Education: Academic	–								
9. Willingness to eat cultivated meat	–								
10. Reasons - Healthy and nutritious	0.73***	–							
11. Reasons - Free of undesirable elements	0.68***	0.73***	–						
12. Reasons - As safe as real meat	0.73***	0.71***	0.75***	–					
13. Reasons - Same sensory quality as real meat	0.71***	0.66***	0.68***	0.79***	–				
14. Reasons - Environmentally friendly	0.70***	0.67***	0.70***	0.72***	0.68***	–			
15. Reasons - Has societal benefits	0.71***	0.69***	0.70***	0.72***	0.67***	0.82***	–		
16. Reasons - Animal friendly	0.67***	0.65***	0.68***	0.69***	0.63***	0.82***	0.83***	–	
17. Psychological well-being	0.34***	0.32***	0.24***	0.25***	0.29***	0.25***	0.24***	0.22***	–

Note. Gender, ethnicity, religion, and educational level were dummy coded with males, non-Chinese, no religion, and no tertiary education serving as reference categories. * $p < .05$; ** $p < .01$; *** $p < .001$.

Table 4

The effect of psychological well-being on willingness to consume cultivated meat, mediated by reasons for consuming cultivated meat.

Mediator (Reasons)	<i>a</i>	<i>b</i>	Indirect effect	Boot SE	Boot LLCI	Boot ULCI
Healthy and nutritious	0.27***	0.26***	0.08*	0.02	0.05	0.12
Free of undesirable elements	0.19***	0.06	0.01	0.01	−0.00	0.03
As safe as real meat	0.21***	0.14***	0.03*	0.01	0.01	0.06
Same sensory quality as real meat	0.26***	0.18***	0.05*	0.01	0.03	0.08
Environmentally friendly	0.21***	0.04	0.01	0.01	−0.01	0.03
Has societal benefits	0.22***	0.16***	0.04*	0.02	0.01	0.07
Animal friendly	0.19***	0.08	0.02	0.01	−0.00	0.04

Note. *a* refers to the standardized regression coefficient by regressing reasons for consuming cultivated meat on psychological well-being. *b* refers to the standardized regression coefficient by regressing willingness to consume cultivated meat on reasons for consuming cultivated meat. Gender, ethnicity, religion, educational level, age, and income were entered as covariates. Gender, ethnicity, religion, and educational level were dummy coded with males, non-Chinese, no religion, and no tertiary education serving as reference categories. * $p < .05$; ** $p < .01$; *** $p < .001$. The indirect effects are unstandardized.

.359); and because it is animal friendly ($\beta = 0.08$, $SE = 0.03$, $p = .056$) – were not significantly associated with their willingness to eat cultivated meat.

We performed a bootstrap estimation analysis with 5000 samples to test the statistical significance of the indirect effect between psychological well-being and willingness to consume cultivated meat via different reasons to consume (i.e., the indirect effect was computed by the product term between the psychological well-being—reasons to consume link and the reasons to consume—willingness to consume link; Shrout & Bolger, 2002). Results indicated that the indirect path pertaining to four of the reasons for consuming cultivated meat – i.e., it is healthy and nutritious ($B = 0.08$, $Boot SE = 0.02$, 95% C.I. = [0.05, 0.12]); it is as safe as real meat ($B = 0.03$, $Boot SE = 0.01$, 95% C.I. = [0.01, 0.06]); it has the same sensory quality as real meat ($B = 0.05$, $Boot SE = 0.01$, 95% C.I. = [0.03, 0.08]); and it has societal benefits ($B = 0.04$, $Boot SE = 0.02$, 95% C.I. = [0.01, 0.07]) as a mediator was significant. The indirect path pertaining to three of the reasons for consuming cultivated meat – it is free of undesirable elements ($B = 0.01$, $Boot SE = 0.01$, 95% C.I. = [−0.00, 0.03]); is environmentally friendly ($B = 0.01$, $Boot SE = 0.01$, 95% C.I. = [−0.01, 0.03]); and is animal friendly ($B = 0.02$, $Boot SE = 0.01$, 95% C.I. = [−0.00, 0.04]) – was not significant. As the direct path between psychological well-being and willingness to consume cultivated meat was still significant ($B = 0.10$, $SE = 0.02$, 95% C.I. = [0.05, 0.14]), the results suggested that the link between well-being and willingness to consume cultivated meat was partially explained by some of the reasons studied in the present research (namely, cultivated meat is healthy and nutritious; is as safe as real meat; has the same sensory quality as real meat; and has societal benefits).

4. Discussion

The present research provided important insights about the relationship between psychological well-being and acceptance of cultivated meat. Presenting the first-ever empirical evidence, our findings confirmed the prediction that participants with higher levels of psychological well-being were more willing to consume cultivated meat. This represents a novel contribution to the extant literature, which shows a positive relationship between health (e.g., Bryant et al., 2019)

and pro-environmental motives (e.g., Zhang et al., 2020), lower food neophobia (e.g., Dupont & Fiebelkorn, 2020; Wilks et al., 2019), and compassion for animals (e.g., Valente et al., 2019) on the one hand, and consumer acceptance of cultivated meat on the other (e.g., Dupont & Fiebelkorn, 2020; Zhang et al., 2020). When probing for the specific reasons that can explain their higher willingness, our results revealed that higher well-being individuals would more readily consume cultivated meat because they tend to perceive that cultivated meat is healthy and nutritious, is as safe as real meat, has the same sensory quality as real meat, and has societal benefits. These results may be explained by higher well-being individuals' greater sensitivity to health and safety motives (e.g., Gong et al., 2020) and their tendency to adopt a future-oriented perspective in recognizing the prospective societal benefits of cultivated meat (Guven, 2012; Ifcher & Zarghamee, 2011; Pyone & Isen, 2011). In addition, their perception that cultivated meat is similar to conventional meat in terms of its sensory qualities (e.g., taste, texture) could have fostered (or at the very least not have dampened) their hedonistic evaluation of cultivated meat, as expected taste has been shown to strongly predict purchase intent for cultivated meat (Mancini & Antonioli, 2019).

4.1. Theoretical and practical values

It has been argued that cultivated meat “represents a product which is appealing to a certain type of consumer” (Bryant & Barnett, 2020, p. 22). In other words, it is not a product that is likely to appeal to the entire population. Previous studies indicate that cultivated meat would be more appealing to younger consumers and men (e.g., Slade, 2018; Wilks & Phillips, 2017); meat eaters (e.g., Wilks & Phillips, 2017); and people with higher education (e.g., Slade, 2018). Accordingly, cultivated meat producers could target consumers with these demographic characteristics. Other studies have identified potential market segments comprising consumers who intend to reduce meat intake (Malek et al., 2019) or consume plant-based protein (Chan, 2019; Van Loo et al., 2020); those who are open to changing their current meat-eating behaviors (Graça et al., 2015; Lemken et al., 2019; Vanhonacker et al., 2013); and those who consume meat substitutes (Hagmann et al., 2019) (see also Nguyen et al., 2022). Our study contributes to the literature on potential consumer segments for cultivated meat by adding an important, but understudied, psychographic characteristic – namely, psychological well-being. This is a meaningful contribution, as the extant literature has focused on demographic rather than psychographic characteristics (e.g., see Bryant & Barnett, 2020; Pakseresht et al., 2022; Nguyen et al., 2022). Psychographic factors are just as important as demographic ones for the effective marketing of products and services (Samuel, 2016). In the agri-food sector, a study by Nazzaro et al. (2019) has shown a strong correlation between consumer psychographics and consumer openness towards innovative product attributes. This research direction can open up novel avenues for understanding how individuals' psychological profiles, beyond their demographic characteristics, influence their receptivity to cultivated meat and other sources of alternative proteins.

More broadly, the present study adds to the important body of work on the meaning of food. Research has shown that people reflect their values, preferences, and beliefs through their food choice (e.g., Hoek et al., 2017; Vainio et al., 2018). For example, Americans' emphasis on individualist values and the availability of choices may explain their consumption of bigger food portions, focus on food quantity (vs. quality), and prioritization of the health consequences of eating (vs. the sheer experience of eating) as compared to their French counterparts (Rozin et al., 2003, 2011). The current investigation contributes new knowledge to the literature on the meaning of food by examining the meaning epitomized by an alternative source of food – cultivated meat – in the postmodern food era. Specifically, it shows how well-being plays a role in influencing how people attach or communicate different meanings (e.g., expressing their health and prosocial priorities; see Gong

et al., 2020; Lim et al., 2022; Steptoe et al., 1995) through the consumption of cultivated meat. More specifically, individuals with higher well-being are more likely than those with lower well-being to recognize the societal, health and safety benefits associated with cultivated meat and thus attach positive meaning to its consumption. The positive meaning attached to cultivated meat consumption in turn fosters greater acceptance.

In terms of the current research's practical value, the findings imply that consumers with higher psychological well-being may find messages that emphasize cultivated meat's safety and health benefits (e.g., absence of growth hormones), societal contributions, and sensory profile ('tastes just like real meat') appealing. Cultivated meat companies may consider the well-being profile of their prospective consumers and provide them more targeted information about the health and safety benefits and societal impacts of cultivated meat. One potential way to do that is to use search advertising by targeting ads and other messages at individuals who search online using words pertaining to healthy, safe, and tasty meat-based foods or words such as "sustainable food choice or diet". These individuals may readily be more receptive to the novel food if the health, safety, and societal outcomes of consuming cultivated meat are communicated to them. Relatedly, companies can consider targeting their promotion and advertising efforts to enhance people's openness to cultivated meat in countries with populations that show a higher happiness or well-being index (World Happiness Report, 2022). This can potentially promote greater awareness of this new food technology in these societies.

4.2. Limitations and future directions

As a first attempt to examine the relationship between psychological well-being and acceptance of cultivated meat and the underlying psychological mechanisms of the relationship, we identified some reasons for consuming cultivated meat (i.e., the seven tested mediators) based on the prior works related to well-being and food consumption. As the studied mediators are not meant to be exhaustive, there are other reasons supporting the consumption of cultivated meat that the current study failed to include. Future research can examine other relevant reasons, such as socialization (Brown et al., 2010; Rozin, 1999), emotional eating, convenience, and price (Gong et al., 2020) to offer a comprehensive understanding of why psychological well-being can meaningfully predict people's acceptance of novel foods.

In addition, the current research employed a cross-sectional design. Thus, it could not allow making causal predictions on whether a higher psychological well-being can lead to an increase in acceptance of cultivated meat via the different mediators we studied. Similarly, the correlational research could not eliminate the possibility of reverse causation where a greater willingness to consume cultivated meat leads to a higher psychological well-being via the different reasons measured in this research. We wanted to note that the current mediation model was grounded on our theorizing that well-being promotes willingness to consume cultivated meat and that various reasons can serve as mediators underlying such a relationship. Also, it may not deem as very theoretically coherent to test the reverse model where the first path denotes how willingness to consume cultivated meat predicts different reasons to consume (rather, it is more coherent to test the current model on how different reasons to consume cultivated meat predicts willingness to consume). To shed more insights on the causal direction, future investigations can utilize experimental or longitudinal design to test the causal impacts of psychological well-being on people's acceptance of cultivated meat.

4.3. Conclusion

In this paper, we present the first empirical support for the positive association between psychological well-being and acceptance of cultivated meat. This relationship can be accounted for by people's

understanding of cultivated meat as healthy, as safe as real meat, having the same sensory quality as real meat, and contributing to the societal good. By examining the understudied psychographic characteristic of psychological well-being, we get one step closer to understanding the drivers for consumer acceptance of cultivated food.

Ethical statement

Procedures performed in the study received the approval of, and were in accordance with, the ethical standards of Singapore Management University's Institutional Review Board (IRB-21-188-E063-M3 (622), 17 June 2022). Participants gave informed consent before taking part in the study.

Author contributions

The research idea was conceived by Angela Leung; Tricia Marjorie Fernandez and Shu Tian Ng conducted the data analyses. Angela Leung wrote the first draft of the manuscript, and Mark Chong, Tricia Fernandez and Shu Tian Ng contributed to some parts of the first draft. All authors commented on the manuscript and contributed to the final version. The work was collaborative, requiring unique inputs from all authors.

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Declaration of interest

There is no conflict of interest in the production of this research.

Data availability

The paper includes the link to the data and syntax files.

Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.appet.2023.106496>.

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