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Review Article

Mock meat and its role in health: a review

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ABSTRACT

Meat doesn't have to come from animals. The definition of meat is shifting radically from being a product of animal origin with limited choices to innovative creation with similar composition and structure like meat. Mock meat is in news for many reasons in corporate or industrial meets and research communities. These plant-based meat substitutes intended to reduce the environmental impact caused by farm animals and the potential to unravel one of the stickiest crises in the climate fight. This research was conceived as a scoping literature review and a novel attempt as a full-fledged review article on mock meat on the basis of recent proofs provided by review and research articles from various genuine sources including electronic media, newsletters, and experts in food industries. The present article touches upon the health benefits of vegan meat as well as different health problems emerge from a large-scale replacement of natural animal meat by fake one also discussed here. The next few years will be crucial to how traditional meat products and meat analogs will coexist in the consumer market. These articles when compiled together point at the same fact that there is a lot of potential may be a game changer in the field of food industries, corporates and scientific communities.

Keywords: Gluten free, Meat analogue, Mycoprotein, Soyfood

INTRODUCTION

The meat industry cannot respond to a surge in demand for meat by increasing resource by aggressive production or breeding animals for food consumption. Concurrently, it is facing stiff competition from non-traditional meat and protein products in an increasingly complicated regulatory setting.[1] These unique products known as 'artificial meat' are utilizing cutting edge technologies designed to meet the issues facing the established meat industry. At present, these artificial meats from genetically modified organisms have no way to compete with conventional meat production.[2] However, meat analogs from plant proteins and mycoproteins are currently the biggest competitors and are gaining a small percentage of the market.[3] They are also known by several names like meat analog, meat substitute, faux meat, imitation meat, and vegan meat (Meat analog, Wikipedia). These foodstuffs almost mimic certain aesthetic qualities like texture, flavor, appearance and chemical characteristics of specific types of meat. Many such products are soy-based or gluten-based and now may also be pea protein-based food.[4] Though this review article not focussed on cultured meat from genetic laboratories but it highlighted the role of other vegan products, so-called mock meats, and their importance in health.

For many people, the pleasure of eating meat comes served with a side of guilt. Breeding animals for food ends up in climate variation, polluted water, and destruction of animal habitat. Many social campaigns and dietary recommendations by various organizations always encourage eating less meat, particularly red meat.[5] But for meat lovers, any kind of alternative protein source does not match for the experience of eating real meat. For this

reason, global demand for meat is projected to skyrocket. In recent times scientists are using food science, tissue engineering and biotechnology to develop new meat substitutes with the texture, taste, and appearance of meat to deliver the pleasure, without the environmental consequences. Mostly these food products are funded by multinational companies. Whether driven by a desire to save the planet or make healthier foods, these food innovators hope high-tech toolkits will help to create products that meat-eaters love.[6] Health-conscious and ecosystem concerned generation trying to stay away from meat consumption. This led to growing attraction towards plant-based mock meat, that mimic the texture and taste of real animal meat.[7]

DIETARY PROTEINS

Meat is considered as the highest quality protein source due to its nutritional characteristics. It contains all the nine essential amino acids along with other non-essential amino acids and for its pleasant taste.[8] Proteins are an essential component of our diet, helps in building, repair and maintaining the body's structure. It can be derived from plant and animal food sources but there are some differences. There are 20 amino acids present in different combinations and numbers in different proteins. Among them, nine amino acids cannot be synthesized by our bodies. They are called essential amino acids and rest are called nonessential amino acids. A complete protein diet refers to a type of food that contains all essential amino acids. One of the major differences between plant and animal protein is in their amino acid composition. Most of the plant proteins are incomplete since they are lacking at least one of the essential amino acids. Also, some plant proteins may take a longer duration for the body to digest. It is important for vegetarians to mix their protein sources and ensure that they are getting all of the essential amino acids in a balanced mode.[9]

HISTORY OF MOCK MEAT

In 1931, Sir Winston Churchill said it was absurd to rear a whole chicken just to eat the breast or wing. This was the food for thought for scientists to grow these parts separately under a suitable medium. Subsequently, in two years wheat-based fake meats and soy products appeared in the market commercially. Back into history, 10th century Buddhist monks during the Song Dynasty were already dishing out vegetarian sausages and mock meat dishes for their meat-loving guests with the ulterior motive to give a feel of the homemade cuisine. Presently we are witnessing the evolution from tofu-based meats to variety of plant-based creations like combination diets of tofu, rice, peas and more. Innovation in the food industry opens up many lab-grown plant-based types of meat which almost mimic the intense taste of real meat with a naturally chewy texture. Although most food varieties are fully vegan, some may contain eggs and dairy-based products. These pseudo meats can be shaped, textured and even coloured to produce unique imitate items like vegan chicken, vegan beef, jumbo-sized shrimps, veggie patties, turkey meat and any kind of meat.

WHY GOING FOR A MEAT SUBSTITUTE?

The vegan population reportedly increased from 1% to 6% from the year 2014 to 2018 in the US. The younger population was inclined towards reduced meat consumption due to environmental reasons.[10] At the same time across the ocean in UK, a study report indicated that 56% of respondents felt the meat is not compulsory in their regular meal. Due to change in the eating habits of people citing religious, ethical, environmental and health concerns the ratio of meat-eaters continue to decrease year after year. Yet, the eating pattern has transformed from consuming real meat to alternative meat products.[11] Some vegetarian meat analogs are based on centuries-old recipes like seitan, wheat gluten rice. Also, other products like mushrooms, legumes with added flavors to taste like natural animal meat. Another popular meat alternative is modified defatted peanut flour, textured vegetable protein (TVP) is used as soy-based meat analogues.

Tofu, a popular meat analog made from soybeans and it was invented in China during the Han dynasty. According to Tao Gu's ancient document tofu was called as small mutton and regarded as imitation meat those days.[12] Tofu and wheat gluten are associated with Buddhist cuisine in many East Asian countries especially in China.[13] Gluten, which is derived from the Latin gluten for "glue," is the blend of two proteins called gliadin and glutenin. These proteins comprise about 80% in addition to starch in wheat and barley.[14] Soybean proteins possess interesting nutritional and functional properties. In the food industry, they used as meat extenders other than health and economic reasons. Despite the good properties it possesses soya protein usage is forbidden or limited to a certain extent in some parts of the cuisine world.[15] Soy protein though considered as an important element in Asian cuisine often plays an underutilized role in North America and many European countries. It has become more and more popular in non-Asian countries too. By easily integrating into western diets, it improves the nutritional value of the food.[16]

During the early 1960s, scientists were predicted that exponential population growth would lead to a global shortage of proteins in the future. This made the nutritional researchers develop a microbial protein source that would be an inexpensive and palatable food product. This is the origin of Mycoprotein, a filamentous fungus that is commonly found in soil as an alternative source of protein.[17] Mycoproteins are prepared by fermenting the fungus Fusarium venenatum in a broth of glucose along with some minerals. Later on, these solid fermented products mixed with egg white and wheat protein binders to form meat like the product.[18] They have been found to deliver a unique combination of health benefits. Though they are vegetable in origin, mycoprotein contains all nine essential amino acids

thereby falls into the category of first-class protein comparable with other animal proteins.[19] One of the studies reported that mycoproteins are suitable for human consumption by providing superior satiety value than other traditional protein-rich foods because of low calorie and high-quality protein content. This is a promising outcome for weight management programs.[20]

BENEFITS AND POTENTIAL IMPACT OF CONSUMING MOCK MEAT

Even the process of mock meat making is therapeutic to watch. These meat substitutes are designed to equal animal alternatives in taste and texture. Similarly, the nutrient composition of vegetarian products to a great extent is analogous to the corresponding meat products in the market. The benefits of the plant-based substitutes over animal food are the presence of a low amount of saturated fat in addition to high fibre content depending on the ingredients. People are switching over from eating natural meat to plant-based mock meat either contains an optimal amount of vitamins, protein, fiber and lower saturated fat thus anticipating long term health benefits such as the reduced risk of cancer, heart ailments, and diabetes. Other than that, relatively less land space and water availability are required for cultivating plants for food than rearing animals for meat.[21] Many Asian countries like Singapore, Hong Kong serves plant-based protein foods as their signature dishes which are impossible to differentiate from the real thing. Some noteworthy items like plant-based pork products having the functionality, consistency, and flavor of traditional ground pork. They are sometimes called superfoods as it contains a high-quality vegan protein with high fiber, is 233% more calcium and 53% high in iron. In addition, nutritionists claim they are free from cholesterol, antibiotics, and hormones and this bowel full of a healthy diet is 62% lower in calories and 71% lower in saturated fat compared to real pork.[22]

Studies suggest that mycoproteins help maintain normal blood cholesterol levels and can even lower LDL cholesterol levels as they are cholesterol-free, low in saturated fat content and no trans fatty acids.[23] Studies proved that soy proteins directly lower the LDL-cholesterol level and blood pressure. The most unique aspect of the soy protein is its high isoflavone content, which is considered as having a lot of health benefits although different studies show a variable degree in claiming such a view Messina M.[24] Nutritionally, tofu is free of cholesterol, low in saturated fat and high in protein content (approximately 50%). It also contains about 27% essential fatty acids and a good amount of calcium. In 1999, the U. S. Food and Drug Administration regarded highly on numerous health benefits of this soy-based product. One of the recent researches has focused on healthier utilization of the by-products of tofu processing which contain nutritionally rich proteins and fats that taste good and can be beneficial to human health.[25]

FAKE MEAT AND HEALTH

In contrast to dairy substitutes, meat substitutes are generally not fortified. Hence, these vegetarian alternatives provide no compensation for nutrients derived from animal products. Unfortunately, these alternatives often contain high amounts of salt along with additives such as flavouring agents or preservatives.[26] These mock meats which are generally priced higher than their traditional counterparts may become more pocket-friendly in the near future as people are very much concerned about food safety globally.

Gluten based mock meat may taste good but only hitch is they come with zero nutritional value, digestive disorders, mood swing and reduced energy balance in the body (Kumar S). Studies have been reported that 1 in 133 people in Canada suffer from celiac disease, a disorder causing changes in the immune response of the body triggered by eating gluten-based food. At the same time, non-celiac gluten sensitivity is estimated to be six to 10 times more prevalent than celiac disease.[27]Another study has shown that eating gluten may contribute to irritable bowel syndrome, obesity, diabetes, and autoimmune disease.[28] Presence of many eateries promoting vegan food but offering fake meat in the market makes us rethink our relationship with food. The number of people turning to veganism is on the rise for both health reasons and ethical ones depending on type of fake meat we consume.[29] But on the flip side, people after consuming these food products reported with digestive complications due to high fiber and protein content. Some are allergic to mycoproteins developed adverse reactions like abdominal pain, vomiting and throat infections. One such UK based brand in the 1980s created ripples by promoting mycoproteins as a meat substitute, which is almost vanished in the year 2000 when these products ended on American shelves due to consumer complaints.[30] Research has shown that soy contains estrogen-like compounds called genistein and daidzein. These are isoflavones believed to interfere with female sex hormones causing breast cancer in women and also contribute to dysfunctions of thyroid hormone metabolism.[31]

The gluten-free diet is highly recommended and an absolute necessity for people with celiac disease or non-celiac gluten sensitivity. According to a 2013 study, 65% of American adults think gluten-free foods are healthier and 27% choose gluten-free products with the sole intention of losing bodyweight (Jones AL).[32] Shockingly, some studies have reported that long term consumption of the gluten-free diet may lead to a reduced level of fiber and minerals like iron, zinc, and potassium in the body.[33] Meanwhile, there is an increased risk of nutritional deficiencies such as B-complex vitamins and trace minerals considered as a major setback due to the impact of a gluten-free diet.[34] It is well known fact that, COVID 19 was spread by an animal to a human by means of meat consumption, like many strains of flu and other

respiratory diseases that have posed potentially pandemic over last few decades. Interestingly, Canada is the one of the countries showed spike in meat free consumerism and growing demand for vegan food since COVID-19. From the moment it was reported that COVID-19 had been transmitted at a meat market in China in late 2019, people around the world self-analysed upon their own eating behaviour. Meat aisle in many supermarkets remained empty and unsold at the peak of COVID 19 and many turned into plant-based and vegan alternatives popularly called as mock meat. We are aware that this behaviour may be temporary and customers may return to old habits once meat serving restaurants, meat processing centres open again, it is reasonable to assume that during COVID 19, a pandemic blessing in disguise changed people perception on plant-based diet and introduced them to new favourite foods and insights.[35]

IN INDIA

Off late, in India also the concept of vegetarian meat is catching up. Many young entrepreneurs after quitting high profile jobs ventured into mock meat business selling products online. They claim these meat substitutes come with long shelf life, without any of the religious objections, adverse health consequences and the horrible effect on the environment. But some are unconvinced of the potential of plant-based meat in India quoting a consumer trend that has been ported out of West but a cultural misfit in India.[36] One of the studies concerning the perception of fake meat by Indians reported that there is a significant acceptance of clean and plant-based meat in India and China compared to the USA. In India, 25.5% were not at all familiar, 35.8% were slightly or moderately familiar and 38.7% were very or extremely familiar with fake meat.

Interestingly the same study also reported that the Indian population is more of an omnivore category and those who eat more meat are considerably more likely to buy clean meat concluding the importance of China and India as prospective future markets. At the same time, messages concerning the environment and animal welfare may be more efficient marketing strategies in India compared to China and the USA.[37] Several US based companies are front runners by sophisticated marketing, investing huge amount in vegan meat innovation. More than taste and health, people are more concerned for the environment and animal welfare as these aspects determine whether people are willing to pay for plant-based meat. Understanding these aspects, vegan mock meat can massively reduce the bulky emissions burden and animal suffering caused by animal husbandry.[38]

CONCLUSION

Healthy eating doesn't have to be complicated. This article is not about eating meat or not eating meat, but about doing the best for ourselves. Though we believe mock meats are the best way for a transition from non-vegetarian to a vegan diet it does not serve the purpose. If our goal is to eat less meat just go ahead, add more vegetables and plant-based proteins. Instead of finding replacements in mock meat or fake meat simply convolute our health.

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