



Student's name: Angel David López Hernández

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Teacher's name: Eduardo Enrique Arreola Jimenez

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Summary

This research work explores nutrition as an interdisciplinary science, analyzing its role in human health and its relationship with biotechnology. The fundamentals of nutrition are examined, differentiating between food and nutrition, as well as the function of macronutrients in the body. The importance of nutrition in Mexico is also addressed, highlighting the double burden of malnutrition that affects children, adolescents and adults, and the main diseases derived from an inadequate diet, such as obesity, type 2 diabetes, hypertension and anemia.

The work delves into biotechnology applied to food, presenting modern tools such as CRISPR-Cas9, transgenic foods and biofortification, with golden rice as a central example, as well as functional and nutraceutical foods,

and the emerging field of nutrigenomics, which allows personalized diets based on the genetic profile. Finally, the controversies and ethical dilemmas associated with these technologies are analyzed, including the safety of GMOs, the socioeconomic impact and the debate on the naturalness of food.

The study concludes that, although biotechnology offers a unique potential to improve nutrition and health, its implementation requires responsibility, regulation and ethical consideration, guaranteeing accessible benefits for the entire population and promoting a sustainable food future.

Introduction

Currently, ensuring adequate nutrition is a global challenge, especially in countries such as Mexico, where problems of malnutrition, obesity and micronutrient deficiencies coexist in different age groups. In addition, it is an interdisciplinary science, connected with biology, chemistry, medicine and biotechnology, which allows to address nutritional problems from different approaches.

Biotechnology emerges as a key tool to face these challenges, providing innovative solutions such as transgenic foods, crop biofortification and functional foods. Nutrigenomics, on the other hand, opens up the possibility of designing personalized diets that consider the genetic profile of each individual, expanding the impact of nutrition on health.

However, these advances generate ethical and social debates about the safety of genetically modified foods, patent control and the perception of "naturalness" in food. This work focused on analyzing nutrition from its scientific bases, its importance in Mexico and its link with biotechnology, exploring practical applications and ethical considerations to offer a comprehensive vision on how to improve health and ensure a sustainable and accesible to the entire population.

Nutrition, in addition, has evolved from being considered only a biological process to consolidating itself as a science applied to human well-being, capable of preventing and treating diet-related diseases. In this sense, recent advances in nutrigenomics and biotechnology are highlighted.

Development

1.0 Fundamentals of Human Nutrition

Nutrition is an interdisciplinary science that studies the biological, chemical and social processes related to the ingestion, digestion, absorption and use of nutrients by the human body. Nutrition is related to branches such as biology, chemistry, medicine, psychology, social sciences and biotechnology, which gives it a transversal and multidisciplinary character.

It is important to differentiate food from nutrition. The first refers to the voluntary act of selecting and consuming food, influenced by cultural, economic and social factors, while the second is an involuntary and physiological process, fundamental for the maintenance of life and health.

Macronutrients, which include carbohydrates, proteins and lipids, are essential to provide energy, build tissues and regulate metabolic functions. For their part, micronutrients, such as vitamins and minerals, do not provide energy but are vital for numerous biochemical reactions and to maintain the body's homeostasis. Micronutrient deficiency can cause serious problems, especially in children and adolescents, while excess energy and fat can lead to chronic diseases in adults.

In Mexico, nutrition is of critical importance, since the country faces a double burden of malnutrition high rates of obesity and overweight coexisting with nutritional deficiencies in vulnerable sectors. Among the diseases derived from poor diet are type 2 diabetes, hypertension, obesity, cardiovascular diseases and anemia, which underlines the need for effective nutritional policies.

2.0 Biotechnology and its Link with Nutrition

Food biotechnology is defined as the use of biological and molecular processes to improve food production, quality and safety.

Although today it is mostly associated with genetic engineering, its roots go back to traditional methods such as fermentation, used in bread, beer or yogurt. The great scientific advances of the last decades, like recombinant DNA and CRISPR - Cas9, now make it possible to edit genes with great precision in plants and animals. These tools are considered essential to develop crops that are more resistant to climate change, pests and diseases, and the same time to improve their nutritional profile, directly benefiting human health. In addition, biotechnology contributes to reducing food waste by creating varieties with a longer shelf life, which is key to ensuring food security worldwide.

3.0 Applications in Nutrition

One of the best-known applications of biotechnology is the development of genetically modified organisms (GMOs) and the biofortification of crops. These techniques aim to increase the nutrient content of staple foods and thus combat deficiencies in vulnerable populations. A clear example is golden rice, enriched with beta-carotene, which helps prevent vitamin A deficiency, a serious problem that can cause blindness and increase child mortality.

Another application is the production of functional and nutraceutical foods, which provide additional health benefits beyond basic nutrition. Products such as yogurt with probiotics or foods enriched with omega-3 fatty acids contribute to intestinal health and cardiovascular prevention, showing how diet can help reduce disease risk.

A third innovative approach is nutrigenomics, a discipline that studies how genes interact with nutrients. Thanks to it, it is possible to design personalized diets according to the genetic profile of each person, which could improve disease prevention and open the door to precision medicine. This represents a promising future in which nutrition adapts individually to optimize well-being.

Additionally, biotechnology also contributes to improving food accessibility and sustainability. By developing crops that are more resistant and productive, nutrient-rich foods can reach more people, especially in regions with limited resources, helping to reduce malnutrition on a larger scale.

4.0 Ethical and Social Considerations

Although biotechnology provides great opportunities, it also generates controversies and ethical debates. One of the most discussed topics is the safety of GMOs and their long-term effects on health and the environment. On the socioeconomic side, the control of patents by large multinational companies can create inequalities, since many farmers depend on seeds that belong to these corporations. Finally, there is the debate about the "naturalness" of food, since part of society rejects the idea of consuming organisms that have been genetically modified.

To address these challenges, the application of biotechnology must be accompanied by clear regulations, ethical responsibility and equitable access. This ensures that nutrition advances benefit everyone responsibly.

Conclusion

Nutrition is an interdisciplinary science that explains how food impacts health, and poor diet is closely related to chronic diseases such as diabetes, hypertension, anemia and cardiovascular problems. This shows the importance of developing effective strategies to improve eating habits and overall well-being.

Biotechnology offers valuable tools such as transgenic foods, biofortification, functional products and nutrigenomics, which allow innovations in both population health and personalized nutrition. However, these advances must be guided by ethical responsibility, clear regulations and equitable access. Integrating nutrition and biotechnology represents a key opportunity to improve quality of life and build a healthier and more sustainable food future.

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