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(54) Title: FOOD FAT COMPONENT INCLUDING UNSATURATED FAT AND BETA-GLUCAN, ITS PRODUCTION AND USE

(57) Abstract: The present invention relates to a food fat component which is capable to prevent oxidation of fatty acids and is especially beneficial for health. In particular, the present invention is suitable to increase the content of fiber and health beneficial beta-glucan in products and to produce desired fat profiles in products and to prevent oxidation of unsaturated fatty acids during processing and storing of the products. Thus, the food fat component is generally suitable to be used especially in production of foods improving their health and organoleptic properties. As practical examples within the food industry, mention can be made of the following applications: bakery products and other cereal products, meat products, dairy products, variety of convenience food products, snack and breakfast type products.

FOOD FAT COMPONENT INCLUDING UNSATURATED FAT AND BETA-GLUCAN, ITS PRODUCTION AND USE

Background of the invention

Field of the invention

The present invention relates to a food fat component which is capable of preventing oxidation of fatty acids and simultaneously improving both the nutritional profile and organoleptic properties of the product, and in which has been added health beneficial beta-glucan. In particular, the component of the present invention is suitable for diversification of nutritional profile and health effects of products. The invention also relates to a method suitable for the production of such a product, as well as products prepared by using this method.

Such food fat component is suitable for a variety of uses. It can be utilized, among other things, in breakfast and snack products and it is additionally suitable for dietary supplement, drug, pharmaceutical and cosmetic industry to improve the compositions of the product.

Description of related art

Beta-glucans are long chained polysaccharides which are composed of glucose units (Hu et al. 2015; Maheshwari et al. 2017). Beta-glucan is found in cereals, such as oats, barley, rye and wheat, and fungi, yeasts, bacteria and algae (Ahmad et al. 2012; Maheshwari et al. 2017). Structure and biological activities of beta-glucan from different sources differ (Zhu et al. 2016). Cereal beta-glucan is structurally linear and straightforward. There are β-(1,3)- and β-(1,4)- glycosidic bonds between glucose units in cereal beta-glucan. The ratios of β-(1,3)- ja β-(1,4)-bonds affect the properties, such as solubility, of the beta-glucan.

In cereals, beta-glucan acts as a structural component of the cell wall and belongs to soluble dietary fibers of cereal. Dietary fiber refers to carbohydrate polymers that are non-degradable in intestinal and thus unabsorbed. Colonic microbes are capable to ferment dietary fiber. In cereals, beta-glucan is most present in oats and barley (Hu et al. 2015). Oats

contains beta-glucan about 3 to 8 % and barley 2 to 20 % of their dry weight (Maheshwari et al. 2017). Oat bran contains about 6 to 12 % beta-glucan (Sibakov et al. 2012). Although barley contains more beta-glucan than oats, a larger proportion of oat beta-glucan is soluble (Maheshwari et al. 2017).

Technological properties of beta-glucan include, among other things, good water retention ability and gelling (Hu et al. 2015). Beta-glucan effectively binds water forming a viscous aqueous solution. The viscosity of beta-glucan is affected by its concentration, solubility and molecular weight (Ahmad et al. 2012). Other factors affecting the viscosity of beta-glucan and other functional properties are for example temperature and pH.

Beta-glucan has potential applications in the field of food, feed, cosmetic, pharmaceutical, veterinary and chemical industries (Zhu et al. 2016). The use of cereal beta-glucan in food applications is of interest due to the functional properties of beta-glucan, in particular associated with the property of acting as a dietary fiber. In addition to acting as a source of dietary fiber, beta-glucan can be utilized in the food industry for its technological properties. It can be used in foods as stabilizer, water binder, oil binder, in fat substitutes or as emulsifying stabilizer and as enhancer of rheological properties (Ahmad et al. 2012). The use of beta-glucan has been studied in food applications for example as an ingredient of meat products, bakery products, dairy products, beverages and extruded snack-type products to improve among other nutritional, organoleptic and structural properties of the products (Ahmad et al. 2012; Zhu et al. 2016).

There have been reported numerous beneficial health effects for beta-glucan of oats and barley, such as lowering blood cholesterol level, smoothing blood glucose and insulin levels, promoting beneficial intestinal microbial growth, facilitating constipation, increasing feeling of salinity and reducing risk of intestinal cancer and diabetes (Mälkki et al. 2001; Hu et al. 2015). Many of the beneficial health effects of beta-glucan are due to the fact that beta-glucan forms a viscous gelatinous mass in intestine. For example, the beneficial effects of beta-glucan for carbohydrate and lipid metabolism are due to the fact that increase in viscosity of digest slows down digestion and absorption of nutrients. Slowing down of glucose absorption prevents changes in blood sugar. According to a health claim approved by European Food Safety Authority (EFSA 2011b), beta-glucan of oats and barley has been shown to reduce the rise in post-meal sugar levels. The claim can be used for foods

containing at least dose of 4 grams of beta-glucan originating from oat or barley per every 30 absorbed carbohydrate grams as part of a meal.

The viscous gel formed by beta-glucan in the small intestine prevents the absorption of cholesterol from the diet. The beta-glucan gel also binds to bile acids. Cholesterol is needed for bile acids synthesis, thus the blood cholesterol level decreases when body cholesterol is used to form bile acids to replace the left ones.

According to health claims accepted by European Food Safety Authority (EFSA 2010; EFSA 2011a), beta-glucan of both oats and barley are shown to reduce blood cholesterol content, which may reduce the risk of cardiovascular diseases. An adequate dose to achieve beneficial effect is 3 grams of beta-glucan of oats or barley per day. The health claim can be used in products which include beta-glucan of oats or barley at least 1 g/dose. For example U.S. Food and Drug Administration (FDA 1997) has as well accepted the health claim concerning beta-glucan of oats and barley and risk of cardiovascular diseases, which claim relates to daily intake of at least 3 g of beta-glucan from food. The use of the claim requires that the food contains at least 0.75 g of beta-glucan per dose.

Dietary fat acid composition affects blood cholesterol levels. High intake of trans fatty acids and saturated fat compared to unsaturated fatty acids is a risk factor of cardiovascular diseases (Farvid et al. 2014). In meta-analysis of Mensink et al. (2003), it was found that replacement of saturated fatty acids with unsaturated fatty acids improved the ratio of total cholesterol and HDL-cholesterol of serum. The most effective effect was observed with oils, such as rapeseed, soy, sunflower and olive oil, which oils included high levels of cis-unsaturated fatty acids.

Patent application CN101999430 (A) presents a functional biscuit composition which is described to lower sugar and fat content of blood. In the manufacturing process of the biscuit, fiber-rich barley powder, beta-glucan, plant sterol and buckwheat flavonoids are added into it. Patent application CN106472641 (A) discloses a steak burger with a low glycemic index. The composition according to the application includes 1 to 10 % oat beta-glucan, $2x10^{-5}$ to$1x10^{-4}$ % chromium, 5 to 20 % white kidney bean extract, 5 to 20 % potato extract, 30 to 50 % gluten-containing flour, 3 to 20 % olive oil or 1 to 2 % yeast powder.

EP patent 2346361 (B1) discloses a naturally sweetened, low calorie beverage which is described to have a beneficial effect on cardiovascular health. Beverage products according to the patent comprise at least one fruit juice, one natural low energy sweetener, homogenized fruit pulp and beta-glucan. In certain embodiments, the composition according to the patent includes about 0.3 to 1.0 weight-% beta-glucan from oats, barley or both. The addition of beta-glucan is described to improve the mouthfeel of the beverage by increasing viscosity and by introducing the cholesterol-lowering effect to the product.

EP patent 1976393 (B1) describes a cereal based food suspension having a beta-glucan content of at least 0.25 g/100 g, preferably at least 0.5 g/100 g. The food suspension is prepared by heat treating a mixture of beta-glucan containing cereal material and water, wherein the starch of the cereal material gels and a suspension is obtained, by cooling the heat treated suspension and by mechanically treating the cooled suspension, wherein a stable food suspension is obtained. Cereal material refers to for example oats, barley, rye, rice, corn, millet or any combination of these. The cereal material is in a form of a bran, flour, flake, wholegrain, fiber concentrate or any combination of these.

Patent application JP2002306064 (A) discloses an emulsified oil and fat composition which includes cereal-derived beta-glucan. Patent JP4698038 (B2) describes an oil and fat composition containing cereal-derived beta-glucan, whereas patent JP4274748 (B2) discloses an oil and fat composition including microbe- or fungi-derived beta-glucan. Patent application WO201420734 (A1) discloses a solid oil- and fat-like composition which can be used in part or in full as a replacement of fat in foods containing fat. The composition includes β-1,3-glucane, which is preferably of microbial origin, oils and fats and gelatin.

Patent EP1361264 (B1) discloses a fat and oil composition including cereal-derived beta-glucan. Beta-glucan is mixed into the fat and oil matrix and the composition is formed by heating the mixture, which composition enables more even distribution of beta-glucan into the product compared to adding beta-glucan directly into the product. The invention is described to have beneficial effects on the texture and flavor properties compared to direct addition of beta-glucan. Patent also discloses an emulsified fat and oil composition containing beta-glucan, in which composition beta-glucan is added into a water and/or oil phase, and water and oil phase is emulsified. Different kinds of additives, such as stabiliz-

ing and emulsifying agents, can be used in the preparation of the composition according to the invention.

Patent CN101999475 (B) discloses a powdery fat or oil composition which contains some glucan, in particular beta-glucan. In the patent, fat or oil is capsulated by using glucan as encapsulating material. Micro capsulated composition is dried into a powder. In a method according to the patent, glucan powdered into a fine powder is dissolved in water and heated to 60 to 100 °C , hydrophilic emulsifier is added and mixed. Fat is heated to 69 to 90 °C, lipophilic emulsifier is added and mixed. Glucan and fat materials are combined, stabilizer is added and mixed. Next the composition is grinded twice by colloid mill and homogenized twice by a high pressure homogenizer. The obtained emulsion is spray-dried. As applications, mention can be made of food applications and medical applications.

US patent application 2005064068 (A1) describes an emulsified liquid baking fat composition, ingredients of which are dietary fiber gel, water and fat. The dietary fiber gel can be microparticulated by homogenization. The dietary fiber is mixed with water and fat and the mixture can be emulsified for example by colloid mill, homogenization or ultrasound treatment by using emulsifier. Emulsified mixture can be pasteurized. Health beneficial components, such as omega-3 and omega-6 fatty acids and beta-glucan, can be used in the composition.

Summary of the invention

The present invention is defined in the independent claims. Certain embodiments are defined in the dependent claims.

According to a first aspect the present invention relates to a food fat component which is capable to prevent oxidation of fatty acids and to diversify nutritional profile and health effects of the products containing it.

According to a second aspect the invention relates to a food fat component which comprises health beneficial soluble dietary fiber, beta-glucan, and unsaturated fat.

According to a third aspect the invention relates to a product wherein the above described food fat component is used to improve nutritional value and technological and organoleptic properties of the product.

According to a fourth aspect the invention relates to a method for the production of the food fat component or product as described above.

According to a fifth aspect the invention relates to the use of a food fat component or product according to the invention.

The method according to the invention and the component produced by the method preferably allows the production of products having a favorable nutritional profile, which products include health beneficial beta-glucan and unsaturated fatty acids. The method according to the invention and the component produced by the method enables the protection of soluble fat against oxidation, and in addition, the beta-glucan added to the component improves the health effects of the component. The food component according to the invention can be used in food products in such a way that the products meet the criteria of the health claim of the European Food Authority concerning beta-glucan decreasing cholesterol content.

The method according to the invention and the component produced by the method enables the protection of soluble fat against oxidation. In said invention the prevention of oxidation of fatty acids is based on a physical barrier and antioxidants optionally contained in the ingredients. The method of the invention allows the preservation of the nutritional quality of soluble fats as well as the prevention of primary oxidation and hence preferably improvement of the quality of fatty acids in the products compared with normal orally consumed products containing soluble fat.

Several benefits are achieved with the present invention. Firstly, the invention facilitates industrial production and provides added and novelty value to the use of a biomaterial containing fats and beta-glucan in industrial processes and in the use of products containing the component described by the invention improving the preservability and enjoyment of the product. The composition according to the invention allows the addition of health bene-

ficial soluble fiber, beta-glucan, to the products and it can be used to affect the desired organoleptic properties and structure properties, such as viscosity.

It has been surprisingly found in the invention that a food fat component preventing oxidation of fat acts as a preferable composition for beta-glucan having a property of digesting deliberately in more refined foods.

Such composition, in which low oxidizing homogenate composition is combined with beta-glucan-rich biomaterial, has not been previously described.

Embodiments

The present invention relates to a food fat component which is capable to prevent oxidation of fatty acids and which in addition comprises health beneficial dietary fiber, beta-glucan.

The component according to the present invention is particularly suitable to improve nutritional properties of products, and it can also have a beneficial effect on technological and organoleptic properties of the products according to the invention.

According to one embodiment the food fat component according to the present invention is based on food fat component presented in patent application FI20175435, in which component has been added beta-glucan.

The described patent application relates to a food fat component which is capable to preventing oxidation of fatty acids and simultaneously improving both the nutritional profile and organoleptic properties of the product. In said patent application the prevention of oxidation of fatty acids is based on a physical barrier and antioxidants optionally contained in the ingredients.

According to the mentioned patent application the function of the fat component is based on the idea that after the addition of protein and biomaterial (optionally also addition of electrolyte) to the oil-in-water mixture the fatty acids contained in the fat are bound by means of a mechanical treatment and assisted by the proteins into small particles, whereupon the proteins and the active chains of their amino acids are via their affinities and part-

ly via interatomic bonds conforted onto the surface of the particles. Also other biomaterial may be added to the mixture, after which the mixture is dehydrated, whereupon a finished food fat component is formed. By forming the oil-in-water mixture prior to addition of protein, the oil and fatty acids have been rendered into stable protected structures, *i.e.* the fat remains in the product without detaching and causing an unpleasant mouthfeel. With the decrease of water as a result of dehydration, the preservability of the food fat component is enhanced and oxidation of fats can simultaneously be reduced. Both the nutritional and organoleptic properties of the products can be improved by means of the presented food fat component.

According to a preferred embodiment, it is significant for the present invention to first form a mixture of oil and water, and optionally electrolyte. Oil-in-water mixture is formed by mixing oil effectively into the water, in which mixture small oil droplets are evenly mixed with the water. The system thus formed is, however, not stable because the oil repels water and small oil droplets easily combine to each other, wherein two separate phases are quickly formed.

Thus, protein should be added to the oil-in-water mixture where the oil droplets are still evenly distributed in the water phase.

Proteins are polar compounds with both hydrophilic and lipophilic parts. According to a preferred embodiment, a water soluble protein is used in the present invention. When water soluble protein is added to the above described oil-in-water mixture, the lipophilic parts of the protein seek on to the surface of the oil droplets before water molecules have time to form a shell around the protein, which shell weakens the interaction between protein and oil droplets. Thus, a protein membrane, in which the hydrophilic part of the protein is outward, is formed around the oil droplets. The hydrophilic part is surrounded by water molecules of the water phase by binding these tightly into the composition, which prevents drying of the food fat component during both storage and heating. Oil-in-water emulsion is formed, in which emulsion protein preferably acts as an emulsifier.

The protein sheath on the surface of the particles formed by the homogenous mixture thus prepared is capable to take in high amounts of biomaterial, after which it acts as a physical barrier creating protection against the environmental conditions for the beta-glucan con-

tained in the biomaterial. Thus, the food fat component according to the present invention acts as a preferred composition for beta-glucan, in which composition the beta-glucan does not degrade so easily during the storage and/or when utilized in more refined foods.

Typically, the food fat component according to the invention comprises 10 to 70 weight-% oil fat, 10 to 70 weight-% biomaterial and 1 to 40 weight-%, preferably 1 to 30 weight-% protein. In addition, the component comprises water and optionally an electrolyte. For example salts can be used as electrolytes. Water content, or more precisely moisture content, of a finished food component is typically 0.1 to 90 weight-%. The moisture content is affected by the possible dehydration, which is optional in the present invention. The moisture can be in the form of pure water or some other aqueous liquid. Milk and vegetable and fruit juices are liquids typically suitable for this purpose.

As biomaterial in the production of the food fat component according to the invention, use is typically made of biomaterial high in beta-glucan. As examples, mention can be made of beta-glucan powder, concentrated by generally known industrial methods, oats and barley flour, bran and semolina. Beta-glucan source of the biomaterial according to the invention is not restricted.

According to one embodiment the biomaterial contained in the food fat component comprises at least 2 weight-% beta-glucan.

According to another embodiment the biomaterial contained in the food fat component comprises 2 to 70 weight-%, more preferably 10 to 60 weight-%, for example 20 to 50 weight-%, beta-glucan.

In addition to the biomaterial containing beta-glucan, other biomaterials can be used. Carbohydrate containing biomaterial, but also proteins and fats containing biomaterial, can be used as other biomaterial. As examples, mention can be made of cereal flours, semolina or flakes (such as wheat, barley, rye, oats, spelt, millet, maize, rice or sorghum); pseudocereal flours, semolina or flakes (such as buckwheat, amaranth or quinoa); legumes (soybeans, peas, chickpeas, beans, lentils, lupines) or field beans. Part of the above mentioned cereals also contain beta-glucan but in smaller amounts than in oats and barley.

Any fat which at least upon heating is oil-like is suitable as the oil fat for use in the present invention. In fact, various different fats or lipid compounds can be used for the production of the component according to the invention, *i.e.* by using the method, different fat profiles can be generated for various orally consumed fat-containing biomatrices. As oil fat, use is typically made of vegetable fat or oil, such a s rapeseed or palm oil, shea butter, or a combination of these. Omega fatty acids are particularly beneficial.

Protein sources used in the invention are not restricted. Any protein obtainable from living organisms can be used in the invention.

According to a preferred embodiment, the protein used is a protein contained in egg, such as avidin, ovalbumin, conalbumin or lysozyme, or a soy protein, or several of these simultaneously.

According to a preferred embodiment the protein source contained in the food fat component has a protein content of at least 50 %, preferably at least 80 %, for example about 90 %.

According to a preferred embodiment, encapsulation of fat is performed without added stabilizing or emulsifying agents, in contrast to several already patented fatty acid microencapsulation methods. The protein source used preferably serves itself as emulsifier, such as in the case of egg. According to one embodiment, a separate emulsifier can also be used. When producing vegan products, for example lecithin can be used.

According to a preferred embodiment, the biomaterial and protein comprised in the food fat component are specifically derived from different sources. This is due to that the protein source should be protein-rich because it is the function of the protein to form a protein membrane around the oil droplets by its polar structure containing both hydrophilic and lipophilic parts. In turn, biomaterial is preferably carbohydrate-rich in order to able to fulfill its function among others by protecting the above described formed structure and acting as a moisture binder.

According to one embodiment biomaterial may also comprise protein and fat, but in that case use is preferably also made of additional protein source.

Ingredients of the food fat component added in right, in the present invention defined, order and mixed form an oil-in-water emulsion in which protein and biomaterial form, as a result of intensive homogenizing, a stable structure on the interfaces of the emulsion.

According to one embodiment the emulsion can be dehydrated, wherein a powder-like solid material is obtained.

According to a preferred embodiment the oil fat contained in the food component contains antioxidants. Antioxidants can, however, be added separately, as well as other oxidation-preventing additives. As additives, use can be made of some vitamins, and trace elements, such as vitamin E or C, selenium or L-tartaric acid, for example.

The present invention also relates to a product in which the food fat component according to the invention has been utilized. The product is typically a food or cosmetic product, or a medicament. The food fat component can be added to the mixture or it can be used to partly or completely replace a typically used fat, protein- or carbohydrate-based ingredient. The food fat component described by the invention can also be used as an independent ingredient in the above mentioned applications.

The food fat component according to the invention can also be used in the manufacture of healthcare equipment.

In one embodiment the food fat component according to the invention comprises a total of 1 to 90 % by weight of oil fat, protein and biomaterial. The product typically contains 10 to 70 weight-%, preferably 10 to 60 weight-%, both oil fat and biomaterial, and typically 2 to 60 weight-%, preferably 2 to 50 weight-%, protein. The amount of protein affects, besides mouth feel, taste and nutritional values, among other things the roast color of the product.. The roast color becomes more intense with increasing amount of protein.

According to a preferred embodiment the use of the product of the invention involves cooking or heating the product in a manner that the Maillard reaction will occur.

According to one embodiment the food fat component or product according to the invention can be used as carries matrix for different ingredients.

In the method according to the invention, a fat phase and salt are added into water to a water content of 20 to 80 weight-%, preferably 30 to 70 weight-%, and the mixture thus obtained is stirred at below 60°C, preferably below 50 °C, for less than 10 min. At the latest as a result of this heating the fat used will be in an oil-like form and an oil-in-water mixture has formed in which the fatty acids are dispersed in the aqueous phase. Protein is added to the mixture, and mechanical stirring is then continued. At the final stage, intense homogenizing treatment is applied for less than 10 min, preferably less than 3 min, until the mixture consists of a homogenous phase or phases. The protein is added at a temperature below 100 °C, preferably 0 to 70 °C, depending on the protein source. When necessary, an electrolyte, typically salts, can additionally be added to the mixture. Homogenization of the mixture is carried out by a commonly known mechanical method which is compatible with the viscosity of the desired mixture. Homogenization is preferably carried out with mechanically cutting blades.

In the next step the mixture is combined with biomaterial containing beta-glucan, wherein the food fat component according to the invention is obtained. Combining takes place by generally known mechanical treatments such as grinding, mixing, high pressure treatment, cutting treatment or a combination of these. The biomaterial must be hygienically clean and fulfill the requirements of generally acceptable standards. As the final result, a homogenous mass, mixture or suspension is obtained.

According to one embodiment the resulting mass, mixture or suspension is dehydrated by generally known and applicable processing methods (e.g. freeze-drying or vacuum drying), preferably by heat treatment. The heat treatment takes place typically at below 250 °C for a time of less than 45 min, depending on the viscosity of the mixture and the volume of the mixture to be processed. According to another alternative the mass, mixture or suspension is dehydrated at below 100 °, in which case longer (from 5 hours up to 48 hours) dehydration times are used, for example about 24 h. Dehydration enables the amount of water to be reduced in the product and the preservability of the product thus improved. Typically the moisture, *i.e.* typically water content of the dehydrated product is about 0.1 to 15 weight-%, depending on the drying conditions. As a result of the treatment the physical, chemical and/or organoleptically observed properties of the prepared product may change according to the pressure and temperature applied in the method. Dehydration is not a necessary step in the production of the food component according to the invention.

According to a preferred embodiment the resulting mass, mixture or suspension is dehydrated as a thin layer, particularly when using heat treatment. The thickness of the layer to be dehydrated is preferably less than 10 mm, for example about 2 to 8 mm, preferably about 5 to 6 mm.

According to one embodiment dehydration takes place through drying the mass, mixture or suspension *e.g.* by freeze-drying or vacuum drying at low temperatures.

According to another embodiment dehydration takes place through baking the mass, mixture or suspension by heat treatment. Preferably heat treatment takes place under 250 °C.

Adjustment of pH is possible during the production process. Since pH is of great importance as regards the functioning of proteins, it can be used to influence the behavior of proteins. At a favorable pH the functional capacity of proteins is highest, whereby they effectively bind fatty acids into small particles, preventing their oxidation. Adjustment of pH thus allows one to have an influence on the degree of oxidation of fatty acids and further on the nutritional profile of the product. For most proteins, the favorable functional pH is approximately 7 to 8.

As mentioned above, according to one embodiment it is possible to add various additional components, such as antioxidants and vitamins (tocopherols, vitamins A, D, E) into the product. The additional components can be components that improve the quality or healthiness of the products. Possible added ingredients include also various spices, aromas or flavorings. The components being added at the mixing stage may also be components reacting chemically with amino acids, forming physicochemical linkages or being based on close-range forces (van der Waals).

According to a preferred embodiment, the components optionally being added to the mixture at the mixing stage are oil-soluble.

The following non-limiting examples represent applications of the present technology.

PRODUCTION EXAMPLES

Production example 1 – Production of food fat component

Ina method according to the invention, 8 weight-% of rapeseed oil and 0.5 weight-% salt were added into water. The mixture was stirred at a temperature of 30 °C. 5 weight-% whey protein was added to the oil-in-water mixture and at the end of stirring intense mechanical mixing was applied until the mixture was homogenous. 14 weight-% oat flour and 17 weight-% beta-glucan-rich biomaterial were mixed with the homogenized mixture, after which the mass was heated at about 60 degrees for about 24 h until the mass exhibited a suitable dryness.

Production example 2 – Production of food fat component

Ina method according to the invention, 12 weight-% of rapeseed oil and 0.5 weight-% salt were added into water. The mixture was stirred at a temperature of 30 °C. 5 weight-% whey protein was added to the oil-in-water mixture and at the end of stirring intense mechanical mixing was applied until the mixture was homogenous. 7 weight-% oat flour and 21 weight-% beta-glucan-rich biomaterial were mixed with the homogenized mixture, after which the mass was heated at about 60 degrees for about 24 h until the mass exhibited a suitable dryness.

Production example 3 – Production of food fat component

10 weight-% of the food fat component produced by the method according to production example 2 was added into smoothie base containing berries, fruits and liquid. The smoothie base was mechanically mixed into smooth mass and the final product was packed with generally known industrial methods.

Production example 4 – Use of food fat component in muesli

40 weight-% of the food fat component produced by the method according to production example 1 was added to a muesli mix. The muesli mixture was packed with generally known industrial methods.

Production example 5 – Use of food fat component in spread

In a method according to the invention a mixture was formed of water, salt and rapeseed oil, which mixture was first homogenized about 5000 to 6000 rpm for about 3 minutes. 10 weight-% whey protein was added into the mixture and homogenization of the mixture was continued until the mixture was smooth. After that oat flour and beta-glucan-rich biomaterial was added into the mixture until the structure exhibited a suitable thickness for a spread, and garlic, lemon juice and black pepper were added as spices.

Production example 6 – Use of food fat component in plant-based beverage

In a method according to the invention oat milk was produced from whole grain oat flakes, in which oat milk was added 1.5 weight-% rapeseed oil and 0.5 weight-% salt. The mixture was stirred at a temperature of 40 °C. 3 weight-% soy protein and 8 weight-% beta-glucan-rich biomaterial was added into the oat milk-oil mixture. At the end of stirring intense mechanical mixing was applied until the mixture was homogenous. For example berries or fruits or coconut can be added into the oat-based milk beverage as flavoring agents.

Production example 7 – Use of food fat component in plant-based beverage

8 weight-% of the food fat component, produced by the method according to the production example 2 and minced into a small particle size, was added into oat milk, homogenized for a while and allowed to swell.

Production example 8 – Use of food fat component in oven porridge

The food fat component produced by the method according to the production example 1 was used as an ingredient of oven porridge. The oven porridge was produced by mixing liquid, oat flakes, dried fruits, salt and 10 weight-% of food fat component according to the invention. The composition was oven cooked by generally known methods until a favorable degree of maturity was achieved.

Production example 9 – Use of food fat component in snack bar

The food fat component produced by the method according to the production example 2was added into production mass to be used in production of cereal-based snack bars in such a way that proportion of the food fat component from the mass was 40 %. The production mass was heat-treated, cut into a shape of snack bars and packed by generally known industrial methods.

Production example 10 – Use of food fat component in muffin type pastry

30 weight-% of the food fat component produced by the method according to the production example 1was added into muffin dough. Production components of the muffin dough were mixed into smooth mass and the muffin dough was dispensed in baking molds by generally known industrial methods. The muffins were oven baked, cooled and packed by generally known industrial methods.

Industrial applicability

The present invention can be used in general to prepare a product containing the food fat component according to the invention.

In particular, the present invention is suitable to be used in products, the nutritional value, organoleptic properties or technological properties of which are to be improved. The present invention is suitable to increase the content of fiber and health beneficial beta-glucan in products and to produce a desired fat profile and to prevent oxidation of unsaturated fatty acids during processing and storing of the products. Thus, the food fat component is generally suitable to be used especially in production of foods improving their health and organoleptic properties.

As practical examples within the food industry, mention can be made of the following applications: bakery products and other cereal products, meat products, dairy products, variety of convenience food products, snack and breakfast type products.

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Claims

1. Food fat component which is capable to prevent oxidation of fatty acids and is beneficial for health, **characterized** in that, it comprises 10 to 70 weight-% oil fat, having 1 to 40 weight-% protein and 10 to 70 weight-% biomaterial comprising at least 2 weight-% beta-glucan added thereto.

2. The food fat component according to claim1, wherein the biomaterial containing beta-glucan comprises 2 to 70 weight-%, more preferably 10 to 60 weight-%, for example 20 to 50 weight-%, beta-glucan.

3. The food fat component according to claim 1 or 2, the moisture content of which is 0.1 to 15 weight-% after dehydration.

4. The food fat component according to any one of claims 1 to 3, which comprises oil fat which is vegetable fat or oil, such as rapeseed or palm oil, shea butter, or a combination of two or more of these fats, wherein the preparation comprises health beneficial fatty acids.

5. The food fat component according to any one of the claims 1 to 4, which comprises protein which is a protein derived from living organisms, preferably some of the proteins contained in egg, such as avidin, conalbumin, ovalbumin or lysozyme or a soy protein, or several of these simultaneously.

6. The food fat component according to any one of the claims 1 to 5, which, in addition to the biomaterial containing beta-glucan, comprises other biomaterial which is cereal flour, semolina or flakes, preferably wheat, barley, rye, oats, spelt, millet, maize, rice or sorghum; pseudocereal flours, semolina or flakes, preferably buckwheat, amaranth or quinoa; legumes, preferably soybeans, peas, chickpeas, beans, lentils, or lupines; field beans; or organic protein sources, preferably insects, seafood, chordates, mammals, fungi, algae or molds.

7. The food fat component according to any one of claims 1 to 6, comprising oil fat comprising antioxidants.

8. The food fat component according to any one of claims 1 to 7, in which have been added antioxidants or other oxidation-preventing additives, such as vitamins or trace elements.

9. A product comprising the food fat component according to any one of claims 1 to 8.

10. Use of food fat component according to any one of claims 1 to 8 or product according to claim 9 in food, pharmaceutical or cosmetic formulation.

11. A method for the production of the food fat component according any one of claims 1 to 8 or the product according to claim 9, **characterized** in that mechanical treatments are performed, in which treatments fat, protein, water, biomaterial containing beta-glucan and optional electrolytes are blended into a homogenous mixture.

INTERNATIONAL SEARCH REPORT

International application No.
PCT/FI2018/050970

A. **CLASSIFICATION OF SUBJECT MATTER**

See extra sheet

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC: A23D, A23L, A51K

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

FI, SE, NO, DK

Electronic data base consulted during the international search (name of data base, and, where practicable, search terms used)

EPODOC, EPO-Internal full-text databases, Full-text translation databases from Asian languages, WPIAP, PRH-Internal, XPESP, XPTK, COMPDX, BIOSIS, EMBASE, NPL, MEDLINE, GOOGLE

C. DOCUMENTS CONSIDERED TO BE RELEVANT

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X	CN 105361141 A (SHIYAN TIANXIANG BIOTECHNOLOGY CO LTD) 02 March 2016 (02.03.2016) & abstracts EPOQUENET EPODOC & WPI [online] & machine translation into English by TXPCNEA/EPO [online][retrieved 18.3.2019] claims 1, 2, 4, 5, 7, 8; p. 1, last paragraph	1-11
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☒ Further documents are listed in the continuation of Box C. ☒ See patent family annex.

* Special categories of cited documents:	
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International application No.
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C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

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X	JP 4698038 B2 (ASAHI DENKA KOGYO KK) 08 June 2011 (08.06.2011) & abstracts EPOQUENET EPODOC & WPI [online] & machine translation into English by EPO & GOOGLE [online] [retrieved 19.3.2019] paragraphs [0028], [0042]-[0044]; paragraph [0060], Example 10; claims 1, 4-11; cited in the application	1, 2, 4-11
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A23D 7/005 (2006.01)
A23L 29/00 (2016.01)
A23L 33/10 (2016.01)
A23L 33/21 (2016.01)
A61K 9/50 (2006.01)
A61K 8/11 (2006.01)