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INVESTIGATION OF CONSUMER PERCEPTIONS OF CULTIVATED MEAT IN SINGAPORE

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Abstract

Food sustainability has been a major focus on the global agenda, including in countries like Singapore, where about 90% of food needs must be imported. It encourages scientists, entrepreneurs, and governments to actively search for alternative food sources to create sustainable solutions and a variety of food ingredients. One of the solutions being developed is the latest technology in meat farming, which has the potential to significantly transform the meat industry. The aim of the study was to analyze consumer perceptions of cultivated meat in Singapore. Research methods use mixed research methods to collect and analyze data through qualitative and quantitative approaches. The first step involves interviews and in-depth observations to gather qualitative data. Furthermore, research confirms and validates the proposition using quantitative research methods, namely surveys. Once the data is collected, qualitative content analysis will be applied to interpret the context of the text data subsequently interpreted. Research shows that although cultivated meat is recognised as healthier by industry experts, most consumers still consider it less natural and less attractive. The majority of consumers see grown meat as an environmentally friendly option, showing that sustainability is a key factor in changing consumer preferences. The research findings point to the importance of building consumer confidence and tackling the neophobia of food technology to support the adoption of grown meat.

Keywords: Consumer Perceptions, Cultivated Meat, in Singapore.

1. INTRODUCTION

Food sustainability has ascended to the forefront of the global agenda, prompting scientists, entrepreneurs, and governments to explore alternative food sources to ensure sustainable food and grocery options (Khoo & Lim, 2021). One such alternative is the breakthrough in cultured meat, which has the potential to revolutionize the meat industry, impacting the environment, health, and animal welfare on a significant scale. Cultured meat offers the promise of mitigating several environmental challenges associated with traditional agriculture, including air, soil, and water contamination. Produced indoors under sterile conditions, cultured meat eliminates disease-causing bacterial contamination, rendering it a healthier option compared to farmed meat (Treich, 2021).

To assess the environmental impacts of large-scale cultured meat production, a life cycle assessment (LCA) study approach was employed. Findings indicate that cultured meat production carries a lower environmental footprint than conventional European meat production. These findings are supported by more efficient energy utilization, reduced greenhouse gas emissions, optimized land usage, and more sustainable water consumption patterns. Despite some uncertainties, cultured meat production demonstrates a significantly lower environmental impact compared to conventional methods (Tuomisto & Teixeira de Mattos, 2011). Additionally, cultured meat holds the potential to not only match but surpass conventional meat in terms of

taste and texture, thereby creating unique product offerings. Should consumers embrace these products, the cultured meat market could potentially reach $25 billion by 2030 (Brennan et al., 2021). Meanwhile, Singapore grapples with persistent food security challenges, with approximately 90% of its food sources imported from over 170 countries (Ong, 2022), while only 10% is produced domestically (Singapore Food Agency, 2020). To address these challenges, Singapore has set an ambitious target to locally produce 30% of its food supply by 2030 ("30 by 30 target"), a substantial increase from the current level of less than 10%. Cultured meat emerges as an ideal solution to achieve this target, requiring minimal land and labor, aligning with Singapore's resource constraints.

The Singapore Food Agency has allocated $144 million for food research, with a particular focus on addressing food security challenges through cultured meat production (Begum, 2019). Substantial investments in research and development have fostered collaborations among universities, government agencies, and private enterprises. Singapore has also taken a pioneering step by approving the world's first commercial cultured meat facility and becoming the first country to authorize the sale of cultured meat in December 2020 (Steffen, 2021; Woodyatt & Wiener-Bronner, 2020).

Previous studies (Bryant & Barnet, 2018) have shown that while most consumers are willing to try cultured meat, few are willing to completely switch from conventional meat or other meat alternatives. Younger, more educated urban residents exhibit greater willingness to try cultured meat. Common reasons for rejecting cultured meat include perceptions of it being unnatural, hence unsafe and unethical to consume, as well as concerns regarding taste inferiority. In a study by (Wilks & Phillips, 2017) aimed at examining perceptions of in-vitro meat (or cultured meat) and identifying potential barriers to engagement, concerns were predominantly related to price, taste, appeal, and the perceived unnaturalness of the product. While consumers may express a willingness to try in-vitro meat, a minority view it as a direct substitute for conventional meat.

This research seeks to address the challenges associated with introducing cultured meat into consumer diets and understand its perceived value in Singapore. Additionally, it aims to investigate the concept of food technology neophobia and its influence on consumer behavior towards cultured meat, as well as whether consumers view cultured meat as a solution to environmental sustainability challenges.

The findings of this research will provide insights into consumer acceptance or rejection of cultured meat, perceptions of its attributes, and strategies to enhance product awareness. It is hoped that these findings will prove valuable for researchers seeking to understand public perceptions of cultured meat and entrepreneurs looking to enter and develop new Agri-Food startup ventures in Singapore.

2. METHODS

This research will employ mixed research methods, considering three primary factors: time, weighting, and mixing (Creswell & Clark, 2007). Data collection will entail the development of instruments based on qualitative findings and quantitative surveys. The qualitative phase will encompass interviews aimed at instrument development, drawing insights from discussions with the local startup company, Shiok Meats.

The objective is to explore the company's perspective on consumer perceptions of cultured meat and to identify any challenges or issues encountered. Concurrently, the quantitative survey phase will utilize online surveys with standardized questionnaires to quantitatively assess consumers' attitudes towards cultured meat. This phase seeks to corroborate findings and hypotheses derived from previous focus group discussions. Following data collection, qualitative content analysis will be employed to contextualize textual data. This process involves systematic procedures such as coding and identifying themes or patterns (Hsieh & Shannon, 2005). Subsequently, to translate research objectives into tangible outcomes, a framework will be delineated, detailing steps encompassing data collection, analysis, and interpretation, in accordance with guidelines outlined by Creswell (2014).

3. RESULTS AND DISCUSSION

3.1 Product awareness and understanding

Our online survey received a total of 177 responses, with 6 invalid responses. The majority of respondents were between 26 and 55 years old, while a smaller number were 18-25 years old and over 55 years old. The majority consume 25% - 75% meat in their daily menu. Although 66% of respondents knew about cultured meat, only 54% understood it. As many as 32% and 31% of respondents initially thought of cultured meat as "artificial meat with added nutrients" and "genetically modified organisms," respectively. These findings indicate a potential lack of understanding or misunderstanding about the product. Additionally, it also suggests that young Singaporeans may not have extensive exposure to or a good understanding of cultured meat. This is based on the assumption that all respondents had never attended a cultured meat introduction event or campaign before responding to our survey. Regarding the level of risk of cultured meat perceived by consumers, 43% of respondents felt unsure about the safety of cultured meat, while 41% believed that it was unsafe for consumption, especially among young Singaporeans. This distrust stems primarily from security concerns. Therefore, the research results highlight the importance of education about cultured meat to increase consumer interest and maintain trust in the long term..

3.2 Research Findings

3.2.1 Major and early users of cultured meat

1) Willingness to try

Research findings revealed that the willingness to try cultured meat was high across different age groups. Specifically, the 18-25 year age range showed a rate of 61.5%, the 26-35 year age range was at 83.3%, the 36-45 year age range stood at 73.1%, the 46-55 year age range was at 50.0%, and those over 55 years old showed a rate of 41.7%. These results suggest that cultured meat is more popular among the younger generation, who tend to be more open to trying new foods than older generations. This trend may be influenced by their education systems, which often emphasize sustainability awareness. As noted by one respondent from Shiok Meat, the younger generation is likely to have been exposed to various meat substitutes and food product innovations from an early age, which could explain their more positive acceptance of new food products compared to older generations.

2) Willingness to consume regularly

The research findings showed that 89% of the 116 respondents who were willing to try cultured meat were also willing to consume it regularly. Despite some misconceptions about the product, such as considering it artificial or genetically modified meat, respondents expressed concerns about sustainability and a desire to contribute to alleviating the environmental crisis.

3) Willingness to consume as a substitute for conventional meat

The research noted that 60% of respondents are willing to switch from conventional meat to cultured meat. It can be concluded that the majority of consumers interested in cultured meat are younger, except for the 18-25 year age group. Our findings indicate that consumers most likely to switch to cultured meat will be between 26 and 35 years old.

3.2.2 Motivation to consume cultured meat

In terms of respondents' perceptions of cultured meat, the majority believe that its consumption has a positive impact on the environment. As many as 23% of respondents consider cultured meat to be more environmentally friendly, while nearly 19% see it as a potential solution to supply disruptions caused by the pandemic, inflation, and geopolitical factors. Meanwhile, around 18% tried cultured meat out of curiosity.

3.2.3 Important factors that drive consumer choice

Analysis of survey data shows that respondents' perceptions of cultured meat are influenced by environmental and ethical issues. However, between 61% and 52% of respondents believe that cultured meat is less natural and less appealing, indicating confusion among consumers seeking sustainable options. Additionally, research shows that cultured meat has not been fully introduced in the Singapore market, indicating a lack of information or exposure to campaigns that could increase product awareness. Although half of respondents believe that cultured meat can be as healthy and delicious as conventional meat, the results suggest the presence of food technology neophobia. According to Cifci et al. (2020), four main constructs that can overcome food technology neophobia include carrying out public disclosure activities, developing appetizing food, building culinary knowledge, and using authority arguments or advertising.

3.2.4 Refusal factors to try or consume cultured meat

Nearly 60% of respondents were unsure and believed that cultured meat was considered unsafe and risky to consume. The majority of respondents attributed this perception to the belief that cultured meat is "artificial meat with added nutrients" or "genetically modified organisms." The findings imply that safety concerns are the main factor driving Singaporeans not to try cultured meat. Around 26% of respondents were hesitant due to safety concerns, while 42% felt uncomfortable trying it because it was considered unnatural and unhealthy. Interestingly, price is not one of the top resistance factors, as it is thought that Singaporeans are aware of the high production costs of new food technologies, especially before they reach mass production and market commercialization.

3.2.5 Advertising to promote product awareness

Promotion of cultured meat through advertising, such as food degustation events, consumer education campaigns, forums, and social media marketing, is considered effective for reaching a larger demographic. As many as 23% of respondents were interested in tasting cultured meat through food degustation advertisements, 22% preferred educational discussions or forums, and 22% chose social media as the main channel for learning about products. Additionally, findings suggest that free samples and price discounts are effective methods to increase awareness and acceptance of cultured meat. As many as 37% of respondents prefer free degustation samples, while 28% believe price discounts and promotions are effective for marketing cultivated meat. Educational content and infographics are considered important for effectively providing product knowledge to the public, alleviating consumer misunderstandings, and expanding product market share.

3.3 Other findings

3.3.1 Reasons to choose cultured meat

Reviews from our respondents revealed that 46% of them are willing to consume cultured meat due to personal preference. These include reasons such as human ethics, animal welfare, reduced animal meat consumption, environmental benefits, sustainable use of meat, alternative access to nutrition, and healthy choices and concerns, etc. Some environmentalists believe that cultured meat is more attractive than plant-based meat because it will become a modern trend for meat lovers to change their eating habits for the sake of sustainability.

3.3.2 Concerns about cultured meat consumption

Various respondents believe that cultured meat can be a complementary product to make their diet more sustainable. However, they recognize that cultured meat may not completely replace conventional meat due to differences in taste, texture and price. Respondents expressed a tendency to switch to cultured meat if the price was affordable and the taste quality was equal or even better than conventional meat.

4. DISCUSSION

4.1 Proposition validation

Although most of the research survey results were in line, there was a significant difference of 33% in consumption motivators between the perspectives of Shiok Meats and the research respondents. According to experts from Shiok Meats, the three main factors driving cultured meat consumption are environmental awareness, animal welfare, and health. The interviews emphasized the belief that younger generations will be early adopters of cultured meat, especially as they are more exposed to environmental news and innovative food options such as plant-based or healthier options.

Interestingly, the perceived impression of cultured meat as a healthier option compared to conventional meat was rated low at 10.6%, indicating a stark difference between Shiok Meats' strategy and consumer views. This can be attributed to consumers' lack of understanding about the product, as shown by the results of a research survey, where only 15% of respondents answered correctly that cultured meat is real meat. Additionally, the survey results also highlight supply chain disruption

as the second major consumer motivator to consume cultured meat. This can be considered a factor specific to Singapore, given the country's dependence on food imports.

There is also a discrepancy in the propositions related to factors influencing consumer choice (67% agree), with differences in lifestyle aspects (as explained by Shiok Meats) and production processes (according to research survey results). The research believes that this can again be linked to consumers' lack of understanding about the product. Therefore, increasing consumer awareness of products and their production processes may be the basis for changes in thinking, including in terms of lifestyle, which can influence preferences for the meat produced.

Further discrepancies also include high prices as a major concern for consumers, as reflected in Shiok Meats' marketing strategy of launching its products in restaurants with high prices. However, this study found that in the survey results, price ranked low at 10.9% compared to other resistance factors. For example, 42% of respondents were hesitant to switch to cultured meat due to its artificial nature and food safety concerns. Therefore, price may not currently have a significant impact compared to food safety, but will likely grow in relevance as the product cycle matures. The Consumer Perception Model will be used to break down differences in perception further, taking into account consumers' opinions, feelings, and beliefs about the product as well as strategies that may influence them to determine future recommendations.

4.2 A cross-academic institutional investigation into the acceptability of cultured meat in Singapore

In Singapore, the cultured meat industry is still considered a growing sector. A recent study from Singapore Management University (Chong et al., 2022) compared the level of consumer acceptance of cultured meat in the United States and Singapore, revealing that Singaporeans are more accepting of these meat products. To increase validity and reliably reflect consumer perceptions, we compared our findings with similar studies. The results show that a relatively small percentage (8.4%) of Singaporeans believe that influencer marketing effectively increases product awareness. Similarly, only 8.5% consider celebrity and influencer endorsements to be an effective marketing campaign to promote cultured meat in local markets, which aligns with findings from Chong et al. (2022). The study concluded that social media influencers or celebrities conveying information about cultured meat are not effective in increasing consumers' perceptions of this product. Although the involvement of influencers has proven successful in promoting products to consumers, more research is needed to understand why social influence decreases when dealing with new food products

Additionally, research findings regarding consumption motivation differ from those reported by Chong et al. (2022). Researchers found that Singaporeans are more prone to consuming cultured meat because they want to stand out from the crowd and look good in front of others (fear of missing out or being left out), making them 'trailblazers' due to the Singaporean cultural trait of 'kiasuism'. Bedford & Chua (2017) define the term 'kiasuism' as 'comparison with others to avoid falling behind or missing out on others', which could be one of the motivators for local residents to express a higher level of acceptance for new foods. However, research findings reveal that only a small percentage (13.6%) of Singaporeans are willing to consume cultured meat due to

personal preferences influenced by peer pressure and trendy consumption behavior. Future research could investigate whether the two studies used different types of demographic criteria to study motivations for consuming cultured meat.

4.3 Behavior change using the SHIFT model

When analyzing the results regarding factors influencing consumer choice, sustainability and environmental considerations were identified as the main motives for choosing manufactured meat over traditionally grown meat. This reinforces the research decision to apply the SHIFT framework (White et al., 2019), which considers barriers to adopting sustainable behavior and establishes connections to tools within the framework that can facilitate change. The need to increase product awareness among consumers was previously identified as fundamental to influencing change. Implementation of the SHIFT framework will focus on lifestyle changes that are likely to highlight the desired image of sustainability, thereby driving behavioral changes to facilitate a shift in mindset from traditionally produced meat to cultivated meat.

Examples of applications of the SHIFT framework include efforts to raise awareness about the safety of cultured meat, driven by understanding social aspirations regarding the ingredients of these products. The limited understanding of the product through surveys shows that cultured meat is still considered a niche product by most consumers today. Therefore, the first step is to overcome the social barriers that influence consumers, enabling further behavioral changes, such as choosing cultured meat despite its higher price. This will ultimately lead to a long-term transformation of habits so that consuming cultured meat becomes a social norm that is attractive to consumers' social image. Although the concrete benefits of this framework still require further identification, as sustainable behavior change needs to be sustained over the long term to see real results, it is currently only possible to measure the results of interviews and surveys. The SHIFT framework provides guiding principles for any future recommendations in this research.

4.4 Intention to consume using the consumer perception model

This research aims to further examine and analyze the correlation of survey results with propositions regarding consumer intentions to try or consume cultured meat, using the Consumer Perception Model. However, as noted in the literature review, this model was originally developed for private label products, so it may only be partially suitable for cultured meat (Jaafar et al., 2012). To adapt the framework to the research project, researchers made small changes to external factors. Because the study intends to explore Singaporeans' intentions to try or consume products, the researchers removed advertising, packaging, and storage images from the model, replacing them with marketing and motivational factors. This decision was based on a review of research literature and preliminary findings indicating that cultured meat is in the early stages of the product life cycle, making it more appropriate to focus on marketing factors and current consumer motivations rather than packaging and store graphics, which researchers believe are more relevant later in the product life cycle when it's ripe.

By applying a customized framework, the research categorized data collected from surveys before correlating each survey result to match them to various purchasing decision factors. For example, attributes such as promotions and free samples were categorized as part of the marketing strategy, which was then included in the external factors that influence consumers' intention to consume cultured meat. To analyze

consumers' intentions to consume cultured meat, researchers built a relationship diagram between factors and attributes. This diagram provides a high-level overview of information, allowing researchers to better analyze attribute correlations and understand their impact on Singaporeans' intentions to consume cultured meat. Meanwhile, the study conducted a second level of analysis to correlate the results with the respective age groups and validate the findings through the application of the framework.

The research developed a scoring system to evaluate all the attributes corresponding to various purchasing decision factors based on the survey age groups. The finding that Singaporeans in the 26 to 35 age group are more willing to consume cultured meat provides encouragement, validating some early findings such as Shiok Meats' strategy of targeting this age group as early adopters. Nonetheless, with the perceived high economic situation and research survey results showing price as a low consumer resistance factor, this prompts the question of whether price, considered by Shiok Meats as a consumer resistance factor, is indeed relevant for future analysis. Researchers acknowledge that the scoring system is based on the team's opinion with a small sample size, so it may contain distortions, although the team attempted to achieve objective results.

5. CONCLUSION

The challenges in introducing cultured meat into consumer diets can be attributed to a lack of understanding of the product among today's consumers. Although recognized by industry experts, such as Shiok Meats, as a healthier alternative to traditionally raised meat, it is still considered less natural and less appealing by most consumers. Factors such as food safety, artificiality, and perceived lack of scientific support remain the main reasons for consumer dissatisfaction in switching to cultured meat. Validation of our mixed methods approach has shown that the majority consider traditional meat to be more environmentally friendly and ethical than cultured meat. It can be concluded that sustainability will be a key factor influencing changes in consumer mindset in choosing cultured meat. The SHIFT framework analysis further emphasizes the importance of positioning the product as an environmentally friendly option in cultured meat companies' marketing efforts, while still increasing consumer awareness of the product. Poor product understanding is a factor that needs to be overcome. These findings indicate that cultured meat is still considered a specialty product by most consumers today. Cultured meat companies, which are in the early stages of the product life cycle, need to place extra emphasis on marketing their products to increase consumer awareness. As a first step, product awareness hurdles must be overcome so that further social influence can take place in the long term. This involves adapting consumer behavior to meet the demands of the social environment, where consuming cultured meat becomes a social norm that appeals to consumers' image of social sustainability.

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