

# Ultrafiltered (UF) Milk Ingredients

Ultrafiltration of milk can be used to produce popular new dairy products and dairy-based foods and beverages that are higher in protein and lower in carbohydrates than traditional milk.

Ultrafiltration is a sieving process that separates milk components according to their size. During this process, milk passes across a membrane. Some of the lactose, soluble minerals and water will cross through the membranes and become the permeate stream. Casein and whey proteins, because of their larger size, will not pass through and will become part of the retentate stream. It is this retentate stream that becomes the ultrafiltered (UF) milk.

UF milk is currently being sold as a fluid ingredient with higher protein and lower lactose levels than condensed milk. UF milk also can be dried to produce a milk protein concentrate powder. (See DMI's Milk Protein Concentrate Ingredients specification sheet for information about dried UF milk ingredients.)

## Typical Composition

The composition of UF milk can vary significantly, depending upon its intended application.

For making yogurt and ice cream, the UF milk specifications often include diafiltration steps for additional carbohydrate removal. Diafiltration is a washing step that involves adding water to the retentate as it is being ultrafiltered to reduce product viscosity and remove even more lactose and minerals. UF milk formulations for these products are typically customized based on product applications.

UF milk for cheese milk fortification tends to be in the range of three times volumetric concentration factor (3X VCF). The term volumetric concentration factor (VCF) describes the ratio of the initial feed volume to the retentate volume. Low VCF is typically 2 to 3 1/2. High VCF is typically 3 1/2 to 5, which can be produced with or without diafiltration.

There are no standards of identity for ultrafiltered milk or the dairy or dairy-based products resulting from it. Currently, fluid UF milk is sold in both whole and skim versions, either raw or pasteurized. Further pasteurization or repasteurization is required at the destination site. Shipment is typically in truckloads. Suggested labeling for fluid UF ingredients is "ultrafiltered milk" or "ultrafiltered skim milk."

Product specifications will vary based on end usage requirements, but below are some examples of products currently being sold.

|                                  | Moisture | Protein | Lactose | Fat    | Ash   |
|----------------------------------|----------|---------|---------|--------|-------|
| UF milk                          | 70-75%   | 10-12%  | <5%     | 11-14% | <2.5% |
| UF skim milk                     | 80-85%   | 10-12%  | <5%     | <0.5%  | <2.5% |
| UF skim milk, with diafiltration | 80-82%   | 16-17%  | <1%     | <0.5%  | <1.5% |

## Nutrition

Ultrafiltration allows food manufacturers to produce lower-carbohydrate versions of milk, ice cream, yogurt and dairy-based beverages to meet consumer demand for these products. Milk that has been ultrafiltered to a three times volumetric concentration factor (3X CF) has had about 65-70% of the carbohydrate lactose removed. What is left behind—the retentate, or UF milk product—delivers high-quality protein ideal for creating lower-carb/higher-protein foods and beverages. UF milk also offers the clean, dairy flavor and nutritional value associated with dairy ingredients overall.

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Dairy products based on UF milk are different from the lactose-free or lactose-reduced dairy products created for consumers concerned about lactose. In the latter, the lactose has been split into its two component sugars—glucose and galactose—to ease digestion but the total carbohydrate content has not changed.

## *Functionality*

UF milk has minimal differences in flavor and solubility from traditional milk. Dairy products that use UF milk have a fresh flavor and an intact casein micelle. However, as these products do not meet the standard of identity for the original dairy product, they must be given an alternate name under current regulations. (This requirement may change as the FDA further defines carbohydrate labeling.)

## *Sample Application: A Reduced-Carbohydrate Dairy-Based Beverage using UF Milk*

Ultrafiltered milk can be used to produce a dairy-based beverage with 3 grams of lactose per 8 oz. serving. Regular milk contains 12 grams of lactose per 8 oz. serving. Additional dairy proteins may be added to this beverage to boost the protein content. High-intensity sweeteners are often added to these products as well.

To learn more about UF milk or for product formulation assistance, contact DMI's Technical Support Hotline: 1-800-248-8829.

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