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## Attitudes and Perceptions Towards Cultured Meat Among General Population in Pakistan

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### ABSTRACTS

Meat demand and production are under strain because of their effect on the atmosphere, animal welfare, and the growing demand for proteins worldwide. Cultured meat (CM) is now an industry, politics, and society's hot subject. While understanding of the effects is on the rise, opposition to the removal of meat from our diets remains. One alternative way of alleviating these consequences is by producing in vitro meat. A pre-coded questionnaire was used to poll the Pakistani population on their views and acceptance of laboratory-cultured meat. The acceptance of CM among the Pakistani population was poor at 27.1%. About one-third of the respondents showed positive attitudes and concerns towards CM and were willing to consume in vitro meat and its substitute products. Participants were more sensitive, concerning its safety, ethical issues, nutritional value, and other health-related concerns. Since the Pakistani population was less likely to accept CM, the government and stakeholders should address this problem through media campaigns and clear people's misconceptions regarding its safety and ethical concerns for the preservation of the environment and meeting the demand for protein.

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## 1. INTRODUCTION

Meat produced in laboratories, also called CM, without having any ethical and environmental concerns, is currently being developed and will be available shortly on store shelves. Such modern meat produced in laboratories and its related products will address the more contentious social issues in the sector, including animal welfare and impacts on the climate, with more changes in food safety potential. It is nevertheless uncertain how customers perceive this kind of food commodity, in particular, as regards its safety, qualities, nutritional value, taste, and its positive environmental, animal welfare, and food safety externalities, owing to its high degree of innovation. Several concurrent causes are putting a strain on the meat processing mechanism at the moment. According to [Tilman et al., \(2011\)](#), there are 815 million starving people on the planet, with an additional 2 billion people predicted to join them by 2050. Furthermore, by 2050, global meat demand will have increased by more than two-thirds due to urbanization, demographic development, and increasing wages in developed countries ([Tilman et al., 2011](#)). Simultaneously, Western buyers are unlikely to significantly decrease meat intake, implying that a dramatic increase in animal demand is likely to occur, resulting in negative impacts on natural capital ([Newton & Blaustein-Rejto, 2021](#)). Anthropogenic greenhouse gas emissions increased by 14.5% due to high livestock output accounts. the number four ([Chriki & Hocquette, 2020](#)).

Recent studies have focused on the advantages of cultured meat processing over traditional meat production in terms of environmental impact. Studies revealed that in vitro meat could reduce energy consumption and land usage by 99%, water consumption by 90%, and energy usage by 40% ([Tuomisto & MJ Teixeira de Mattos, 2011](#)). Some scholars have recently recorded a reduced output of CM as a consequence of possessing a smaller land footprint and lower anthropogenic greenhouse gas emissions. [Chriki & Hocquette, \(2020\)](#) other advantages of cultured meat have been described in the literature: It would eliminate the need for animals in the meat industry as well as alleviate ethical concerns of people regarding commercial livestock operations ([Hadi & Brightwell, 2021](#)). It would solve global hunger problems, preventing the meat from being a luxury meal for the majority of consumers ([Treich et al., 2021](#)). Human-animal encounters will be reduced as a result of the regulated atmosphere of the development phase, lowering the likelihood of zoonotic diseases.

Consumer awareness, on the other hand, is critical to the market viability of in vitro meat. Moritz has a comprehensive analysis of market perceptions of CM, as well as other recent research on the subject ([Moritz et al., 2015](#); [Treich et al., 2021](#)) the objection to cultured meat is often based on personal or social considerations. The above is primarily concerned with the demise of conventional animal agriculture, public mistrust of companies that produce in vitro meat, and the resources needed for processing. Consumers' favorable perceptions of in vitro meat are often linked to animal health and environmental protection, with nutritional quality and safety coming in second and third. Nonetheless, addressing the "learning gap" might not be enough to solve the resistance to novel food-production technologies ([Moritz et al., 2015](#)) indeed, the latest literature does not include a systematic review of consumers' perceptions of the inherent qualities and beneficial externalities that cultured meat contains. Further study is required to explain whether knowledge relating to both intrinsic traits and positive externalities may successfully affect consumers' perceptions and attitudes, as indicated by. This will reveal the characteristics and externalities that need interventions other than providing constructive facts to overcome social obstacles such as mistrust and security. To the best of our knowledge, there is no study based on an assessment of knowledge, attitudes,

and perceptions towards in vitro meat consumption in Pakistan and other Asian countries. The current study aimed to assess the knowledge and perceptions of participants towards CM acceptance, consumption, and purchase.

According to leading scientists involved in the production of cultured meat, "detailed research is essential to achieve a better understanding of the possible psychological barriers to refusal" (Rostand *et al.*, 1997). Given the general inability of the American public to sacrifice meat from its diet, some hesitation may be faced with this modern approach to meat development. The study has explored the functional and metaphysical components of CM since the GM principle was developed (Bryant & Dillard, 2019). To date, though, popular opinion remains largely undetected. Some qualitative analyses were conducted on commentary from online news platforms, as well as in a community forum and interview setting, analyzing CM acceptance in individuals. Good views have generally been linked to public wellbeing and possible advantages for the community, with negative issues focusing on unattractive characteristics of products and the protection and viability of industrial manufacturing. In general, citizens were ready to try the product but hesitated to continue (Bryant & Dillard, 2019). In addition, a study showed that the regional position was linked to positivity — with more pessimistic opinions regarding the commodity for those living in rural areas. To improve our general view of this commodity, perceptions of similar goods must be studied. Research on genetically modified (GM) food processing is important. GM foods have been used for a long time and have been extensively updated in several items. Nevertheless, the general worldwide view of GM remains negative (Knight *et al.*, 2009). In addition, there is general resistance among people's deliberate lack of substantial knowledge. In the meta-analysis, a range of constantly associated factors such as greater perceived harm than value, little faith in institutions, and moral considerations have been identified (Gaskell *et al.*, 2004).

In comparison, early perceptions of CM were positive—although many obstacles to naturalness, genetic modification, and future costs were found. The discrepancies in interpretations of the two items could be the result of methodological alterations among experiments. However, this may also be attributed to the methodological variations between CM and GM food production; the ability to alleviate issues related to the climate and animal health. In many surveys, animal protection has been consistently listed as one of the top three key motivators for deciding to refrain from eating, as well as wellbeing and the environment (Gaskell *et al.*, 2004). This specific aspect is important if we are to consider the help and potential obstacles to CM as an acceptable form of future meat processing. This study aims to reveal attitudes, understanding, approval, and the desire to pursue and pay for CM when it is available on store shelves, which will reconvene the impact of supplying customers with positive knowledge. This research provides fresh insights into the advancement of tailored marketing campaigns through deepening customer awareness of this food generated by the laboratory. Indeed, research shows that favorable evidence influences customers' perceptions of the protection and nutritious features of grown meat and their ability to pay a high price accordingly.

## 2. METHODOLOGY

### 2.1. Study Design

A cross-sectional online survey was conducted in Pakistan for 3 months from January 2021 to March 2021. Participants were invited through social media platforms. Participants who showed their interest in studies were requested to see the brief introduction of CM at the end of the questionnaire on Google forms. For the collection of participants' data, a self-administered questionnaire was utilized. However, in instances where participants could not complete the questionnaire due to literacy problems, interviewer-assisted approaches for data collection were employed.

### 2.2. Research Instrumentation

After an extensive literature study of the associated published studies. A questionnaire was developed. After the initial version was drawn out, the questionnaire was subordinated by a panel of five experts, including two diet specialists, one epidemiologist, one public health analyst, and one sociologist. The study instrument is split into three parts. The first section included informed consent and participants' demographic information. Participants were asked about their age, gender, education, marital status, and 2 questions were related to their behavior towards dietary habits and meat consumption. Section two assessed participants' knowledge and perceptions towards acceptance of CM. Participants were asked about their knowledge regarding cultured meat, whether they had ever heard of this term, their willingness to pay high prices for cultured meat, and ethical, environmental, safety, production, and religious concerns. These questions were arranged in the range of 1 (strongly agree) to 5 (strongly disagree), on the Likert scale. A series of follow-up questions were provided to participants if they chose 1-4 choices. These follow-up questions included their behavior towards its purchase and the money spent on it. Section 3 investigated general concerns and predictors of hesitancy towards cultured meat. While perceptions and attitudes towards cultural meat were analyzed by agreeing, disagreeing, or being uncertain about statements. A multi-response choice was then given to all participants to examine the circumstances under which they were not prepared to test cultured meat. There was also an open-ended answer to this issue. Two additional multi-response questions were then asked which meat kinds they are currently eating and which meat varieties they are willing to consume if processed using in-vitro approaches. In conclusion, members were enquired to assess how ample they settled with a numeral of declarations at the Likert scale of 1 (strongly agreed)—5 (strongly agree) assessed views about statements.

### 2.3. Ethical Approval

This study was ethically authorized by the review board of the University of Agriculture Faisalabad. The research was also conducted in accordance with the ethical norm for research (Sisk et al., 2020). Participants were educated on the research goals and gave their informed consent before data collection began.

### 2.4. Statistical Analysis

SPSS Version 25 was utilized to analyze the data. Categorical variables were presented as percentages and counts. Continuous variables such as age were arranged by mean and standard deviation.

### 3. RESULTS

A total of 417 participants with a mean age of 34 completed the questionnaire. 4 participants were not considered for the study because they did not follow the inclusion criteria as they were below 18. This study was the first study in Pakistan conducted for the assessment of knowledge and participants' behavior towards cultured meat acceptance. Participants' acceptance of cultured meat was poor at 27.1%.

#### 3.1. Socio-Demographic Elements

The mean age of the 413 participants who participated in the study was 34. More than half of the study participants were male, 77.8%. The same pattern emerged in the context of marital status. Half of the study participants were married. Half of the participants have passed their primary education while only 9.2% of participants have a university degree. In sociodemographic characteristics, participants eating habits were also studied more than half 75.3% of the study participants were meat-eaters while a very little number of people stated that they preferred to be vegan 1.2% (see **Table 1**). 44% of the participants were inclined towards poultry while fish meat consumption ranks second in this context 30.8%.

**Table 1.** Socio-demographic characteristics of study participants.

| Variable                                 | N (%)     |
|--|-----------|
| <b>Age (years)</b>                       |           |
| MEAN (Standard deviation)                | 34(11.3)  |
| <b>Gender</b>                            |           |
| Male                                     | 321(77.8) |
| Female                                   | 92(22.2)  |
| <b>Marital status</b>                    |           |
| Married                                  | 217(52.6) |
| Single                                   | 269(65.1) |
| Others (Common-law marriage or Divorced) | 7(1.7)    |
| <b>Education (Degree)</b>                |           |
| School education                         | 211(51.0) |
| High School                              | 97(23.4)  |
| College                                  | 67(16.2)  |
| University graduate                      | 38(9.2)   |
| <b>Eating habits</b>                     |           |
| Meat eater                               | 311(75.3) |
| Vegetarian                               | 97(23.4)  |
| Vegan                                    | 5(1.2)    |
| <b>Type of meat</b>                      |           |
| Poultry                                  | 182(44.0) |
| Beef                                     | 102(24.7) |
| Fish                                     | 127(30.8) |
| Other                                    | 2(0.5)    |

### 3.2. Willingness to Participate

**Table 2** indicates that people's acceptance and willingness to pursue cultured meat was poor at 27.3%. Half of the participants rejected it due to a lack of knowledge and awareness. Less than one-fourth stated that they were ready to eat cultured meat when it was available on store shelves. Only 20% of participants strongly agreed that cultured meat should be replaced with farmed meat. The same pattern emerged when participants were asked to show their willingness to eat it. Only 23.5% strongly agreed that cultured meat should be consumed. Participants were also concerned regarding the price of cultured meat. Only 9.9% of the responses strongly disagree with this statement. While half of the participants showed their negative attitudes towards cultured meat by either accepting it or adopting it for eating purposes (see **Table 2**).

**Table 2.** The willingness of participants towards CM.

| Questions and responses                                      | N (%)     |
|--|-----------|
| <b>Willing to pursue cultured meat</b>                       |           |
| Strongly agree   | 113(27.3) |
| Agree  | 18(4.3)   |
| Uncertain  | 43(10.4)  |
| Disagree   | 201(48.7) |
| Strongly disagree  | 38(9.2)   |
| <b>Willing to eat cultured meat</b>                          |           |
| Strongly agree   | 97(23.5)  |
| Agree  | 17(4.1)   |
| Uncertain  | 89(21.6)  |
| Disagree   | 189(45.8) |
| Strongly disagree  | 21(5.0)   |
| <b>Willing to eat cultured meat by replacing farmed meat</b> |           |
| Strongly agree   | 83(20.1)  |
| Agree  | 15(3.7)   |
| Uncertain  | 97(23.4)  |
| Disagree   | 178(43.1) |
| Strongly disagree  | 40(9.7)   |
| <b>Willing to pay premium prices for cultured meat</b>       |           |
| Strongly agree   | 41(9.9)   |
| Agree  | 9(2.2)    |
| Uncertain  | 119(28.9) |
| Disagree   | 169(41.0) |
| Strongly disagree  | 75(18.0)  |

### 3.3. Perception Towards Cultured Meat

People as well showed negative perceptions and concerns towards CM as only one-fourth of the participants were ready to accept it. Due to lack of knowledge regarding CM half of the participants stated that it is not healthy while compared with farmed meat. Taste preferences were the foremost concern of participants 66% stated that their taste will not be good. The same pattern emerged when we considered the ethical concerns, environmentally friendly, and able to lower the burden of zoonotic diseases, half of the participants showed their negative perceptions against all these statements. In contrast to this half of the participants stated that they believed that this cultured meat has had the potential to ameliorate the food

security issues that it could lower the global demand. Only 21% believed that these CM were safe (see **Table 3**).

**Table 3.** Perceptions towards CM and related concerns.

| Perceptions towards cultured meat                         | Agree (%) | Uncertain (%) |
|---|-----------|---------------|
| CM is healthy in comparison to farmed meat.               | 112(27.1) | 81(19.6)      |
| CM is environmentally friendly.                           | 153(37.0) | 79(19.1)      |
| CM will be available on in-store shelves with good taste. | 97(23.4)  | 43(10.4)      |
| There will be less burden of zoonotic disorders with CM.  | 163(39.4) | 95(23.0)      |
| CM has no ethical concerns.                               | 132(32.0) | 69(16.7)      |
| CM could lower the meat demand.                           | 209(50.6) | 54(13.0)      |
| CM is safer.  | 89(21.5)  | 76(18.4)      |
| Abbreviation. CM (Cultured meat)                          |           |               |

### 3.4. Attitudes towards CM.

Participants also showed negative attitudes toward cultured meat which enable us to conclude that there should be more awareness and knowledge required for awareness of people towards CM. Its safety, production, and all aspects should be cleared. 60% of participants stated that CM and its production are totally against the religious norms. The same pattern emerged among the study participants when asked that either it affects the socio-economic development of traditional farmers and its production, storage, and availability in store shelves is totally against nature. Half of the participants supported this cause. In contrast, half of the study participants revealed that it had the potential to fight against food security issues and global warming (see **Table 4**).

**Table 4.** Attitudes towards CM.

| Items   | Agree (%) | Uncertain (%) | Disagree  |
|---|-----------|---------------|-----------|
| CM production is not against the religious norms              | 121(29.2) | 42(10.1)      | 250(60.5) |
| CM is ethically stabled                                       | 156(37.8) | 56(13.6)      | 201(48.7) |
| CM is in the right of animal welfare                          | 107(25.9) | 97(23.4)      | 209(50.6) |
| CM production could affect farmers socially and economically. | 189(45.8) | 43(10.4)      | 181(43.8) |
| CM is against the nature                                      | 173(41.9) | 49(11.9)      | 191(46.2) |
| CM could solve food security issues.                          | 211(51.1) | 41(9.9)       | 161(39.0) |
| CM could ameliorate the global warming issues in the world.   | 194(47.1) | 89(21.5)      | 130(31.4) |
| Abbreviation. CM (Cultured meat)                              |           |               |           |

However, members have concluded that a variety of beneficial aspects would enhance standards for animal health, including that of it. Furthermore, some consensus was reached that cultured meat is ethical, a sustainable solution to farmed meat, which can hit global famine glitches and reduce the effects of farm-related global warming. The respondents denied that it does not honor nature or reduce the number of happy animals on earth. The reasoning behind this later concept is that the development of cultured meat might replace intensively farmed cattle, of which the public is most worried, leaving animals in extended

agricultural systems that are probably better off. On average, however, respondents often thought that the effect on conventional farmers would be negative.

These findings show an obvious paradox: those who are still stringent in meat seem less likely to deal with it; but This may illustrate the negative views of farmed meat because, considering the knowledge of the possible benefits, people that do not consume meat now do not want to associate with it. Meat eaters, though, tend to be more committed to the food regardless of its ethical/health prospects. Furthermore, those participants with a higher estimated amount of meat in their diet continued to share fewer favorable views on cultured meat than those with a lower percentage, however, their ability to associate with the substance did not change.

#### 4. DISCUSSION

A current study revealed that the acceptance of the general population in Pakistan towards CM was very poor at 27.1%. Overall, these observations illustrate the dynamic connection between the perceptions and conduct of people themselves and how they are attitudinal and able to interact with CM. While a significant proportion of the sample expressed readiness to pursue cultured meat in the future, the thought of integrating it into one's diet consistently seems to hesitate. Resistance appears predominantly from physical constraints, such as taste and price — mostly non-psychological influences (Moritz et al., 2015). This problem must be solved solely by the market and the commodity itself. Naturality and attraction are, however, often mentioned concerns (Mouat & Prince, 2018).

According to research, the addition of a gene from another animal causes the greatest decreases in natural vision compared to other mechanisms such as freezing or the use of synthetic chemicals—a mechanism that is conceptually identical to CM processing (Faccio et al., 2019). GM food opposition and the idea of moral disgust have been discussed through past studies in an American sample (Gaskell et al., 2004). Of the half of the participants who opposed cultured food, the authors observed that most of them may be identified as moral absolutists, i.e., their resistance to cultured meat was not responsive to any question. The investigators have found that, contrary to previous investigations, the philosophical absolutism of participants could not be influenced by strong claims — thus indicating modest opposition to accepting genetically modified foods (Knight et al., 2009).

Respondents' perceptions and attitudes regarding CM were affected by lack of knowledge, awareness, and other intrinsic factors, such as concern about safety, production, ethical and religious aspects of CM. Respondents showed positive attitudes towards ameliorating famines, food security issues, and environmental preservation. They showed positive attitudes concerning these factors towards CM. That meat produced in the laboratory could help to preserve nature and the environment, along with coping with issues of food security and protein malnutrition (Mancini et al., 2017).

In contrast, respondents were not allowed to compromise with CM taste preferences. Pakistan is an Islamic country where people trust religious scholars for their diet and lifestyle. It was the major predictor of CM refusal among the general population in Pakistan because they were more concerned about the halal or haram concept of CM. Vegetarians show their positive concerns towards CM in the context of animal welfare, food security issues, and a cheaper source of protein for ameliorating protein malnutrition. From 75 people responded, they were also concerned about the ethical aspects of CM. Illiteracy was also a predictor of CM refusal (van der Weele & Driessen, 2019). A current study revealed that half of the population had passed their primary schooling, which was the reason they had poor knowledge and awareness of liberty procedures and meat produced in the laboratory. A



recent study found that people with higher education had better analytical knowledge and thinking skills instead of emotional perceptions, making them accept new foods more readily compared to illiterate participants with socioeconomic vulnerability (Mancini & Antonioli, 2020). Age is also a factor in the acceptance of new food scenarios compared to older people who stick to their traditional habits, which could be cautious regarding the acceptance of CM. Half of the participants were concerned regarding availability, distribution, sustainability, and safety issues that influenced attitudes and perceptions of those who did not know the term CM (Hearn et al., 2008). Hence, it is important to create awareness regarding CM among the general population. The latest research revealed that lack of awareness and providing information regarding CM, its production, sustainability, and safety had diverse impacts on people's behavior towards reluctance to consume it. More in-depth studies are needed to enhance the knowledge and behavior towards acceptance of CM by third parties, such as media campaigns, universities, and other welfare organizations. There should be authority approval if they consider the customers' safety (Faccio et al., 2019).

As indicated in the study, participants showed no significant variation in pursuing CM and willingness to eat it between the two levels of the questionnaire. This is the possibility of the fact that respondents show poor acceptance and willingness towards CM. In the 2nd level of the questionnaire, participants were much more positive about their answers as they stated that half of the participants were given their strong disagreement towards pursuing CM. These findings are consistent with previous studies, as Muslims preferred slaughtering of animals instead of using alternative sources for protein (Benzertiha et al., 2018).

The limitations of these studies lie in the bias of the results as respondents tend to overestimate their willingness to purchase CM. As socio-demographic elements indicate that study participants were young for many reasons, as the study was conducted by using online tools, older populations were less engaged in this study to this extent. Assessment of knowledge and perceptions of the older population will be gained in the future (Djisolov et al., 2021). Hence, this sample could not consider the whole population. However, respondents' willingness to posture and engage in CM was also biased because of the young people in the sample, as they were more likely to engage in future food scenarios. Future research should cover the predictors of CM hesitancy among the general population in a wide range. A previous survey conducted highlighted the positive effects and characteristics of CM that helped to cope with the critical aspects and negative perceptions regarding CM (Gibson et al., 2008). Respondents responded positively towards its environmental friendliness as they were aware of large-scale production, agricultural land substitution, and the economic sustainability of livestock. Hence, scientists who are working on the production of CM and stakeholders involved in marketing strategies say that, for them, CM could be categorized between nutritional value and ethical concerns. This seems to ameliorate the meat paradox. CM could compromise the balance between ethical issues and customer behavior towards CM acceptance.

The survey was conducted by using an online platform called Google form. Due to this, we were unable to deal with the older population due to a lack of digital devices and internet connections. The illiteracy rate is higher among older people in Pakistan; hence our studies covered the data collected from the younger population. We are not able to consider their attitudes towards the whole population. Due to higher literacy among the younger population in Pakistan, and their battery of analytical thinking skills, they helped them to change their climate by promoting healthy lifestyles, adoption of environmentally friendly practices, and positive perceptions and concerns towards accepting new food choices.

Another limitation of this study is that we measured their general perception of pursuing it, not their actual behavior and attitudes towards it. While the intention is not considered as an indication of perfect behavior, the theory of planned behavior reveals its associations with action, including alteration in food intake. 1991, Ajzen... However, CM is not available on store shelves, and none of the participants had tasted it. Hence, the lack of these things is the major predictor of their reluctance towards CM acceptance.

## 5. CONCLUSION

Meat demand and production are under strain because of their effect on the atmosphere, animal welfare, and the growing demand for proteins worldwide. Cultured meat (CM) is now an industry, politics, and society's hot subject. While understanding of the effects is on the rise, opposition to the removal of meat from our diets remains. One alternative way of alleviating these consequences is by producing in vitro meat. A pre-coded questionnaire was used to poll the Pakistani population on their views and acceptance of laboratory-cultured meat.

This research was the first study conducted to assess the participants' perceptions towards CM acceptance. The result shows that negative attitudes and perceptions towards CM acceptance were related to a lack of knowledge and awareness among the general population. And when they talk about pursuing it or willingness to purchase it at premium prices, perceptions are concerned about safety, production, sustainability, and nutritional value. In contrast, opposition occurred concerning taste preferences, compared to farmed meat. Hence, proper information and awareness towards acceptance of CM combined with different approaches will enhance customers' perceptions and attitudes towards CM acceptance. In addition, regarding data and material availability, data gathered during current study available from corresponding authors on demand.

## 6. AUTHORS' NOTE

The authors declare that there is no conflict of interest regarding the publication of this article. The authors confirmed that the paper was free of plagiarism.

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