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Social Psychological Aspects of the Transition from Conventional Meat to Cultured Meat

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Abstract

Cultured meat is increasingly being seen as a viable food option in Thailand, thereby mitigating the environmental consequences of livestock rearing. It is necessary to explore the variables that impact consumer responsiveness to cultured meat. This study investigated the social psychological aspects that influence the shift from conventional meat to cultured meat. A cross-sectional design was employed to conduct quantitative research techniques because it allows for a systematic measurement and analysis of attitudes, beliefs, and behaviors associated with this transition among a larger population. An online survey was used to obtain 603 responses. The study results reveal that 77% of respondents indicated a willingness or potential to replace conventional meat with cultured meat (CM), whereas 42.95% of participants were price sensitive. Results from logistic models indicate that social psychological factors were associated with the transition from conventional to CM. Potential consumers had an incentive to choose alternatives to conventional meat on account of health-related concerns. Some individuals considered a transfer if the price was affordable and reasonable. This presents a wonderful chance for food companies to develop their own CM product. This advancement will result in an expanded assortment of brands and an increased degree of competition within the market. However, it is the responsibility of the entrepreneurs to provide insight into the perceived naturalness of the CM product, which is a pivotal determinant in shaping consumers' decision to purchase it.

Keywords

Cultured meat, Conventional meat, Social psychology, Naturalness perception

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Introduction

Meat is a very good source of protein and is strongly associated with food culture. A significant amount of the world's meat production, approximately 316 million metric tons of chicken, pork, and beef in 2022 (FAO, 2023), is consumed by just a fraction of the global population, particularly in industrialized nations. The demand for meat is projected to surpass 376 million metric tonnes (MMT) by 2030 (Hicks et al, 2018). As a result, the global livestock industry is expected to expand, contributing to 14.5% of total greenhouse gas emissions. Cattle are the largest source of emissions within the industry, responsible for 65% of these emissions (Poore & Nemecek, 2018).

The United Nations (2015) has emphasized the importance of addressing environmental issues by promoting "responsible consumption and production" as part of its Sustainable Development Goals (SDGs) to be achieved by 2030. This initiative aims to reduce negative impacts like greenhouse gas emissions, a key contributor to climate change. In response, developed countries have been increasingly alerted to the need for more sustainable practices, especially as meat consumption, a major source of such emissions, has been declining in these nations. This shift highlights the growing awareness and alignment with the SDGs to create a more sustainable food system. Consumers are increasingly expressing concerns regarding animal welfare and the sustainability of meat production In developing nations such as China, India, and Russia, consumers are generally reluctant to decrease their meat consumption, which is contributing to the increase in global meat consumption. As these populations become middle-class, they will increase their expenditures on luxury goods and services, such as premium meat and other animal products (e.g., cheese, yoghurt, and other dairy products) (Chriki & Hocquette, 2020). It is therefore a big challenge for the livestock sector to address global issues as they cannot ignore the increasing recognition of carbon emissions associated with cattle and other ethical considerations surrounding meat production. This has sparked a growing interest in exploring more sustainable alternatives to meat, one of which is cultured meat (Pakseresht et al., 2022).

Cultured meat (CM), also known as clean, cell-based, in-vitro, or lab-grown meat, could be a solution. This kind of meat is produced entirely in a lab by using cell culture and tissue engineering based on stem cells (Kenigsberg and Zivotofsky, 2020). CM is anticipated to reduce the health consequences of meat eating by offering sufficient nutrients and hormones, making it a viable option for conscientious consumers who choose to maintain their current diet (Chriki & Hocquette, 2020). As the alternative protein industry is growing, the production of cultured meat on an industrial scale is still in its early stages. The efficiency of technology in this sector needs to be improved and production costs need to be reduced in order for the industry to be competitive Pakresesht et al., 2022). Consumers' acceptance is

the key point of their transition from conventional meat to CM. They will also compare taste, texture, and flavour to traditional meat, posing a considerable barrier to CM acceptability (Caputo et al., 2022). The biggest obstacle to CM in food markets will be consumer acceptance, which will depend on several factors. This is a big challenge for both lab-grown meat manufacturers and consumers who dislike unnatural food (Chriki & Hocquette, 2020).

Researchers have attempted to reveal strategies that promote customers' acceptance of CM across various aspects, including consumer attitude, consumer perception, individual traits or personalities, and cultural differences. While there have been studies conducted by Mancini & Antonioli (2019), Siegrist & Hartmann (2020a) and Jaeger et al. (2022), there is a lack of research on the social psychological elements of CM in Thailand. In order to bridge the current gap in knowledge, the present study aims to investigate the social psychological aspects that influence the shift from conventional meat to cultured meat. The study aims to analyse customer perception, belief, attitude, and personality to explore the relationship between these factors and consumer decisions about the substitution of traditional meat with lab-meat alternatives.

Literature Review

Cultured meat

Cultured meat (CM) refers to the production of meat in a laboratory setting, with the primary objective of addressing environmental concerns. It involves the growing of animal cells, as opposed to the rearing of entire animals. This food advancement differs from plant-based meat technology, as it aims at replicating the flavor and texture of traditional meat. This technology was initially introduced to the public through the testing of a cultured beef hamburger on August 5, 2013, in London. CM is purported to be an outstanding protein alternative that inspires greater environmental sustainability potentially at a lower price (Bekker et al., 2017). Businesses are actively searching for methods to enhance their productivity and reduce expenses in order to introduce their items into the fiercely competitive market. Therefore, there are still certain technological manufacturing challenges that require resolution and the most challenging barrier to launching CM is consumer acceptance (Mancini & Antonioli, 2019; Pakseresht et al., 2022).

Consumer acceptance of cultured meat

Previous CM studies have showed that a majority of consumers in the United States, Italy, Germany, India, and China are willing to try or consume it regularly. Some are willing to pay a premium price to replace conventional meat (Bryant et al., 2019; Mancini & Antonioli, 2019; Pakseresht et al., 2022; Weinrich et al., 2020). Egolf et al. (2019) found that Swiss consumers were more accepting of CM than genetically modified food, which supports

food companies launching their products in Europe. Comparing CM to PBM, Slade (2018) found that consumer preferences for these types of foods are correlated. Consumers widely accept PBM over CM currently because PBM products are already available. Some consumers who wish to reduce their red meat consumption or change to a plant-based diet have tried PBM (Bryant et al., 2019). Bryant and Barnett (2020) noted that while CM nearly meets commercial feasibility, there are other concerns about consumer acceptance such as perceptions, attitudes, personality (food neophobia), economic factors (e.g., price and income), and taste. Moreover, a recent study found that the transition from conventional meat to cultured meat needs high stakeholder engagement (Morais-da-Silva et al., 2022)

Focusing on consumer acceptance, Verbeke et al. (2015) separated perceptions determining acceptance or rejection of novel foods into two sets: the perceived relevance of individuals (e.g., perceived personal, societal benefits, and risks of technology), and the perceived scientific knowledge or uncertainty of technology itself. Perceived personal relevance is defined by Verbeke et al. (2015) as the extent of individual thought about things that will benefit or harm their life. When an individual perceives food technologies to be highly relevant to their lifestyle, they are more likely to have positive attitudes toward those food products and are willing to buy them. On the other hand, if they perceive a product will impact their life negatively, they will reject it. Understanding and tracking consumers' barriers to accept novel food technologies is very complex because it involves understanding individual perception, risk-benefit analysis, knowledge, and socio-economic characteristics.

Information is an important factor in customer perception and adoption of innovative food. Mancini and Antonioli (2020) highlight that when information on safety and nutritional qualities is provided, customer perception of CM is dramatically influenced, however the opposite is true when it comes to product flavor. More information regarding the environmental benefits of CM displayed more readiness to try it compared to those who were just given basic information. Also, Pakseresht et al. (2022) show that consumer acceptance and rejection of cultured meat are primarily influenced by public knowledge, perceived naturalness, and food-related risk perception. Consumers are prepared to pay more for meat replacements, but not necessarily cultured meat, due to ethical and environmental concerns (ibid.).

Healthiness is perceived as the result of addressing personal health problems and making informed food choices. This is because many foods produced with new technologies have not undergone rigorous testing and evaluation to assess their long-term impact on human health. Bryant and Barnett (2020) emphasized that the personal benefits of CM, such as possible health and food safety, are less well understood than the societal benefits and therefore more positive information is needed. However, CM has been perceived to be tastier than insects or plant-based meat in some markets, and is commonly viewed as healthier, and

safer alternative to conventional meat (Gomez-Luciano et al., 2019). As a consequence, perceived healthiness and nutrition of cultured meat were among the most important predictors of willingness to pay for cultured meat across nations in their study.

New food technology will be a part of the future food, rather than a barrier to customers consuming healthier. The perceived healthiness of customers should be prioritized. In the food sector, scientists and corporate actors have worked together to improve the food chain to the highest standards, which is a crucial component influencing customer perceptions of risk and health-related quality concerns. Consumers will be hesitant to purchase revolutionary food-related technologies unless they have trust and a positive assessment of the health advantages. Wilks and Phillips (2017) discovered that vegetarians and vegans had a positive opinion of the health benefits of CM over traditional meat but were less likely to try it than meat eaters in the United States. On the one hand, perceived healthiness can predict consumer's decision to accept of PBM and CM in China (Bryant et al., 2019). These findings will be highly valuable for food marketers as they adjust product profiles that include health and nutrition information.

Consumer perception of cultured meat

Some experiments indicate that gene technology is perceived as less natural than traditional breeding technologies, leading to lower perceived advantages for the former (Siegrist et al.,2018). Therefore, perceived naturalness significantly influences consumer behavior, impacting their intent to purchase, desire to consume, and actual purchasing and consumption habits (Michel & Siegrist, 2019). Roman et al. (2017) divided food naturalness into three categories: 1) the way food is cultivated (food origin), 2) what and how technology and ingredients are employed, and 3) the final product qualities such as healthiness, tastiness, freshness, and eco-friendliness. Previous studies have employed this factor to be considered in terms of willingness to consume organic, local-traditional, functional, and healthy food (ibid).

Wilks et al. (2021) showed that customer judgment of CM's naturalness may not be based on analytical reasoning. Instead, evaluations of unnaturalness are based on emotive responses like disgust and anxiety. As a result, food unnaturalness is the source of distaste and health/safety concerns. A reduced perceived naturalness of unfamiliar meals correlates with a decreased propensity to consume or reject them (Michel & Siegrist, 2019). Unfamiliar meals are often perceived as unnatural, but this perception may be less important than other factors when it comes to deciding whether to try them. Consumers rely on their thoughts and evaluations of the naturalness or trustworthiness of any food they agree to eat. According to Siegrist et al. (2018), individuals demonstrate limited acceptance of CM because they believe it to be less natural than organic meat, despite the fact that CM is marketed as an

ecologically and animal-friendly alternative to traditional meat. This is in line with Wilks et al. (2021) who state that the notion of CM as unnatural is a significant impediment to its acceptability. Importantly, one's sense of naturalness indirectly influences their willingness to consume CM via the mediation of evoked disgust, which has a detrimental impact on consumer willingness to adopt CM.

Food neophobia

Pliner and Hobden (1992, p.105) introduced the term "food neophobia," defining it as "a reluctance to eat and/or avoidance of novel foods." This personal trait has significant implications for children's nutrition, as they often exhibit a preference for a limited range of foods, driven in part by a heightened level of food neophobia (FN) or food neophobia scale (FNS). Notably, FN is not exclusive to children; it can also affect adults. Henriques et al. (2009) found that FN is prevalent in both children and adults, especially when novel foods are perceived as potentially harmful, strange, or containing unfamiliar substances. Scientific confidence plays a key role in mitigating neophobia related to novel food technology (Ross et al., 2022), further highlighting the impact of this internal factor. Even though FN and food technology neophobia are distinct concepts, they are interrelated (Cox & Evans, 2008). Both types of neophobia contribute to consumers' reluctance to consume novel foods and their resistance to such innovations.

FN has been established as a significant indicator of CM rejection in nations throughout America, Europe, and Asia (Bryant et al., 2019; Dupont et al., 2020 cited in Bryant and Barnett, 2020). This is consistent with Bryant et al. (2019) performed study in the United States, China, and India, and discovered that FN had a significant and unfavorable impact on consumer acceptability of both plant-based meat (PBM) and cultured meat (CM). Importantly, their findings show that customers who are more familiar with innovative food products are more likely to buy them. However, Gomez-Luciano et al. (2019) argues that with the exception of FN in Brazil, neither FN nor food technology neophobia predicted CM rejection in the worldwide sample. However, considering the numerous qualities and factors impacting food choices across cultures, it is critical to study the association between FN and consumer transition to CM, particularly among Thai consumers.

Conceptual Framework

This study aims to answer the research question: what social psychological factors impact the transition from conventional meat to CM. The researcher conducted a quantitative survey to examine customer perception, beliefs, attitudes, and food neophobia. These factors are explanatory variables of two models. The first model aims conducting the level of transition to cultured meat in general without price consideration and the second model aims

to explore the different groups of acceptance when the price has been involved as shown in Figure 1.

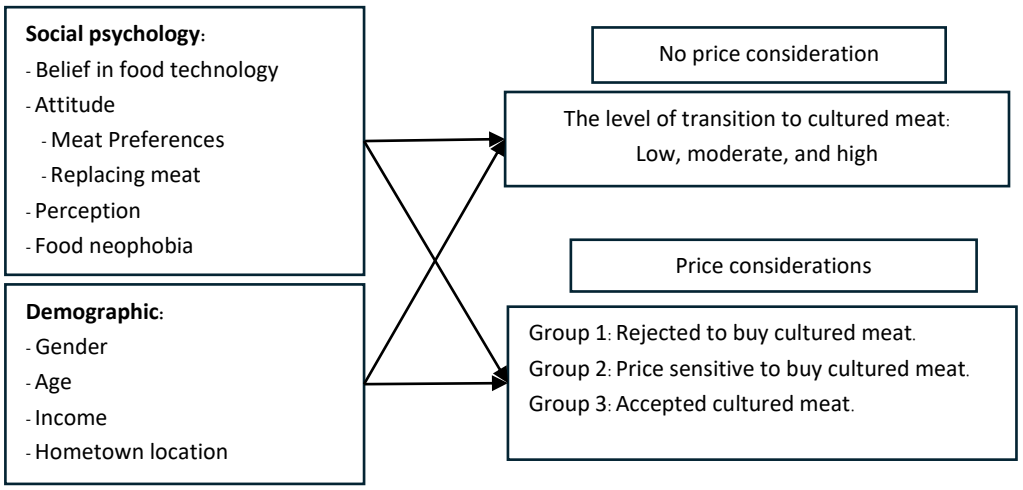

Figure 1 Conceptual framework of social psychology factors impacting the transition to cultured meat.

Source: Authors, 2024

Research Method

Population and sample

This study employed a quantitative cross-sectional design. The data were collected by online questionnaire between April and November 2021. The study targeted Thai consumers aged 18 and above who individually made choices regarding their food purchases. The sample size was calculated following Cochran's formula because of the unknown population size (Cochran, 1977). The sample size was 384, calculated by assuming a confident interval of 95% and a 5% margin of error. However, Bujang et al., (2018) suggested that in the case of observational studies with large population sizes analysed by logistic regression, the minimum size requires at least 500 observations. The participants were selected through purposive sampling based on the study criteria and agreed to participate via Google Forms. According to the results, the sample size of the study is 603 final participants who provided qualified responses after the data were cleaned.

Research Instruments

This study's questionnaire was designed to elicit social psychological factors impacting the willingness to replace conventional meat with cultured meat. The questionnaire was divided into three parts: 1) a set of social psychology statements focused on attitudes,

beliefs, perception, and personality; 2) cultured meat replacement; and 3) participants' personal information.

In the section of the questionnaire focused on attitudes, four statements were measured on a 5-point scale of agreement (1 = 'disagree strongly' to 5 = 'agree strongly'). The first statement measured meat preferences: "meat is delicious" (ATT1). This statement was followed by three others related to the environment, global warming, and health. They included: "Choosing to eat plant-based products can help reduce global warming" (ATT2); "To reduce health risks, I could reduce and stop eating meat and animal products" (ATT3); and " To help reduce the environmental impact, I can reduce or stop eating meat and products" (ATT4).

The perception part of the questionnaire focused on food produced by novel food technology and included a 7-level semantic differential in four aspects: bad-good (PER1), tasteless-tasty (PER2), unhealthy-healthy (PER3), and unnatural-natural (PER4). Two statements measure belief about food technology on a 7-point scale of agreement (1 = 'disagree strongly' to 7 = 'agree strongly'). The statements were: "I believe that the utilisation of advanced technology and scientific chemicals in the food manufacturing business has considerable potential for the future advancement of food products" (BEL1) and "I believe that the technology and scientific chemicals used in the food industry are inevitable" (BEL2). A semantic differential scale was used for these two sets of perception and belief instead of a 5-point Likert scale, as the latter merely indicates participants' levels of agreement or disagreement. A Semantic Differential scale provides insights into the position of participants' perspectives along an imaginary line between two opposite adjectives. It requires enhanced cognitive engagement from participants due to abstraction of interpreting the phrasing of the goal labels.

For personality traits, the study focused on food neophobia applied to the 10 statements that proposed by Pliner & Hobden (1992), which contained five neophilic statements and five neophobic statements. Each item used a Likert scale ranging from 1 to 5, with 1 indicating "strongly disagree" and 5 indicating "strongly agree." We calculated the total individual food neophobia scores (FNS) by summarizing the values of each scale item, ranging from 1 to 5, resulting in a cumulative score between 10 and 50 points. A lower number of FNS corresponds to neophobic propensity.

The questionnaire section on CM starts by providing the following information:

> Cultured meat or in vitro meat is a product that is produced by taking tissues or cells from prototypes, extracting them into whole cells, and then breeding them on glass plates until more cells are produced. These growing cells begin to cling to each other like plates of muscle fibres in

the tissues of organisms. When the cells in the plant are more numerous, they can be cooked like bones-less flesh.

The synthetic material from the lab is still in the research phase so it is not available in Thailand but is likely to be manufactured and marketed in the future.

The next section of the questionnaire focused on behavioural differential questions. It began with the question "If you get a chance to try a cultured meat product, would you like to try it?" The rating was on a 7-level semantic differential (1 = not tried, 7 = tried). The next question was, "If a cultured meat product becomes available in the future, would you choose to consume cultured meat instead of conventional meat?" Then, participants were asked to rate on a 7-level semantic differential (1 = not consumed, 7 = consumed). Results of the second question were divided into three groups: low (rating 1-3), moderate (rating 4-5), and high (rating 6-7) level of replacement. This question does not involve the price which is an important factor for consumers. Therefore, we asked another two questions by presenting a burger using cultured meat with price offer (359 THB and 159 THB) and measured by dichotomous scale (buying and not buying). The price of 359 was established based on the retail price of a plant-based burger offered by a restaurant chain in Thailand. The price of 159 was the outcome of the pilot test achieved at the switching point. The questions were: 1) if this cultured meat burger was 359 THB, would you buy it? And 2) if this cultured meat burger was 159 THB, would you buy it? The results of these questions separated participants in three groups. The first group, called the rejected group, included whoever rejected buying both options. The second group, called the price-sensitive group, included participants who intended to buy the burger at 359 THB or 159 THB, and the last group, called the accepted group, included participants who strongly intended to buy a CM burger.

Data analysis

Ordered logistic regression was used to estimate the relationship between social psychological aspects and the outcome of CM replacement. The dependent variable, CM_i, was an ordinal categorical variable with three levels of substitution of conventional meat with CM: low, moderate, and high. This variable represents, different levels of participant's decisions regarding CM replacement. The observable variable CM_i was obtained from the ordered logit model as follows:

Low level: $CM_i = 0 \ \ if \ CM_i^* \leq k_0$

Moderate level: $CM_i = 1 \ \ if \ k_0 \leq CM_i^* \leq k_1$

High level: $CM_i = 2 \ \ if \ CM_i^* \geq k_1$

Given that k_0 and k_1 are the thresholds- the point of separation of the variable's values- that define observed discrete answers and can be estimated, CM_i^* is the continuous latent variable, estimated as a score based on a linear function of explanatory variables:

$$CM_i^* = \sum_k^K \beta_k X_{ki} + \varepsilon_i$$

β_k includes the coefficients or weights that quantify the influence of different social psychological factors and demographic variables on the CM_i^* which estimated by the maximum likelihood method.

The model includes demographic variables as control variables. ε_i is residual error which is logistically distributed. The predicted probability of CM_i^* for participants being categorised into levels of CM transition (0 = low level, 1 = moderate level, and 2 = is high level) is estimated as:

Low level: $\mathrm{P}(CM_i = 0) = \mathrm{P}(CM_i^* \geq k_0)$

Moderate level: $\mathrm{P}(CM_i = 1) = \mathrm{P}(k_0 < CM_i^* \leq k_1)$

High level: $\mathrm{P}(CM_i = 2) = \mathrm{P}(k_1 < CM_i^*)$

To explore the influence of social psychology aspects on consumer purchasing when prices change, a multinomial logistic regression was used to estimate three purchasing outcomes (ACM) for CM burgers: rejected, price sensitive, and accepted group. The rejected group was assigned as the baseline group. Two logistic transformations of the odds for the price-sensitive group and accepted group follow:

Price-sensitive group: $ln\left(\frac{P(ACM=sensitive}{P(ACM=rejected)}\right) = b_0^s + b_1^s X_1 + \cdots + b_p^s X_p$

Accepted group: $ln\left(\frac{P(ACM=accepted}{P(ACM=rejected)}\right) = b_0^a + b_1^a X_1 + \cdots + b_p^a X_p$

Both ordered and multinomial logistic models have the underlying variables:

FEMALE = 1 if the participant was a female; 0 otherwise,

AGE is the age of the participant in years.

EDU represents education grouped into three groups: EDU = 1 if the participant graduated below bachelor's degree, EDU = 2 if the participant earned a bachelor's degree, and EDU = 3 if the participant earned a graduate degree

BKK = 1 If the participant's hometown is in Bangkok; 0 otherwise.

ATT represents attitudes toward reducing meat consumption.

PER represents perception of food produced by novel food technology.

BEL represents beliefs about technology and scientific chemicals used in the food industry.

FNS represents the food neophobia score.

Results

General information of participants

The study's participants consisted of a higher proportion of females (69.32%) compared to males (28.52%). The average age of the participants was 28.10, with the majority (70.65%) holding a bachelor's degree and 20.73% holding a highly advanced degree. Most participants (57.21%) earned less than 18,000 THB/month, while (42.79%) earned more than 18,001 THB/ month. Additionally, 40.80% of the participants live in Bangkok, while 59.20% live in other provinces. Following the data cleaning process, a total of 603 observations met the criteria for data analysis (Table 1). Nonetheless, in the regression analysis, the model excluded the LGBTQ+ variable due to an insufficient number of participants (13 out of 603) in the sample size. As a result, the regression model had a sample size of 590 observations.

Table 1 Personal information of participants

Variable	Subgroup	Number (%)
Gender	Male	172 (28.52%)
	Female	418 (69.32%)
	LGBTQ+	13 (2.16)
Age	Age in years	28.10 (8.334)
Education	Below a bachelor’s degree (EDU1)	52 (8.62%)
	Bachelor’s degree or equivalent (EDU2)	426 (70.65%)
	Above bachelor’s degree (EDU3)	125 (20.73)
Income	Less than 18,000 Baht	345 (57.21%)
	More than 18,001 Baht	258(42.79%)
Location	Bangkok	246 (40.80%)
	Another province	357 (59.20%)

Source: Authors, 2024

Following the evaluation of participant’s decision to consume CM, an ordered logit model was used to assess behavioural intention to change. The findings show that the

majority of participants were moderate (50.19%), which means they were unsure whether they would consume cultured meat instead of conventional meat if a cultured meat product became available in the future. This finding was followed by participants who were willing to change if CM became available (26.27%). Furthermore, multinomial logistic regression models were generated to investigate the price aspect that explains various levels of desire to buy a CM burger. According to the findings, the majority of participants (42.88%) were sensitive to price changes. This suggests that if the price changes from 359 Baht to 159 Baht or 159 Baht to 359 Baht, they would consider purchasing CM. The reject group followed, with 38.98% indicating that they would reject buying a burger whether the price was 159 Baht or 359 Baht (Table 2).

Table 2 Description of dependent variables (n=590)

Dependent variable	**Coding**	**Number (%)**
Ordered Logit model:		
Transition level	Low	133 (22.54%)
	Moderate	302 (51.19%)
	High	155 (26.27%)
Multinomial logit model:		
Purchasing a CM burger	Rejected	230 (38.98%)
	Price sensitive	253 (42.88%)
	Accepted	107 (18.14%)

Source: Authors, 2024

Table 3 Number of participants in the transition level group with the intention to adopt CM

Potential of transition	**Intention to adopt CM**			
	Rejected	**Sensitive**	**Accepted**	**Total**
Low	105	25	3	133
Moderate	98	150	54	302
High	27	78	50	155
Total	230	253	107	590

Source: Authors, 2024

Social psychology factors

The results reveal that if the participants had a chance to try CM, they might try it ($\bar{x}$= 5.10, SD = 1.63), but the opportunity that they will buy the product in the future was neutral ($\bar{x}$= 4.45, SD = 1.58) (Table 4).

The findings indicate that, among the social psychology categories, respondents placed the greatest weight on food phobia ($\bar{x}$= 28.29, SD = 4.64) followed by their perspective that the use of advanced technology and scientific compounds in the food manufacturing sector has significant potential for the future advancement of food items ($\bar{x}$= 5.73, SD = 1.41). They also believe that CM is slightly good ($\bar{x}$= 5.04, SD = 1.29). Although health and environmental concerns are among the reasons that turn consumers toward veganism, participants' attitudes towards eating plant-based meat were neutral regarding its potential to mitigate global warming ($\bar{x}$= 3.47, SD = 1.07) and environmental effects ($\bar{x}$= 3.25, SD = 0.98) (Table 4).

Table 5 illustrates that the FNS mean for each group varied between 27 and 30, with the accepting group having the highest score. A statistically significant difference exists in the mean FNS among the three distinct groups regarding intentions to purchase a CM burger ($F = 12.50$, $p < 0.00$). A Tukey post-hoc test indicates that FNS is statistically significantly higher in the accepting group compared to the price-sensitive group ($t=4.26$, $p < 0.00$). Furthermore, it is statistically significantly lower in the price-sensitive group compared to the rejected group. However, there is no statistical significance between the accepting group and the rejecting group (0.56 ± 0.533 FNS, $p = 0.536$). For the transitioning groups, there is indifference in purchasing intentions.

Table 4 Mean, standard deviation and interpretation of social psychology variables

Variables		**Mean (SD)**	**Interpretation**
Willing to try CM	If you get a chance to try a cultured meat product, would you like to try it?	5.10 (1.625)	Slightly trying
Willing to swich	If a cultured meat product becomes available in the future, would you choose to consume cultured meat instead of conventional meat?	4.45 (1.583)	Neutral
Attitudes	**ATT1**: Meat is delicious.	4.20 (0.901)	Agree
	ATT2: Choosing to eat plant-based meat can help reduce global warming	3.47 (1.071)	Neutral
	ATT3: To reduce health risks, I could reduce and stop eating meat and animal products.	3.21 (1.030)	Agree
	ATT4: To help reduce the environmental impact, I can reduce or stop eating meat and products.	3.25 (0.981)	Neural
Perceptions	For you, food produced by novel food technology is…		

Table 4 Mean, standard deviation and interpretation of social psychology variables (continued)

Variables		Mean (SD)	Interpretation
	PER1: bad-good	5.04 (1.295)	Slightly good
	PER2: tasteless-tasty	3.75 (1.501)	Neural
	PER3: unhealthy-healthy	4.88 (1.253)	Neural
	PER4: unnatural-natural	4.06 (1.697)	Neural
Belief	**BEL1**: I believe that the utilisation of advanced technology and scientific chemicals in the food manufacturing business has considerable potential for the future advancement of food products	5.37 (1.410)	Strongly agree
	BEL2: I believe that the technology and scientific chemicals used in the food industry are inevitable	4.79 (1.544)	Neural
Personality	**FNS**: Food neophobia score (overall)	28.29 (4.644)	

Source: Authors, 2024

Table 5 Mean of Food Neophobia Score of groups of transition and purchasing (n=590)

Groups		n	Mean	SD	Min	Max	F test
Overall		590	28.29	4.644	15	43	
Transition	Low	133	28.88	5.117	16	43	1.55
level	Moderate	302	28.20	4.329	15	39	
	High	155	27.09	4.793	15	39	
Purchasing	Rejected	230	28.09	4.516	16	42	12.50***
CM burger	Price sensitive	253	27.23	4.825	15	43	
	Accepted	107	29.47	3.941	17	38	

Source: Authors, 2024

Notes: *** p<0.01, ** p<0.05, * p<0.1

Predictors of transition from conventional meat to CM

The following is an examination of social psychology factors influencing the substitution of traditional meat with CM using an ordered probit model. The odds ratio measures the influence of salient factors such as attitudes, perceptions, beliefs, and personality traits on individuals' behavioural intention to switch from conventional meat to CM. If the odds ratio is greater than 1, it indicates a positive transition to CM. On the other hand, if the odds ratio is above 1, the variable has a negative transition to CM (Table 6).

Attitude: The results suggest that the delicious taste of meat (odds ratio = 0.79), eating plant-based meat can help decrease global warming (odds ratio = 1.25), and the ability to reduce and quit eating meat and animal products to minimise risks to health (odds ratio = 1.39) are statistically significant at 0.05. This finding indicates that a one-point increase in customers' health attitude concern correlates with a 4.8% rise in their propensity to transition to Cm (Table 7). Although the taste of meat is statistically significant, it has a detrimental influence on the replacement of CM for traditional meat.

Personality: Food neophobia had a substantial impact on consumer intention to transition to CM (odds ratio = 0.95) and is statistically significant at 0.05. If individuals have a higher FNS score by one unit, they will switch to CM, resulting in a 0.6 percent increase.

Beliefs: Beliefs that the utilisation of advanced technology and scientific chemicals in the food manufacturing business has considerable potential for the future advancement of food products (odds ratio = 1.32) and the technology and scientific chemicals used in the food industry are inevitable (odds ratio of 1.28) were statistically significant at 0.01.

Personality: Food neophobia has a substantial impact on consumer intention to transition to cultured meat (odds ratio = 0.95, and is statistically significant at 0.05. If individuals have higher FNS by one score, they will switch to cultured meats, resulting in a 0.6 percent increase.

In terms of demographics, the results illustrate that age and hometown are statistically significant at 0.05 and 0.10. This means that consumers aged 22-25 are less likely to switch to CM, whereas customers in Bangkok are more likely to do so.

What stands out in the table is the belief that the use of advanced technology and scientific chemicals in the food manufacturing business has significant potential for the future advancement of food products, with an odds ratio of 1.32. This was the strongest predictor influencing consumers' intention to switch to CM. This also demonstrates that if customers enhance their belief of advanced food technology by one unit, their desire to switch to cultured meats increases by 4.10%. If individuals increase their belief in the unavoidable use of technology and scientific chemicals in production, they will switch to cultured meats, resulting in a 3.6%increase (Table 7).

Table 6 Results of the ordered logistic model explaining the transition to CM.

Variables		**Odds ratio**	**Robust S.E.**
Attitudes	ATT1	0.793**	0.075
	ATT2	1.256**	0.128
	ATT3	1.391***	0.158
	ATT4	1.109	0.125
Perception	PER1	1.120	0.117
	PER2	1.111	0.078
	PER3	1.182	0.125
	PER4	1.251***	0.085
Beliefs	BEL1	1.325***	0.118
	BEL2	1.281***	0.086
Personality	FN	0.957**	0.020
Demographic	FEMALE	0.743	0.143
	AGE	0.867**	0.055
	AGE2	1.002**	0.000
	INCOME	0.953	0.219
	EDU2	0.729	0.188
	EDU3	0.825	0.309
	BKK	1.308*	0.218
k_0(Threshold)		1.094	1.433
k_2(Threshold)		4.093	1.457

Source: Authors, 2024

Notes: *** p<0.01, ** p<0.05, * p<0.1

Table 7 Marginal effects of the transition from conventional meat to CM at mean value of independent variables.

Variables		Low level	Moderate level	High level
Attitudes	ATT1	0.031**	0.002	-0.034**
	ATT2	-0.031**	-0.002	0.033**
	ATT3	-0.044**	-0.003	0.048**
	ATT4	-0.012	-0.001	0.013
Perception	PER1	-0.015	-0.001	0.016
	PER2	-0.014	-0.001	0.015
	PER3	-0.022	-0.001	-0.024
	PER4	-0.030***	-0.002	0.033***
Beliefs	BEL1	-0.038***	-0.003***	0.041***
	BEL2	-0.033***	-0.002	0.036***
Personality	FN	0.005**	0.000	0.006**
Demographic	FEMALE	0.039	0.005	-0.044
	AGE	0.019**	0.001	-0.021**
	AGE2	-0.000**	-0.000	0.000**
	INCOME	0.169***	0.634***	0.196***
	EDU2	0.172***	0.634***	0.192***
	EDU3	0.155***	0.631***	0.212***
	BKK	0.144***	0.627***	0.227***
Overall, at mean		0.165	0.633	0.201

Source: Authors, 2024

Notes: *** p<0.01, ** p<0.05, * p<0.1

Predictors of purchasing a CM burger

Table 8 displays the outcomes of the multinomial logistic regression with relative risk ratios (RRR), relying on the rejected group as the reference category. The RRR coefficient signifies a shift in the risk of the outcome occurring in the price-sensitive and accepted groups relative to the risk of the outcome occurring in the rejected group as the variable score increases by one unit. If the RRR exceeds 1, the outcome that is price sensitive or acceptable is more likely. An RRR of less than 1 indicates a higher probability of the outcome occurring in the rejected group. The Wald chi2 of 143.01 with a p-value < 0.000 confirms that the model fits significantly. The results demonstrate that a number of social psychological characteristics are significantly and independently related to the difference between the price-sensitive and accepted groups, as follows:

Attitude: There were no attitudes that impact the price-sensitive group at a 95% confidence interval. Participants in the accepted group who had more positive feelings about the taste of meat were significantly less likely to buy cultured meat, being 5.40% less likely for every one-point increase in meat taste preferences (Table 9).

Perception: The price-sensitive group was more likely to purchase cultured beef when they perceived the product as more health advantages and more natural (2.59% and 4.29% more likely for every one-point rise in healthiness and naturalness). For the accepted group, the higher the degree of positive perception, the more likely they were to shift to cultured meat, with each one-point rise increasing the likelihood of purchasing by 2.89%.

Beliefs: Price-sensitive participants who believed in " the utilisation of advanced technology and scientific chemicals in the food manufacturing business has considerable potential for the future advancement of food products" were significantly more likely to switch to buy cultured meat, with each one-point increase in their beliefs boosting the likelihood of switching by 4.87% . Higher-scoring individuals in the accepted group, on the other hand, were 2.71% more likely to switch to buy cultured meat due to technological and scientific advances in the food business.

Personality in terms of FN: Participants who were regarded as price-sensitive and had a higher score on food neophobia were 1.65% less likely to buy cultured meat.

Demographics: In terms of age, individuals in the accepted group were less likely to turn to CM when they were between the ages of 22 and 25, with each additional year of age linked to a 4.12% decrease in the chance of adopting CM. However, when they were between 26 and 30 years old, they were more likely to turn to CM as they got older, with a one-year increase in age related to a concomitant 0.04% increase in the chance of accepting CM. Participants in the accepted group with a higher income were more likely to switch to CM (12.99% increase in likelihood for every one-point rise) (Table 9).The accepted group with a bachelor's degree and higher—were more prone to shift to using CM. Regarding hometown, the price-sensitive group from Bangkok was more likely to switch to CM than the accepted group.

Table 8 Results of the multinomial logistic analysis explaining consumers' purchasing CM burger

		Price-sensitive vs Rejected		Accepted vs Rejected	
Variables		**RRR**	**S.E.**	**RRR**	**S.E.**
Attitudes	ATT1	1.047	0.132	0.662***	0.090
	ATT2	1.127	0.122	1.211	0.172
	ATT3	1.050	0.125	1.381**	0.220
	ATT4	1.260*	0.160	1.009	0.159
Perception	PER1	0.907	0.095	0.885	0.141
	PER2	1.108	0.078	0.942	0.099
	PER3	1.266**	0.140	1.108	0.169
	PER4	1.063	0.078	1.308***	0.125
Beliefs	BEL1	1.302***	0.116	1.110	0.146
	BEL2	1.008	0.074	1.252*	0.144
Personality	FN	0.922***	0.022	0.991	0.031
Demographic	FEMALE	0.939	0.210	0.888	0.263
	AGE	0.885*	0.062	0.668***	0.066
	AGE2	1.001**	0.000	1.004***	0.001
	INCOME	1.290	0.368	3.341***	1.159
	EDU2	0.724	0.298	0.369**	0.161
	EDU3	0.561	0.285	0.425	0.251
	BKK	2.129***	0.449	1.746**	0.476
	cons	0.848	1.417	59.772*	126.427

Source: Authors, 2024

Notes: Robust standard errors. *** p<0.01, ** p<0.05, * p<0.1

Table 9 Marginal effects of the multinomial logistic analysis explaining consumers' purchasing CM burger

Variables		Rejected	Price sensitive	Accepted
Attitudes	ATT1	0.0151	0.0388	-0.0540***
	ATT2	-0.0279	0.0124	0.0154
	ATT3	-0.0249	-0.0115	0.0364**
	ATT4	-0.0338	0.0484**	-0.0145
Perception	PER1	-0.0237*	-0.0052	0.0289***
	PER2	0.0207	-0.0122	-0.0084
	PER3	-0.0115	0.0259*	-0.0143
	PER4	-0.0396*	0.0429**	-0.0033
Beliefs	BEL1	-0.0438***	0.0487***	-0.0049
	BEL2	-0.0136	-0.0134	0.0271**
Personality	FN	0.0121***	-0.0165***	0.0044
Demographic	FEMALE	0.4010***	0.4570***	0.1419***
	AGE	0.0397***	0.0014	-0.0412***
	AGE2	-0.0005***	0.0000	0.0004***
	INCOME	0.3252***	0.4368***	0.2378***
	EDU2	0.3972***	0.4728***	0.1299***
	EDU3	0.4349***	0.4012***	0.1637***
	BKK	0.3015***	0.5452***	0.1532***
Overall	At mean	0.3957***	0.4592***	0.1449***

Source: Authors, 2024

Notes: *** p<0.01, ** p<0.05, * p<0.1

Discussion

Considering the survey outcomes, it is evident that a majority of the participants (77%) possessed the potential to substitute conventional meat with CM whereas 42.88% of the participants were price sensitive. The findings presented in this study align with the research conducted by Bryant et al. (2019), which addressed the existing knowledge gap regarding the significant variation in the acceptance of CM across different cultures, especially in Asia. Despite the fact that 30.43% of participants in the low transition level were still open to trying the product, 21.05% stated that they would buy a CM burger once the price drops. Even though aggressive promotion of food marketing, farm-raised meat is still the favoured choice for this group of people (Van Loo et al., 2020). They are at least open-minded to trying meat alternatives, which is a good sign for the CM industry (Zhang et al., 2020).

According to the findings of the initial model, there exists a relationship between several aspects of social psychology and the shift from traditional meat consumption to CM. Consumers' attitudes have a crucial role in determining the acceptance of meat alternatives. Individuals with a stronger preference towards meat are more prone to continue consuming meat rather than transitioning to the consumption of CM products. This supports the findings of Van Loo et al. (2020) that meat reared on farms will continue to hold the largest market share.

The positive attitudes towards eating plant-based meat and helping global warming support the transition. At this point, individuals who are considering incorporating vegetarian and vegan options into their dietary habits as flexitarians may benefit from the provision of CM (Hicks et al, 2018). There is a lack of consensus regarding the correlation between reducing meat consumption and addressing environmental issues, which is why this element is not aligned with the move to CM. Nevertheless, the study solely presents an idea of CM creation and fails to address the negative environmental effects associated with livestock farming reduction. More environmental information may provide different results (Chen et al., 2023). This could potentially be a matter of the perceived sustainable product's context, which could lead to an alternative outcome (Bekker et al., 2017). There exists a strong correlation between views towards reducing health risks through meat avoidance and the process of transitioning. Consumers can decrease and stop consuming meat and animal products. In accordance with the findings of Hicks et al. (2018), it has been observed that CM has the ability to preserve proteins derived from animals, resulting in a significant level of nutrient intake upon consumption. The significance of this work is noteworthy in the context of flexitarian, vegan, and vegetarian diets (Lui et al., 2023).

In terms of perception, only perceived naturalness is strongly correlated with switching to CM, contrary to Slade's (2018) findings. This research reveals that individuals who consider food generated by modern technologies as more natural (highly perceived naturalness) tend to have high possibility to consuming CM. The belief that the use of advanced technology and scientific substances in the food manufacturing industry holds significant potential for the future progress of food items is one possible rationale. The provision of further information regarding the process of developing CM serves to mitigate customer suspicions (Siegrist et al., 2020). Moreover, they slightly believe that the technology and scientific chemicals used in the food industry are inevitable, which positively correlates with the transition to CM. This belief is also significantly associated with the accepted group, while the sensitive group is not significant. It implies that individuals who currently embrace food technology are more likely to eventually embrace novel foods.

When considering personality, it is evident that FN generates a significant and detrimental influence on Thai consumers, similar to its impact on consumers in several

nations such the United States, China, India, and Brazil. (Bryant et al., 2019; Gomez-Luciano et al., 2019; Siegrist & Hartmann, 2020b). To increase the possibility of a transition from conventional meat to CM, emphasis should be placed on its similarity to conventional meat as opposed to its technical production process, which may elicit feelings of unnaturalness and disgust (Siegrist & Hartmann, 2020b).

According to the second model, our findings suggest that prospective consumers of CM prioritize their health concerns, which are reflected in their perception of healthiness. Consumers who perceive novel foods as healthier than natural foods will be more likely to transition to CM. They willingly reduce or avoid consuming meat and animal products in order to mitigate health hazards. Consuming CM would serve as an acceptable choice for sustaining their protein consumption (Hicks et al., 2018). Furthermore, the perceived naturalness of the products holds significant importance among the target consumers who have a tendency towards adopting CM technology (Siegrist & Hartmann, 2020b).

Conclusions

The conclusions of this study underline that Thai consumers have the potential to convert to CM. There are relationships between social psychological factors and the shift from conventional meat to CM. The attitude towards meat preferences is expected to be less beneficial for the shift to CM, similar to the situation with FN. The perception of positive naturalness in food produced through new technology is projected to have a positive correlation with the transition. Similarly, favourable beliefs on the utilisation of technology and scientific chemicals in the food industry are expected to be favourably associated with the replacement of conventional meat with CM.

Certain consumer segments are inclined to substitute conventional meat due to health-related considerations. Some may consider making a switch if the price is reasonable. This provides food companies with an excellent opportunity to develop their own CM product. This development will lead to a broader range of brands and a heightened level of competition in the marketplace. Nevertheless, creators have a responsibility to explain the perceived naturalness of the CM product, a critical factor in influencing consumers' purchasing decisions. Ensuring the provision of additional detail regarding the development idea of cultured meat effectively mitigates consumer suspicions. Moreover, in order to eliminate the FN of consumers, marketers should highlight the similarities of CM to traditional meat rather than its technical manufacturing technique, which may arouse thoughts of unnaturalness and rejection.

Academic Implications

The findings of this study emphasize the importance of social psychology elements in the decision making of consumers in the context of CM. However, the involvement of these

elements may not align with other novel foods because of different ingredients or techniques. Researchers can conduct other novel foods produced by gene editing that will be nearly exist in the market. Additionally, the Big Five personality traits can serve as a valuable tool for food marketers in identifying client segments and developing tailored marketing strategies for each target. This personality trait should be taken into consideration by researchers for the purpose of further advancing the model.

Future Research

This paper presents a concept of CM production, without addressing the advantages of mitigating environmental consequences resulting from the reduction of cattle livestock rearing. The contextual factors surrounding the perception of a sustainable product need to be tested. The knowledge information of cultured meat may influence consumer's decision-making; however, this aspect was omitted from the analysis presented in this paper. Moreover, the rationale behind drawing lessons from historical experiences is based on the observation that advancements in the food industry frequently result in significant market failures, as the viability of a novel food technology in the marketplace is contingent upon its acceptance among consumers. The current study highlights that food neophobia is a key element of consumer acceptance. However, food technology neophobia is another key that allows food businesses to identify consumer segments that would be willing to try novel foods. Thus, future studies should explore food technology neophobia and provide a deeper understanding of the reasons behind consumers' reluctance to consume foods manufactured using novel technologies.

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