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Nutritional Animal Models

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Introduction

Nutritional understanding today is largely based on the use of appropriate animal models and standardised diets. Animal models have been used to solve nutrient-nutrient interactions, evaluate bioavailability of nutrients and nutrient precursors, and test for nutrient tolerances and toxicities, according to several examples. The benefits, drawbacks, and peculiarities of numerous animal species are examined.

Combs (1) identifies three critical elements in the finding of vital nutrients: 1) recognition that certain diseases are linked to diet; 2) development of appropriate animal models with a specific requirement for the nutrient in question, followed by the use of bioassay procedures to first produce and then ameliorate 1 or more deficiency symptoms; 3) development of defined purified diets that could be made singly deficient in the nutritional entity under investigation [1]. In most cases, the diet-disease link came before the isolation of the nutrient and the establishing of nutrient function. Thus, long before specified diets were utilised in bioassays to completely examine the metabolic functions of vitamin C, iodine, and thiamine, the benefits of fruits for scurvy, seaweed or sponge ashes for goitre, and rice husks for beriberi were discovered [2]. The discovery that beriberi, or nutritional polyneuritis, was caused by a deficiency of what was later discovered to be thiamine, an essential nutrient, led to the term "vitamin" (later changed to "vitamin") being used to describe a category of (trace organic) nutrients necessary for life, thanks to Eijkman's classic work with chicks fed a polished rice diet in the late 1800s.

In the discovery of necessary nutrients, there were aspects of remarkable imagination and close observation, but serendipity also played a role in many situations. Many hormone discoveries were made in the same way. The late 1800s saw the start of research on the pancreas' involvement in digestion, which eventually led to the discovery of insulin. It was discovered that flies were drawn to the urine of dogs after their pancreas was removed [3]. The urine was discovered to be high in sugar after an analysis. As a result, animal pancreatic secretions were employed to treat human diabetes, and the 51-amino-acid sequence of bovine insulin was determined in 1953.

The following review focuses on the contributions of experimental animal models to current knowledge of nutrient-nutrient interactions, bioavailability of nutrients and nutrient precursors, and nutrient tolerance levels [4].

Studies on the bioavailability of nutrients and nutrient precursors are probably the best examples of how experimental animals have contributed basic nutritional information [5]. The majority of food energy values, digestibility and protein quality, absorption efficiencies of mineral salts and minerals in foods, absorption efficiencies of vitamin components of foods and various vitamin precursors, and amino acid utilisation from various amino acid precursors, analogues, and metabolites have all been derived from animal model studies. However, stable isotope techniques are now allowing more and more human participants to be used in nutrient bioavailability research.

Animal research has greatly influenced our understanding of nutrition and metabolism. The juvenile pig has risen to prominence as an animal model in recent years, particularly for research of amino acid metabolism, complete parenteral feeding, rotavirus infection, and bacterial and viral pneumonia. Pigs, aside from monkeys, are regarded to be the animal model that most closely resembles humans. Many animal species have well-documented differences in how they use, metabolise, and excrete nutrients among those that have contributed useful nutrition information [6].

Conclusion

The importance of selecting the appropriate animal model for predicting what can happen in humans is evident from this (incomplete) list of species differences. Other factors to consider are the availability of facilities and the expense of the tests to be carried out. Clearly, animal model research has been beneficial in furthering our understanding of nutrition. The first half of the twentieth century can be considered the qualitative period of nutrition, with the discovery of the majority of necessary nutrients and their roles. The quantitative era, which spanned the last 50 years, was characterised by an emphasis on dietary needs, nutrient-nutrient interactions, and pharmacologic properties of nutrients. An outstanding assessment of how research with food animals has contributed to our understanding of nutrition concepts and principles in energetics, carbohydrates and lipids, proteins, and body composition and growth was presented at a 2006 Experimental Biology (History of Nutrition) symposium.

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Conflict of Interest

None

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