

Cultured Meat for Indonesian Muslim Communities: A Review of *Maslahah* and Prospect

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Abstract

The aim of this study is to examine the concerns surrounding cultured meat and the obstacles it presents in terms of halal issues, particularly for Muslim communities in Indonesia. The production of cultured meat is currently being heralded as one of the most significant advances of this century. Cultured meat is something that is made in a lab using techniques from bioengineering. Although it is not raised on farms like traditional meat, it shares many of the same biological similarities. This innovation still confronts several obstacles, such as the halal issue, which is still discussed by many Muslim academics, including those in Indonesia. A full qualitative method was employed, which was based on library research to investigate the stated problems, and all the findings were analyzed descriptively. The findings of the study have revealed that, despite various different arguments from Muslim academics' perspectives regarding the halal status of cultured meat, it will be wiser if the related authorities as well as religious institutions join forces to examine the halal status of cultured meat. Once cultured meat is recognized as halal, it will provide more significant benefits, particularly for Muslim communities in Indonesia. It is also taken

into consideration that cultured meat may have the ability to overcome global problems associated with the environmental implications of meat production, animal welfare, food security, as well as human health, or in other words it can offer certain *mashlahab* in comparison to traditional meat production.

Keywords: Islam; cultured meat; *mashlahab*; prospect

Introduction

Since the beginning of recorded history, humans have engaged in the habit of consuming meat in various forms. For the purpose of obtaining the proteins and fats that it contains, people have developed a taste for the meats of a variety of animals that are still kept in large numbers in farms specifically for this reason.¹ As the world's population expands, worldwide meat demand is expected to increase as meat is an essential source of nutrients needed in human beings. However, the vast consumption of this protein source negatively impacts the environment, such as greenhouse gas emissions, climate change, and public health issues, including antibiotic resistance and animal-transmitted pandemics.²

Food technology is expanding at a quick rate due to the development of science and technology, which has led to the acquisition of a wide variety of ingredients and new technologies that may be employed in the manufacturing of food items.³ Hence, as an alternative to conventional meat production, lab-grown meat, also known as cultured meat or cultivate meat or in vitro meat, has been produced, which does not involve the slaughtering process and is created using in vitro cultivation of the animal cells to imitate the real meat.⁴ It is because humans in need of lab-grown meat due to the fact that human have been consuming meat at a faster pace than ever before.⁵

¹ A. Larsson, S. C., & Wolk, "Meat Consumption and Risk of Colorectal Cancer: A Meta-Analysis of Prospective Studies," *International Journal of Cancer* 119, no. 11 (2006): 42.

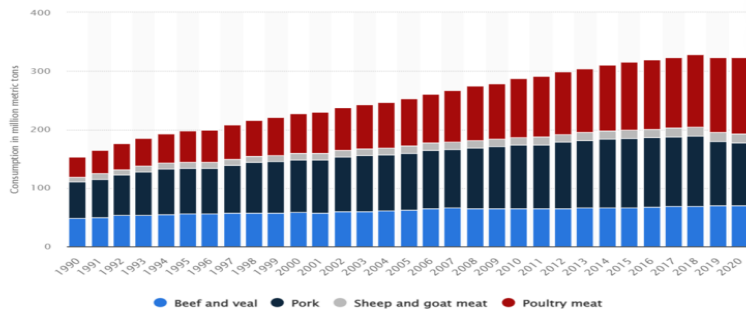
² M. J. Post, "Cultured Beef: Medical Technology to Produce Food," *Journal of the Science of Food and Agriculture* 94, no. 6 (2014).

³ Julie Barnett Christopher Bryant, "Consumer Acceptance of Cultured Meat: A Systematic Review," *Meat Science* 143, no. 01 (2018): 8–17.

⁴ Mohammad Naqib Hamdan et al., "Cultured Meat: Islamic and Other Religious Perspectives," *UMRAN - International Journal of Islamic and Civilizational Studies* 8, no. 2 (2021): 11–19, <https://doi.org/10.11113/umran2021.8n2.475>.

⁵ Akif Akif, "Is Lab-Grown Meat Halal?," *The Halal Times*, 2022, <https://www.halaltimes.com/is-lab-grown-meat-halal/>.

Picture 1: Global Per Capita Consumption of Meat



Source: Statista, <https://www.statista.com/statistics/274522/global-per-capita-consumption-of-meat/>.com

Since 1990, the worldwide meat consumption has more than doubled, reaching 328 million metric tons in 2021. The amount of poultry that was consumed all over the world increased from 34.6 million metric tons in the year 1990 to more than 132 million metric tons in the year 2021. By weight, poultry is presently the most frequent type of meat consumed globally. The significant increase in the demand for meat has resulted in higher levels of deforestation and greenhouse gas emissions all across the world, particularly from cattle production.⁶

Besides, scientific report demonstrates that the OECD-FAO predicted that the consumption of poultry meat in Indonesia will continue to rise over the next few years by a total of 1.5 kilos per capita, an increase that represents an increase of 11.64 percent. As a result, it is anticipated that the consumption on an individual level will equal to 14.39 kilograms in the year 2031.⁷ Hence, the consumption of meat in Indonesia has been growing over the past few years. This indicates that humans have been cultivating and slaughtering a greater number of animals than ever before, which has had a wide range of consequences.

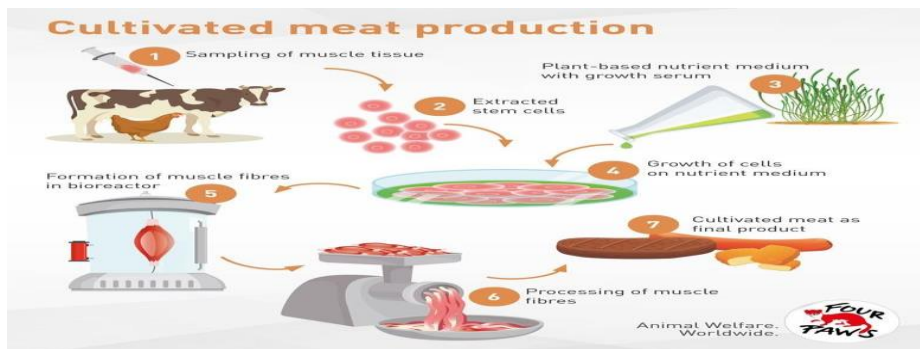
According to some studies, the global population likely will reach 9 billion by 2050. If production continued at its current rate, there would only be enough food for around 8 billion people that year. Because of the growing demands of the world's population, the global meat industry will need to expand by approximately 65 percent by the year 2050 where production will remain

⁶ M. Shahbandeh, “Global Meat Consumption by Type 1990-2021 | Statista,” Statista.com, 2022, <https://www.statista.com/statistics/274522/global-per-capita-consumption-of-meat/>.

⁷ Statista Statista, “Indonesia: Poultry Consumption per Capita 2031 | Statista,” Statista.com, 2022, <https://www.statista.com/statistics/757796/indonesia-poultry-consumption-per-capita/>.

largely insufficient to meet demand.⁸ Amongst those transformational innovations comes the in vitro meat or cultured meat to address those problems.

Picture 2: Production Stages of Cultured Meat



Source: <https://www.four-paws.org/campaigns-topics/topics/nutrition/cultivated-meat-food-innovation/what-is-cultivated-meat>

Cultured meat is a recent food that has been successfully developed using synthetic technology. It is also supposed to solve the problem of food insecurity. Nevertheless, the ultimate success of cultured meat depends on customer acceptability. As it is grown in the lab, there are many concerns about cultured meat such as as nutrient content, quality, safety issues and religious matters.

There have been previous studies concerning cultured meat. For instance, article “Brits and British Muslims and their perceptions of cultured meat: How big is their willingness to purchase?” written by Boer boom and Vriesekoop, concluded that the British Muslim and the British non-Muslim population are largely aligned in their considerations about food in general, livestock meat, and cultured meat.⁹

Ahsan’s study under the title “Attitudes and Perceptions Towards Cultured Meat Among General Population in Pakistan” showed that the acceptance of cultured meat among the Pakistani population was poor caused several reasons (safety, nutritional value, ethical issues) while just about one-third of the respondents showed positive attitudes and willing to consume in vitro meat and its substitute products.¹⁰ Bryant under the topic “Culture, meat,

⁸ Statista Statista, “Per Capita Poultry Consumption in Indonesia 2010-2030,” Statista.com, 2022, <https://www.statista.com/statistics/757796/indonesia-poultry-consumption-per-capita/>.

⁹ Anouk Boereboom and Frank Vriesekoop, “Brits and British Muslims and Their Perceptions of Cultured Meat : How Big Is Their Willingness to Purchase ?,” *Food Frontiers*, no. May (2022): 1–12, <https://doi.org/10.1002/fft2.165>.

¹⁰ Muhammad Ahsan, Muhammad Uzair, and Moazzam Ali, “Attitudes and Perceptions Towards Cultured Meat Among General Population in Pakistan,” *ASEAN Journal*

and cultured meat”. This article concluded that lab-grown meat grown from animal cells has the potential to tackle many of the ethical, environmental, and public health issues associated with conventional meat production. However, in order to do so, it will need to take into account a wide range of social issues, such as the appeal and acceptance of cultivated meat among consumers, the religious status of cultured meat, regulation, and other issues.¹¹

Further, an article entitled “Perspectives of Meat Eaters on the Consumption of Cultured Beef (in vitro production) From the Eastern Cape of South Africa”, written by Falowo¹², concluded that that the majority of the people who participated in the survey were not familiar with the idea of producing cultured beef, but that they would be willing to consume cultured beef if it were offered to them after the concept and process of producing cultured beef were explained to them.

Therefore, this study tries to examine not only Islamic perspective on cultured meat, but also the aspect of its *mashlahab* project to the Muslim community in Indonesia which is recognized as one of the largest Muslim population around the world. This is a qualitative research applying literature study. The data sources were gathered from books, journals, previous study, websites or from supporting documents that were relevant to the research and then reviewed and analyzed descriptively.

Discussion

History of Cultured Meat

Advances in technology make something that was previously considered impossible become something that can be created. For example, in the past when someone wanted to plant, it had to be from seeds, but with the advancement of tissue culture technology (bio culture), someone can plant without using seeds, but by taking certain cells and then developing them in-vitro or through a laboratory. This also happens to other objects such as farm animals, known by several terms including cultured meat, lab-grown meat, cultivated meat, and in vitro meat which means meat obtained from outside the body of farm animals.¹³

of Science and Engineering Education 2, no. 1 (2021): 111–22, <https://doi.org/10.17509/ajsee.v2i1.38766>.

¹¹ Christopher J Bryant, “Culture , Meat , and Cultured Meat,” *Journal of Animal Science* 98, no. 8 (2020): 1–7, <https://doi.org/10.1093/jas/skaa172>.

¹² Bamidele Andrew Falowo, Yiseyon Sunday Hosu, and Emrobowansan Monday Idamokoro, “Perspectives of Meat Eaters on the Consumption of Cultured Beef (in Vitro Production) From the Eastern Cape of South Africa,” *Frontiers in Sustainable Food Systems* 6 (June 23, 2022): 1–9, <https://doi.org/10.3389/FSUFS.2022.924396>.

¹³ Alice Munz et al., “Technological Prospecting : The Case of Cultured Meat” 6, no. June (2022), <https://doi.org/10.1016/j.fufo.2022.100156>.

Historically, stated that the production of cultured meat started in the 1930s by two Western scholars, namely Fredick Edwin Smith (1930) and Winston Churchill (1932). They are believed to have gotten the idea from the success of a scientist named Dr. Alexis Carrel (1937), who succeeded in ensuring that embryonic chicken heart cells live ex vivo for a long period. His effort was the first success of its kind. In 1943, a science fiction novelist described the use of cultured meat in restaurants in his novel entitled 'Ravage'¹⁴ since the technology at that time was still not capable of culturing cells or tissues and the idea of cultured meat remained only a dream for several decades. In 1999, Willem van Eelen from the Netherlands became the first scientist to apply for and obtain a patent internationally and in the United States for the concept of meat processing using meat culture techniques

Historically, Bryant explains that the development of cultured meat was initiated in the 1930s by two Western scholars, Fredick Edwin Smith (1930) and Winston Churchill (1932).¹⁵ It is believed that they obtained the idea from the accomplishment of a scientist named Dr. Alexis Carrel (1937), who was successful in maintaining the viability of embryonic chicken heart cells in an ex vivo environment for an extended period of time. His effort was the first success of its kind. In his novel titled "Ravage," which was published in 1943, a science fiction author described the use of cultured meat in restaurants. At the time, however, technology was not yet capable of culturing cells or tissues, so the concept of cultured meat remained only a dream for a period of time.¹⁶ However, cultured meat was described in this novel. Willem van Eelen, a Dutchman, was the first scientist in the world and the first scientist in the United States to apply for and be granted a patent for the concept of meat processing utilizing meat culture techniques in 1999.¹⁷

Specifically, cultured meat is a contemporary food that has been made using synthetic technology with success. It is also meant to address the issue of food insecurity, yet the ultimate success of cultured meat is contingent on consumer acceptance. In general, cultured meat is meat that is generated outside of the animal's body through the use of culturing methods, either by growing animal tissue or stem cells.¹⁸ Following this step, the tissue or stem cells are suspended in an appropriate medium, which enables them to proliferate and

¹⁴ Zuhaib Fayaz Bhat, "Animal-Free Meat Biofabrication," *American Journal of Food Technology* 6, no. 6 (2011): 441–459.

¹⁵ Bryant, "Culture, Meat, and Cultured Meat."

¹⁶ Zuhaib Fayaz Bhat, Sunil Kumar, and Hina Fayaz, "In Vitro Meat Production: Challenges and Benefits over Conventional Meat Production," *Journal of Integrative Agriculture* 14, no. 2 (2015): 241–48, [https://doi.org/10.1016/S2095-3119\(14\)60887-X](https://doi.org/10.1016/S2095-3119(14)60887-X).

¹⁷ A. Orzechowski, "Artificial Meat? Feasible Approach Based on the Experience from Cell Culture Studies," *Journal of Integrative Agriculture* 14, no. 2 (2015): 17–221.

¹⁸ Bhat, "Animal-Free Meat Biofabrication."

expand until they turn into meat. To ensure that the tissue or stem cells can continue to replicate, the medium must have all of the nutrients and sources of energy that they require.¹⁹

Therefore, lab-grown meat can be identified in several ways, including the source, the manufacturing process, the medium, and the final product. First, cultured meat must be derived from either animal tissue or animal stem cells. Second, the synthesis of cultured meat occurs *ex vivo*, or outside the animal's body. Third, cultured meat will be cultivated in an appropriate medium. Fourth, meat will be produced using meat culture. The look of cultured meat, on the other hand, is more like to that of ground meat than it is to that of conventionally raised meat. This is the key characteristic that sets cultured meat apart from conventionally raised meat.²⁰ As it is grown in the lab, there are many concerns about cultured meat including religious matters which are the most critical issue for Muslim consumers particularly in Indonesia, whether the cultured meat is *halal* to be consumed and meets the *halal al-tayyibah* principles.

Consumption of Lab-Grown Meat in Islamic Perspective

Through the application of technology, something that was once considered impossible can now be accomplished. Due to advances in tissue culture technology (bioculture), it is now possible to plant without seeds by culturing cells *in vitro* or a laboratory. This also occurs with other objects, such as livestock, which has multiple names, including cultivated meat, cultured meat, lab-grown meat, and *in vitro* meat, which refers to meat obtained outside farm animals' bodies. Meat produced in a laboratory might originate from one of these three different types of animals: (1) living animals, (2) slaughtered animals, or (3) animals that have not been killed.²¹

The manufacture and consumption of cultured meat generated in a laboratory have sparked a jurisprudential debate about whether cultivating meat is allowed under the Shari'ah or whether it should be outlawed as they contravene the rules of nature. Because this problem is considered one of the most pressing concerns facing modern Muslim countries, it is inevitable that discussions surrounding the *halal* status of cultured meat will continue to occur whenever new individuals bring it up. On the other hand, Muslims are commanded to consume only *halal* and *tayyib* food as Allah subhānahu wata'ālā said:

¹⁹ Zuhaib Fayaz Bhat, "In Vitro Meat Production: Challenges and Benefits Over Conventional Meat Production," *Journal of Integrative Agriculture*, 14, no. 2 (2015): 241–248.

²⁰ Hamdan Mohammad Naqib and Ramli Mohd Anuar, "Daging Kultur Menurut Perspektif Islam: Analisis Terhadap Penggunaan ESCs Sebagai Sumber Sel Stem," *Global Journal Al-Thaqafah* 6, no. 2 (2016): 129–41, <https://doi.org/10.7187/gjat11920160602>.

²¹ Mohammad Naqib and Mohd Anuar.

يَا أَيُّهَا النَّاسُ كُلُوا مِمَّا فِي الْأَرْضِ حَلَالًا طَيِّبًا

“O mankind, eat from whatever is on earth that is lawful and good.” (Surah Al-Baqarah: 168)



“And eat of what Allah has provided for you [which is] lawful and good. And fear Allah, in whom you are believers.” (Surah Al-Maidah: 88)

يَا أَيُّهَا الَّذِينَ آمَنُوا كُلُوا مِنْ طَيِّبَاتِ مَا رَزَقْنَاكُمْ وَاشْكُرُوا لِلَّهِ إِنْ كُنْتُمْ تَعْبُدُونَ

“Believers! Eat of the pure things wherewith We have provided you for sustenance and give thanks to Allah¹⁷⁰ if it is Him that you serve.” (Surah Al-Baqarah: 172)

Due to the reason that cultured meat is still a relatively new discovery, there have been no official statements released by the International Union of Muslim Scholars or Halal authorities regarding the consumption of Stem Cell Meat. Nevertheless, a number of Muslim legal experts have been discussing the matter, including in Indonesia. Nahdlatul Ulama (NU), one of the biggest Islamic organizations in Indonesia, has declared that cultured meat derived from living animal cells is legally impure and forbidden for consumption.

They argue that the culture of meat should be discussed alongside the discourse of separation of the animal body because the stem cells used are taken from the animal while the animal is still alive or before it is slaughtered. This means that culture meat should be considered part of the animal body. The purpose of cultured meat is to produce meat without subjecting the animal to the process of slaughter; however, Islam does not permit this practice for religious reasons²² as mentioned below.

عن أبي واقد الليثي رضي الله عنه قال: قَدِمَ النَّبِيُّ صَلَّى اللهُ عَلَيْهِ وَسَلَّمَ الْمَدِينَةَ وَهُمْ يَجُبُّونَ أَسْنِمَةَ الْإِبِلِ، وَيَقْطَعُونَ أَلْيَاتِ الْغَنَمِ، فَقَالَ: مَا قُطِعَ مِنَ الْبَهِيمَةِ وَهِيَ حَيَّةٌ فَهِيَ مَيْتَةٌ

“Abu Wāqid al-Laithi reported: The Prophet PBUH came to Madinah and they were in the habit of cutting the humps off the camels and cutting the buttocks from the sheep. He said: “Whatever is cut from an animal while it is alive, then it is dead flesh.” (Hadith at-Tirmidhi)

حُرِّمَتْ عَلَيْكُمُ الْمَيْتَةُ وَالْدَّمُ وَلَحْمُ الْخِنْزِيرِ وَمَا أَهَلَ لِغَيْرِ اللَّهِ بِهِ وَالْمُنْخَنِقَةُ

²² Muhammad Syamsudin, “Halal-Haram Produk Daging Hasil Kultur Laboratorium | NU Online,” *NUonline*, 2021, <https://islam.nu.or.id/syariah/halal-haram-produk-daging-hasil-kultur-laboratorium-zmyv3>.

وَالْمَوْقُودَةُ وَالْمُتَرَدِّيَّةُ وَالنَّطِيحَةُ وَمَا أَكَلَ السَّبُعُ إِلَّا مَا ذَكَّيْتُمْ وَمَا ذُبِحَ عَلَى
النُّصَبِ

“Forbidden to you are carrion, blood, and swine; what is slaughtered in the name of any other than Allah; what is killed by strangling, beating, a fall, or by being gored to death; what is partly eaten by a predator unless you slaughter it; and what is sacrificed on altars.” (Surah Al-Mā'idah: 3)

Eminent scholars came to the conclusion that body parts were not deemed to be a carcass if they were removed from an animal after it had been slaughtered and was dead, where it is not against Islamic law to be consumed. Therefore, in the context of cultured meat, if the source of stem cells was extracted after the animal was slaughtered, the resulting cultured meat is clean and permissible for consumption since the source is lawful or halal. If the source of the stem cells was taken while the animal was still living, then the cultured meat that was produced is unclean, and it is banned by Islamic law to consume as Quran and hadith previously mentioned.²³

Others, such as Abdul Qahir Qamar from the International Islamic Fiqh Academy in Jeddah, Saudi Arabia, argued that lab-grown meat is halal. He saw cultured meat similarly to yogurt where milk is extracted from a live animal, as long as the cells employed are not sourced from animals prohibited by Islamic law. Besides, several professors at the College of Sharia and Islamic Studies at Kuwait University hold a similar opinion and described that in vitro meat could be halal for Muslims to consume.²⁴

They argue that as long as the stem cells used to produce the meat came from animals that Muslims are allowed to eat and the production method did not involve any components that Muslims are not permitted to consume, such as blood, blood serum, or blood plasma, then lab-grown meat might be considered halal. They also emphasized how important it is that the animals whose cells are being used to manufacture cultured meat either be alive but uninjured, which means that they do not suffer any pain throughout the process or be slaughtered following the principles of Islamic tradition.²⁵

***Mashlahah* of Cultured Meat**

Mashlahah, as defined by Al-Ghazali, is “consideration which secure a benefit or prevent a harm”. In other words, *mashlahah* is legal principle in

²³ Mohammad Naqib Hamdan et al., “Cultured Meat in Islamic Perspective,” *Journal of Religion and Health* 57, no. 6 (2018): 2193–2206, <https://doi.org/10.1007/s10943-017-0403-3>.

²⁴ Sarah Diao, “Is Lab-Grown Meat Halal? What Experts Say,” *Gulfnews*, 2019, <https://gulfnews.com/business/is-lab-grown-meat-halal-what-experts-say-1.62531421>.

²⁵ Riham Darwish, “What Is Lab-Grown Meat and Will It Be Halal?,” *Albawaba*, 2022, <https://www.albawaba.com/business/will-lab-grown-meat-be-halal-1463885>.

legislation which harmonious with Maqashid Sharia or objective of Islamic law, either by obtaining benefit or avoiding harm. Maslahat is employed in Islamic law in many secondary areas such as economics and other worldly activities (*muamalah*) which require flexibility based on respective time and space. *Mashlahah* is legal principle in legislation to obtain benefit or avoid harm which must be harmonious with Maqashid Sharia or objective of Islamic law. In the classic literature, Al-Ghazali classified Maqashid Sharia further into five elements, which are safeguarding (*hifz*) of faith (*deen*), self (*nafs*), intellect (*aql*), lineage (*nasl*) and wealth (*maal*).²⁶ The innovation of cultured meat is expected to entail, at least three elements of maqashid sharia, as follow:

1. *Hifz Nafs* and Spurring the health aspect of Muslim inclusively

The global average per capital consumption of meat is rising rapidly due to the population growth. Nevertheless, the consumption of meat in Indonesia is low at 2,9 kilograms per capita which is bellow global average at 6,4 kilograms. The weak purchasing powers as well as insufficient production remain to be obstacle for many Indonesians to consume meat.²⁷

On the other hand, according to Global Nutrition Report found that in Indonesia the prevalence of stunting in toddlers under five years old is at 30,8 percent. In other words, one of three children in Indonesia face stunting issue. Research by Headey conclude that meat consumption is associated with less stunting among children. This reflects that the high number of stunting in Indonesia is contributed by low intake of meats which is source of protein, ferrum, vitamins B as well as important element in building healthy tissues. Cultured meat is expected to assist the accessibility of meat consumption in ensuring the proper growth and health for the nation.²⁸

Table 1. Consumption per capita in 2019

Country	Meat Consumption Per Capita	Total Need (in Kg)	Poultry Consumption Per Capita	Total Need (in Kg)
Indonesia	2.9	774,234,000	16.99	4,534,496
Minimum target	6.4	1,708,654,345	33	8,807,438

²⁶ M. K. A. Awang, M. D., Asutay, M. & Jusoh, "Understanding Of Maslaha And Maqasid Al-Shariah Concepts On Islamic Banking Operations In Malaysia," *International Conference of Global Islamic Studies 2014*, 2014, 12–32.

²⁷ Bhat, Kumar, and Fayaz, "In Vitro Meat Production: Challenges and Benefits over Conventional Meat Production."

²⁸ Derek Headey, Kalle Hirvonen, and John Hoddinott, "Animal Sourced Foods and Child Stunting," *American Journal of Agricultural Economics* 100, no. 5 (2018): 1302–19, <https://doi.org/10.1093/ajae/aay053>.

(Global
Average)

Source: Konsumsi Bahan Pokok 2019 by Badan Pusat Statistik, processed by authors

As shown in the table, both meat and poultry should be produced more than doubled to match the global average. This is challenging issue for the supply side as livestock needs to do animal rearing which takes time to grow. Consequently, the current visible alternative for the Indonesia is to import meat from other country. Cultured meat, in contrast, takes significantly shorter time to produce. While it takes a long conversion time with years for cows and months for chickens before their meat can be harvested, cultured meat needs several weeks to be produced.²⁹ For example, to acquire 1 kg of beef, a cow would be slaughtered only after four years of breeding while, cultured meat technology can obtain the meat in more time-saving. Within the time being, cultured meat can be produced more to make needed supply for the nation to consume.

Additionally, the data above and the efficiency of cultured meat also necessitate the economic prospect for Halal industry to utilize the innovation to penetrate a bigger market share. At the current stage which is a research and experimentation process, cultured meat could cost up to 50.000 USD per pound to produce. Nevertheless, many scientists expect that the cultured meat has the ability to become mainstream demand after becoming large-scale production with massive market penetration.³⁰ This is due to the harvesting mature muscle cells after differentiation and processing them into various meat product do not need a large number of livestock and land use as in the conventional industry.

The radical change from cultured meat can provide an alternative for stakeholder to consider. Forward, the hunger and insufficient nutrient should not be the obstacle to grow and develop the nation as meat is no longer considered as luxury food. Therefore, the *mashlahah* of *in vitro* meat is expected to spur the wellbeing of Muslim in Indonesia, especially from the health aspect.

2. *Hifẓ Nasl* and Ensuring a more environment-friendly meat production

There are two *mashlahah* related to lineage or future generation that cultured meat offers. Firstly, ensuring a better health of toddlers in the nation can be a *mashlahah* that need to be considered. Global Nutrition Report found that in Indonesia the prevalence of stunting in toddlers under five years old is at 30,8 percent. In other words, one of three children in Indonesia face stunting

²⁹ Bhat, Kumar, and Fayaz, "In Vitro Meat Production: Challenges and Benefits over Conventional Meat Production."

³⁰ Bhat, Kumar, and Fayaz.

issue.³¹ Research by Headey concluded that meat consumption is associated with less stunting among children. This reflects that the high number of stunting in Indonesia is contributed by low intake of meats which is source of protein, ferrum, vitamins B as well as important element in building healthy tissues. Cultured meat is expected to assist the accessibility of meat consumption in ensuring the proper growth and health for the nation.³²

Secondly, cultured meat provides an environment-friendly production process that can ensure a safer earth for future generation. Currently, livestock farming is criticized for having a major negative impact on the environment. Firstly, livestock production contributes to atmospheric greenhouse-gas nitrous oxide emissions from the utilization of fertilizer on croplands and pasture, as well as methane from enteric fermentation.³³ Welin & Weelestated that 18% of global anthropogenic is produced from livestock, which is larger than transportation sector.³⁴ Secondly, despite rises in crop yields and efficiency of livestock production, the land use for the industry keeps increasing, by 464 Mha for merely five decades to 2011.³⁵ Furthermore, to produce 1 kg of meat, Chriki found that the cow needs to consume 500-700 liter water. In other words, livestock shares a massive contribution towards climate change that the global stakeholders should overcome.³⁶

Therefore, the radical alteration for livestock production should be formulated to substantially mitigate the thread of climate change. Tuomisto analyses a life cycle assessment where they assume that cyanobacteria are employed as the source of energy and nutrients. They found that cultured meat reduce 78 to 96 percent emissions of greenhouse gases, 7 to 45 percent energy used, 82 to 96 percent utilization of water and 99 percent land use than the

³¹ Global Nutrition Report (2022).

³² Headey, Hirvonen, and Hoddinott, "Animal Sourced Foods and Child Stunting."

³³ Peter Alexander et al., "This Is a Repository Copy of Could Consumption of Insects , Cultured Meat or Imitation Meat Reduce Global Agricultural Land Use? . White Rose Research Online URL for This Paper : Version : Published Version Article : Consumption of Insects , Cultured Mea," 2017.

³⁴ Welin Stellan, and Cor van der Weele. "Climate Change and Sustainable Development: Ethical Perspectives on Land Use and Food Production." *Climate Change and Sustainable Development: Ethical Perspectives on Land Use and Food Production*, no. December 2016 (2012): 1–526. <https://doi.org/10.3920/978-90-8686-753-0>.

³⁵ Peter Alexander et al., "Drivers for Global Agricultural Land Use Change: The Nexus of Diet, Population, Yield and Bioenergy," *Global Environmental Change* 35 (2015): 138–47, <https://doi.org/10.1016/j.gloenvcha.2015.08.011>.

³⁶ Chriki Sghaier, and Jean François Hocquette. "The Myth of Cultured Meat: A Review." *Frontiers in Nutrition* 7 (February 7, 2020).

traditional livestock. These findings show that cultured meat offers environmental promise.³⁷

The carbon footprint and energy requirement are reduced as the feed for the animal can forgo the metabolism and inedible structure like neurological tissue or skeleton. In cultured meat, the nutrient and energy are employed only for the lean meat production. Additionally, the process which necessitates certain part of meat can drastically enhance the time efficiency that give the cultured meat a comparative advantage as compared to the conventional livestock industry.³⁸

The reduction of land use can be implemented as the in vitro facilities can be built up vertically which takes dramatic less ground space as compared to the traditional cattle farming. Furthermore, the laboratorium could place production centers in cities which reduce cost such as transportation.³⁹ The smaller land footprint is also one of causes a reduced output of anthropogenic greenhouse gas emission. For instance, the reduction of land use may open the possibility that the land can be employed for other purposes like nature.

According to Climate Scorecard greenhouse gas that is emitted by Indonesia were at 542 metric tons, or a drastic increase by 313,47% from 1990. The report accused the country responsible at least 1,69% of global carbon emission.⁴⁰ Furthermore, from 2002 to 2021, the country lost 9.95 Mha of humid primary forest which make up 36% of its total tree cover loss.⁴¹ Many of the land then is transformed as agriculture or livestock farming. This finding is the challenge for Indonesia in its commitment on climate changing. The radical change which cultured meat is prospected may offer the *mashlahab* to tackle the issue where the consumption of meat is not concerned on halal basis only, but the *tayyib* impact for the world.

Conclusion

In general, all meats are regarded as halal aside from those that are forbidden by the Quran, the hadith, and the views of Islamic scholars. However, the status of the meat may shift depending on how it is prepared. This is because the state of the meat may alter. Because of this, we are unable to

³⁷ Tuomisto Hanna L., and M. Joost Teixeira De Mattos. "Environmental Impacts of Cultured Meat Production." *Environmental Science and Technology* 45, no. 14 (2011): 6117–23. <https://doi.org/10.1021/es200130u>.

³⁸ Bhat, Kumar, and Fayaz, "In Vitro Meat Production: Challenges and Benefits over Conventional Meat Production."

³⁹ I. Datar and M. Betti, "Possibilities for an in Vitro Meat Production System," *Innovative Food Science and Emerging Technologies* 11, no. 1 (2010): 13–22, <https://doi.org/10.1016/j.ifset.2009.10.007>.

⁴⁰ Climate Scorecard (2020)

⁴¹ "Global Forest Watch," 2022.

determine the Halal status of a product in a straightforward manner because, in order to do so, all of the processes that occur from "lab to fork," including the removal of tissue, the addition of substances, and the production of cultured meat, must first be investigated and verified. However, once cultured meat is recognized as halal, it will provide more significant benefits, particularly for Muslim communities in Indonesia. However, in order to ensure that cultured meat complies with the halal principle, it will be more prudent for the relevant authorities to work together to ensure the halal status based on the information provided by lab-based scientists who demonstrate the manufacturing process. This will ensure that cultured meat satisfies the requirements of the halal principle. At some point in the future, the ingestion of cultured meat may become an option for Muslims.

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