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Cultured meat and halal: A comprehensive analysis from jurisprudence, biology, and ethics

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Abstract

With the growing global Muslim population, dietary practices remain firmly rooted in the principles of halal and *tayyib*. The rise of cultured meat, produced through cellular agriculture without traditional slaughter, presents significant ethical, spiritual, and jurisprudential challenges. This research evaluates the halal status of cultured meat by examining its production processes, scientific complexities, and alignment with Islamic dietary laws. Through a qualitative review of scientific literature, Islamic jurisprudence, and consumer perspectives, the study focuses on cell-based meat production techniques, health and ethical concerns, and theological positions regarding halal compliance. The findings reveal that cultured meat lacks essential components of natural meat, such as a functional immune system and inherent biological processes, and does not fulfil critical *zabiha* requirements, including invoking *Allah's* name and proper blood drainage. Additionally, the absence of these spiritual and biological elements creates a disconnect from *tayyib* principles, contributing to scepticism and uncertainty among Muslim consumers. Despite its sustainability potential, cultured meat does not meet the criteria for halal status under current Islamic jurisprudence.

1. Introduction

With a global population exceeding 1.8 billion, Muslims adhere to Islamic dietary laws that distinguish between halal (permissible) and *haram* (forbidden) foods. At the heart of these dietary regulations is the process of *zabiha*, a method of slaughter that ensures the meat consumed aligns with Islamic jurisprudence (Abdullah *et al.*, 2019). However, the emergence of cultured meat, lab-grown or cell-based meat, introduces a challenge to traditional halal food standards. This scientific innovation, which produces meat by cultivating animal cells in a controlled laboratory environment without the need for conventional slaughter, has sparked debates within the Muslim community regarding its compliance with halal and *tayyib* principles (Alzeer *et al.*, 2018; Ho *et al.*, 2023). The key question for the Islamic community revolves around whether cultured meat aligns with Islamic dietary laws and should be classified as halal, based on Islamic principles.

As the global demand for sustainable and ethical food sources rises, cultured meat presents a potential alternative to traditional livestock farming, offering environmental and animal welfare benefits. The production process involves extracting a small sample of cells from a live animal and growing them in a nutrient-rich medium to develop muscle tissue resembling conventional meat. The entire process typically takes between two and eight weeks, depending on the type of meat being produced (Franceković *et al.*, 2021). While this method eliminates many concerns related to industrial farming, contamination, and disease, it raises fundamental questions about whether cultured meat can be classified as halal under Islamic dietary laws (Kashim *et al.*, 2024).

For Muslim consumers, halal compliance extends beyond just the ingredients to include the method of production, processing, and ethical considerations (Alzeer *et al.*, 2025). Since cultured meat does not undergo the traditional *zabiha* process, there is an ongoing debate among Islamic scholars regarding its legitimacy. Some argue that it represents an ethical and sustainable innovation, while others question whether it meets the spiritual and ritualistic criteria of halal meat (Chandia & Soon, 2018). This uncertainty highlights the need for a comprehensive examination of cultured meat through the lens of Islamic jurisprudence, ethical considerations, and consumer perceptions (Kouarfaté & Durif, 2023).

Despite advancements in cellular agriculture and increasing interest in sustainable food alternatives, no scholarly consensus exists on whether cultured meat can satisfy the *Qur'anic* and jurisprudential requirements for halal. Furthermore, while studies indicate that cultured meat may produce up to 78% fewer greenhouse gas emissions, use 45% less energy, and require 99% less land compared to conventional beef production (Tuomisto & Teixeira de Mattos, 2011), its alignment with Islamic principles remains unresolved.

This article aims to independently study the halal status of cultured meat by analysing its production process, evaluating

its alignment with Islamic principles of halal and *tayyib*, and integrating scholarly opinions. While references such as Ho *et al.* (2023), Rejeb (2018), and Boereboom *et al.* (2022) inform parts of the literature study, the conclusions and critical evaluation herein reflect the author's interpretation and contribution.

2. Materials and methods

This study adopted a qualitative narrative review approach to explore the halal permissibility and broader ethical, theological, and scientific implications of cultured meat. Recognising the issue's multidimensional nature, the methodology combined sources from contemporary scientific literature and classical Islamic jurisprudence, allowing for a comprehensive analysis across theological, technological, and ethical domains.

2.1 Search strategy and data sources

A structured search was conducted across academic databases including Scopus, Web of Science, JSTOR, and Google Scholar, to identify peer-reviewed studies on cultured meat production, its associated health and environmental risks, and ethical evaluations. In parallel, authoritative Islamic legal texts and fatwa were retrieved from classical fiqh compendia as well as institutional repositories of fatwa and legal opinions, including those from *Dar Al-Ifta* (Egypt), JAKIM (Malaysia), IFANCA (USA), and the International Islamic Fiqh Academy (IIFA).

The search covered materials published between 2000 and 2023, using combinations of the following keywords:

- "Cultured meat" OR "cell-based meat" AND "Halal"
- "Islamic jurisprudence" AND "biotechnology"
- "Fatwa" AND "Lab-grown meat"
- "*Tayyib*" AND "Synthetic food"

2.2 Inclusion and exclusion criteria

Included sources met the following criteria: (1) English-language texts or verified translations, (2) peer-reviewed scientific studies, official fatwa, or recognised Islamic legal analyses, and (3) relevance to halal principles or scientific risks/benefits related to cultured meat or novel food technologies. Excluded sources included duplicate records, non-scholarly editorials, and texts without proper citations or verified translations.

2.3 Data analysis and synthesis

A thematic synthesis method was used to extract and organise insights into two central domains:

1. Scientific and technological themes include stem cell sourcing, growth media, bioreactor conditions, environmental impact, and health considerations.
2. Islamic legal and theological themes — including halal slaughter requirements, blood removal, transformation (istihalah), impurity (najasah), and alignment with the objectives of *Shari'ah* (*Maqasid Al-Shari'ah*).
3.

Themes were coded iteratively and grouped according to relevance and recurrence. This allowed the identification of points of convergence and conflict between Islamic law and cultured meat science.

2.4 Corpus overview

An initial pool of 137 sources was identified. After applying the inclusion criteria and assessing relevance, 100 sources were retained and analysed in depth:

- 40 scientific studies addressing cultured meat production, environmental and nutritional impact, and associated risks.
- 35 ethical or philosophical analyses exploring moral frameworks, religious ethics, food justice, and consumer perception.
- 25 jurisprudential sources, including classical legal opinions and contemporary fatwa, focus on cultured meat's permissibility and novel food technologies.

This curated body of literature provides the foundation for the manuscript's analytical framework and supports the critical discussion of cultured meat through empirical and jurisprudential lenses.

3. Cell-based meat production

Cellular agriculture has revolutionised the potential for meat production by introducing cultured meat, also known as cell-based or lab-grown meat. This innovative technology offers a compelling alternative to traditional animal agriculture, addressing pressing ethical, environmental, and food security concerns. Instead of raising and slaughtering animals, cultured meat is produced by cultivating animal cells directly, essentially growing meat in a controlled laboratory setting. The environmental benefits of cultured meat are significant, as it is estimated that it could require up to 99% less land than conventional meat production, thus alleviating some of the pressures on agricultural land and resources (Jönsson, 2020; Post *et al.*, 2020).

The process begins with the careful and ethical sourcing of animal cells. A small tissue sample is typically taken from a live animal, often through a minimally invasive biopsy designed to minimise discomfort. The cells of interest, muscle progenitor cells (myoblasts) or stem cells, are then isolated and selected. These cells have the remarkable ability to self-renew and differentiate, which is fundamental to cultured meat production (Reiss *et al.*, 2021; Bhat *et al.*, 2019). Researchers are also exploring advanced biotechnological methods, such as the use of induced pluripotent stem cells (iPSCs), which offer a potentially more versatile and efficient platform for meat production due to their ability to differentiate into a broader range of cell lineages (Tuomisto *et al.*, 2022).

After isolation, the selected cells are transferred to a bioreactor, a carefully controlled and sterile system designed to replicate the ideal conditions in a living organism. This environment is crucial for cell proliferation, providing the nutrients and growth factors in a liquid medium (Allan *et al.*, 2019; Ge *et al.*, 2023). Historically, fetal bovine serum (FBS) was a common supplement used to provide essential growth factors; however, ethical considerations and high costs have led the industry to pursue plant-based and recombinant alternatives (Escobar *et al.*, 2021). These alternatives promise to make the process more sustainable and ethically sound, aligning with the broader goals of cellular agriculture to reduce animal suffering and environmental impact (Munteanu *et al.*, 2021).

The next critical step is differentiation, where the rapidly multiplying cells are guided to mature into organised muscle fibres. This transformation is essential for replicating conventional meat's texture, structure, and functional properties. Researchers are exploring various techniques to

enhance this differentiation process, including mechanical stretching to align muscle fibres, electrical stimulation to promote muscle development, and scaffold-based structuring (Gome *et al.*, 2024; Zagury *et al.*, 2022). Scaffolds, which are edible or biodegradable matrices, provide a three-dimensional support system for the cells to attach to and grow upon, mimicking the natural architecture of muscle tissue (Kulus *et al.*, 2023; Yun *et al.*, 2024). In conjunction with bioprinting, these techniques enable the creation of complex cuts of meat with realistic textures and structures, moving beyond simple, amorphous cell masses (Roy *et al.*, 2023).

4. Challenges in cultured meat

The development of cultured meat presents several scientific and health-related challenges that must be addressed before widespread consumer adoption. One of the primary concerns is cellular instability and mutations that can occur during the rapid cell division process required for *in vitro* meat production. While many mutations may be harmless, others could produce undesirable changes in the final product, potentially introducing unknown health risks (Stephens *et al.*, 2018). The reliance on growth factors and hormones to stimulate cell growth raises concerns about their safety, residual presence in the final product, and long-term effects on human health (Gu *et al.*, 2022; Bhat *et al.*, 2019). Moreover, ensuring that cultured meat provides a complete and balanced nutritional profile, comparable to traditional meat, remains a significant obstacle. Deficiencies in essential micronutrients or the absence of naturally occurring beneficial compounds could affect its overall suitability as an essential food (Naraoka *et al.*, 2024; Bryant, 2020).

Beyond direct health concerns, contamination risks also pose a significant challenge. Although produced in a controlled environment, cultured meat is still susceptible to bacterial, viral, or prion contamination, necessitating stringent hygiene and sterility protocols (Post *et al.*, 2020). Introducing novel cell lines, growth media, or scaffolding materials could also lead to unexpected allergic reactions in consumers, requiring comprehensive allergenicity testing and transparent labelling (Shaikh *et al.*, 2021). Furthermore, using processing aids and additives to enhance texture, flavour, and structure in cultured meat products raises questions about their long-term safety and potential health impacts (Treich, 2021). Since this technology is still in its early stages, long-term studies are essential to assess the potential effects of regular consumption on gut health, immune function, and overall human physiology (Melzener *et al.*, 2020). Another pressing concern is antibiotic resistance, as using antibiotics to prevent contamination in cell cultures could contribute to developing resistant bacterial strains, posing broader public health risks (Mattick *et al.*, 2015).

In addition to scientific and health considerations, cultured meat presents ethical and environmental challenges. While it is often promoted as a sustainable alternative to traditional livestock farming, the shift toward lab-grown meat production could have unforeseen ecological consequences (Tuomisto & Mattos, 2011). The potential decline in traditional farming may disrupt existing agricultural systems, affecting rural economies and biodiversity (Alzeer et.al., 2020; Guo & Wiwattanadate, 2023). Additionally, reducing reliance on livestock raises ethical questions about the future role of animals in food production, particularly in cultures where animal husbandry is deeply linked with livelihoods and traditions (Pilařová *et al.*, 2023). To ensure a responsible and ethical transition, policymakers, scientists, and industry leaders must engage in transparent discussions, develop robust regulatory frameworks, and prioritise long-term sustainability and consumer well-being in the evolution of food production systems.

5. Islamic views on cultured meat

Islamic scholars are engaged in extensive discussions regarding the permissibility of cultured meat within Islamic dietary laws. This discourse is necessitated by the absence of explicit directives on cultured meat in the *Qur'an* and *Hadith*, requiring contemporary religious scholars to interpret halal principles in a modern context (Kashim *et al.*, 2024).

A segment of scholars posits that cultured meat could be considered halal if specific conditions are met. Their arguments primarily centre on the initial cells being derived from an animal slaughtered according to Islamic rites, and the cultivation process strictly avoiding *haram* (forbidden) substances, such as blood or ingredients originating from pigs. Under these prerequisites, cultured meat is deemed potentially permissible for consumption (Hamdan *et al.*, 2024; Ho *et al.*, 2023). Research indicates that Muslim acceptance of cultured meat is contingent mainly upon using halal-certified stem cells or tissues (Hamdan *et al.*, 2021).

Conversely, other scholars express significant reservations, primarily due to the absence of traditional slaughtering practices, which they consider integral to halal meat. They emphasise the ritual slaughter's profound spiritual and ethical importance, arguing that its omission in cultured meat production raises fundamental questions about permissibility (Hamdan *et al.*, 2017). Furthermore, concerns persist regarding the use of fetal bovine serum (FBS) or other blood components in cultivation media, as Islam strictly prohibits the intake of animal blood (Kashim *et al.*, 2022; Kashim *et al.*, 2023).

Given the novelty of cultured meat technology, a unanimous consensus among Islamic scholars on its halal status is currently lacking. The ongoing scholarly deliberation reflects a meticulous examination of this emerging food technology's ethical, spiritual, and legal implications. As the field evolves, further theological guidance and scientific collaboration will be crucial for providing clear directives to the Muslim community (Qotadah *et al.*, 2022).

6. Cultured meat and halal concern

The emergence of cultured meat has spurred critical comparisons with conventionally farmed meat, revealing profound distinctions across fundamental dimensions. Natural meat, derived from animals raised through traditional agriculture, necessitates the entire lifecycle of animal husbandry, culminating in slaughter. This established practice, however, generates considerable ethical concerns regarding animal welfare and significant environmental impacts, including substantial greenhouse gas emissions and extensive land utilisation (Sánchez-Sabaté & Sabaté, 2019; Malek *et al.*, 2018). In contrast, cultured meat, produced via cellular agriculture in controlled laboratory environments, circumvents the need for animal rearing and slaughter. This innovative approach effectively addresses some inherent animal welfare issues and offers potential environmental benefits, such as reduced land use, although its production demands considerable energy inputs (Mattick & Allenby, 2012; Ahmad

et al., 2023; Kim *et al.*, 2024).

From a biological perspective, conventionally produced meat results from intricate natural processes, including robust immune system activity, complex hormonal regulation, and efficient nutrient absorption, all contributing to its unique structure and comprehensive nutritional profile (Wolk, 2016; Godfray *et al.*, 2018). This natural development endows it with essential proteins, vitamins, and bioactive compounds. Cultured meat, conversely, seeks to replicate muscle tissue in a synthetic environment, lacking the physiological complexities of a living organism. Consequently, its nutritional composition is heavily dependent on the artificial formulations of its growth media, potentially leading to deficiencies if not carefully engineered to mimic the comprehensive nutritional benefits of natural meat (Kim *et al.*, 2024; Ahmad *et al.*, 2023).

These intrinsic differences extend to specific religious and ethical compliance frameworks. Traditional Islamic jurisprudence, for instance, mandates that permissible (halal) meat must adhere to strict criteria concerning the animal's species, the method of slaughter, and the overall wholesomeness (*tayyib*) of the product. Central to *zabiha*, the ritual slaughter, is the prerequisite that the act be performed on a whole, living animal possessing all its natural biological systems, including a fully functional immune system. This integrated system is paramount for disease resistance and maintaining natural biological ratios (Wilujeng *et al.*, 2024). Cultured meat, originating from isolated cells cultivated *in vitro*, inherently lacks these complex, interconnected defence mechanisms of a living animal (Badu *et al.*, 2021), raising a fundamental question about its accommodation within the traditional understanding of a "permissible animal."

Further challenging halal compliance is the critical element of blood drainage, an indispensable part of the *zabiha* process. This practice carries profound hygienic and spiritual significance in Islamic tradition, symbolising purification and the animal's sacred transition to permissible food (Fuseini *et al.*, 2020). Cultured meat, by its very design, lacks a circulatory system and therefore cannot undergo this fundamental act of purification. The absence of blood drainage is not merely a procedural oversight but a significant deviation from a divinely ordained requirement that distinguishes permissible meat from the impure (Bonne & Verbeke, 2007). Thus, the circumvention of an integrated immune system and the necessary blood drainage process represents a substantial departure from the established paradigm of halal slaughter (Bouzraa *et al.*, 2023).

Finally, the potential for unnatural manipulation in cultured meat production poses additional concerns for its *tayyib* status. Unlike conventional farming, where natural biological frameworks limit compositional alterations (Hakim *et al.*, 2020), cultured meat bypasses these constraints, allowing producers to precisely control and manipulate cellular growth and composition (Fuseini *et al.*, 2017). This capacity for unnaturally altered ratios of muscle to fat or the introduction of synthetic compounds, even for perceived health benefits, could undermine the *tayyib* principle of purity, wholesomeness, and natural balance by prioritising profit-driven modifications over inherent integrity (Jalil *et al.*, 2018) (Table 1). The concept of *istihala* (transformation) in Islamic law becomes crucial here, as the halal status often hinges on the source of the initial cells and the permissibility of growth media, such as fetal bovine serum, which may raise ethical and religious concerns (Kashim *et al.*, 2024; Kashim *et al.*, 2022).

7. The Islamic perspective on cultured meat

In Islam, food transcends physical sustenance, embodying deep spiritual significance governed by divine guidance. The concept of halal dictates requirements for lawful consumption, encompassing *zabiha* (ritual slaughter), the supplication of *Allah's* name (*tasmiyah*), and the elimination of prohibited substances like blood and pork. The *Qur'an* explicitly forbids specific categories of meat (*Surah Al-Ma'idah* 5:3), underscoring that these prohibitions cultivate discipline and trust in divine wisdom, and are not subject to modification by scientific or societal trends (Lau *et al.*, 2016).

This foundational principle is particularly relevant when evaluating cultured meat, which bypasses core requirements of Islamic dietary law despite being presented as a sustainable alternative (Arsil *et al.*, 2018). The *hadiths* of Prophet Muhammad (PBUH) further emphasise *zabiha* as an essential condition for halal meat, instructing precision and humane treatment ("When you slaughter, slaughter well," *Sahih Muslim*, 1955; Dahlal *et al.*, 2024). Crucially, the Prophet (PBUH) warned against consuming meat on which *Allah's* name has not been pronounced, signifying that halal slaughter is an act of obedience and devotion (Rashid & Bojei, 2019). Cultured meat from isolated cells in a laboratory without ritual slaughter circumvents these essential spiritual requirements, rendering it invalid under halal law (Sansinova *et al.*, 2023). The spiritual essence of halal sustenance is rooted in *tasmiyah*, humane methods, and natural blood drainage, which collectively imbue the meat with *barakah* (blessing).

Beyond halal, the principle of *tayyib* (purity, wholesomeness) holds equal significance. The Prophet (PBUH) stated, "*Allah* is pure and only accepts that which is pure" (*Sahih Muslim*, 1015), emphasising the importance of food's inherent goodness. Cultured meat, being artificially engineered with potential genetic modifications and synthetic substances, introduces uncertainty regarding its purity and wholesomeness, raising concerns about its Islamic permissibility. Furthermore, the Prophet Muhammad (PBUH) warned against doubtful matters (*shubuhat*), advising avoidance to preserve one's religion and honour. Cultured meat's biological novelty and ethical ambiguities place it within this realm of *shubuhat*, which Islam advises avoiding.

Islam teaches that all living creatures are manifestations of *Allah's* divine creation, possessing both biological and spiritual significance. Cultured meat, in contrast, circumvents this natural order by artificially extracting and multiplying animal cells in a controlled laboratory. This process yields a substance detached from the divine cycle of life and sustenance, lacking the inherent spiritual connection fostered by respecting a creature's life and acknowledging its sacrifice through proper slaughter. By bypassing this sacred process, cultured meat disrupts the *fitrah* (natural order) and weakens this spiritual bond. Moreover, Islam cautions against human attempts to imitate divine creation. The *Qur'an* recounts *iblis's* vow to mislead humanity and alter *Allah's* creation (*Surah An-Nisa* 4:119; Harwati *et al.*, 2023). The artificial engineering of cultured meat can be viewed through this lens, where human intervention manipulates the natural cycle of life rather than aligning with it. While scientific advancements are encouraged within Islamic ethics, the mass production of synthetic meat blurs the line between creation and imitation, potentially desensitising believers to the sanctity of life

Table 1: Aspect natural meat and cultured meat

Aspect	Natural Meat	Cultured Meat
Origin & Production	Derived from live animals raised through natural farming processes	Produced in laboratories through cellular agriculture (Mattick & Allenby, 2012).
Biological Perspective	The natural immune system, hormonal activity, and nutrient absorption contribute to the meat's final structure and composition. Muscle tissue forms within a living organism via cellular growth, metabolism, and interactions with the surrounding biological environment. Naturally contains proteins, vitamins (B12, iron, zinc), and bioactive compounds (creatine, taurine).	While it replicates muscle tissue structure, it lacks the complex interplay of immune responses, metabolic processes, and natural nutrient assimilation found in traditionally grown meat. Nutrients are artificially introduced through growth media (Kim *et al.*, 2024).
Ethical Considerations	Animal welfare concerns are due to slaughtering practices.	Eliminates animal suffering as cells are grown without raising or slaughtering animals (Ahmad *et al.*, 2023).
Environmental Impact	Contributes to deforestation, greenhouse gas emissions, and water depletion.	Reduces land, water, and feed usage but requires high energy for lab operations (Kim *et al.*, 2024).
Halal Slaughter (*zabiha*)	Requires *tasmiyah* (invocation of *Allah's* name) during slaughter.	No traditional slaughter occurs.
Growth Medium	Meat grows naturally through metabolic processes using nutrients from feed and water.	Requires synthetic growth media with potentially non-halal components (e.g., fetal bovine serum) (Kashim *et al.*, 2022).
Spiritual Significance	Represents life, sacrifice, and divine providence. Maintains connection to natural life cycles.	Lacks the spiritual essence of life and sacrifice. Viewed as spiritually disconnected from natural processes (Arora *et al.*, 2023).
Principle of *Tayyib*	Naturally obtained through ecological balance. No chemical additives required.	Produced with synthetic additives (e.g., growth factors, chemical scaffolds).
***Istihala* (Transformation)**	Halal if derived from halal-slaughtered animals. Natural transformation	Cell transformation occurs artificially. Meat does not undergo complete Istihala (Kashim *et al.*, 2024).
Psychological Perception	Familiar and culturally accepted due to longstanding historical consumption.	Due to its laboratory origin triggers scepticism and psychological aversion (Ahmad *et al.*, 2023).
Metaphysical Perspective	Part of the divine natural cycle of life.	Lacks connection to natural ecosystems.
***Qur'anic* Perspective**	Aligned with natural processes described in the *Qur'an*. "So eat of that upon which *Allah's* name has been mentioned." (*Surah Al-An'am* 6:118).	Involves artificial interventions in natural creation. "And I will command them so that they will change the creation of *Allah*."

		(*Surah An-Nisa* 4:119).
Economic Impact	Supports traditional farming industries.	Threatens traditional livestock industries.
Long-Term Safety	Meat safety is evaluated through traditional hygiene standards.	Long-term health effects of cultured meat remain uncertain.

8. Halal status of cultured meat

From an Islamic perspective, health and vitality are holistically approached, extending beyond the physical composition of food to encompass its spiritual significance and alignment with one's lifestyle and beliefs (Alzeer, 2025). Traditional meat, as a product of natural biological processes, embodies this holistic enrichment, forming within an animal's self-regulated system with naturally balanced composition and essential nutrients. This process involves the animal's metabolism, immune system, and natural diet, yielding a biologically sound and spiritually significant product.

In contrast, advancements in food technology have introduced cultured meat, which is regenerated unnaturally in laboratory environments. This process involves extracting and cultivating cells in bioreactors with significant human intervention, determining quality, composition, and nutrient ratios. Unlike naturally optimised meat, lab-grown meat requires external regulation of texture, fat content, and nutrient enrichment. It bypasses the inherent biological and spiritual elements of naturally produced meat. This fundamental shift towards engineered meat represents a significant departure from the natural paradigm.

Cultured meat, derived from isolated animal cells in a laboratory, fundamentally lacks the essential elements of holistic enrichment as defined in Islamic principles. It is disconnected from the natural biological processes that contribute to the purity, integrity, and spiritual significance of halal food. Specifically, cultured meat does not possess a fully functional immune system, which is crucial for the health and integrity of natural meat. Furthermore, its production bypasses the critical steps of the *zabiha* procedure, including the invocation of *Allah's* name (*tasmiyah*) during slaughter and the complete drainage of blood, both of which are fundamental to purification in Islamic dietary law. This disconnection from the natural life cycle and the absence of these essential spiritual and ethical elements result in a product processed by the human body as an artificial substitute for natural meat. The spiritual and ethical dimensions confer halal status, inseparable from natural growth and proper slaughter and notably absent in cultured meat.

While the *Qur'an* offers broad principles for halal and non-halal matters, meat consumption is a notable exception, with explicit and detailed conditions specified. The emphasis on the slaughter process, *tasmiyah*, and blood removal is not merely technical but a spiritual necessity, ensuring purity and harmony with divine law. Meat, in Islam, represents sacred sustenance, deeply connected to life, sacrifice, and gratitude. By circumventing these natural and spiritual processes, cultured meat becomes a materially engineered product devoid of the inherent purity required by halal and *tayyib* principles. Regardless of branding or marketing claims, our understanding suggests that the absence of natural growth, functional immunity, and proper slaughter raises significant concerns, ultimately rendering cultured meat non-halal-*tayyib* under current Islamic jurisprudence.

Given the evolving nature of cultured meat technology and the complexities of Islamic jurisprudence, the acceptance of cultured meat as halal food for Muslim consumption remains uncertain until scientific advancements comprehensively align with the divine principles outlined in the *Qur'an* and *hadith*, and until scholars reach a broad consensus based on sound theological reasoning. Our analysis aims to contribute to this critical discourse by thoroughly evaluating the specific production processes and existing theological arguments to provide a more nuanced understanding of halal permissibility's prerequisites and foster this much-needed consensus.

9. Discussion and critical analysis

Cultured meat presents a novel intersection between technological advancement and Islamic dietary law. While proponents argue for its environmental and ethical benefits, this paper highlights that such innovations cannot bypass Islam's essential theological, biological, and spiritual standards. The absence of a fully developed immune system, the lack of ritual slaughter, and the artificial manipulation of biological processes compromise both Halal compliance and Tayyib integrity.

Furthermore, the spiritual significance of meat in Islam is deeply tied to the process of life, sacrifice, and divine invocation. Cultured meat, by design, circumvents this natural and metaphysical continuum, resulting in what can be perceived as a biologically engineered but spiritually void substance. The invocation of Allah's name (*Tasmiyah*), the removal of blood, and the recognition of the animal's soul are not procedural details; they are theological pillars that confer spiritual legitimacy to food.

This critical analysis suggests that current methods of cultured meat production, especially those relying on non-Halal growth media or avoiding ritual slaughter, cannot fulfil the integrated Halal-Tayyib framework. Until these theological and technical gaps are addressed, cultured meat should not be classified as Halal for Muslim consumption. Importantly, this discussion aims not to stifle innovation but to call for deeper collaboration between scientists, jurists, and ethicists to align biotechnological progress with sacred dietary principles.

10. Conclusion

Introducing cultured meat presents a significant intersection between scientific innovation and Islamic dietary principles. While this lab-grown alternative offers potential benefits for environmental sustainability and animal welfare, it challenges fundamental aspects of halal and *tayyib* guidelines, which extend beyond technical criteria to encompass the natural lifecycle, biological integrity, and spiritual significance of the slaughtering process. The absence of slaughter, the lack of a functional immune system, and the artificial manipulation of cellular structures diverge from the *Qur'anic* concept of

permissible food. Moreover, food in Islam is considered divine sustenance, deeply connected to life, sacrifice, and gratitude, an essence that cultured meat, produced without the natural processes of growth and slaughter, fails to replicate. This disconnect raises concerns about the meat's spiritual authenticity, reinforcing its non-halal status under current Islamic jurisprudence. Moving forward, meaningful collaboration between scholars and scientists is essential to address these concerns, ensuring that technological advancements in food production align with religious principles without compromising spiritual integrity.

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