Cultured Meat

Sonae. S, Lakshmissruti. M. M, Sanjeevi. M, Poojitha. P*
*Corresponding author: poojithapushparaj@gmail.com

Abstract
Cultured meat is made from animal cells in in vitro method. Traditional meat production has many problems such as public health issues, ethical and environment issues. This cultured meat will be helpful to solve these problems. Along with its advantages it also has some challenges, like public acceptance. religious acceptance, media coverage, consumer acceptance of cultured meat, factors influencing, personal concerns about cultured meat like unnaturalness, health, taste, texture and appearance, what are the regulations for cultured meat and its positivity
Keywords: Cultured meat, In vitro method, food safety, ethics.

Introduction

As cultured meat are made in lab, it is also known as lab grown clean or cultivated meat. The goal of this cultured meat is to make the production of meat more environmentally free and death of animals not necessary. These are done by tissue engineering techniques. The steps are the muscle cells are collected from an animal and then it is developed into muscle tissues in culture media. It is predicted by FAO that meat demand will rise in future. As a result, the price will go up, also contributing in global warming. The main objective behind this cultured meat idea is to decrease animal killing and ethical global food chain. In a study in 2018, it was stated that cultured meat will emit less greenhouse gases and that it also requires less water and land. Initially there was challenges in flavor but it was resolved by some companies. This review article is also about consumer acceptance of cultured meat, factors influencing, personal concerns about cultured meat like unnaturalness, health, taste, texture and appearance, what are the regulations for cultured meat and its positivity.

Benefits of cultured meat

The benefits of cultured meat are that it requires less land and it emits lesser greenhouse gases that conventional meat[1]. Killing of animals will be decreased; many food-borne diseases may spread through conventional meat but when switched to cultured meat it will decrease.

History of Lab Grown Meat

Willem van Eelen was the first to assert the ownership of the concept of cultured meat. Winston Churchill was the first to publish an essay on cultured meat in 1931.
Significant achievements are
1. In 2001. NASA experiments with turkey cells
2. Development of goldfish fillet in 2002
3. Serving of a $300.000 burger in 2013.

Manufacturing of cultured meat

The first step is collecting and storing stem cells from an animal. Then these cells are grown in bioreactor / cultivators. These are done at large densities and volume. Then it is fed a culture medium containing basic nutrients.

Immature cells differentiate into different things like skeletal muscle, fat and connective tissue. These make up the flesh it is due to the changes that occur in medium composition. These are then combined to form a structure. After this process. process like extraction processing, and package are done. The duration of the process takes up to 2-8weeks as in fig.1.

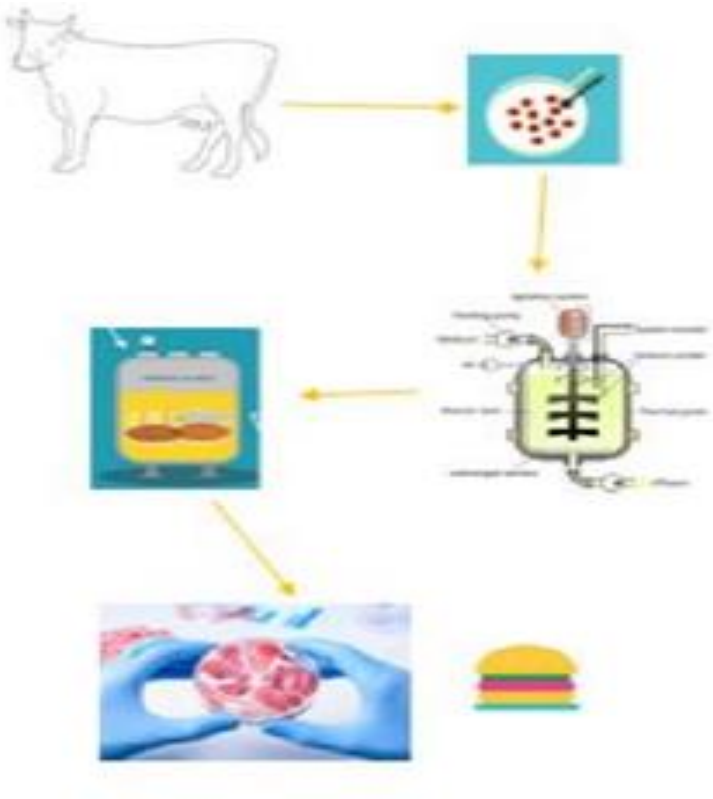

FIGURE 1

Environmental Conquences

Cyanobacteria hydrolysate is used as the nutrient and energy source of muscle cell growth. When compared conventional meats uses more energy and more land use. When concluded it is found that environmental impacts are of cultured meat are lower than conventionally produced meat.

But it may have some disadvantages. There will be negative effects on rural biodiversity. Bio fuel are obtained from energy crops, for these grasslands are converted into forest. This while benefiting some species, will harm some others.

Technological Challenges in production of cultured meat

Along with all other issues, technological challenges are also faced. The three main steps in the production process are cell collection, cell culture, cultured meat. Gathering living cells is the problem in cell collection, designing and mass produce is the issue in cell culture. Establishing a process procedure is the challenge in cultured meat production.

Technological challenges and advancement in cultured meat

Meat production technological challenges in cultured meat production

The largest issue among the three phases is the method of designing and mass-producing culture media Most business couldn't complete the entire process. The final solution has yet to be discovered.

Culture medium development technology

Culture medium contains amino acids. Vitamins, inorganic salts. glucose and growth factors. The important aspect of culture medium is growth factors because cells can't reproduce without them. Growth factors are obtained from fetuses of livestock . This is very difficult to obtain in large amounts and the whole process is expensive and time-consuming.

Due to the high cost of growth factors. price of cultured meat will go up. Many companies are trying to produce cultured meat without growth factors obtained from cell tissues. The main objective is making the process cost effective [2].

Mass production technology

Two-dimensional cell culture is the popular method for cell culture. But the disadvantage of it is bulk production is challenging because only limited number of cells can be cultivated. As a solution to this problem, three-dimensional cell culture was found Keeping a homogenous environment inside bioreactors was becoming a problem[3]. The issues are the atmosphere of the bioreactors not being consistent, temperatures that are very hot or very low. As a result, the cells die To improve these elements a consortium was found in the United States. It consists of start-ups, large corporations, and non-profit groups.

Pros and Cons

The aim of the process to reproduce the complicated structure of animal muscles. The muscles will be converted into different types of cells. The cells when cultivated in adequate culture media will start to divide. The excellent medium is known as fetal bovine serum (FBM). It is derived from the blood of deceased cow. It is rate limiting but it cannot be consumed by vegetarians and vegans. If the FBS is used, it has the ability to multiply larger numbers. Due to much cell multiplication, a smaller number of animals will be required In vitro meat is meant to be slaughter free. The serum used is costly and that will affect the price of meat production. This difficulty is said to be solved.

Positivity

The most common benefit of cultured meat is avoiding animal slaughtering. And some people state that cultured meat will reduce reduction in animal population and will improve animal welfare conditions and disagreed that it would reduce happy animals. The environment of cultured reduce greenhouse gas emission. And some have a belief that cultured meat will be environmental costs or be less efficient but quantitative data indicates that people highly believe that cultured meat is environmentally friendly than conventional meat mainly in terms of greenhouse gas[3]. Some studies state that cultured meat has low fat content and avoid zoonotic disease and several studies

also reports that poor can afford cultured meat unlike conventional meat. Presents of higher capacity protein production was the common reason for supporting cultured meat. We can come into assumption that cultured meat can be manufactured in large scale and cheaper than compared to cultured meat. For global food security cultured meat is a great benefit.

Safety

Cultured meat is produced in a controlled environment with no other organism hence it is safer than convectional meat, even if each tissue is protected by skin convectional meat comes into contact with the outside environment. Whereas cultured meat does not come into contact with organs nearby, no contamination during butchering and pathogens like E. coli, salmonella, campylobacter these pathogens cause millions of illnesses catch year. However, scientists can't control everything and any error could lead to health problems.

It is common in industrial preparation of chopped meat. Advantage of culture meat is, it is not generated form animals grown in place which eliminates the need for costly vaccines against cattle diseases like influenza. In this process cells live in large number in incubator not the animals. But some cell culture is never completely regulated which leads to biological pathways can arise. Due to cell multiplication dysregulation of cell is likely to occur like cancer cells deregulated cells are being deleted for consumption. Consumption of vitro meat might have unknown potential impacts in human metabolism and health. Cultured meat is kept in controlled environment where any sights of infection can be detected and stopped

By altering the fat composites used in production, nutritional composition can he regulated. And it is easy to manage the ratio of saturated to polyunsaturated fatty acids. The risk of increased rancidity must be avoided. Biological compounds and the arrangement of cultured cells might enhance the effects of micronutrients.

Market entry

The firm should explain that their product is safe to EFSA (European Food Safety Authority) and cultured meat must undergo 10-month testing phase. The firs market entry was on November 2020 it was done by super meat in Ness ziona, Israel where experts and selected group of consumers can sample the food while peering through a glass window into the production line.

Artificial meat

Artificial meat is safer than real meat produced in controlled environment. It will not contaminate with bacteria such as E. coli but with animal meat there is always risk of contamination. In artificial meat production plant, everything should be kept sterile because the nutrient rich environment is perfect breeding ground for microbes [4].

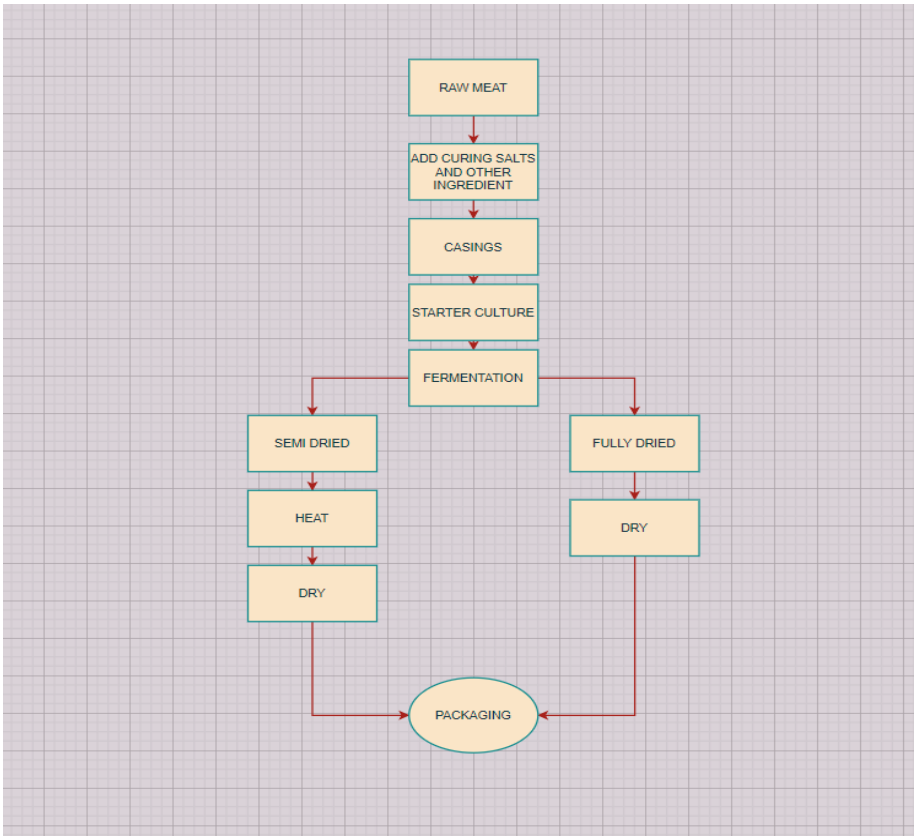

FIGURE 2

Sustainable from an ethical, healthy and environmental point of view

Cultivated or cell-based meat are other names of cultured meat, it eliminates the need to bread and butcher animal for human conception and reduces the environmental effect of traditional meat production. Farmed meat production reduces global warming. Cultured meat produced from animal cells provides ethical meat without animal welfare problems created by industrial farming methods.

Production of cultured meat is done in a clean and sterile environment which reduces the infection caused by viruses and bacteria. But in large scale manufacturing rapid safety checks will be performed from beginning to end. With this rules food safety and quality can be assured before it reaches the consumers [5].

Ethical implications

The announcement of cultured meat sale in Singapore widespread in media. The edible animal tissue created without animals is a viable solution to humanity's most pressing ethical issue.

More than 16 billion invested in the business with goods coming from Israel Netherland and other countries so food might travel from lab to deli in several years [6].

Becki Calder-Flynn is the coordinator of Mosa meat's operations it was a Dutch firm which was founded in Maastricht in 2016, this firm created the first cultured Hamburger. Because cultured meat is less

expensive than compared to real meat and produced mer efficiently.

Vegetarians and vegans can find cultured meat appropriate the objective is to provide animal friendly meat to majority meat consumers, this will have grate impact on decreasing animal and environmental harm.

The most serious and important ethical issue with growing medium for meat cell is the use of foetal bovine serum. At Mosa meat they don't use FBS because the product is produced from the fetuses of butchered cows would be unstable for production. The good food institute is an NGO that promotes plant-based alternatives to animal foods and cultured meats. Less land is used by both cultured meat ant plant-based meat it causes less pollution. As development of cultured meat will give rise to "cruelty-free agriculture", this innovation is encouraged by many advocates, NGOs and philosophers. It is also a "moral obligation". As it promotes welfare of animals, PETA offered one-million-dollar reward to the research lab which first produced the cultured meat [6].

Consumer acceptance of cultured meat

Factors influencing

Familiarity of cultured met is based on increased acceptance of it though it is not statistically tested. At 2015 it was reported that people were less resistance to the concept at the end than compared to the start. lack of familiarity might be a great problem To improve the network of familiarity cultured meat can be anchored to more familiar technologies and can also be improved by defining the cultured meat in terms of similarity and differences than compared to conventional meat.

Data collected by performing an experiment indicates that the acceptance sensitive. Sans, van loo and verbeckc found that people willingness will to purchase cultured meat increase when they are given additional information like their benefit for the environment and public health compared to when they have a basic and common knowledge about cultured meat [4].

Personal concerns

Unnaturalness

There are lot of objections that cultured meat is unnatural. Many claims that cultured meat might be dangerous to consume and will cause environmental harm, cultured meat unnaturalness will cause people to believe that they are unethical.

Laestadius provides an analysis for the unnaturalness perception, she argued that ethical concerns occurred due to unnaturalness of cultured meat is of two categories: fundamental concept of unnaturalness as inherently unethical and unknown consequences of harm to human health or the environment due to technology. She says that a former could be addressed with further research. In other evidence the people state cultured meat freakish and weird and 10% use terms like lab-meat and test tube meat [7].

Health

There is a common concern about the nutritional content of cultured meat. Generally, people thought that cultured meat is less healthy than conventional meat and they were also concerned that cultured meat have less protein content than conventional

meat. 28.6% think cultured meat is healthy and 37.9% thought it would be unhealthy [8]

Taste, texture and appearance

Many predict that cultured meat has inferior texture, taste and appearance than compared to conventional meat, the lack of sensory apple was the main reason for the rejection of cultured meat. People say that if cultured meat taste good as conventional meat it would be the condition for regular consumption. of news article anticipate a good and bad taste in equal measure and often mention about lack of fat, 23.6% of people say cultured meat would be tasty, 39% thought it would not be and 37.5% don't know whether it is tasty or not. 90% believe that cultured meat would taste worse than conventional meat and most thought it would taste better than plant-based meat alternative.

Regulation

Consumers are anxious to ensure the proper regulation for cultured meat, and they also wanted to ensure that food products maintain their quality and people would know what they are eating and there are detailed demands like marketing, information provisions and transparent labelling [9]. Regulation is a major tool to build public trust.

Cultured meat as a solution

Smallholder animal agriculture is necessary for maintaining poor countries, but in rich countries there are objections and cases against animal husbandry. From the COVID -19 plight, it can be understood that animal food is the beginning of majority infectious diseases. Animal food consumption causes a lot of health problems but on the other hand it also contains many necessary nutrients [10]. Overconsumption of animal products, meat are said to cause health issues like coronary heart disease, type 2 diabetes, obesity and various cancers. The average consumption of red meat per week is 100g and for poultry it is 200 g, but large number of people consume more than this limit. Poore and Nemecek did a study on "environmental impacts of dietary choices". It states that animal products take about 83% of the world's farmland, it gives 57% different types of food and it gives only 37% proteins and 18% of human calories. Addition to this problem, about 70 billion farm animals are raised and killed every year for the production of animal products. For this process, a large number of animals are grown in intensive farming condition or limited access to the outer environment. This is state of almost 99% farm animals, this results in restriction of basic movement [10]. These issues also are a part of reason to reduce or stop the consumption of meat.

Impact of cultured meat on consumers

Among the consumers, some may ignore the upcoming new product while some will come forward to try and test. Making the more choices for consumers comes under consumer's welfare Hence development of cultured meat also come under betterment of consumer's welfare. There is also a chance to vegetarians to consume this meat.

Although the technology is able to produce the conventional meat, it may not be able to produce the accurate qualities. At instant, as conventional meat is not for sales or for consumers intake, its demand cannot be calculated but can only be forecasted. Until

now, studies on consumers acceptance are done by the basis of surveys, experiments etc. From them the group which tends to accept the conventional meat are more educated, young and broadminded. The aspect which is interfering in the accepting levels is the taste, texture and appearance. Some believe that it's not safe and for some it disgusts them [4]. If seen among the genders, males tend to accept the conventional meat more than female. There might be many reasons for this. It may be because men in general consume more meat or it may be also because females are more concerned about the health, safety because in most of families, females are the one to buy/cook food for the whole family.

Supply side effects

In the case of successful development of cultured meat, almost everything might be affected including producers. In the case of regional side effects, agricultural land may no longer be needed for the production of meat. Cultured meat might affect the market too in a significant level like in Protein production sector, duplicating the production. And if the innovation succeeds the innovators and producers will gain profit but on the other hand, farmers will be significantly affected. This is arguably unbalanced situation. Economy issues will emerge because of research and other things. The side effects on employment are not clear as of now. The environmental side effects of normal meat production are that it will cause contamination of local water, soil and air. In a study it has been said that main air polluting section in US is agriculture, animal farming And also, as said earlier many diseases come from animals, easily spread. Problems like fecal contamination are also occurring. If production of cultured meat takes place, these issues will largely disappear [6].

Conclusion

Cultured meat is far better than traditional meat because they are ethical and environmental producers and supporters of cultured meat must access their relationship to variety of social and cultural phenomena. There are many technical hurdles to face by a producer many of them are unrelated. By 2050 there will be great growth in population which increases the demand by 20 percent. Livestock plays an important role in this environment ensuring nutrition security and global food. Due to environmental and animal welfare concerns there will be criticism of livestock farming and to avoid than more protein production methods are being developed to reach the need for world increasing population. Since culture meat useless animals, it is more ethical than compared to traditional cattle it is appealing to vegetarians and vegans but few animals have to be grown in order to extract cell from them to produce cultured meat. Energy consumption can also be reduced because cultured meat requires less energy for storage then compared to regular meat because they have low moisture due to absence of non-edible parts like bones and blood. And how consumer acceptance of cultured meat is, what are the factors influencing the production of cultured meat, people have personal concerns about cultured meat like unnaturalness, health, taste, texture and appearance.

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