ALTERNATIVE SOURCES OF PROTEIN IN THE FOOD INDUSTRY

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According to the FAO report in 2009, "How to Feed the World in 2050," global food production is expected to increase by about 70% in 2050 [1]. According to a review of world agriculture in 2012 until 2030/2050, in order to satisfy the nutrition of a growing population, the total volume of meat production should be increased from 258 million tons in 2005 to 455 million tons by 2050. For milk and eggs to 1077 and 102 million tons by 2050 respectively [2]. Similar trends have been observed for other high-quality protein sources. These forecasts show a significant increase in protein demand, to meet the growing population and well-being of countries with emerging economies.

At the same time, there was a tendency in the west countries toward predominant consumption of products containing more plant protein. Due to the expected increase in the world population to 9 billion by 2050, the growing demand for food proteins can be met through the use of proteins obtained from new sources, including insects, fungi and algae, as well as food waste and plant resources [3].

Protein is an important nutrient for human health and plays a key role in supporting many biological processes. Although proteins can be obtained from a variety of products, such as animal and plant raw materials, as well as some alternative sources in the future, the question of supporting global protein production is critical due to the world's population growth and improving economies in developing countries in transition to increase protein intake compared to carbohydrate intake in their diets. In addition, there is increasing interest in the production of functional foods using proteins, protein derivatives and additives based on them to meet consumer needs. The food protein market is constantly growing, especially in the field of nutrition and health; a large assortment of high protein products has been successfully put into production. This area of effective protein involvement is expected to grow in the coming decades.

Along with the use of well-known animal and plant proteins, other sources of protein, such as insects and micro-organisms, and new ways of producing muscle proteins by stem cells or meat cultivation, are increasingly discussed.

Today, in Europe and in most west countries, insects are not consciously eaten. However, insects have great potential to be use as a possible protein source.

Premalatha and others have written that insects are cold-blooded organisms and therefore spend much less energy and nutrients than warm-blooded animals, so insects produce more protein per kilogram of consumed phytomass than a normal

animal. In addition, insects are characterized by high fertility and significantly faster growth rates than conventional animals. These signs, combined with very high nutritional value, have prompted scientists to consider using insects as food [4,5]. Insects have a high protein content (40-75 g per 100 g dry weight, or 77-98%), which is very well absorbed.

However, despite all the advantages that insects can offer as a source of protein, there is only a very small amount of information about the possibilities of agricultural breeding of insects, the technological properties of their proteins, the possibility of creating food products based on proteins derived from insects.

Also, the tendency of including insects in the diet is not perceived adequately by Western Europeans and requires further study, as well as inferencing significant advantages, organoleptic aspects and safety that are present when introducing new protein sources into the human diet.

In vitro meat, so-called cultured meat, cell meat or pure meat, is a product of animal origin obtained after the isolation and identification of cells, cell culture protocols and tissue engineering. For example, a research project is underway in the Netherlands, in which stem cells are selected from a pig embryo and subsequently grown from their muscle cells in the bioreactor by maintaining optimal environmental conditions.

The obvious advantage of using in vitro meat is the ability to produce meat without slaughtering animals, as well as having a meat product with significantly less environmental impact. The control all processes of obtaining such meat, means that consumers can be assured that they are offered a standard product. However, the production process requires the use of chemicals, such as hormones, which are not desired in foods [6].

The need for simultaneous co-cultivation of variou cells, such as muscle and fat, and potential genetic instability due to the growth rate, leads to the formation of cancer cells. However, consumer attitudes will have the main influence on the level of such products implementation.

The successful introduction or development of these alternative products depends on many factors. Meat substitutes, non-dairy milk drinks and in vitro meat must meet a number of criteria before they are accepted by the consumer: they must have standard properties, be affordable and safe, preserve the properties and microbiological indexes for a long time.

The microorganisms, from which the protein is obtained, can be divided into four categories: bacteria, yeast, fungi and algae. The main characteristics of their choice are rapid growth, the ability to develop in simple environments and high yields. Schwenzfeier and others demonstrated the potential of Tetraselmis algae compared with plant proteins. In addition to this type of algae, Spirulina (Arthrospira), Chlorella, Dunaliella and (to a lesser extent and only at the regional level) Nostoc è Aphanizomenon are also promising for use in human nutrition. Currently, this type of protein requires the improvement of protein extraction technologies from microalgae, and the development of the ways to use in food technologies [7].

Yeast and yeast extracts are used as seasonings in the meat industry and in the production of semi-finished products. In addition to being used as a seasonings,

various yeasts are considered as a new source of protein, and much of the knowledge on microbial protein production is related to yeast. It is known that yeast contains a small amount of sulfur-containing amino acids and is widely recognized as a protein source by consumers.

Bacteria demonstrate very high growth rates compared to algae and fungi, so they are of particular interest as a source of microbial protein. Along with the very small cell size, the bacteria have a high content of nucleic acids, which makes them unsuitable for human nutrition. A wide range of bacteria is considered as a raw material for protein production.

The use of mushrooms in food is not a new concept. However, modern technologies for the production of meat analogues use mycoproteins from the mycelium fungi Fusarium venenatum. Mycoproteins are a promising source of protein and demonstrate health benefits because they lower the level of cholesterol and improve heart function. However, adverse reactions are also known, a detailed mechanism that requires further study.

Based on this information, it is obvious that proteins of plant and animal origin have been and remain the single most common and safe source of protein compounds for the human body.

References

1. Diouf, J., 2009. Documents FAO's director-general on how to feed the world in 2050. Popul. Dev. Rev. 5, 837–840.

2. Buttriss, J.L., 2013. Food security through the lens of nutrition. Nutr. Bull. 38 (2), 254–261.

3. Asgar, M.A., et al., Nonmeat Protein Alternatives as Meat Extenders and Meat Analogs. Comprehensive Reviews in Food Science and Food Safety, 2010. 9(5): p. 513-529.

4. Premalatha, M., et al., Energy-efficient food production to reduce global warming and ecodegradation: The use of edible insects. Renewable and Sustainable Energy Reviews, 2011. 15(9): p. 4357-4360.

5. Belluco, S., Halloran, A., & Ricci, A. (2017). New protein sources and food legislation: The case of edible insects and EU law.Food Secur. 9, 803–814.

6. Hocquette, J.-F. Is in vitro meat the solution for the future? Meat Sci. 2016, 120, 167–176.

7. Kuhad, R.C., et al., Microorganisms as an Alternative Source of Protein. Nutrition Reviews, 1997. 55(3): p. 65-75.