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Cultured Meat and Community Knowledge in Iraq

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This study assessed the understanding and acceptability of cultured meat among knowledgeable consumers and the public. A survey was conducted with 204 food scientists and 386 public participants to examine whether awareness of meat and food production influences cultured meat adoption. Most respondents were female (53%), meat eaters (78%), and preferred red meat (55%). Most were uncertain about the healthiness (54%) and long-term effects (71%) of cultured meat, with 82% believing it is less healthy than regular meat and 92% perceiving it as unnatural. Concerns included its impact on meat quality (71%), safety (87%), environmental effects (35%), and carbon footprint (70%). Additionally, 71% disagreed that it would improve animal welfare. Many felt scientific evidence on its safety is lacking (70%) and that it may be harmful to human health (68%). Media bias was also a concern, with 42% noting skewed portrayals and 86% believing benefits are overstated. A majority (64%) feared a rapid transition could be risky, and 91% doubted it would replace conventional beef. These findings highlight the need for further research and public engagement to address uncertainties and ensure informed participation in the future of food production.

1. Introduction

Both sectors and the media exhibit considerable interest in this novel food product, attributing to its substantial potential to affect meat consumption. Cell culture has garnered significant popular and scientific interest. Although several cell-based products have been proposed or are in the research phase, cell-based meat, often called cultured meat, has garnered international interest and is being produced in laboratories and commercial research facilities across multiple nations (Hadi & Brightwell, 2021). Previous research indicates that the acceptance or rejection of genetically modified food is mainly influenced by framing and perception rather than by changes in technical, economic, or agricultural conditions. Perceptions of advantages and dangers are crucial mediators that affect attitudes and behaviours toward new food items (Nagaraj, 2021; Pillai et al., 2022). Research indicates that several customers choose natural food over manufactured alternatives, even though naturalness does not inherently correlate with healthfulness. Consumers often consider cultured meat unnatural. Perceptions of naturalness often correlate with evaluations of possible food contamination (Rubio et al., 2020). leading to rejecting unnatural foods due to concerns about their possibly infectious features. Another underlying consideration is that natural food may benefit both health and the environment since it does not need fertilisers and pesticides, thereby mitigating issues associated with pollution and pesticide residues. Research indicates that a deficiency in perceived naturalness results in diminished benefit perceptions of

genetic technology and may also reduce the acceptance of risks associated with cultured meat. Researchers are investigating several facets of cultured meat, including cell sources, culture conditions, scaffold construction, 3D structure, and customer responses to this innovative product (Chen et al., 2022). Research on the social and psychological dimensions of cultured meat has assessed the perceptions and acceptance among individuals in various countries, including Europe, China, Australia, and the UK, to identify the determinants of its varying levels of acceptance and the associated positive or negative sentiments. Despite the high production costs of cultured meat in laboratories, it is anticipated to enter the consumer market at a reasonable price owing to the rapid advancement of pertinent technologies, such as the enhanced commercialisation of in vitro methods and the integration of artificial intelligence in the production process (Garrison et al., 2022; Treich, 2021). The social acceptability of a novel food product is the paramount element influencing its commercial success. Numerous research studies have assessed cultured meat's acceptability and knowledge across various areas and nations (Vapnek et al., 2021). Nevertheless, most of these acceptance tests used typical customers with an inadequate understanding of meat and food production, which may affect their perceptions of a novel product. It is necessary to assess the acceptability of cultured meat among the public, educated individuals, and professionals to determine if meat and food production knowledge influences this acceptance. This research aims to assess the acceptability and awareness of food scientists and professionals with a comprehensive grasp of the meat business' nutrition, biology, and environmental implications. This study may provide insights and conclusions pertinent to scholars and policymakers about the industry's development and future.

2. Materials and Methods

2.1. Research Design, Sampling Plan, and Data Analysis

The study was performed in compliance with all human ethical regulations. A multistage sampling strategy was used, resulting in the random selection of 204 food science researchers and 386 members of the general public as respondents by an exploratory study design (Khusun et al., 2022). Graduate students with master's or doctorate degrees from departments involved in research and instruction in food science and technology were randomly chosen using a lottery approach. The students were chosen from several Baghdad and Babylon, Iraq, institutions, including Al-Qasim Green University, Babylon University, Baghdad University, and Al-Nahrain University. Table 1 presents the overall background and characteristics of the survey respondents. Participants were solicited to complete an online survey using a Google form created for the research. Invitations were sent by email, and a signed agreement was acquired by the participants. The Google form utilised a pre-structured questionnaire comprising diverse data (refer to Table 2) formulated from prior literature (Zhang, Li, & Bai, 2020). With assistance from a select group of participants, they addressed anticipated negative impacts and benefits, including environmental and animal welfare considerations, health implications, perceived anomalies, safety concerns, future societal impacts, and media coverage. Respondents might explain their rationale for their answers or provide criticism if desired. Participants ranged in age from 19 to 51 years and gave written agreement to participate. Participants could withdraw from the survey until April 2023, the study's end date, without the need to provide a rationale or face any repercussions. Participants were allowed to verify the survey texts until the research data was analysed. The Statistical Package for the Social Sciences (SPSS) was used to analyse the survey data, and the findings are shown in tables.

3. Results and Discussion

3.1. Overview of Respondents' Profiles and Backgrounds

The acceptability and knowledge of cultured meat among food scientists and the public were evaluated. Table 1 presents the overall characteristics and background of the respondents. The online poll comprised 204 food science students and faculty from several institutions in Iraq and 386 members of the public. The predominant demographic of food scientists (51%) and the general population (53%) were females aged 19 to 62. While food scientists were obtaining their MSc, PhD, or BSc degrees in food science and technology or related topics from several institutions in Iraq, the general populace had BSc, MSc, or PhD degrees in many disciplines. A significant proportion of respondents, including both scientists and the public, ingested meat (76%) and exhibited a preference for red meat (72%), with an average consumption frequency of twice weekly (42%). The pronounced inclination for red meat indicates that consumers are reluctant to forgo it despite its detrimental effects on human health and the environment, as well as the increasing scientific data opposing the habitual intake of red and processed meat (Krings, 2021).

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Table 1: Overview of Respondents' Profiles and Backgrounds of the Respondents and the List of Universities.

No.	The Variable		General Public	Academics in the Field of Food Science
1	Respondents' count		386	204
2	Gender	Male	46.76 %	48.34 %
		Female	53.24 %	51.66 %
3	The age (years)		19–62	23–51
4	Level of education		Undergoing master's or PhD	Bachelors or master's or PhD
5	The job	Food science professionals are employed as students, professors, and staff in the departments and colleges of food science, as well as by the public in Baghdad and Babylon, Iraq.		
6	Meat consumption frequency	Every day	9.35 %	2.92 %
		Three times a week	29.23 %	28.94 %
		Two times per week	42.58 %	39.42 %
		Not at all	18.84 %	28.72 %
7	Preferred protein source	Meat with red color	45.54 %	31.21 %
		Only white meat	32.62 %	38.98 %
		Vegetarian diet	21.84 %	29.81 %

Table 2: Consciousness and Acknowledgment of food Science Scholars and Veterinary Professionals Towards Cultured Meat.

No	Statements.	public			Academics in the field of food science		
		Would You Agree (%)	No Agreement (%)	Neither Concur Nor Dissent (%)	Would You Agree (%)	No Agreement (%)	Neither Concur Nor Dissent (%)
Health and Dietary Considerations							
1	I assert that cultured meat is nutritious.	5.29	52.11	42.60	14.35	31.66	53.99
2	Fortification, manipulation, and coculturing will facilitate the attainment of balanced meat and meat products.	6.19	48.97	44.84	14.98	32.11	52.91
3	Cultured beef is expected to have enduring adverse health consequences.	21.12	19.86	59.02	11.46	17.24	71.30
4	Researchers are confident about the effects of cultured meat on human health.	29.10	19.69	51.21	52.12	19.04	28.84
5	Cultured meat seems to be no healthier than traditional meat and meat products.	82.22	7.91	9.87	63.88	8.34	27.78
6	The cultivation of meat seems to give individuals more autonomy over their dietary preferences to accommodate specific consumer needs.	18.31	44.81	36.88	32.01	36.81	31.18
7	Consuming lab-cultured meat and animal products is unnecessary since traditional meat products are already sufficiently palatable and healthy.	86.14	7.12	6.74	33.51	39.48	27.01
Criteria for Animal and Environmental Welfare							
8	I contend that cultured beef is beneficial for the environment.	16.32	48.15	35.35	39.18	36.15	24.67
9	Insufficient scientific data exists to support the assertion of a minimal carbon footprint in the manufacturing process.	18.13	11.26	70.61	29.55	17.09	53.36
10	The cultivation of meat may result in enduring adverse environmental consequences.	32.15	29.37	38.48	22.17	31.93	45.90
11	I assert that cultured meat improves animal welfare and reduces animal pain.	62.75	41.10	3.85	71.12	21.74	7.14
Safety Considerations							
12	In summary, cultured meat seems to be safe.	4.98	7.09	87.39	23.19	6.27	70.54
13	Cultured meat potentially poses a significant health risk.	24.39	7.92	67.69	17.21	16.37	66.42
14	Cultured meat's safety has not been adequately shown by science just yet.	70.19	4.94	24.87	42.83	17.32	39.85
15	Researchers and experts disagree over the possible implications of cultured meat.	68.29	27.09	4.62	51.07	41.44	7.49
16	Uncertainty surrounds novel technology like cultured meat manufacturing.	72.61	6.34	21.05	44.81	21.04	34.15

You may see the results as a percentage of the total responses divided by the score. In this case, the score equals the total number of respondents who agreed or disagreed with the sentences. The results indicate that awareness of the adverse effects of meat production and consumption may not significantly affect consumers' propensity to consume red or processed meat. These results align with prior research and prevailing trends indicating that consumers typically do not forgo meat despite their heightened knowledge of the environmental and health repercussions associated with meat production and consumption (Font-i-Furnols & Guerrero, 2022). Recent studies indicate that consumers in the United States are reluctant to forgo meat; conversely, they have diminished their consumption of plant-based alternatives due to elevated prices, unsubstantiated claimed benefits, and inferior sensory quality relative to meat and meat products (Hashimoto et al., 2024). Consumers may not alter their dietary practices despite acknowledging ethical considerations. Findings from a 2020 Swedish national survey indicated that most consumers (75%) are reluctant to decrease their meat consumption. Despite the heightened consumer concern and awareness regarding the adverse ethical, health, and environmental ramifications of meat consumption, recent research indicates that only a tiny fraction of consumers are inclined to diminish their meat consumption in response to ecological and environmental apprehensions. Environmental issues have prompted just a minority of consumers (4–19%) to decrease their meat consumption in Western nations, including Belgium, the Netherlands, and the United States (Dagevos, 2021). Notably, perceived

advantages had a more significant impact on customer attitudes than perceived hazards. This tendency has been seen in prior investigations as well. For instance. In a meta-analysis examining the perceived advantages and hazards influencing the acceptability of novel food technology. Found that perceived benefits significantly outweigh perceived dangers in real purchasing choices (Li & Li, 2023). Elucidate this phenomenon by highlighting consumers' propensity to engage with information on advantages since it typically corresponds with their already-held beliefs. Consumers know the advantages of consuming meat products (e.g., energy, nutrition, and taste). Nevertheless, individuals may be constrained by time or cognitive capacity to assess all possible dangers linked to a particular product thoroughly (Pagliai et al., 2021). The possible hazards linked to a product may not be as apparent or conspicuous as the advantages promoted. Contended that perceived advantages significantly impact the acceptability of novel food technology, provided that the perceived hazards stay within the individual's acceptable limits. Individuals often emphasise positive information in their evaluations (Chen & Antonelli, 2020). Consequently, customers may be more predisposed to concentrate on the apparent advantages that occupy their thoughts.

3.2. Consciousness and Acknowledgment

3.2.1. Health and Dietary Considerations

Table 2 displays the data averages about cultured meat knowledge and acceptability in health, environmental, animal welfare, and safety categories. When asked whether cultured beef is healthy or has long-term detrimental consequences on human health, most responders (53%) were unsure (neither agreed nor disagreed). While 52% of those polled did not think cultured beef is good for you, 19% did not think it would hurt you in the long run. We do not yet know how cultured beef will affect human health, particularly in the long run, since toxicological studies are still being done and the product has not hit store shelves. Toxicological investigations are necessary to determine the effects of chronic ingestion on human health. However, cultured meat seems to be safe for human eating in general. The settings seem entirely modifiable, and changes, such as coculturing and changes in the growth medium, may impact the composition of the final products when cultured meat is developed within a bioreactor and bypasses the digestive system. Fortification, modification, and coculturing would lead to better-balanced meat and meat products; nevertheless, half of the respondents were unsure (neither agreed nor disagreed), and almost half disagreed. Although conventional meat may also undergo all the available composition modifications and fortifications during processing, the changes to cultured meat's composition do not make it healthier than conventional meat. Compared to traditional beef, cultured meat does not provide greater control to consumers over their eating choices (32%), is not healthier (82%), and is not more nutritious (71%). 51% of those who took the survey think that scientists know how cultured meat would affect people's health. Some medical conditions and diseases, like obesity, colorectal cancer, hypertension, and cardiovascular diseases, have been linked to the long-term consumption of meat even though meat is culturally essential and satisfies nutritional needs (Dankner et al., 2024; de Medeiros et al., 2023). There is mounting evidence that eating processed and red meats harms human health, and these relationships hold more accuracy for the long-term intake of these foods. There was a strong positive correlation between societal concern and the propensity to eat cultured beef. According to Palmieri, Perito, & Lupi (2021), cultured meat has environmental benefits like reduced resource usage and greenhouse gas emissions. However, consumers view traditional animal-raised meat as more natural and environmentally friendly (Wang & Scrimgeour, 2023).

The Gap between the Educated Young and the Rest of Society

The Acceptor and Pioneer sectors have a younger average age and a higher proportion of people with advanced educational attainment than the Conservative segment. This corroborates earlier research indicating that younger and more educated individuals exhibit a greater propensity to embrace cultured meat compared to older and less educated individuals (Leung et al., 2023; Piochi, Micheloni, & Torri, 2022).

The Public's Understanding of the Benefits of Cultured Meat is Critical in its Widespread Adoption

This aligns with other research indicating that familiarity with cultured meat significantly influences consumer acceptability (Cornelissen & Piqueras-Fiszman, 2023; Fidder & Graça, 2023; Hanan et al., 2024).

3.2.2. Criteria for Animal and Environmental Welfare

Nearly three-quarters of those surveyed think cultured

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meat would improve animals' lives and be less painful. While 35% of those polled were unsure if cultured beef was helpful or harmful to the environment, 31% strongly opposed it and worried about the potential negative impacts in the long run. There is insufficient scientific evidence to support the claim that this innovative manufacturing has a minimal carbon impact, according to 29% of respondents, while 46% were unsure. Cultured meat proponents endorse this innovative production method because of its sound effects on animal welfare and the environment. Over the last ten years, we have seen a meteoric rise in non-traditional proteins in burger patties worldwide. Customers' growing demand for environmentally friendly food production practices propels this trend. Concerns about food sustainability, climate change, and public health are brought up by humans' high consumption of meat (González et al., 2020; Parlasca & Qaim, 2022; Van Vliet, Kronberg, & Provenza, 2020). (Parlasca & Qaim, 2022; Shapiro, 2024) Found that yearly meat consumption continues to climb globally despite these concerns. One promising new way to tackle these issues is with the help of grown meat, a relatively new technique. A new technique has been developed that uses adult animal muscle stem cells to grow into structured meats like steak, hamburgers, and meatballs (Kumar et al., 2021). Reduced land, water, and energy consumption make farmed beef a more environmentally friendly option for food production. If this theory holds, it would only take 1.5 months to grow 1 billion beef patties from a single live cow, as opposed to the 0.5 million cows needed to generate the same amount of beef burgers using traditional techniques, which would take 18 months. Furthermore, unlike traditional meat production, which involves murdering animals, grown meat does not include slaughtering animals, which eliminates ethical and welfare concerns. The potential for increased food security is another significant benefit of farmed meat. Cultivated meat provides an alternative to conventionally raised meat that does not include antibiotics and pesticides (Hadi & Brightwell, 2021).

Criticisms Regarding Meat that has been Cultured

Despite the potential benefits of cultured meat. Pointed out a few potential downsides, such as the ethical dilemma of raising animals for cell harvesting, the lack of transparency about the control of the nutritional composition of cultured meat, and the dysregulation of cell lines caused by high levels of cell multiplication (like cancer cells). Potential obstacles to increasing farmed meat consumption include technological difficulties in producing it on a wide scale and poor consumer acceptability (Santos et al., 2023). Consumers worry that consuming cultured meat can harm local animal husbandry and cause people to lose their culinary traditions, according to previous research (Zhang et al., 2020).

Table 3: Education and Acceptance of Cultured Meat among Food Scientists and the Public.

No	Statements	Public			Academics in the Field of Food Science		
		Would You Agree (%)	No Agreement (%)	Neither Concur Nor Dissent (%)	Would You Agree (%)	No Agreement (%)	Neither Concur Nor Dissent (%)
	Unnaturalness as Seen						
1	I contend that cultured flesh is artificial.	92.31	1.00	6.69	87.47	2.09	10.44
2	The inherent flavor and texture of meat and meat products appear to be diminished when cultured in bioreactors	71.37	24.87	3.76	51.79	36.21	12.00
	The News and Media						
3	The media's portrayal of cultured meat is often discriminatory and lacks fairness.	27.36	19.67	47.03	42.77	39.01	18.22
4	It is common for the advantages of cultured meat to be greatly exaggerated.	73.90	11.38	14.72	86.01	3.50	10.49
	Factors about the Future and Society						
5	Cultured meat production shouldn't be society's go-to solution for food insecurity.	58.19	3.01	38.80	31.82	34.09	34.09
6	6_ Eating cultured beef does not pose a significant risk to future generations.	12.89	37.01	50.10	30.89	22.01	47.10
7	Generally, cultured meat will benefit humankind in the long run.	12.66	34.51	52.83	32.73	21.17	46.10
8	Conventional meat production is expected to be supplanted by cultured meat production.	3.70	91.87	4.43	4.27	51.75	43.98
9	Using cultured meat and similar technologies without proper planning may be dangerous.	64.98	8.19	26.83	41.88	39.76	18.36

3.2.3. Safety Considerations

A large majority of respondents (70%) believe that there is insufficient data and scientific evidence to support the safety of cultured meat, even if most were unsure whether cultured meat is safe (87%), poses a health risk (67%), or is neither. Beyond that, most people are unsure about new technology like cultured meat production (72%), and most think that scientists and researchers are not convinced about the possible effects of cultured meat (68%). An initiative to legalise cultured meat for commercial production is underway, and the Food and Drug Administration of the United States has already approved it (Caputo et al., 2024). The only two countries that economically generate cultured meat are Singapore and Israel. As a result of culinary research, the

production cost of cultured meat patties has dropped from USD 325,000 to USD 11.36 and USD 4.00 per 100 g of in vitro chicken breasts (Kumar et al., 2021; Samad et al., 2024). In order to win over today's discerning shoppers, who are willing to pay a premium for products with certain hidden qualities, such as guarantees of food safety and knowledge of product traceability, these factors are crucial (Elnahla, 2021). To guarantee the microbial and chemical safety of cultured meat, which is a highly regulated commodity, its production will be carried out under close supervision and with the use of modern quality management systems like HACCP (hazard analysis and critical control points) and GMP (good manufacturing practices) (Ong et al., 2021; Sogore et al., 2024). It would be irresponsible to rule out the possibility of a hazard related to cell culture since toxicological studies are still ongoing in this field. Nevertheless, the consensus is that cultured meat will be microbiologically and chemically safe for human consumption. Some recent positive events that have helped advance this business include the release of cultured meat-based goods (nuggets and sandwiches) in Singapore and the USDA's clearance of Upside Foods' chicken (Chen et al., 2022).

3.2.4. Unnaturalness as Seen

Cultured meat is not natural, according to 92% of respondents, and 71% of those same people think that the bioreactor process diminishes the meat's natural flavour (Table 3). According to neoclassical economic theory, consumers' rational behaviour in the food industry results from a utility-maximising mental process (Abdellatef, 2021). Cultured meat has less market demand and acceptability than conventionally raised meat because people tend to link it with negative emotions such as disgust, the yucky factor, and food neophobia (Hamlin, McNeill, & Sim, 2022). Even though it is hard to predict how people will react to a food product before it is even on the market, factors like how unnatural it seems, along with price, concerns about safety, and unfavourable sensory expectations, are significant influences (Sunstein, 2020). Food neophobia, as previously found in research on the acceptability of meat substitutes like cultured meat, is a psychological barrier that causes people to be hesitant to try new foods. This reluctance can have cultural roots or result from fears of the unknown. Consumer acceptability of cultured meat is negatively impacted by food neophobia, according to studies examining its effects. Concerns about safety, rather than a perceived lack of naturalness, have been shown to hurt respondents' willingness to eat cultured meat burgers (Cornelissen & Piqueras-Fiszman, 2023), highlighting the need for both short- and long-term scientific trials to prove the product is safe. Various conflicting processes may impact the stereotyped impression of health. One may argue that farmed meat is healthier than regular meat, as it requires fewer chemicals. Conversely, people may worry that farmed meat harms their health because it looks—unnatural (Munteanu et al., 2021). Depending on their opinion, a person's view of cultured meat may be excellent or negative. In the context of food, it stands for the fact that two opposing forces—neophilia, the desire to try something new, and neophobia, the fear of the unknown—are always at work, creating demand (Fu et al., 2023; Texeira, 2020).

3.2.5. The News and Media

A large majority of respondents (86%) feel that the media presents an inflated and biased portrayal of cultured meat's advantages. According to Shapiro (2024), the media should use a more everyday image instead of depicting cultured beef in a scientifically advanced light using images of Petri dishes and test tubes. Customers may reject food items, for instance, if they are discovered to be in violation of social norms, which can lead to moral disgust. Furthermore, when given insufficient information, like the product's name, customers might not have the prior knowledge or internal motivation to decide if a product is acceptable. Instead, while weighing the product's pros and cons, people make an emotional connection based on past experiences (Cai, Ding, & Legendre, 2021; Hoffmann et al., 2020; Sidlauskiene, 2022). Our findings corroborate the assertions made by Maye et al. (2021) and Painter, Brennen, & Kristiansen (2020) that there is a lack of confidence in science. The urge to protect oneself is the root reason for people's negative views toward science, and this concern is usually stoked by firsthand knowledge or evidence of the negative effects that scientific products might have. These outcomes are in line with those of Mancini & Antonioli (2022), Soudry (2024), and Treich (2021). They also highlight the lack of confidence in science.

3.2.6. Factors about the Future and Society

Most people who took the survey think it is risky to transition to cultured meat and similar technologies too fast (64%), and 91% do not think it will replace traditional meat production. Half were uncertain whether it threatened generations to come, while roughly a third believed it did not. The majority of those who took the

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survey were undecided. However, 38 per cent thought cultured meat was terrible for future generations, and 58 per cent said we should not put too much faith in its creation to fix our food concerns. Overcoming the technological hurdles of guaranteeing cultured meat's safety and nutritional worth and permitting large-scale manufacturing is crucial to facilitate a transition towards more sustainable, ethical, and healthful food consumption. Concurrently, knowing what makes cultured meat appealing to consumers is essential. Several recent studies have examined how people's ideas and perceptions regarding cultured meat affect their willingness to consume it. Cultured beef, for instance, is well-received due to the favourable correlation between its perceived naturalness and this food type (Ahmad et al., 2023). The present study investigated common misconceptions about cultured meat consumers to address this knowledge gap. Also included are people's assumptions on how non-cultivated meat eaters are seen. We contend that these ideas on how other people see cultured meat eaters could help spread the word about cultured meat, even if they vary from one's views. Similarly, cultured beef can potentially cause moral and theological uproar in religious institutions (Jung, 2022; Singh, 2021; Zuckerman, 2020). We believe that cultured meat must fulfil the requirements below before the Muslim community may consume it. Cultured beef stem cells must originate from halal animals that were killed in compliance with Islamic law. The medium and scaffolding materials used in cultured meat development must also not originate from animals and be halal (food that is halal, permissible in nature, including undeniable constituents, healthful, safe, and nutritious). The six guidelines in this research should be followed when cultured meat is produced. Authorities, businesses, society, and other nations with comparable values to Malaysia might use this early research as a reference (Mohd Adi, Mohd Angsor, & Abd Samat, 2022). As the population and consumption of meat are projected to rise in the following decades, it seems that both the cultured meat and traditional meat businesses will prosper simultaneously (Newton & Blaustein-Rejto, 2021). There are many obstacles to expansion in this sector, so it is best to enter the market. The sector is projected to increase from USD 246 million in 2022 to USD 94 billion by 2030. Nevertheless, there are some obstacles that it must overcome. These include a lack of social acceptance, technological improvements (such as plant-based media and fully regulated meat), lower production costs, new regulatory frameworks and bodies, and a reduced carbon footprint (Apaza et al., 2002; Trostle et al., 2011). Although 590 people participated in the research, they were all Iraqis from Babylon and Baghdad; therefore, our findings may not apply to the rest of the world. Additionally, we did not evaluate how gender influenced perception. Participants in future research should be well-informed experts from various nations, including the West.

3.2.7. The Economics of Meat Culture

In 2015, cultured meat producers announced that the cost of producing a lab-grown burger had dropped from $325,000 to between $11.36 and $80 per kilogram of cultured meat. This significant cost reduction in just two years is a positive indicator of the commercial potential of cultured meat. (Hong et al., 2021) By comparison, current prices for conventional protein sources (meat) per kilogram in Iraq are: ground beef $14, boneless beef $14, and lamb on the bone $16 as of 2024, which are increasingly priced, according to ASGIS (2024). Low prices encourage its use. Furthermore, there may be a market for cultured meat outside of traditional food markets. For companion animals such as dogs or cats, such meat may provide a livelihood, as most pet owners do not place much importance on its acceptance. Early adopters—both human and animal—may contribute to enhancing public confidence in these products (Oven, Yoxon, & Milburn, 2022). Startups such as Memphis Meats (USA), Super Meat (Israel), and Musa Meat (Netherlands), led by scientist Mark Post, have emerged to develop and market cultured meat. However, regulatory challenges remain that hinder the adoption of this technology, as entrepreneurs face difficulties related to the vague laws and bodies responsible for regulating these products. One of the most significant challenges is the need to demonstrate the similarity of cultured meat to conventional meat to secure regulatory approval, especially since conventional products have been tested and proven safe (Fernandes et al., 2022). The US government launched initiatives to review regulations on agricultural biotechnology. The National Academies of Sciences, Engineering, and Medicine in Washington, D.C., discussed the future of regulations for these technologies. These efforts are expected to accelerate the development of legal frameworks for cultured meat, which could accelerate its adoption and commercialisation (Stephens, Sexton, & Driessen, 2019).

4. Conclusions

This research-based research aimed to determine whether familiarity with meat and food production affects the public's and food scientists' willingness to consume

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cultured meat. Many participants were female, identified as meat eaters, preferred red meat, and expressed uncertainty about the health benefits or potential long-term impacts of cultured meat on human health. Nearly everyone thought it looked unhealthy compared to regular meat and detracted from the natural flavour of meat and meat products since it was not natural. According to our findings, scientific examination is necessary to guarantee the product's safety for public consumption over the long term. Bioreactor meat is not inherently healthier than traditional meat, even though conditions can be readily controlled and changes to the meat's composition can be easily accomplished. We must invest in the research and development of meat and 3D-structured media. Utilising media will enhance the product's sustainability, affordability, and social acceptability while decreasing its carbon impact. Creating bioreactors and incubators suitable for industrial use and quality control systems and monitors are additional crucial inputs that need research. Using a global team of specialists from many nations, future research on cultured meat should investigate untapped facets, such as doing a SWOT (strengths, weaknesses, opportunities, and threats) study.

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