There are two major proteins present in milk. They are casein and whey. Casein accounts for 80% of the protein and whey for 20%. They are both excellent high quality protein sources.

Significantly more people are familiar with whey protein rather than casein protein. This says a lot about the power of marketing. Whey is a milk protein that is known to almost everyone because it is for sale in most gyms and grocery stores and has been touted for years as “the supplement to take to build muscle.

Casein is a protein source on a par with whey but not as well known to the public. In this article we will focus on casein to give you a better understanding of what it is, how it is produced, and some unusual qualities it has. Both casein and whey are excellent sources of the essential amino acids. They provide the body with the necessary building blocks for hormones, enzymes, blood components, muscle components, and a host of other substances necessary for maintaining homeostasis and good health.
Protein Quality Evaluation

The current standard for evaluating the quality of protein is the Protein Digestibility Corrected Amino Acid Score (PDCAAS). This method of evaluating protein quality is based on the food protein’s essential amino acid profile, how well it is able to be digested, and its ability to supply the World Health Organization’s amino acid requirements for two to five year-olds (considered the most nutritionally-demanding age group).

The PDCAAS rating was adopted by the US Food and Drug Administration (FDA) and the Food and Agricultural Organization of the United Nations/World Health Organization (FAO/WHO) in 1993 as “the preferred ‘best’” method to determine protein quality (1). Utilizing this method both casein and whey receive a rating of 1.00, which is the highest rating possible.

What is Casein?

Casein is the principal protein found in cow’s milk from which it is extracted commercially. It is responsible for the white, opaque appearance of milk and is combined with calcium and phosphorus as clusters of casein molecules, called micelles.

The major uses of casein until the 1960s were in technical, non-food applications. Some of these include adhesives for wood, paper coating products, leather finishing, concrete additives, flooring compounds, ink, plastic button components, shoe polish, and dog chew bones (3).

During the past 50 years, however, food scientists have recognized the amazing properties of caseinates for the food industry. As a result caseinates are widely used as an ingredient in foods to enhance their physical (so-called functional.) properties, such as whipping, foaming, water binding, thickening, emulsification, texture, flavor, solubility, and to improve their nutritional value.

Casein is usually obtained by starting with pasteurized skimmed milk. Acid or the enzyme rennet is then added to the milk which causes the casein to precipitate out. The protein content of rennet casein is approximately 80.5% and the protein content of acid casein is approximately 86%.
Precipitated casein is not soluble. It is very usable for technical applications. In order to make casein more usable for the food industry it is typically made soluble by transforming it into caseinates. This is accomplished by treating the precipitated acid casein with various alkalis such as sodium hydroxide, ammonium hydroxide, calcium hydroxide, or potassium hydroxide. This produces respectively sodium caseinate, ammonium caseinate, calcium caseinate, and potassium caseinate in a spray dried, roller dried or extruded form, depending on the drying equipment used. Different caseinates have different functions and uses which will be addressed in a future article.

Micellar casein is another form of casein which is soluble and extremely desirable. It is most commonly used for nutritional applications. Micellar casein is produced using a low temperature microfiltration process, which preserves the casein in its natural or undenatured state. Casein exists naturally in milk in the form of micelles and the micellar casein produced by this process maintains its’ undenatured integrity. The structure of the micelles is not altered and micellar casein is soluble as opposed to acid casein which is not.
Bioactive Peptides Produced from Milk Protein

A major difference between casein and whey is the speed at which each is digested. Whey is more of a “fast” protein source in that it is digested and absorbed more rapidly than casein, which can be thought of as a “slow” protein source (2). Whey produces a more rapid rise in amino acids in the blood, whereas casein forms a clot in the stomach and releases its’ amino acids over a longer period of time. Many serious body builders will use a combination of the two to get maximum benefit from these two milk proteins.

Milk Protein has some rather unique properties in addition to those mentioned above. Chains of amino acids called “peptides” are produced as a result of digestive enzymes acting on casein and whey. Many of these peptides have the ability to influence biological processes which may beneficially affect us but more research is necessary in this regard and they are mentioned more in an anecdotal sense.

Antibacterial qualities are exhibited by three bioactive peptides called casecidin, casocodin-1, and isracidin (4,5).

Animal studies using hypertensive lab animals have revealed that casein peptides called casokinins have the ability to lower blood pressure in the same manner that human “ace inhibitors” do for humans (6).

Casoplatelin is a peptide derived from casein which has the ability to affect platelets and cause an anti-thrombotic affect (7). Amazingly, two antithrombotic peptides have been identified in the plasma of newborns, both after breast feeding and ingestion of cow’s milk based formula (8).

Casomorphins are a group of opioid-like peptides that have beneficial actions. In the same way our bodies produce endorphins from exercise, casomorphins are exorphins with many of the same attributes (9).

There are many wonderful sources of quality protein. We will explore them on this website. Casein is one of the few that is not only an outstanding nutritional source that has the ability to enhance food from both a functional and nutritional standpoint but is widely used in various industrial and technical applications. It is therefore quite unique.
References


