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SUMMARY AND ANALYSIS OF MEAT SUBSTITUTES

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Abstract
This article analyses meat substitutes as a response to the environmental impact and health concerns associated with meat production. It looks at the different types of substitutes—plant-based, mycoprotein, and lab-grown meats—and discusses the ability of each type to reduce greenhouse gas emissions, conserve vital resources, and promote healthier diets.
The discussion addresses important reasons why meat substitutes may or may not be accepted by consumers. These scientific perceptions, taste, nutrition, and cost. The article also discusses the technology and other social concerns that aim to develop safe protein alternatives. This research is important because it provides relevant information in relation to the growing concern of sustainability by integrating alternative meat research, market developments, and innovations into one coherent narrative.

Keywords. Meat, meat substitutes, environmental impact, plant-based meat, protein alternatives, sustainability.

Introduction

The importance of environmental impacts related to meat production is highlighted by the projected 70 per cent increase in food production by 2050. To minimise the environmental impact caused by livestock, various meat substitutes are being developed, including plant-based, mycoprotein-based, dairy-based, and animal-based alternatives. To replace meat in the human diet, products such as plant-based meat substitutes are used. Advanced technology has allowed these

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products to evolve from traditional whole-grain meat substitutes. Traditional meat consumption is associated with environmental and health challenges, which can be addressed by introducing meat substitutes. To spread these alternatives widely, it is important to overcome consumer resistance and ensure their long-term sustainability. The focus of this paper is on substitutes, including how plant-based meat alternatives and artificial meat affect the environment and human health, taking into account people's preferences and ethical concerns.

In recent years, there has been an increase in the popularity of meat substitutes due to the growing demand for sustainable and environmentally friendly protein sources. By substituting traditional meat in people's diets with meat substitutes (such as plant-based products or lab-grown meats), the environment may be less polluted and people's health can be improved by mimicking the texture, taste, and appearance of meat.

It's hard to come up with a solution like this because meat is enjoyed by people and they believe it provides significant nutritional benefits. However, plant-based meat substitutes are a healthier option for people who want to reduce their consumption of animal products because they tend to be lower in saturated fats and cholesterol. (Tziva et al., 2020).

In an effort to reduce this craving and expand rapidly worldwide, the food industry has created meat substitutes that aim to replace traditional meat. Their lower environmental footprint is the main advantage of meat substitutes compared to traditional meat. The production of meat substitutes results in lower land, water, and energy requirements, as well as lower greenhouse gas emissions. (Dagevos, 2021).

Concerns about environmental damage are raised about meat production, which is the most impactful activity in food production. To address the environmental costs of meat production, meat analogs have been developed and successfully introduced to the market and production. (Smetana et al., 2015). The environment will experience positive effects if traditional meat is replaced with plant-based meat alternatives or artificial meat, as there is a broad consensus. Traditional meat

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production demands a lot of land and water, while also causing a lot of greenhouse gas emissions.

According to analyses by Nezlek (2022). In his "Meat Substitutes" article, plant-based meat alternatives and artificial meat production require significantly less land and water and do not produce as much carbon dioxide as greenhouses do. Also, producing meat substitutes close to consumer markets has the indirect benefit of reducing the environmental impact of transporting products to consumers. Plant-based meat substitutes that are both well-known and successful include soy, peas, lupine, and rice.

Current patterns of consuming conventional meat are generally accepted to harm people's health, as they are linked to a higher risk of cardiovascular disease, cancer, and obesity, ultimately resulting in more illnesses. Certain types of meat, such as high saturated fat, are responsible for some of these risks. The question of whether highly processed meat substitutes, made with refined ingredients, are a healthy alternative to traditional meat has generated a lot of debate. (Santo et al., 2020). According to Salome (2023) "Plant-based meat substitutes ", the health risks associated with consuming traditional meat could be eliminated or drastically reduced by transitioning to plant-based meat alternatives and artificial meat. Still, there are disadvantages, for example, many plant-based meat alternatives are highly treated and may not provide similar nutritional benefits as the foods they are generated from, such as legumes and soybeans. Additionally, PBMA may not have the same protein content as the traditional products it substitutes. It's important to assess, compare, and take critical notes on the nutritional composition and processing nature of the ingredients in these products due to this speculation (Albuquerque et al., 2022).

As reviewed by Eckl (2021) "Replacement of meat with non-meat protein sources" and various other studies investigated, consumers' acceptance of meat substitutes partially depends on their organoleptic properties, including their appearance, texture, smell, and taste. Regardless of the variety of products tested with participants across various countries, people tend to favor traditional meat products over plant-based counterparts.

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The Meat Attachment Questionnaire measures people's attitudes toward meat to understand reactions to and perceptions of meat substitutes (Graça et al., 2015). A study that was conducted in the United States, India, and China found that meat attachment was associated with the approval of plant-based meat alternatives, but not with the acceptance of plant-based meat alternatives in China. The acceptance of artificial meat substitutes in China and India was positively correlated with meat attachment similarly.

Another consideration of people toward meat substitutes is its' high price compared to traditional. Traditional meat is significantly less expensive than plant-based and artificial meat at present. As demonstrated by Axworthy (2024), in the United States: "Though retail sales for plant-based meat grew by 45% in 2020, on average, Neilson data demonstrates that plant-based meat on a per-pound basis is currently twice as expensive as conventional beef, three times as expensive as pork, and four times as expensive as chicken.

A more sustainable and ethical food system is presented as a compelling case by the increasing popularity of meat alternatives. The text provided above emphasizes that traditional meat production has significant environmental and health consequences.

The mass of foods was used to base the main comparison between meat and meat substitutes. There are authors who believe that it is not necessary to compare food based on nutritional value because the differences can be significant (Schau & Fet, 2007).

Food's primary purpose for humans is to provide energy that is necessary for the organism to function properly. Even if plant-based meat is not as nutritious as the traditional one, it is known as a diet-rich product, which contains proteins that will lower the risk of heart disease, stroke, type 2 diabetes, and certain types of cancer. It's worth mentioning that alternatives can provide necessary nutrients like iron, zinc, and B12 instead of animal meat (Day et al., 2022).

Traditional meat is responsible for environmental catastrophes like water and air pollution, land degradation, and deforestation due to its extensive use of land, water, and energy from an environmental perspective. In contrast, artificially

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raised meat can provide sustainable solutions to the mentioned problems, as it is supported by technologies and the use of non-animal products. According to Bryant (2022), the production of meat analogs is more sustainable than animal products, after analyzing 43 studies. At the same time, Detzel et al. (2021) pointed out that plant-based meat substitutes could decrease the environmental effects of food consumption by simplifying ingredient processing and improving protein ingredient production efficiency.

The choice of plant/protein sources has been shown to have a strong impact on perceived sensory attributes and consumer acceptance in previous studies. In the process of developing meat alternatives, it is crucial to consider the ingredients that can be used as a substitute for meat (Tucker, 2014). The sensory acceptance of early products that mimic processed meat products, such as mycoproteins, is low due to their low taste and texture (Elzerman et al., 2011). As a result, meat eaters are less likely to consider these products as real meat substitutes (Hashempour-Baltork et al., 2020). Reproducing the complex and delicate sensory profile of farmed meat can be a challenge. For example, plant-based products could lose color or taste due to exposure to light or oxygen, leading to undesirable characteristics (Fiorentini et al., 2020). The first factor to be assessed when assessing products is usually their appearance, making it a crucial factor in food acceptance.

The production of traditional meat is causing environmental damage and eating meat is associated with greater health risks for individuals. The decrease in traditional meat production and consumption has an impact on both the planet and humanity's health. Because meat demand is likely to increase, reducing traditional meat with meat substitutes could reduce environmental worsening and improve people's health while meeting consumers' needs. Reducing the production of traditional meat will improve the welfare of animals.

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