



THE UPS AND DOWNS OF PLANT PROTEINS

Introduction

Consumer food trends are influenced by the health, environmental, cultural and economic factors associated with the consumption and production of major protein sources. The growing popularity of plant-based ‘meat’ alternatives and dairy-free ‘milk’ provides the opportunity to substitute ingredients derived from animals with alternatives derived completely from plants.

Protein is an essential dietary nutrient that is made up of amino acids needed to support and maintain normal cellular function. There are 20 standard amino acids. However, nine are classified as essential amino acids (EAA) and must be consumed through the diet. **Proteins also provide sensory and functional characteristics to foods, such as flavour, gel and foam formation, emulsification, and water and oil holding capacity that make them desirable as ingredients in processed foods to impart unique textures and structures into food products.**

Using Proteins as Ingredients in Food Products

The use of protein as an ingredient in processed foods is continuously growing due to consumer demands for high-protein products, plant-based foods, and unique food experiences. In these products, proteins have two primary roles: **provide nutrition and functionality.**

The selection of a protein ingredient during the product development stage involves finding a balance between the nutritional, functional, and sensory profile of the food product.

Sources of Protein

Dietary sources of animal protein such as beef, dairy, pork, chicken, eggs and fish are considered complete proteins because they contain all 9 EAA.

Most dietary sources of plant proteins (beans, pulses, nuts, seeds) are deficient in one or more EAA and are considered incomplete protein sources. Soy is one of few agricultural crops that provides a complete protein explaining why soy-based products dominate the market-share of meat alternatives. Using a combination of plant proteins is an effective way to create products with balanced amino acids (for example legumes which are low in methionine can be complemented by foods high in methionine such as rice or nuts). Plant proteins contain more carbohydrates and thus contain less protein per 100g serving (**Table 1**), in comparison to animal proteins.

Table 1. Protein density in common plant and animal foods.

Source	Protein Content / 100 g	
	Wet Basis	Dry Basis
Ground beef, raw	17.4	47.8
Fish, tilapia, raw	20.1	91.6
Fish, salmon, Atlantic, farmed, raw	20.4	58.2
Milk, whole	3.2	26.5
Peas, green, raw	5.4	25.6
Soybean, green, raw	13.0	39.9
Almond, raw	21.2	22.1
Broccoli, raw	2.6	25.7

FoodData Central, 2020, United States Department of Agriculture



FACT SHEET

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Protein Quality

The quality of protein from plant and animal sources are commonly scored by assessing the availability of all 9 EAA in that source and how efficiently it is absorbed by the digestive system. In **Table 2**, the closer the Protein Digestibility Score to 1.0 means the more digestible and efficient the protein is.

Table 2. Protein Quality Rankings

Protein Type	Protein Digestibility Corrected Amino Acid Score
Beef	0.92
Black Beans	0.75
Casein	1.00
Egg	1.00
Milk	1.00
Peanuts	0.52
Soy protein	1.00
Wheat gluten	0.25
Whey protein	1.00

Hoffman, J.R. and Falvo, M.J. 2004. Protein – which is best? *Journal of Sports Science and Medicine*. 3, 118-130.

Selection of Protein Ingredients in Product Development

Proteins are major sources of flavour compounds due to their amino acid compositions and the chemical reactions that occur during cooking. A major obstacle preventing the incorporation of plant proteins into food products is their contribution to off-flavours, where terms such as 'bitter', 'beany', 'astringent' and 'cardboardy' are commonly used to describe plant proteins and foods containing them. This can present some challenges to developing protein-based products, but there are opportunities to adjust with other ingredients such as flavours or masking agents.

The 9 Essential Amino Acids

- histidine
- isoleucine
- leucine
- lysine
- methionine
- phenylalanine
- threonine
- tryptophan
- valine

References

- (1) GlobalData. Ingredient insights: the high-protein trend. August 2018.
- (2) GlobalData. Ingredient insights: opportunities in meat substitutes. December 2019.