

Title: Satiety inducing milk product

The present invention relates to the field of functional foods. In particular, it relates to whey proteins and the use thereof in (milk-based) compositions for body weight management.

The obese population is growing worldwide as energy intake exceeds
5 energy expenditure. Consequently, more people are at risk of developing
obesity-related diseases such as diabetes mellitus type 2 and cardiovascular
diseases. High protein (HP) diets have shown to induce weight loss and weight
maintenance after a weight loss period. As proteins are not very energy
efficient, the effect of HP diets is thought to be based on a satiating effect and
10 an increased (diet-induced) thermogenesis (DIT). Anderson et al. (J. of
Nutrition 134:3011-3015, 2004) reported that the protein source, protein
quantity and time of consumption determine the effect of proteins on short-
term food intake. It was found that whey protein consistently resulted in the
greatest food intake suppression relative to control, sucrose as well as in
15 comparison with other protein sources such as egg albumin and soy protein.
The effect of whey was attributed to several aspects of whey metabolism.
Briefly, whey compared with casein digests quickly and provides a rapid
increase in plasma amino acids that is sustained for more than 2 hours and
which may contribute to food intake suppression through increased brain
20 amino acid concentrations. Also, whey ingestion results in the release of gut
peptide hormones, such as cholecystokinin (CCK), involved in satiety
induction.

A positive association between dairy consumption and the
maintenance of a healthy body weight has led to various studies into the
25 effects of individual milk components in the regulation of food intake and
satiety. Whey proteins have received particular attention because whey is an
inexpensive source of high nutritional quality protein. WO2007/042341 relates

to a composition and method for providing nutritional support to obese patients. The composition comprises a protein source which comprises at least 30% by weight of whey protein and which provides at least 30% of the total calories of the composition.

5 The role of whey proteins in food intake regulation was recently reviewed by Luhovyy *et al.* (J. of the American College of Nutrition, Vol. 26, No. 6, 704S-712S (2007)). Whey protein is the collection of globular proteins that can be isolated from whey, a by-product of cheese manufactured from cow's milk. It is typically a mixture of beta-lactoglobulin (~65%), alpha-
10 lactalbumin (~25%), and serum albumin (~8%), which are soluble in their native forms, independent of pH. Casein macropeptide (hereinafter: CMP) is present in significant quantities (between 15 and 25%) in whey from cheeses made by rennet coagulation. Studies were performed to elucidate the role of individual whey proteins in weight management. CMP in particular has been
15 suggested to be the important component of whey proteins with respect to the satiety inducing effect based on the observation that CMP is a strong stimulant of CCK production in rats. WO/2001/062086 relates to nutritional intervention composition taken before or during a meal for enhancing and extending post meal satiety by stimulating CCK. The dry nutritional
20 composition includes protein, casein macropeptide or glycomacropeptide, long chain fatty acids, soluble and/or insoluble fibers. Studies by Burton-Freeman *et al.*(Physiology and Behaviour 93 (2008) 379-387) however indicated that CMP in whey or delivered as an isolate did not produce remarkable effects during a pre-test meal satiety period, although indirect effects of CMP preload
25 were evident on CCK release and subsequent food intake in women. The authors conclude that more work is required before CMP can be strategically incorporated in the diet to achieve desired outcomes. Luhovyy *et al.* cites a study showing increased food intake by *Macaca rhesus* infants upon feeding with a CMP-enriched formula, and similarly states that the effect of this
30 component of whey on food intake remains uncertain.

Nieuwenhuizen et al. (British J. of Nutrition (2008) Nov 19:1-8) addressed the role of the amino acid tryptophan (TRP) in the satiating properties of dietary protein by comparing breakfasts containing either alpha-lactalbumin (high in TRP), gelatine (low in TRP) or gelatine with added TRP, on appetite. It was found that ingestion of a breakfast containing a-lactalbumin (hereinafter: a-LA) as the only protein source results in a more prolonged suppression of hunger than a breakfast containing gelatin.

A role for beta-lactoglobulin is suggested in patent application FR 2889067-A1, which relates to the use of a whey protein fraction comprising at least 5-fold excess (by weight) of beta-lactoglobulin over a-LA for reducing body mass. It is suggested the whey fraction can reduce the assimilation of fatty matter.

The above indicates that whey proteins have potential as functional food component for person with obesity, but that the relative and absolute contribution of individual whey proteins remains to be elucidated. The present inventors therefore set out to gain further insights into the role of individual whey components in the regulation of body weight, in particular diet-induced thermogenesis and satiety induction. It was surprisingly found that the relative weight ratio between a-LA and CMP was found to be a relevant determinant in suppressing hunger and increasing energy expenditure. For example, an enhanced satiating effect can be observed with a whey protein fraction that is depleted in CMP and at the same time enriched with a-LA.

Accordingly, the invention provides the use of a whey fraction comprising a-LA and CMP, wherein the weight ratio between a-LA and CMP is at least 2, for the manufacture of a nutritional, dietary or pharmaceutical composition for promoting a healthy body weight. Preferably, the weight ratio a-LA to CMP is at least 3, for example 3.5, 3.6, 3.7 or even higher like at least 4. The upper limit of the ratio is not critical although the a-LA/CMP ratio will typically be below 50, like up to 20 or 10.

As used herein, casein macropeptide (CMP) is meant to refer to the hydrophilic, soluble protein fragment released from bovine kappa-casein (κ -casein) by chymosin, the predominant enzyme in calf rennet used in cheese making. CMP is also referred to in the art as glycomacropptide (GMP) due to its high carbohydrate content, or as casein-derived peptide (CDP). CMP is a heterogeneous group of peptides having the same peptide length (64 amino acids) but variable carbohydrate and phosphorus contents. The CMP homologue free of carbohydrate constitutes a large part of the CMP fraction.

10 The term CMP as used in the present invention covers different peptides with or without carbohydrate moieties.

The expression "for promoting a healthy body weight" refers to any contribution to obtaining or maintaining a non-obese body weight of a subject, preferably a human subject. It may involve promoting weight loss, preventing weight gain, reducing food intake, reducing adipocyte mass, increasing energy expenditure, improving the equilibrium between lean and fatty tissue, and combinations thereof. The healthy human weight range widely used by doctors is based on a measurement known as the body mass index (BMI). In general, BMIs are classified in four categories and according to level of body weight and as follows: A BMI of less than 20 – Underweight; over 20 to 25 – Desirable or healthy range; over 25-30 – Overweight; over 30-35 – Obese (Class I); over 35-40 – Obese (Class II); over 40 – Morbidly or severely obese (Class III). A strong relationship exists between BMI and risk of associated diseases whereby individuals with a BMI of less than 25 have a low-average risk, and those with a BMI above 40 have a very severe disease risk. In one embodiment, the invention provides the use of the specific whey fraction to achieve or maintain a BMI between 20-35, preferably 20-30.

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Promoting a healthy body weight using a whey fraction according to the invention may occur via various mechanisms, such as diet-induced thermogenesis (DIT), satiety or a combination thereof. DIT refers to the

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increase in heat production by the body after eating. It is due to both the metabolic energy cost of digestion (the secretion of digestive enzymes, active transport of nutrients from the gut, and gut motility) and the energy cost of forming tissue reserves of fat, glycogen, and protein. It can be up to 10-15% of the energy intake.

The whey fraction for use in the present invention typically has a total protein content of 35% to 80%, preferably 70% to 77%. The whey fraction may comprise hydrolyzed whey proteins.

10 The a-LA content can vary but will generally range from about 20% to 40%, preferably 25-35 %.

 The CMP content is significantly lower, and typically represents 1% to 15% of total protein. Other whey proteins may of course also be present, such as beta-lac, lactoferrin, serum albumin, lysozyme, immunoglobulins.. In one aspect, the whey fraction is further characterized by: (a) a lactose content of 10% or less; (b) a total protein content of 12.5% to 95%; (c) a fat content of 15% or less; and / or (d) an ash content of 4.5% or less.

 A whey protein fraction for use in the present invention can be readily achieved by methods known in the art. For example, WO99/188808 discloses a process for producing a whey protein concentrate substantially depleted in CMP which comprises adjusting the whey to a pH greater than about 4, contacting the whey with an anion exchanger to yield a bound whey fraction enriched in CMP and an unbound whey protein fraction depleted in CMP. After concentration and drying, this fraction is a powdered whey protein concentrate (WPC) depleted in CMP. Preferably, the whey fraction for use in the present invention is depleted in CMP and supplemented with a-LA.

 a-LA rich whey protein products are often used because of their high tryptophan content. In particular, synthetic infant formula based on cow's milk (relatively low in a-LA) can be 'humanised' using cow's milk protein fraction having a high bovine a-LA content. The high tryptophan and cystein content,

together with a low methionine content of a-LA results in an overall amino acid composition more closely resembling that of human milk. The manufacture of a-LA rich whey products is known in the art. Older techniques are generally based on lowering of the pH, leading to coagulation of a-LA. See
5 for instance EP1196045, teaching a process for manufacturing an a-lactalbumin enriched whey protein product comprising mixing a whey protein product with a sufficient amount of an acid such that the pH of the whey protein product is lowered to 4.0 or below; fractionating the proteins in the acidified whey protein product to produce an a-lactalbumin enriched whey
10 protein product. EP0604684 discloses a process for the recovery of alpha -lactalbumin and/or beta -lactoglobulin enriched whey protein concentrate from a whey protein product, involving incubating a solution comprising said whey protein product with a calcium-binding ionic exchange resin in its acid form to initiate the instabilization of a-LA. More recent technologies for isolating a-LA
15 involve membrane filtration. Cheang et al. (2003 Wiley Periodicals, Inc. Biotechnol Bioeng 83: 201-209) report the separation of –alpha-lactalbumin and beta-lactoglobulin using membrane ultrafiltration. EP0311283 relates to a process for producing an a-LA-enhanced fraction from a liquid containing whey protein including a-LA and beta -lactoglobulin characterised by the step of
20 subjecting the said liquid to ultrafiltration using a membrane having a molecular weight cut off of substantially 100,000.

A highly suitable source of a-LA for practicing the present invention is known under the tradename Vivinal™-Alpha (Borculo Domo Ingredients), which has a relatively high alpha-lactalbumin content and a low beta-
25 lactoglobulin content. Thanks to its typical amino acid composition, it is widely used for the production of an infant nutrition resembling human milk more closely. The a-LA/CMP weight ratio of Vivinal™-alpha is about 3.7.

The invention so concerns the application of a whey fraction enriched in a-LA but depleted in CMP in food products, like yoghurt, to induce
30 an improvement in satiation together with an increase in energy expenditure.

The invention herewith provides an economically attractive nutraceutical which does not require the use of highly purified, and therefore expensive, a-LA as protein source. In one embodiment, it relates to a milk product comprising a whey fraction comprising a-LA and CMP, wherein the weight
5 ratio between a-LA and GMP is ≥ 2 .

CMP is known to be a suppressor of gastric acid secretion and has been used as an anti-ulcer agent. On the other hand, a-LA requires a pH value below about 3.5 in the stomach for an optimal digestion process and, hence, liberation of satiety-inducing peptides into the blood stream. Without wishing
10 to be bound by theory, the present inventors postulate that a low relative CMP content contributes to an acidic environment, thereby promoting a-LA digestion and the formation of satiety-inducing protein fragments.

It is preferred that the nutritional, dietary or pharmaceutical composition has a pH value of below 5.5, preferably below 5 and most
15 preferably below 4.6. This may further enhance a sufficient acidity during the a-LA digestion process.

Another aspect of the invention therefore relates to a sour milk product comprising a whey fraction comprising a-LA and CMP, wherein the weight ratio between a-LA and GMP in said fraction is ≥ 2 . Preferably, the
20 weight ratio a-LA to CMP is ≥ 3 , more preferably ≥ 4 .
The pH of said sour milk product is below 5.5, preferably below 5 and most preferably below 4.6. Numerous sour milk products can be made by combining milk containing different levels of fat and dry matter with various starter cultures. To produce sour milk, micro-organisms are added to milk, which is
25 the fermentation substrate. Lactic fermentation is the most important process in the manufacture of sour milk products. The production time and properties of the end product depend on the qualities and activity of the starter culture. A sour milk product according to the invention is readily prepared by supplementing a traditional sour milk product with a suitable source of whey
30 proteins having the desired a-LA/CMP weight ratio. For example, 100 gram of

a regular sour milk product (e.g. yoghurt) comprises about 1-5 grams milk protein, 80% of which is casein and 20% is whey proteins. The milk product may be supplemented with at least an equal amount by weight (e.g. 1-10 grams/100 gram yoghurt) of a whey protein fraction according to the invention
5 to achieve the desired satiety-inducing effect. Of course, it is also possible to partially or fully replace milk protein by a whey fraction comprising a-LA and CMP, wherein the weight ratio between a-LA and GMP is ≥ 2 .

For instance, the sour milk product is selected from the group
10 consisting of fermented milk, buttermilk, stirred yoghurt, set yoghurt, yoghurt drink. A preferred embodiment relates to a satiety-inducing (drinkable) yoghurt. The traditional yoghurt culture comprises *Streptococcus thermophilus* (*Streptococcus salivarius* ssp. *thermophilus*) and *Lactobacillus bulgaricus* (*Lactobacillus delbrueckii* ssp. *bulgaricus*). Both micro-organisms have a
15 symbiotic relationship, i.e. they are mutually beneficial during fermentation. The optimum souring temperature of the yoghurt culture is between 42 and 44°C, and incubation takes around 3 hours until the desired acidity is reached. Both micro-organisms perform better in symbiosis than if grown separately. The pH value of the unsoured milk meets the requirements of the streptococci,
20 so they grow quicker at the start. The increasingly acidic surroundings then favour the lactobacilli, whose pH optimum is under 4.5.

In another embodiment, the sour milk product is a curded milk product, for instance quark (quarg), fresh cheese, cottage cheese, cream cheese, kefir, kumyss, viili or ymer.

25 Kefir is a refreshing fermented milk product with a mildly acid taste. Kefir is made by incubating milk with kefir grains or a mother culture made from them. The microflora of the kefir grain and kefir comprise lactic acid bacteria (streptococci, leuconostoc and lactobacillae), yeasts, and possibly acetic acid bacteria. Kefir grains are a complex and specific mix of these micro-
30 organisms and are held together by a polysaccharide matrix. Pasteurised milk

is inoculated with the kefir grains for between 18 and 24 hours at 20 to 25°C. The kefir grains are then filtered off. As well as lactic acid, the combined fermentation produces CO₂, a small amount of alcohol, and aromatic substances. All together they give the kefir its organoleptically unique taste.

5 Kumyss, a refreshing, slightly brisk drink made from mare's milk by lactic and alcoholic fermentation, has been used by the nomadic tribes of Asia for thousands of years. Compared with cow's milk the lower casein content (casein/whey protein 1:1 instead of 4:1 in cow's milk) makes the product runny and the gel softer than Western sour milk products. Nowadays most kumyss
10 production is concentrated in Russia and Mongolia. Both kumyss and kefir are said to be highly beneficial to health.

Ymer, produced especially in Denmark, is a sour milk product of increased protein content. The product contains a minimum of 6% protein, 11% non-fat dry matter and 3.5% fat. Using a traditional method, pasteurised skim
15 milk is incubated with mesophilic mother cultures (starters) at temperatures of between 20 and 25°C until coagulation occurs. It is then gently stirred and heated and the emerging whey removed (up to approx. 50% of the milk volume). Cream is added to adjust the fat content, it is homogenised, cooled and packed. In modern production the dry matter is increased by
20 ultrafiltration.

To ensure an effective satiety inducing effect of the milk product, it is preferred that the whey proteins (α-LA and CMP) provide a significant amount of the caloric value of the milk product. For example, in one embodiment the whey fraction provides at least 10%, preferably at least 15 or
25 even 25% or more, of the total caloric content of the milk product. In another embodiment, the whey fraction contributes to at least 40%, preferably at least 50%, of the total caloric value provided by the proteins of the product

The invention also relates to the use of a whey fraction comprising α-LA and CMP, wherein the weight ratio between α-LA and GMP is ≥ 2 as a
30 satiety-enhancing agent and/or to increase energy expenditure

Also provided is the use of a whey fraction comprising the whey proteins α -lactalbumin (α -LA) and casein macropeptide (CMP), wherein the weight ratio between α -LA and CMP is ≥ 2 , as a (satiety-inducing) food additive, preferably as an additive for sour milk products.

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The (sour) milk product may of course contain one or more additional ingredients that are of benefit for health, in particular gut health. For example, it comprises at least one short (e.g. C₂- C₈) chain organic acid or a salt thereof. The organic acid may be selected from the group consisting of
10 lactate, citrate, hydroxycitrate, fumarate, adipate, propionate, acetate, tartarate, succinate and sorbate. The undissociated molecules of these short chain organic acids are in particular active against pathogens in the porte d'entree (place of entry), a process which is concentration- and pH- dependent.

15 A further beneficial ingredient for use in combination with the high α -LA/low CMP whey fraction is a milk oligosaccharide, in particular sialyllactose (3' and/or 6' sialyllactose), which can prevent the adherence of pathogens to the intestinal wall, for instance Gram-negative bacteria, like *E.coli* , *Salmonellae* or *Enterobacter sakazakii*. In this manner, the low content of CMP, also known
20 to inhibit pathogen adhesion, can be at least partially compensated for.

Other useful additives are oligopeptides and/or free amino acids, such as proline, non-digestible oligosaccharides including prebiotics, in particular FOS and/or GOS, free or conjugated fatty acids, including polyunsaturated fatty
25 acids (PUFAs), such as arachidonic acid (AA), eicosapentaenoic acid (EPA), docosahexaenoic acid (DHA), Gamma-Linolenic Acid (GLA), Dihomogamma Linolenic Acid (DHGLA), stearic acid (SA) and conjugated linolenic acid (CLA).

In still a further embodiment, a milk product provided herein further
30 comprising at least one polyphenol, preferably selected from the group

consisting of epigallocatechin gallate, resveratrol, hydroxytyrosol, oleuropein, polyphenols present in green tea extracts, catechins, polyphenols present in extracts of red grape skin, polyphenols present in olives and/or olive waste water, and their mixtures. Green tea polyphenols of particular interest for the present invention, catechins being most preferred. Green tea polyphenols are known phytochemicals that have antioxidant, anti-micromobial, anticancer, and anti-inflammation properties, and were recently found to promote skin homeostasis and protect against autoimmune diseases. Research shows that green tea can help with weight loss. Extracts of green tea have been used for medicinal purposes for generations in China. Green tea polyphenols in extracts are mostly water-soluble, and can be easily oxidized if they are mixed in emulsions containing water.

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Example I

A high protein yoghurt was prepared, to which as whey proteins were added Hiprotal 60MP or Vivinal Alpha (DOMO, Beilen, The Netherlands). Briefly, the yoghurt milk was pasteurized 1 minute at 85°C and cooled to 43-45°C after which the fermenting bacterial cultures were added. After fermentation to a pH of 4,4 the yoghurt was mixed and subsequently homogenized at 200 bar. Whey proteins were added (4,5 grams per 100 ml) to the homogenized yoghurt. The yoghurt contained 8 % protein in total, of which 3,5 % whole milk proteins and 4,5 % whey-proteins resp. resulting from Hiprotal 60MP and Vivinal.

Hiprotal is an ultrafiltrated whey protein powder with as typical analysis 60% protein, 26 % lactose , 6 % minerals, 4,5 % fat and 3,5 %

moisture. The whey protein fraction is characterized to comprise 16% CMP and 13 % alfa-lactalbumin so that the ratio a-LA / CMP is about 0.8.

Vivinal Alpha has as typical analysis : 72% protein , 12 % fat , 4,5 % minerals , 7 % lactose and 4,5 % moisture. The whey protein-fraction
5 comprises 22 % alfa-lactalbumin and 6 % CMP. Ratio a-LA /CMP 3,6 :1.

Example II

This Example describes the effect of the addition of either A) a whey protein
10 fraction having an a-LA/CMP ratio < 1 (whey) or B) a whey protein fraction having an a-LA/CMP ratio ≥ 2 to breakfast yoghurt drink on energy expenditure and satiety in humans.

15 Methods

35 subjects (aged 18-60 years; BMI: 23.0 ± 2.1 kg/m²) participated in an experiment with a randomised, 3 arms, crossover design where diet-induced energy expenditure, respiratory quotient and satiety were measured. They traveled by public transport or car, in order to avoid physical activity that
20 would have increased Resting energy expenditure (REE). Subjects arrived in the fasted state at 08.15h and were kept in a time-blinded surrounding. They emptied their bladder before the test. The subjects were lying in the supine position. After 30 min of rest, subjects received either one of the two breakfasts, consisting of the yoghurts supplemented with either Hiprotal
25 (herein referred to as "HP<1") or Vivinal Alpha ("HP ≥ 2 "). The tested sour milk products were iso-energetic.

Results.

Hunger and desire to eat were significantly more suppressed after the high protein yoghurt with a high a-LA/CMP ratio ($HP \geq 2$) than after the high-protein yoghurt with a relatively high CMP content ($HP < 1$). See table 1.

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Table 1. Area Under (or Above) Curve of desire to eat, hunger, satiety and fullness

10	HP<1	HP $\geq$ 2
Desire to eat	-5070.4 $\pm$ 873.8	-6750.6 $\pm$ 805.5#
Hunger	-5448.0 $\pm$ 913.0	-6627.4 $\pm$ 823.2*
15		
Satiety	6175.5 $\pm$ 842.0	6583.5 $\pm$ 730.2
Fullness	6245.6 $\pm$ 840.7	6584.1 $\pm$ 763.3

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All data are mean $\pm$ SE. ANOVA repeated measures.

25 Conclusion.

Hunger and desire to eat were significantly lower after $HP \geq 2$ yoghurt than after $HP < 1$ yoghurt # ($p < 0.01$), * ($p < 0.05$).

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Example III

Prepared was a $HP \geq 2$ yoghurt comprising Vivinal, as described in Example I. As an additional ingredient, 1 % potassium citrate was added.

5 Example IV

As example III, but 1% sodium fumarate was added instead of potassium citrate.

Example V

10 The product of example III, but instead of 1% lactose was incorporated 1 % sialyllactose.

Example VI

The product of example V but 0,5 % hydroxycitrate + 0,5 % sialyllactose was
15 added instead of 1% sialyllactose.

Example VII

Stirred yoghurt was prepared by inoculating skimmed milk, to which 1% by weight of skimmed milk powder was added, with traditional yoghurt cultures
20 of the type *S. thermophilus* and *L. bulgaricus*. The latter was cultured at 32°C until a pH value of 4.4 was reached. Thereafter, it was stirred to form a smooth composition while at the same time 2% by weight of a composition comprising unsaturated fatty acids, comprising a.o. AA, EPA and DHA was added. In addition, 2% by weight of Vivinal Alpha was added. The product was
25 cooled and filled in containers. This product is suitable for consumption once or more times a day, so as to provide a long lasting feeling of satiety while at the same time contributing to gut health.

Example VIII

Skimmed milk was incubated at 28 °C with a starter culture (*Streptococcus lactis/cremoris* and *Streptococcus diacetylactis*), while rennet was added as well. After 16 hours, a coagulum was formed and a pH value of 4,7 was
5 reached. The coagulum was then stirred thoroughly using a high speed agitator, after which the Quarg (also known as fresh cheese) was heated to 60°C for up to 3 minutes and then cooled. Subsequently, the whey was separated in a separator.

10 Cream and Vivinal Alpha were mixed with the coagulum at a temperature of 8 °C, after which the product was filled in containers and stored. Optionally, the Vivinal Alpha can be fully or partially hydrolyzed. Additional ingredients may be added, for instance fruits or parts thereof, seasonings, acidulants, stabilizers, unsaturated organic acids, prebiotics, flavours. Other beneficial
15 additives include those capable of inhibiting the accumulation of (visceral) fat and/or stimulating breakdown of the latter, such as hydroxycitrate, arachidonic acid (AA), pinolenic acid, CLA or green tea extract.

Claims

1. Use of a whey fraction comprising the whey proteins α -lactalbumin (a-LA) and casein macropeptide (CMP), wherein the weight ratio between a-LA and CMP is ≥ 2 , for the manufacture of a nutritional, dietary or pharmaceutical composition for promoting a healthy body weight.
2. Use according to claim 1, wherein the weight ratio a-LA to CMP is ≥ 3 , preferably ≥ 4 .
3. Use according to claim 1 or 2, wherein said whey fraction has an a-LA content of 20% to 36% and a CMP content of 3% to 15% of total protein.
4. Use according to any one of claims 1-3, wherein said whey fraction is further characterized by: (a) a lactose content of 10% or less; (b) a total protein content of 12.5% to 95%; (c) a fat content of 15% or less ; and / or (d) an ash content of 4.5% or less.
5. Use according to any of the preceding claims, wherein said whey fraction has a total protein content of 35% to 80%, preferably 70% to 77%.
6. Use according to any of the preceding claims, wherein said whey fraction comprises hydrolyzed whey proteins.
7. Use according to any of the preceding claims, wherein the pH of said nutritional, dietary or pharmaceutical composition is below 5.5, preferably below 5 and most preferably below 4.6.
8. A milk product comprising a whey fraction comprising α -lactalbumin (a-LA) and casein macropeptide (CMP), wherein the weight ratio between a-LA and CMP is ≥ 2 .
9. Milk product according to claim 8, wherein the weight ratio a-LA to CMP is ≥ 3 , preferably ≥ 4 .

10. Milk product according to claim 8 or 9, wherein the whey fraction provides at least 30% of the total caloric content of the milk product.
- 5 11. Milk product according to any one of claims 8-10, being a sour milk product having a pH below 5,5, preferably below 5 and most preferably below 4.6.
12. Milk product according to any one of claims 8-11, being a fermented milk product, preferably selected from the group consisting of, buttermilk, stirred yoghurt, set yoghurt and yoghurt drink.
- 10 13. Milk product according to any one of claims 8-11, being a curded milk product, preferably selected from the group consisting of quark (quarg), fresh cheese, cottage cheese, cream cheese, kefir, kumyss, viili and ymer.
- 15 14. Milk product according to any one of claims 8-13, further comprising at least one short chain organic acid or a salt thereof, preferably wherein the organic acid is selected from the group consisting of lactate, citrate, hydroxycitrate, fumarate, adipate, propionate, acetate, tartarate, succinate and sorbate.
- 20 15. Milk product according to any one of claims 8-14, further comprising at least one additive selected from the group consisting of oligopeptides and/or free amino acids, such as proline; non-digestible oligosaccharides including prebiotics, in particular FOS and/or GOS; free or conjugated fatty acids, including polyunsaturated fatty acids (PUFAs), such as arachidonic acid (AA), eicosapentaenoic acid (EPA), docosahexaenoic acid (DHA),
25 gamma-linolenic acid (GLA), dihomogamma linolenic Acid (DHGLA), stearic acid (SA) and conjugated linolenic acid (CLA).
- 30 16. Milk product according to any one of claims 8-15, further comprising at least one polyphenol, preferably selected from the group consisting of epigallocatechin gallate, resveratrol, hydroxytyrosol,

oleuropein, polyphenols present in green tea extracts, catechins, polyphenols present in extracts of red grape skin, polyphenols present in olives and/or olive waste water, and their mixtures.

- 5 17. Use of a whey fraction comprising the whey proteins α -lactalbumin (a-LA) and casein macropeptide (CMP), wherein the weight ratio between a-LA and GMP is ≥ 2 as a satiety-enhancing agent.
18. Use of a whey fraction comprising the whey proteins α -lactalbumin (a-LA) and casein macropeptide (CMP), wherein the weight ratio between a-LA and GMP is ≥ 2 to increase energy expenditure.
- 10 19. Use of a whey fraction comprising the whey proteins α -lactalbumin (a-LA) and casein macropeptide (CMP), wherein the weight ratio between a-LA and GMP is ≥ 2 , as a nutritional additive, preferably an additive for sour milk products.