Title: WHOLE CEREAL FOOD PRODUCTS

Abstract: The present invention relates to food products derived from cereals grains in combination with one or more fruit, berry or vegetable. The invention further relates to processes to obtain such products, as well as the use of the products for the preparation of further processed food products.
WHOLE CEREAL FOOD PRODUCTS

FIELD OF THE INVENTION

The present invention relates to food products derived from cereals grains in combination with one or more fruit, berry or vegetable. The invention further relates to processes to obtain such products, as well as the use of the products for the preparation of further processed food products.

BACKGROUND OF THE INVENTION

A transition in the disease pattern is observed worldwide. Infectious diseases are gradually decreasing while chronic diseases as metabolic syndrome, cardiovascular diseases (CVD), cancer and diabetes increasingly characterise the disease pattern and accounts for a major cause of mortality, morbidity and disability, globally. The change in disease pattern is attributed an immense change in lifestyle pattern especially the increase access to food resources e.g. an unhealthy diet, tobacco smoking and the decreased need for physical activity. Strategies for chronic disease prevention and health promotion are thus of outmost relevance.

Natural occurring bioactive components from cereals, fruits, berries and vegetables have shown several and different health beneficial properties on chronic diseases and several diet-related initiatives have been promoted. In Denmark, the slogan "6-a-day - eat more fruits and vegetables" equivalent to the 5-a-day campaigns in several other countries was launched in 1998 to recommend the public to increase its intake of fruit and vegetables to 600 g/d. The recommendation originates from review of evidence on fruit and vegetables preventative effect on a number of chronic diseases. This includes the complex and, most likely, combined effects of various fruit and vegetable components that induces defence enzymes, has antioxidant effects, affect the hormonal system, selectively kills cancer cells, hinders blood coagulation in blood vessels or in other way protects against cancer or heart diseases. Moreover, a diet high in fruit and vegetables and thus rich in antioxidants, folate and flavonoids are associated with lower levels of biomarkers for inflammation and oxidative stress. Recently, berries were shown to have highest antioxidant activity and melons the lowest antioxidant activity of 25 fruits tested and furthermore, the cellular antioxidant activity was shown to correlate
with the total content of phenolics. The antioxidants especially the folate and flavonoids present in fruit and vegetable are associated with reduction in inflammatory markers, which supports the beneficial effects on chronic disease development. The protective properties begin early in life, which suggests that sustained high intake of fruits and vegetables through childhood and adolescent years to adult life may amplify the beneficial health properties on reducing the risk of chronic diseases. However, the contribution of antioxidant to prevention of oxidative damage is controversial and it remains yet to be elucidated which components of a plant based diet are protective and their mechanisms of action.

Similarly, the health beneficial properties of a high intake of whole grains and thereby dietary fibres have been associated with low risk of type 2 diabetes and cardiovascular disease especially effected by the insoluble fibre. The soluble fibre has, in addition, shown favourable effects on postprandial glucose and insulin responses, glycaemia, lipid profile and gastrointestinal motility. Oats contain a high content of soluble fibres e.g. β-glucan but contains also insoluble fibres as arabinoxylans and cellulose. The physiological effects of β-glucan on lowering plasma glucose and insulin response, decreasing serum cholesterol levels and exhibiting high excretion of bile acids are directly associated with the functional physico-chemical properties of β-glucan. β-glucan exhibit high viscosities at relatively low concentrations, which results in slower gastric emptying and slower absorption of nutrients. High MW β-glucan predominantly displays viscous flow behaviour whereas gelation may be observed particularly in solutions of low MW. The higher proportion of (1→3)-linked cellotriosyl units in the structure the more rapid the gelation and, thus barley β-glucan will gel more readily than oat β-glucan at the same concentration and MW.

In the large intestine, β-glucan are readily fermented by the colonizing bacterias present in caecum and the upper colon. Oats have shown to increase the proportion of butyrate. Butyrate has regulatory functions in cell proliferation and differentiation, β-glucan leads mainly to the production of propionate, which has been suggested as one of the mechanisms for the cholesterol lowering effects of oats and other β-glucan containing products.

The stability of various classes of polyphenols antioxidants in an apple juice is a function of storage temperature and oxygen concentration. The most thermally sensitive
compounds are the various quercetin glycosides and epicatechin, whereas phloridzin and chlorogenic acid are more stable. (J. Agric. Food Chem., 2005, 53 (4), pp 1073-1080)

Chlorogenic acid belongs to a family of naturally occurring organic compounds which are esters of cinnamic acids and (-)-quinic acid. It is an important biosynthetic intermediate. It also is one of the phenols found in coffee, in the bamboo Phyllostachys edulis as well as many other plants. This compound, long known as an antioxidant, also slows the release of glucose into the bloodstream after a meal.

Chlorogenic acid is both an antioxidant and an inhibitor of the tumor promoting activity of phorbol esters. Chlorogenic acid and caffeic acid are antioxidants in vitro and might therefore contribute to the prevention of Type 2 Diabetes Mellitus and cardiovascular disease. It is claimed to have antiviral, antibacterial and antifungal effects with relatively low toxicity and side effects, alongside properties that do not lead to antimicrobial resistance.

Chlorogenic acid is one of the compounds which are responsible for making a brown color in apple products when enzymatically transformed.

Chlorogenic acid concentrations in juice have been measured to be as low as 1 mg/100 ml of juice, and flavonol glycosides at levels as low as 0.2 mg/100 ml. Results for several apple juices, indicates concentrations of chlorogenic acid ranging from 12-31 mg/100 ml juice. Flavonol glycosides in conventional juices has been measured to 0.4-0.7 mg/100 ml, whereas special juices has 6.5-8.5 mg/100 ml.


Oat beta-glucan is a soluble fiber. It is a viscous polysaccharide made up of units of the monosaccharide D-glucose. Oat beta-glucan is composed of mixed-linkage polysaccharides. This means that the bonds between the D-glucose or D-glucopyranosyl units are either beta-1, 3 linkages or beta-1, 4 linkages. This type of beta-glucan is also referred to as a mixed-linkage (1→3), (1→4)-beta-D-glucan. The (1→3)-linkages break up the uniform structure of the beta-D-glucan molecule and make it soluble and flexible.
WO 2007/044737 is directed to formed foods that include at least one soluble anionic fibre and at least one multivalent cation and methods for inducing satiety in an animal, reducing caloric intake in an animal, reducing weight in an animal, improving weight reduction in an animal, and decreasing blood glucose and insulin levels using the ingestible compositions.

DE 101 49 076 A1 relates to a composition containing oat bran and at least one further component selected from apple fibres and/or apple fibre flakes, artichoke, alfalfa, green tea, garlic, Fenugreek, Javanese turmeric, walnuts, linseed and sesame.

EP 1 872 666 relates to a process for the preparation of a whole grain-containing composite food products.

US897181 relates to a process for the preparation of cereals.

OBJECT OF THE INVENTION

It is an object of embodiments of the invention to provide food products maintaining the plant constituents in a highly native state, without removing or significantly changing the constituents of the food products.

SUMMARY OF THE INVENTION

It has been found by the present inventors that well-tasting food products maintaining the plant constituents in a highly native state may be produced by simple processes and that the food products may be designed with respect to taste, colour, energy content to fit individual needs and other requirements for the products.

In a broad aspect the present invention relates to food product derived from at least one whole cereal grain in combination with at least one whole fruit, berry or vegetable.

So, in a first aspect the present invention relates to a food product obtainable by a process comprising the steps of

a) Disintegration of at least one whole cereal grain;
b) Disintegration of at least one whole fruit, berry or vegetable;

c) Separation into a soluble and an insoluble fraction of said at least one whole cereal grain;

d) Separation into a soluble and an insoluble fraction of said at least one whole fruit, berry or vegetable; and

e) Combination of said soluble or insoluble fractions obtained in steps c) and d) in a predetermined ratio to produce a whole food drink or a whole food fibre product, respectively.

In a second aspect, the present invention relates to a process for the production of a food product comprising the steps of

a) Disintegration of at least one whole cereal grain;

b) Disintegration of at least one whole fruit, berry or vegetable;

c) Separation into a soluble and an insoluble fraction of said at least one whole cereal grain;

d) Separation into a soluble and an insoluble fraction of said at least one whole fruit, berry or vegetable; and

e) Combination of said soluble or insoluble fractions obtained in steps c) and d) in a predetermined ratio to produce a whole food drink or a whole food fibre product, respectively.

In a third aspect, the present invention relates to the use of a food product according to the invention in the preparation of a further processed food product, such as one selected from bread, ice cream, or cake.

In a further aspect, the present invention relates to a kit comprising

a) a whole food fibre product according to the invention; and
b) a whole food drink according to the invention.

DETAILED DISCLOSURE OF THE INVENTION

It has surprisingly been found that beverage and solid food products can be made by mild processing and without processing aids, such as pH adjustments, preservation chemicals and enzymes, of whole cereals such as whole oat in combination with whole fruit, berries, vegetable and aromatic plant extracts.

Where, mild processing is an optimization of process parameters aiming at maintaining the plant constituents in a highly native state, i.e. no temperatures above 100 °C is applied, and further heat treatments, in terms of time and temperature, is minimized to inactivation of the raw material's own enzymes which otherwise would destroy the products and to secure general food safety, such as microbial contamination.

The combined processing represented by the present invention results in two types of products which in combination deliver an easy and well tasting administration of soluble carbohydrates such as β-glucans, dietary fibres, proteins, poly-phenols, antioxidants, minerals, vitamins and lipids.

In particular and as an example a daily intake of more than 3 g β-glucan can be administrated by drinking approximately 1 liter of beverage and eating approximately 2 x 50g-140 g fruit and oat powder or 140 g as biscuits. Further in aforementioned example the content of approximately 6-880 grams apples is administrated.

The flexibility of the technology applied enables preparation of a wide variety of combinations which enable adjustment to cultures and needs worldwide, i.e. beverage and biscuits flavor can be adjusted using local preferences and further the energy, protein and fat content can be adjusted.

The aim of this project is to produce unique combinations of fruits, berries, vegetables and grains (oat) specific for children and adolescent and for adults to result in healthier life style and decreasing risk of chronic diseases later in life. With the specific focus on preservation of bioactivity components of the designed products, it seems reasonable to establish unique combinations of the antioxidant capacity which have been shown to be high in berries (such as strawberries, cherries, blackcurrants, blackberries and
blueberries) with the various established health beneficial effects of especially β-glucan in oats.

The invention is characterised by combining cereals, fruits, berries, vegetables and if appropriate water to make a whole food drink and a whole food fibre bar.

Cereals such as whole seeds of wheat, oat, barley, rye etc. is mixed with fruits such as apples, pears, lemons, lime fruits, oranges, mango, tomatoes, cucumbers etc., berries such as straw barriers, cherries, black currants, crane barriers, plums, etc., vegetables such as carrots, beat roots, sugar beats, cabbage, broccoli etc. and if appropriate water to make a whole food drink and a whole food fibre bar.

It is an aspect of the invention to make whole food drinks and whole food fibre bars containing a high level of natural native biological components such as vitamins, carbohydrates, polyphenols, antioxidants, proteins, lipids, glucosides, glucosinolates and soluble/insoluble fibres characterised by any combination of cereals, fruits, barriers and vegetables as described in the first aspect of the invention.

Further aspects of the invention are characterised by making use of simple gentle processing methods tailored to requirements of each single ingredients, wherein;

a) The ingredients are stored, at temperatures such as -30 °C to 25 °C, as intact cereals, fruits, berries and vegetables;

b) Pressed or mixed in any appropriate tank or mixer with cold water and/or if appropriate a short heat treatment can be applied;

c) Blending or wet milling of the mixture to increase solubility of soluble components;

d) Separation of the mixture into a liquid rich in soluble components and a solid fraction rich in water insoluble fibres by use any appropriate separation system such as decanter, centrifuges or sieves;

e) The liquid fraction is tapped as whole food drink; and
The solid fraction is dewatered at low temperature and pressure by use of methods such as gentle pressing, milling, low temperature dry air, vacuum or any combination hereof, and formed to a whole food fibre bar.

It is noted that a reduction of microbial contamination to food safety levels may be obtained by optional washing or cleaning of the ingredients and optionally short steam treatment of the intact cereals, fruits, berries and vegetables and/or by short heat treatment after b), c), d) or e).

Further aspects of the invention are characterised by combining whole oat and whole apples to make a whole food drink and a whole fibre bar characterised by having a content of:

**Oat**
- Beta-D-glucans
- Pantothenic acid (B5)
- Folate (Vit. B9)
- (α, β) - Tocopherols (E-vitamines)
- (α, β) - Tocotrienols (E-vitamines)
- p-coumaric acid
- Ferulic acid
- Caffeic acid
- Vanillin
- (c,f,p) - Avenanthramides
- Avenalin
- Avenin

**Apple**
- Vitamin A
- Thiamin (Vit. Bl)
- Riboflavin (Vit. B2)
- Niacin (Vit. B3)
- Pantothenic acid (B5)
- Vitamin B6
- Folate (Vit. B9)
- Vitamin C
- Quercetin, Quercetin 3-glycosides
- Epicatechin
- Procyanidin B2
Further aspects of the invention are characterised by combining whole oat, whole apples and whole carrots to make a whole food drink and a whole fibre bar characterised by having a content of:

**Oat**
- Beta-D-glucans
- Pantothenic acid (B5)
- Folate (Vit. B9)
- $(\alpha, \beta)$ - Tocopherols (E-vitamines)
- $(\alpha, \beta)$ - Tocotrienols (E-vitamines)
- p-coumaric acid
- Ferulic acid
- Caffeic acid
- Vanillin
- (c.f,p) - Avenanthramides
- Avenalin
- Avenin

**Apple**
- Vitamin A
- Thiamin (Vit. Bl)
- Riboflavin (Vit. B2)
- Niacin (Vit. B3)
- Pantothenic acid (B5)
- Vitamin B6
- Folate (Vit. B9)
- Vitamin C
- Quercetin, Quercetin 3-glycosides
- Epicatechin
- Procyanidin B2
- Myricetin
- Kampeferol
Further aspects of the invention are characterised by combining whole oat, whole apples or whole carrots or beet root or broccoli to make a whole food drink characterised by having the colours according to the following guidance:

Off white or light red characterised by the pigments contained in oat and apples such as anthocyanin, cyanidin.

Light yellow/orange characterised by the pigments contained in oat, apples and carrots such as carotenes, β-carotene.

Light red characterised by the pigments contained in oat, apple, black currant and beet root such as anthocyanins, betalain pigments, indicaxanthin and vulgaxanthins.

Light green characterised by the pigments contained in oat, apple and broccoli such as chlorophyll.

Further aspects of the invention are characterised by using the coloured pigments as visual indicator for the oxidation state of the whole food drinks.
Oats are generally considered "healthy", or a health food, being touted commercially as nutritious. The discovery of the healthy cholesterol-lowering properties has led to wider appreciation of oats as human food.

Oat bran is the outer casing of the oat. Its consumption is believed to lower LDL ("bad") cholesterol, and possibly to reduce the risk of heart disease.

After reports found that oats can help lower cholesterol, an "oat bran craze" swept the U.S. in the late 1980s, peaking in 1989, when potato chips with added oat bran were marketed. The food fad was short-lived and faded by the early 1990s. The popularity of oatmeal and other oat products again increased after the January 1998 decision by the Food and Drug Administration (FDA) when it issued its final rule allowing a health claim to be made on the labels of foods containing soluble fibre from whole oats (oat bran, oat flour and rolled oats), noting that 3.00 grams of soluble fibre daily from these foods, in conjunction with a diet low in saturated fat, cholesterol, and fat may reduce the risk of heart disease. In order to qualify for the health claim, the whole oat-containing food must provide at least 0.75 grams of soluble fibre per serving. The soluble fibre in whole oats comprise a class of polysaccharides known as Beta-D-glucan.

Beta-D-glucans, usually referred to as beta-glucans, comprise a class of non-digestible polysaccharides widely found in nature in sources such as grains, barley, yeast, bacteria, algae and mushrooms. In oats, barley and other cereal grains, they are located primarily in the endosperm cell wall.

Intact beta-glucan from oat has a molecular weight around 1.0 - 2.0 x 10^6, however processing can have a large effect on the molecular weight of beta-glucans. Degradation of cereal beta-glucan is usually attributed to enzymes such as beta-glucanases, acid hydrolysis or Fenton type oxidation all leading to depolymerisation or degradation of beta-glucans, in processing oats it is therefore important to avoid condition which favors degradation.
By preparing whole food kits using whole cereals, fruits, berries and vegetables, and mild processing conditions, as described, it has surprisingly been found that well tasting beverage and fibre products can be prepared with a surprisingly high preservation of antioxidants such as chlorogenic acid.

A significant aspect of preparation of food kit is that the whole cereals, fruits, berries and vegetables are stored appropriate in their intact structure and under conditions which are well described and known to the industry. I.e. Cereals are stored dry at ambient temperature, fruits, berries and vegetables are stored cold under controlled atmosphere. Further, as a special aspect the whole raw materials are processed simultaneously at the same day as described in the examples. Further, an important aspect is that the food kit can be produced on a daily basis all year, providing healthy products all year.

**Whole food drink**

In some embodiments the concentration of chlorogenic acid in the whole food drink prepared according to the present invention is higher than at least about 1 mg/100 ml or at least about 50 %, such as at least about 60 %, such as at least about 70%, such as at least about 80, or at least about 90-100 % of the content of the raw material used in the whole food drink.

In some embodiments the concentration of flavonol glycosides in the whole food drink prepared according to the present invention is higher than at least about 0.2 mg/100 ml.

In some embodiments the concentration of beta-glucan in the whole food drink prepared according to the present invention is higher than at least about 20, such as at least about 30, such as at least about 40, such as at least about 50 mg/100 ml.

In some embodiments the concentration of dietary fibers in the whole food drink prepared according to the present invention is higher than at least about 50, such as at least about 70, such as at least about 80, such as at least about 90, such as at least about 100 mg/100 ml.

In some embodiments the molecular weight of beta-glucans in the whole food drink prepared according to the present invention is higher than at least about 1.0 x 10^6.

**Whole food fiber product**
In some embodiments the concentration of chlorogenic acid in the whole food fibre product prepared according to the present invention is higher than at least about 0.8 mg/100 g or at least about 50%, such as at least about 60%, such as at least about 70%, such as at least about 80, or at least about 90-100% of the content of the raw material used in the whole food fibre product.

In some embodiments the concentration of flavonol glycosides in the whole food fibre product prepared according to the present invention is higher than at least about 0.16 mg/100 g.

In some embodiments the concentration of beta-glucan in the whole food fibre product prepared according to the present invention is higher than at least about 2 g/100 g.

In some embodiments the concentration of Dietary fibers in the whole food fibre product prepared according to the present invention is higher than at least about 10 g/100 g.

In some embodiments the molecular weight of beta-glucans in the whole food fibre product prepared according to the present invention is higher than at least about 1.0 x 10^6.

Oat beta-glucan is a soluble fibre. It is a viscous polysaccharide made up of units of the sugar D-glucose. Oat beta-glucan is comprised of mixed-linkage polysaccharides. This means that the bonds between the D-glucose or D-glucopyranosyl units are either beta-1, 3 linkages or beta-1, 4 linkages. This type of beta-glucan is also referred to as a mixed-linkage (1,3), (1,4)-beta-D-glucan. The (1,3)-linkages break up the uniform structure of the beta-D-glucan molecule and make it soluble and flexible. In comparison, the non-digestible polysaccharide cellulose is also a beta-glucan but is non-soluble. The reason that it is non-soluble is that cellulose consists only of (1,4)-beta-D-linkages. The percentages of beta-glucan in the various whole oat products are: oat bran, greater than 5.5% and up to 23.0%; rolled oats, about 4%; whole oat flour about 4%.

Oats after corn (maize) has the highest lipid content of any cereal, e.g., greater than 10 percent for oats and as high as 17 percent for some maize cultivars compared to about 2-3 percent for wheat and most other cereals. The polar lipid content of oats (about 8-17% glycolipid and 10-20% phospholipid or a total of about 33%) is greater than that of other cereals since much of the lipid fraction is contained within the endosperm.
Oats

Nutritional value per 100 g (3.5 oz)

<table>
<thead>
<tr>
<th>Component</th>
<th>Value 100 g</th>
<th>Percentages</th>
</tr>
</thead>
<tbody>
<tr>
<td>Energy</td>
<td>390 kcal</td>
<td>1630 kJ</td>
</tr>
<tr>
<td>Carbohydrates</td>
<td>66 g</td>
<td></td>
</tr>
<tr>
<td>Dietary fibre</td>
<td>5 g</td>
<td></td>
</tr>
<tr>
<td>Fat</td>
<td>7 g</td>
<td></td>
</tr>
<tr>
<td>Protein</td>
<td>17 g</td>
<td></td>
</tr>
<tr>
<td>Pantothenic acid (B5)</td>
<td>1.3 mg</td>
<td>26%</td>
</tr>
<tr>
<td>Folate (Vit. B9)</td>
<td>56 µg</td>
<td>14%</td>
</tr>
<tr>
<td>Iron</td>
<td>5 mg</td>
<td>40%</td>
</tr>
<tr>
<td>Magnesium</td>
<td>177 mg</td>
<td>48%</td>
</tr>
<tr>
<td>β-glucan (soluble fibre)</td>
<td>4 g</td>
<td></td>
</tr>
</tbody>
</table>

Percentages are relative to US recommendations for adults.

Source: USDA Nutrient database

Protein

Oat is the only cereal containing a globulin or legume-like protein, avenalin, as the major (80%) storage protein. Globulins are characterized by water solubility; because of this property, oats may be turned into milk but not into bread. The more typical cereal proteins such as gluten and zein are prolamines (prolamins). The minor protein of oat is a prolamine: avenin.

Oat protein is nearly equivalent in quality to soy protein, which has been shown by the World Health Organization to be equal to meat, milk, and egg protein. The protein content of the hull-less oat kernel (groat) ranges from 12-24%, the highest among cereals.

Celiac Disease

Coeliac disease, or celiac disease, from Greek "koiliakos", meaning "suffering in the bowels", is a disease often associated with ingestion of wheat, or more specifically a group of proteins labelled prolamines, or more commonly, gluten.
Oats lack many of the prolamines found in wheat; however, oats do contain avenin. Avenin is a prolamine that is toxic to the intestinal submucosa and can trigger a reaction in some celiacs.

Although oats do contain avenin, there are several studies suggesting that oats can be a part of a gluten free diet if it is pure. The first such study was published in 1995. A follow-up study indicated that it is safe to use oats even in a longer period.

Additionally, oats are frequently processed near wheat, barley and other grains such that they become contaminated with other glutenins. Because of this, the FAO's Codex Alimentarius Commission officially lists them as a crop containing gluten. Oats from Ireland and Scotland, where less wheat is grown, are less likely to be contaminated in this way.

Oats are part of a gluten free diet in, for example, Finland and Sweden. In both of these countries there are "pure oat" products on the market.

**Antioxidants**

Oat contains antioxidants such as

- $(\alpha, \beta)$ - Tocopherols (E-vitamines)
- $(\alpha, \beta)$ - Tocotrienols (E-vitamines)
- p-coumaric acid
- Ferulic acid
- Caffeic acid
- Vanillin
- $(c,f,p)$ - Avenanthramides

**Antioxidant in berries such as blackcurrant**

Antioxidants such as (polyphenols/anthocyanins) from blackcurrants have been demonstrated in laboratory experiments with potential to inhibit inflammation mechanisms suspected to be at the origin of heart disease, cancer, microbial infections or neurological disorders like Alzheimer's disease. Major anthocyanins in blackcurrant pomace are delphinidin-3-O-glucoside, delphinidin-3-O-rutinoside, cyanidin-3-O-glucoside, and cyanidin-3-O-rutinoside which are retained in the juice concentrate among other yet unidentified polyphenols.
**Carrot juice constituents**

Carrot juice has a particularly high content of Provitamin A (β-carotene), but is also high in B complex vitamins and many minerals including calcium, copper, magnesium, potassium, phosphorus, iron, and folic acid.

Carrot, raw (Nutritional value per 100 g (3.5 oz), Energy 40 kcal  170 kJ):

- Sugars  5 g
- Dietary fibre  3 g

Fat  0.2 g

Protein  1 g

Vitamin A equiv.  835 µg  93%
- β-carotene  8285 µg  77%

Thiamin (Vit. Bl)  0.04 mg  3%
Riboflavin (Vit. B2)  0.05 mg 3%

Niacin (Vit. B3)  1.2 mg  8%

Vitamin B6  0.1 mg  8%

Vitamin C  7 mg  12%
Calcium  33 mg  3%
Iron  0.66 mg  5%

Magnesium  18 mg  5%
Phosphorus  35 mg  5%
Potassium  240 mg  5%
Sodium  2.4 mg  0%

(Percentages are relative to US recommendations for adults)

**Apples**

An old proverb attests to the health benefits of the fruit: "An apple a day keeps the doctor away." Research suggests that apples may reduce the risk of colon cancer, prostate cancer and lung cancer. Like many fruits, apples contain Vitamin C as well as a host of other antioxidant compounds, which may reduce the risk of cancer by preventing DNA damage. The fibre content, while less than in most other fruits, helps regulate bowel movements and may thus reduce the risk of colon cancer. They may also help with heart disease, weight loss and controlling cholesterol, as they do not have any cholesterol, have fibre (which reduces cholesterol by preventing reabsorption), and are bulky for their caloric content like most fruits and vegetables.
There is evidence that in vitro, apples possess phenolic compounds which may be cancer-protective and demonstrate antioxidant activity. The predominant phenolic phytochemicals in apples are quercetin, epicatechin, and procyanidin B2. The seeds are mildly poisonous, containing a small amount of amygdalin, a cyanogenic glycoside; usually not enough to be dangerous to humans, but it can deter birds.

Apples, with skin (edible parts), Nutritional value per 100 g (3.5 oz), Energy 50 kcal (220 kJ)

<table>
<thead>
<tr>
<th>Carbohydrates</th>
<th>13.81 g</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Sugars</td>
<td>10.39 g</td>
</tr>
<tr>
<td>- Dietary fibre</td>
<td>2.4 g</td>
</tr>
<tr>
<td>Fat</td>
<td>0.17 g</td>
</tr>
<tr>
<td>Protein</td>
<td>0.26 g</td>
</tr>
<tr>
<td>Vitamin A equiv.</td>
<td>3 µg</td>
</tr>
<tr>
<td>Thiamin (Vit. Bl)</td>
<td>0.017 mg</td>
</tr>
<tr>
<td>Riboflavin (Vit. B2)</td>
<td>0.026 mg</td>
</tr>
<tr>
<td>Niacin (Vit. B3)</td>
<td>0.091 mg</td>
</tr>
<tr>
<td>Pantothentic acid (B5)</td>
<td>0.061 mg</td>
</tr>
<tr>
<td>Vitamin B6</td>
<td>0.041 mg</td>
</tr>
<tr>
<td>Folate (Vit. B9)</td>
<td>3 µg</td>
</tr>
<tr>
<td>Vitamin C</td>
<td>4.6 mg</td>
</tr>
<tr>
<td>Calcium</td>
<td>6 mg</td>
</tr>
<tr>
<td>Iron</td>
<td>0.12 mg</td>
</tr>
<tr>
<td>Magnesium</td>
<td>5 mg</td>
</tr>
<tr>
<td>Phosphorus</td>
<td>11 mg</td>
</tr>
<tr>
<td>Potassium</td>
<td>107 mg</td>
</tr>
<tr>
<td>Zinc</td>
<td>0.04 mg</td>
</tr>
</tbody>
</table>

(Percentages are relative to US recommendations for adults.

Source: USDA Nutrient database)

**Beta vulgaris**

Beta vulgaris roots contain significant amounts of vitamin C, whilst the leaves are an excellent source of vitamin A. They are also high in folate, soluble and insoluble dietary fibre and antioxidants. It is among the sweetest of vegetables, containing more sugar
even than carrots or sweet corn. The content of sugar in beetroot is no more than 10%; in the sugar beet it is typically 15 to 20%.

An average sized cup (225.8 grams) of sliced beets will contain:

<table>
<thead>
<tr>
<th>Food</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carbohydrate</td>
<td>8.5 g</td>
</tr>
<tr>
<td>Dietary fibre</td>
<td>1.5 g</td>
</tr>
<tr>
<td>Folate</td>
<td>53.2 µg</td>
</tr>
<tr>
<td>Phosphorus</td>
<td>32 mg</td>
</tr>
<tr>
<td>Potassium</td>
<td>259 mg</td>
</tr>
<tr>
<td>Protein</td>
<td>1.5 g</td>
</tr>
</tbody>
</table>

Beet roots are rich in the nutrient betaine. Betaine supplements, manufactured as a byproduct of sugar beet processing, are prescribed to lower potentially toxic levels of homocysteine (Hey), a homologue of the naturally occurring amino acid cysteine, and can be harmful to blood vessels thereby contributing to the development of heart disease, stroke, and peripheral vascular disease.

**Red colouring**

The colour of red beet root is due to a variety of betalain pigments, unlike most other red plants, such as red cabbage, which contain anthocyanin pigments. The composition of different betalain pigments can vary, giving breeds of beetroot which are yellow or other colors in addition to the familiar deep red. Some of the betalains in beets are betanin, isobetanin, probetanin, and neobetanin (the red to violet ones are known collectively as betacyanin). Other pigments contained in beet are indicaxanthin and vulgaxanthins (yellow to orange pigments known as betaxanthins). Indicaxanthin has been shown as a powerful protective antioxidant for thalassemia, as well as prevents the breakdown of alpha-tocopherol (Vitamin E).

Betacyanin in beetroot may cause red urine and feces in some people who are unable to break it down. This is called beeturia.

The pigments are contained in cell vacuoles. Beetroot cells are quite unstable and will "leak" when cut, heated, or when in contact with air or sunlight. This is why red beetroots
leave a purple stain. Leaving the skin on when cooking, however, will maintain the integrity of the cells and therefore minimise leakage.

In some embodiments the food product according to the present invention is designed to have a nutritional value higher than a certain amount of kiloJoule (kJ), such as in humanitarian hunger relief efforts in developing countries. This may be accomplished by incorporation into the food product of a plant oil, such as a plant oil derived from soybean, rapeseed, sunflower, lentil linseed, flax, sesame, poppy seeds, ricebran, safflower, cottonseed, olives, Palms, Coconut, peanuts,

Definitions

The term “disintegration” as used herein refers to the treatment of cereal grain, fruit, berry or vegetables, wherein the intact structure of the plant material is destroyed, such as by the treatment of milling, blending, pressing or the like.

The term “whole food drink” as used herein refers to a beverage, drinkable liquid substance made directly from at least one whole cereal grain in combination with at least one whole fruit, berry or vegetable. Suitable the whole food drink contain all soluble components of the cereal and fruit, berry or vegetable.

It is to be understood that in a “whole food drink” according to the present invention essentially no soluble or dispersible material has been removed from the soluble fraction and substantially no components other than water may have been added.

The term “whole food fibre product” as used herein refers to a substantially solid substance made directly from at least one whole cereal grain in combination with at least one whole fruit, berry or vegetable. Suitable the whole food fibre product contain all insoluble components of the cereal and fruit, berry or vegetable.

It is to be understood that in a “whole food fibre product” according to the present invention, essentially no insoluble material has been removed and substantially no components other than water may have been added. The only exceptions are that solid materials, such as fruit seeds, stalk, and endocarp may have been removed from a fruit, berry or vegetable as part of the process of disintegration and/or separation into soluble and insoluble fractions.
The term "endogenous liquid", as used herein refers to the soluble fraction or liquid part of a fruit, berry or vegetable obtained in a step of separation into a soluble and an insoluble fraction of this fruit, berry or vegetable.

The term "exogenous water" as used herein refers to an amount of water added in the process for the preparation a food product according to the invention.

The phrase "reduce microbial activity" as used herein refers to the killing, elimination or reduction in amount of transmissible agents (such as fungi, bacteria, viruses, spore forms) from a food product.

The term "whole cereal grain" as used herein refers to the complete fruit seed or caryopsis of grasses of the monocot families Poaceae or Gramineae comprising the coarse outer bran layer, the endosperm, and the germ. As used herein the whole cereal grain do not include the glumellae (or hull). Included within this term is also the pseudo-cereals quinoa and buckwheat.

The term "soluble fraction" as used herein refers to a liquid part, such as an aqueous extract part of a whole cereal, fruit, berry or vegetable. Included within this term are both compounds which are chemically soluble as well as compounds, which would be contained in a "supernate" or "supernatant liquid" after standard centrifugation, such as water dispersible constituents of a whole food drink.

The term "insoluble fraction" as used herein, refers to the non-liquid part of a whole cereal, fruit, berry or vegetable. Included within this term are both compounds which are chemically insoluble as well as compounds, which would be contained in a precipitate after standard centrifugation.

The term "whole fruit" as used herein refers to the entire edible content of a true fruits, in a botanical sense, sometimes referred to as vegetables or culinary vegetables in cooking and food preparation, as well as culinary "fruits", which are not true fruits in the botanical sense but is any sweet tasting plant product associated with seed(s) and nuts. Included within true fruits are the cucurbits (e.g., squash, pumpkin, and cucumber), tomatoes, peas, beans, corn, eggplant, and sweet pepper; some spices, such as allspice and chilies. Included within the culinary "fruits" is rhubarb. Included within nuts are both fruits and edible seeds, such as walnuts and pistachios.
The term "whole fruit" as used herein does not encompass cereal grains, although they technically may be considered a fruit termed a caryopsis.

The term "berry" as used herein refers to a berry in botanical language (or true berries), which is a simple fruit having seeds and pulp produced from a single ovary, as well as non-botanical, but known as berries in common language.

The true berry is the most common type of fleshy fruit in which the entire ovary wall ripens into an edible pericarp. The flowers of these plants have a superior ovary and one or more carpels within a thin covering and fleshy interiors. The seeds are embedded in the common flesh of the ovary.

Examples of true berries include Grape, Vitis vinifera, Tomato, Lycopersicon esculentum and other species of the family Solanaceae, such as Capsicum, and aubergine (Solanum melongena) and Wolfberry or Goji berries (Lycium barbarum, Lycium spp.; Solanaceae); Barberry (Berberis; Berberidaceae); Currant (Ribes spp.; Grossulariaceae), red, black, and white types; Elderberry (Sambucus niger; Caprifoliaceae); Gooseberry (Ribes spp.; Grossulariaceae); Honeysuckle: the berries of some species (called honeyberries) are edible, others are poisonous (Lonicera spp.; Caprifoliaceae); Mayapple (Podophyllum spp.; Berberidaceae); Nannyberry or sheepberry (Viburnum spp.; Caprifoliaceae); Oregon-grape (Mahonia aquifolium; Berberidaceae); Sea-buckthorn (Hippophae rhamnoides; Elaeagnaceae).

Non-botanical berries includes drupes (fruits produced from a single-seeded ovary or achene) such as Hackberry (Celtis spp.; Cannabaceae); and Açaf (Euterpe), a palm fruit native to the Amazon region; Epigynous fruits (berry-like fruits formed from inferior ovaries, in which the receptacle is included) such as the fruits of the Ericaceae, including blueberry, huckleberry and cranberry; Bearberry (Arctostaphylos spp.), Crowberry (Empetrum spp.) and Cranberry; Lingonberry (Vaccinium vitis-idaea); Strawberry Tree (Arbutus unedo), not to be confused with the actual strawberry (Fragaria); Sea Grape (Coccoloba uvifera; Polygonaceae); The fruit of cucumbers, melons and their relatives are modified berries called "pepoes"; Compound fruits (groups or aggregates of multiple individual fruits) such as blackberry, raspberry, bayberry, boysenberry, mulberry, strawberry, raspberries, blackberry, and hybrids, such as dewberry, boysenberry, olallieberry, and tayberry (genus Rubus); Cloudberry (Rubus chamaemorus); Loganberry (Rubus loganobaccus); Raspberry, Rubus idaeus and some other species of Rubus;
Salmonberry (Rubus spectabilis); Thimbleberry (Rubus parviflorus); Wineberry (Rubus phoenicolasius).

"Fonio" as used herein refers to cultivated grains in the Digitaria genus.

Quinoa refers to a species of goosefoot (Chenopodium), the grain-like crop grown primarily for its edible seeds. It is a pseudocereal rather than a true cereal, or grain, as it is not a grass.

The term "oxidation state", as used herein refers to the fact that specific compounds contained within certain fruits, such as anthocyanin of apples have a colour that will change, when oxidized over time. Accordingly, the food product containing such fruit will also change colour and this may be used as a measure of the freshness of the food product.

The term "oat" as used herein refers to the cereal grain of the species Avena sativa.

The term "carrots" as used herein refers to the plant root used as vegetables of the species Daucus carota.

The term "apple" as used herein refers to the fruit of the species Malus domestica.

The terms "beet root" as used herein refers to a plant in the beet root family Chenopodiaceae In some embodiments, the beet root is of the species Beta vulgaris.

The term "whole aromatic plant" as used herein refers to any essentially complete culinary herb and spice that may be used in a food product. It is to be understood that in a "whole aromatic plant" according to the present invention, essentially no material has been removed. It is to be understood that in some embodiments, such as for e.g. lavender, only the flower of the plant is used, such as in water extraction. Included within this definition is Ajwain (Trachyspermum ammi), Akudjura (Solanum centrale), Alexanders (Smyrnium olusatrum), Alkanet (Anchusa arvensis), Allspice (Pimenta dioica), (Alpinia galanga) Galangal, Amchur - mango powder (Mangifera), Angelica (Angelica archangelica), Anise (Pimpinella anisum), Aniseed myrtle (Syzygium anisatum), Annatto (Bixa orellana L.), Apple mint (Mentha suaveolens), Asafoetida
(Ferula assafoetida), Avocado Leaf (Persea americana), Barberry (Berberis vulgaris), Basil (Ocimum basilicum), Bay Leaf (Laurus nobilis), Bee Balm (Monarda didyma), Borage (Borago officinalis), Black Cardamom (Amomum subulatum), Black Mustard (Brassica nigra), Blue Fenugreek, Blue melilot (Trigonella caerulea), Brown Mustard (Brassica juncea), Burdock (Arctium lappa), Calamint, (Calamintha spp.), Calamus, (Acorus calamus americanus), Calendula, Pot Marigold (Calendula officinalis), Cananga, Ylang-ylang, Kenanga (Cananga odorata), Candle nut (Aleurites moluccanus), Capers (Capparis spinosa), Caraway (Carum carvi), Cardamom (Elettaria cardamomum), Catnip (Nepeta cataria), Cassia (Cinnamomum aromaticum), Casuaria, Cayenne pepper (Capsicum annuum), Celery seed (Apium graveolens), Chervil (Anthriscus cerefolium), Chicory (Cichorium intybus), Chili pepper (Capsicum spp.), Chipotle (Capsicum annuum), Chives (Allium schoenoprasum), Cicely (Myrrhis odorata), Cilantro, Coriander Greens, Coriander Herb (Coriandrum sativum), Cinchona (Cinchona), Cinnamon, True or Ceylon (Cinnamomum verum), Cinnamon Myrtle (Backhousia myrtifolia), Clary, Clary Sage (Salvia sclarea), Clove (Syzygium aromaticus), Coriander seed (Coriandrum sativum), Costmary (Tanacetum balsamita), Cowslip (Primula veris), Cress, Cuban Oregano (Plectranthus amboinicus), Cubeb pepper (Piper cubeba), Cudweed (in Vietnamese cuisine), Culantro (Eryngium foetidum), Cumin (Cuminum cyminum), Curry leaf (Murraya koenigii), Curry Plant (Helichrysum italicum), Dill seed (Anethum graveolens), Dill herb or weed (Anethum graveolens), Dorrigo Pepper (Tasmannia stipitata), Elderflower (Sambucus spp.), Elecampane (Inula helenium), Epazote (Chenopodium ambrosioides), Eryngium foetidum (Culantro, Long Coriander), Fennel (Foeniculum vulgare), Fenugreek (Trigonella foenum-graecum), File powder (Sassafras albidum), Fingerroot, krachai, temu kunjii (Boesenbergia rotunda), French sorrel (Rumex scutatus), Fumitory (Fumaria spp.), Galangal (Alpinia officinarum), Galingle (Cyperus spp.), Garlic chives (Allium tuberosum), Garlic (Allium sativum), Ginger (Zingiber officinale), Ginkgo nuts (Ginkgo biloba), Golpar (Heracleum persicum.), Gotu Kola, Centella (Centella asiatica), Grains of paradise (Aframomum melegueta), Grains of SeNn (Xylopia aethiopica), Green tea (Camellia sinensis), Ground ivy (Glechoma hederacea), Hops (Humulus lupulus), Horehound (Marrubium vulgare), Horseradish (Armoracia rusticana), Houttuynia (Houttuynia cordata), Hyssop (Hyssopus officinalis), Indian Bay-leaf, Malabathrum, Tejpat (Cinnamomum tamala, c. tejpata), Indonesian Bay-Leaf, Daun salam (Eugenia polyantha, Syzygium polyanthum), Indonesian Cinnamon (Cinnamomum burmannii, Cassia vera), Jasmine (Jasminum spp.), Juniper berry (Juniperus communis), Kaffir Lime Leaves (Citrus hystrix, C. papeda), Kokam (Garcinia indica), Lady's Bedstraw (Galium verum), Lavender (Lavandula spp.), Laser, laserpicium, or lasarpicium, Lemon Balm (Melissa officinalis), Lemon basil (Ocimum x
citriodorum), Lemongrass (Cymbopogon citratus, C. flexuosus, and other species), Lemon Ironbark (Eucalyptus staigeriana), Lemon mint (Monarda citriodora), Lemon Myrtle (Backhousia citriodora), Lemon Thyme (Thymus x citriodorus), Lemon verbena (Lippia citriodora), Lesser galangal, Kentjur (Kaempferia galanga), Licorice, Liquorice (Glycyrrhiza glabra), Lime Flower (Tilia spp.), Limnophila aromatica, Rice paddy herb (in Vietnamese cuisine), Long pepper (Piper longum), Lovage (Levisticum officinale), Luohanguo, (Siraitia grosvenorii), Mace (Myristica fragrans), Mahlab (Prunus mahaleb), Malabathrum (Cinnamomum tamala, C. tejpata), Manchurian Thorn Tree (Aralia manchurica), Marjoram (Origanum majorana), Marrubium vulgare (white horehound), Marsh Labrador Tea, Mastic (Pistacia lentiscus), Meadowsweet (Filipendula vulgaris), Melegueta Pepper (Aframomum melegueta), Mexican Pepperleaf (Piper auritum), Mexican Tarragon (Tagetes lucida), Mint (Mentha spp.), Micromeria (Micromeria spp.), Mitsuba (Cryptotaenia japonica), Mugwort (Artemisia vulgaris), Murraya koenigii, Curry Tree, Curry Leaf, Mustard Seed, Myrtle berry and leaf (Myrtus communis), Nasturtium (Tropaeolum majus), Neem (Azadirachta indica), Nigella sativa (Kalonji, Black caraway), Nutmeg (Myristica fragrans), Oldia (Eucalyptus olida), Oregano (Origanum vulgare, O. heracleoticum, and other species), Orris root (Iris germanica, I. florentina, I. pallida), Osmorhiza, Sweet Cicely, Pandan flower, Kewra (Pandanus odoratissimus), Pandan leaf, Screwpine (Pandanus amaryllifolius), Paprika (Capsicum annum), Paracress (Spilanthes aemella, S. oleracea) (used in Brazil), Parsley (Petroselinum crispum), Pelargonium (Pelargonium spp.), Pepper: black, white, and green (Piper nigrum), Peng (Celastrus paniculatus), Peppermint (Mentha piperata), Peppermint Gum leaf (Eucalyptus dives), Perilla, Shiso (Perilla spp.), Pink Pepper (Schinus terebinthifolius), Piper sarmentosum, Poppy seed (Papaver somniferum), Ramsons, wood garlic (Allium ursinum), Riberry (Syzygium luehmannii), Rice Paddy Herb (Limnophila aromatica), Rosemary (Rosmarinus officinalis), Rue (Ruta graveolens), Safflower (Carthamus tinctorius), primarily for color, Saffron (Crocus sativus), Sage (Salvia officinalis), Saigon Cinnamon (Cinnamomum loureiroi), Salad Burnet (Sanguisorba minor), Salep (Orchis mascula), Sassafras (Sassafras albidum), Savory, Summer (Satureja hortensis), and winter (S. montana), Sesame seed (Sesamum indicum), Sheep's sorrel (Rumex acetosella), Sichuan pepper (Xanthoxyllum piperitum), Silphium, Sloe berries (Prunus spinosus), Soapwort (Saponaria officinalis), Sorrel (Rumex acetosa, R. acetoella, R. scutatus), Southernwood (Artemisia abrotanum), Spearmint (Mentha spicata), Spikenard (Nardostachys grandiflora or N. jatamansi), Star anise (Illicium verum), Stevia (Stevia rebaudiana), Suma (Pfaffia paniculata), Sumac (Rhus coriaria), Summer savory (Satureja hortensis), Sweet cicely (Myrrhis odorata), Sweet woodruff (Galium odoratum), Tamarind (Tamarindus indica), Tansy (Tanacetum vulgare), Tarragon
(Artemisia dracunculus), Tasmanian Pepper (Tasmannia lanceolata), Tea (Camellia sinensis), Teucrium polium (felty germander), Thai basil (Ocimum basilicum var. thrysiflora, O. xcitriodorum, or O. sanctum), Thyme (Thymus vulgaris), Tulsi (Ocimum tenuiflorum), Turmeric (Curcuma longa), Twinleaf onion (Allium ances), Vanilla (Vanilla planifolia), Vietnamese Balm (Elsholtzia ciliata), Vietnamese Cinnamon (Cinnamomum loureiroi), Vietnamese Coriander (Persicaria odorata), Water Pepper, Smartweed (Polygonum hydropiper), Watercress (Rorippa nasturtium-aquatica), Wattleseed, Australian acacia, White Mustard (Sinapis alba), Wild thyme (Thymus serpyllum), Winter savory (Satureja montana), Wintergreen (Gaultheria procumbens), Wood Avens, Herb Bennet (Geum urbanum), Woodruff (Galium odoratum), Wormwood, Absinthe (Artemisia absinthium), Yarrow (Alchemilla millefolium), Yellow Mustard (Brassica hirta=Sinapis alba), Yerba Buena, and Zedoary (Curcuma zedoaria).

As used herein the term "kit" refers to a whole food drink and the complementary whole food fibre product obtained from the same starting raw materials, wherein at least one whole grain and at least one whole fruit, berry or vegetable are used.

Specific embodiments of the invention

As detailed above the present invention relates to a food product obtainable by a process comprising the steps of

a) Disintegration of at least one whole cereal grain;

b) Disintegration of at least one whole fruit, berry or vegetable;

c) Separation into a soluble and an insoluble fraction of said at least one whole cereal grain;

d) Separation into a soluble and an insoluble fraction of said at least one whole fruit, berry or vegetable; and

e) Combination of said soluble or insoluble fractions obtained in steps c) and d) in a predetermined ratio to produce a whole food drink or a whole food fibre product, respectively.
In some embodiments according to the invention one or more steps independently selected from a), b), c), d) and e) are performed simultaneously.

It is to be understood that some of the steps may be performed simultaneously, whereas other may not. Accordingly, step a) and b) may be performed simultaneously, if the whole cereal grain and whole fruit, berry or vegetable is processed together. Also, if the whole cereal grain and whole fruit, berry or vegetable are processed by pressing, the step of disintegration and separation into a soluble and an insoluble fraction may be performed simultaneously in one step.

In some embodiments according to the invention one or more steps a), b), c), d), and e) are performed as separate steps.

In some embodiments according to the invention one or more step independently selected from a), b), c), d), and e) are performed in the presence of water.

In some embodiments according to the invention the process is performed in the absence of addition of exogenous water.

In some embodiments according to the invention the process is performed in the absence of addition of any exogenous compound other than water.

In some embodiments according to the invention one or more steps a), b), c), d), and e) are performed in the presence of an endogenous liquid obtained in a separate step.

In some embodiments according to the invention the only solid material removed in the process from said at least one whole fruit, berry or vegetable is selected from the group consisting of the fruit seeds, stalk, and endocarp.

In some embodiments according to the invention the separation into a soluble and an insoluble fraction of at least one whole fruit, berry or vegetable is by sieving, pressing, and/or centrifugation.

In some embodiments according to the invention the separation into a soluble and an insoluble fraction of at least one whole cereal grain is by sieving and/or centrifugation.
In some embodiments according to the invention said disintegration of at least one whole cereal grain is by milling, such as dry or wet milling.

In some embodiments according to the invention said disintegration of at least one whole fruit, berry or vegetable is by milling, such as wet milling, blending and/or pressing.

In some embodiments according to the invention said disintegration of at least one whole fruit, berry or vegetable is by blending.

In some embodiments according to the invention said process comprises a step of separation of said soluble or insoluble fractions obtained in steps c) and d) respectively into a substantially liquid fraction and a substantially solid fraction.

In some embodiments according to the invention said process comprises a step of heat treatment to inactivate endogenous enzyme activity and/or to reduce microbial activity in said food product.

In some embodiments according to the invention said at least one whole fruit, berry or vegetable is a fruit selected from the list consisting of apples, grapes, mango, banana, pears, lemons, lime fruit, oranges, mango, tomatoes, peaches, apricots, almonds, genus Prunus, Bird cherry, genus Prunus padus and cucumbers.

It is to be understood that the food product according to the invention may be prepared with the use of a whole fruit, berry or vegetable derived from the country or local area of where the food product is to be produced. The specific fruit berry or vegetable may accordingly vary considerably.

In some embodiments according to the invention said at least one whole fruit, berry or vegetable is a berry selected from the list consisting of strawberries, cherries, cranberries, black currants, and plums.

In some embodiments according to the invention said at least one whole fruit, berry or vegetable is a vegetable selected from the list consisting of carrots, beet roots, sugar beets, cabbage, and broccoli.
In some embodiments according to the invention the whole cereal grain is selected from the list consisting of maize, rice, wheat, barley, sorghum, millets, oats, rye, triticale, buckwheat, fonio, and quinoa.

In some embodiments according to the invention the food product only comprises one type of a cereal grain.

In some embodiments according to the invention the cereal grain is oat.

In some embodiments according to the invention the food product does not comprise exogenously added products selected from oils and sweetening compounds.

In some embodiments according to the invention the food product is characterized by having a colour derived from the at least one whole fruit, berry or vegetable.

In some embodiments according to the invention the colour is used as an indicator for the oxidation state of said food product.

In some embodiments according to the invention the food product is a whole food drink.

In some embodiments according to the invention the food product is a whole food fibre product selected from a bar, chips, a snack, sticks, biscuits, powder, granulate, and crisp bread.

In some embodiments according to the invention the whole food fibre product is dewatered.

In some embodiments according to the invention the whole food fibre product contain less than 15 % (w/w), such as less than 10 %, such as less than 8 %, such as less than 5 % of water.

In some embodiments according to the invention the whole food fibre product is dewatered by application of a step selected from pressing and low temperature air drying or vacuum drying.

In some embodiments according to the invention the whole food fibre product has been subject to a further step of milling to obtain a granulate or powder.
In some embodiments according to the invention the food product is a whole food drink characterized by having a nutritional value lower than 400 kilojoule (kJ), such as lower than 300 kJ, such as lower than 200 kJ, such as lower than 150 kJ, such as lower than 100 kJ per 100 gram of food product.

In some embodiments according to the invention the food product is a whole food fibre product characterized by having a nutritional value lower than 2000 kilojoule (kJ), such as lower than 1800 kJ, such as lower than 1500 kJ, such as lower than 1300 kJ per 100 gram of food product.

In some embodiments according to the invention the food product is a whole food fibre product characterized by having a nutritional value higher than 1000 kilojoule (kJ), such as higher than 1500 kJ, such as higher than 1800 kJ, such as higher than 2000 kJ per 100 gram of food product.

In some embodiments according to the invention the food product is characterized by having less than 10 % (w/w), such as less than 8 % (w/w), such as less than 5 % (w/w), such as less than 3 % (w/w) of fat.

In some embodiments according to the invention the process further comprises the steps of treating a whole aromatic plant to make an aromatic extract and combining said aromatic extract with said whole food drink and/or said whole food fibre product obtained in step e).

In some embodiments according to the invention the whole aromatic plant is selected from the list consisting of Chili, genus *Capsicum*, Lemon grass, genus *Cymbopogon*, Lemon balm, genus *Melissa* such as *officinalis*, Tarragon, genus *Artemisia* such as *dracunculus*, Fennel, genus *Foeniculum* such as *vulgare*, Geranium, genus *Geranium*, Spruce, genus *Picea*, Borage, genus *Borago*, Elderberry, genus *Sambucus*, Camille, genus *Tripleurospermum*, Angelica, genus *Angelica* such as *archangelica*, Mint, genus * Mentha* such as *piperita*, Thyme, genus *Thymus*, Celery, genus *Apium*, Rosemary, genus *Rosmarinus officinalis*, and Tea plant, genus *Camellia sinensis*.

In some embodiments the whole food product is a whole food drink comprising

a) 0.1-30 % (w/v) derived from said whole cereal grain; and
b) 1-99.9 % (v/v) derived from said whole fruit, berry or vegetable.

The (w/v) percentage refers to dry weight content per volume of the final product. It is to be understood, that a food drink comprising 0.5 g of a whole cereal grain per 100 ml of final drink, would contain 0.5 % (w/v) of the cereal grain. The (v/v) percentage refers to a volume content per volume of final product expressed in percent.

In some embodiments the whole food product is a whole food drink comprising

a) 0,1-25 % (w/v) derived from said whole cereal grain; and

b) 25-75 % (v/v) derived from said whole fruit, berry or vegetable.

In some embodiments the whole food product is a whole food drink comprising

a) 0,1-10 % (w/v) derived from said whole cereal grain; and

b) 45-55 % (v/v) derived from said whole fruit, berry or vegetable.

In some embodiments the whole food product is a whole food drink comprising

a) 1-20 % (w/v) derived from said whole cereal grain; and

b) 80-99 % (v/v) derived from said whole fruit, berry or vegetable.

In some embodiments the whole food product is a whole food fibre product comprising

a) 3-8 % (w/v) derived from said whole cereal grain; and

b) 92-97 % (v/v) derived from said whole fruit, berry or vegetable.

In some embodiments the whole food product is a whole food fibre product comprising

a) 30-70 % (w/w) derived from said whole cereal grain; and

b) 30-70 % (w/w) derived from said whole fruit, berry or vegetable.
The (w/w) percentage refers to dry weight content per dry weight of final product.

In some embodiments the whole food product is a whole food fibre product comprising

a) 40-60 % (w/w) derived from said whole cereal grain; and

b) 40-60 % (w/w) derived from said whole fruit, berry or vegetable.

In some embodiments the whole food product is a whole food drink comprising: chlorogenic acid in a concentration of at least about 1 mg/100 ml, such as at least 5 mg/100 ml of the whole food drink.

In some embodiments the whole food product is a whole food drink comprising: beta-glucan in a concentration of at least about 20 mg/100 ml, such as at least about 50 mg/100 ml, such as at least about 100 mg/100 ml, such as at least about 150 mg/100 ml of the whole food drink.

In some embodiments the whole food product is a whole food fibre product comprising: chlorogenic acid in a concentration of at least about 1 mg/100 ml, such as at least 5 mg/100 g of the whole food fibre product.

In some embodiments the whole food product is a whole food fibre product comprising: beta-glucan in a concentration of at least about 3 g/100 g of the whole food fibre product.

The invention further relates to a kit comprising

a) a whole food fibre product according to the invention; and

b) a whole food drink according to the invention.

In some embodiments according to the invention the whole food fibre product and the whole food drink are derived from the same species of a whole cereal grain and whole fruit, berry or vegetable.
In one series of embodiments at least one whole cereal grain is one or more, such as one, two, three, four or five species of a whole cereal grain.

In one series of embodiments at least one whole fruit, berry or vegetable is one or more, such as one, two, three, four or five species of a fruit, berry or vegetable.

5 BRIEF DESCRIPTION OF THE FIGURES

Examples of the invention will now be described with reference to the Figures, in which:

Fig. 1 show a flow diagram for part of the process according to the invention, wherein a whole oat is disintegrated and processed into soluble and insoluble fractions.

Fig. 2 show a flow diagram for part of the process according to the invention, wherein whole fruit/berries are disintegrated and processed into soluble and insoluble fractions.

Fig. 3 shows a flow diagram for part of the process according to the invention, wherein a whole aromatic plant is disintegrated and processed into soluble and insoluble fractions.

Fig. 4 shows a flow diagram for part of the process according to the invention, wherein soluble and insoluble fractions of whole oat, whole fruit/berries, and whole aromatic plants are combined to produce a whole food drink or a whole food fibre product, respectively.

Fig. 5 illustrates the analysis of drink produced as described in example 6.

Fig. 6 illustrates the analysis of raw apple used to produce drink of example 6.

20 EXAMPLES

EXAMPLE 1

Basic solution of aqueous oat extract:
Whole oat such as *Avena sativa* can be treated and extracted in a number ways in order to make aqueous extracts and solids containing different concentrations of soluble carbohydrates such as β-glucans, dietary fibres, proteins, poly-phenols, antioxidants, minerals, vitamins and lipids.

Figure 1 illustrates a flow diagram showing the extraction of whole oat.

Whole oat grain is dehulled by milling/shifting in step to obtain oat starch flour and oat flour/oat bran. Fruits and/or vegetables or alternatively water is added to in a ratio of water (fruits/vegetable extracts) : oat of about 20:1. The composition is treated at a temperature of 85-95 °C for < 1 or up to 10 minutes under stirring and cooled to about 40-45 °C. Water is added in step to reach a temperature of 40-45 °C for about 120 min. In step the solution is centrifuged for about 10 minutes at 3000 rpm and separated in a fibre/starch slurry and an aqueous extract.

Thus possible processes could be as described in the following A, B and C:

**A**

1. Whole oat is mixed with water 1:20 at 90 °C for < 1 or up to 10 minutes under stirring and cooled to 45 °C.
2. Stirring the solution over i.e. 12-24 hours non-starch polysaccharides can be extracted.

**B**

1. Whole oat is dry milled and extracted as described in methods for oat extract.

**C**

1. Whole oat is dry milled and separated into a starch rich fraction (oat flour) and a fibre rich fraction (oat bran), oat bran is extracted as described in methods for oat extract.
2. Oat bran can be further concentrated in relation to constituents such as β-glucans by further milling and separation of starch, in order to reduce starch content before aqueous extraction.
Method for oat extract:

1. 100 g of oat bran is mixed under stirring with 1 l. of water at 90 °C for 60 seconds.
2. 1 l. water is added to reach a temperature at 45 °C for 120 min.
3. The solution is centrifuged for 10 minutes at 3000 rpm.
4. The aqueous extract is used as basis solution for preparation of beverages.
5. The solids are used as ingredients in biscuits.
Example 1
Extract whole oat

Whole oat grain

Dehulling / Milling / shifting

Oat starch flour

Fruits and/or vegetables

Oat flour hulls/cran
Aqueous extraction
Wet milling

Total water (Fruit/Vegetable extract) oat / 20 l

Temperature:
1. Inactivation glucanase 85 - 95 C < 60 sec
2. Hydration 40 - 45 C 120 mm

Heat treatment 1

Hydration Wet milling 2

Separation Centrifuge type

Fibre/starch slurry

Aqueous extract
Light turbid

Mass balance
From 100 g oat bran 1400 ml. of aqueous extract containing approximately 0.6 % of dry matter and 600 g of oat solids containing approximately 14 % of dry matter is obtained.

Aqueous extract approximately content pr. 100 g dry weight:
- Protein (Nx5.7) 12 g
- Starch 20 g
- β-glucan > 3 g
- Energy content < 1542 kJ

Solids approximately content pr. 100 g dry weight:
- Protein (Nx5.7) 14 g
- β-glucan > 7 g
- Energy content 1542 kJ

EXAMPLE 2

Figure 2 illustrates a flow diagram 200 showing the extraction of whole fruits and/or whole vegetables.

Whole fruits and/or vegetables 202 are pressed in a fruit press 204 to obtain a fruit/vegetable juice faction 206 and a fruit/vegetable fibre faction 208. Water is added to the fruit/vegetable fibre faction 208 in a ratio of water: fruits/vegetable fibre of about 5:1 to obtain a composition 210. Composition 210 is treated in a first separation step 212 using a 1000 µm sieve to separate kernels and hulks 214. A second separation step 216 results in a fruit/vegetable fibre faction 218 and an aqueous fruit/vegetable extract 220.

Thus the extraction of whole fruits and/or whole vegetables may be performed as follows.

Method for preparation of fruit and vegetable juice and solid:

1. 1 kg of apples is pressed in a traditional fruit press.
2. The juice are skimmed and used as ingredients of beverage.
3. The solids are used as ingredients in biscuits.

Kernels and hulks can preferably be separated after the first milling/meshing in a liquid solution, such as water or juice, by sedimentation of kernels and hulks. After sedimentation the fruit meat is transported to the fruit press.
The same method has been applied for apples, pears, strawberries, rhubarb, cherries, black currant and carrots.

Apple mass balance:

<table>
<thead>
<tr>
<th>Masse balance</th>
<th>Discovery</th>
<th>% Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weight</td>
<td>%DM</td>
<td>% DM yield</td>
</tr>
<tr>
<td>Apples</td>
<td>4,6</td>
<td>14,3</td>
</tr>
<tr>
<td>Kernels</td>
<td>0,7</td>
<td>15,1</td>
</tr>
<tr>
<td>Pulp</td>
<td>1,5</td>
<td>17,4</td>
</tr>
<tr>
<td>Juice</td>
<td>2,3</td>
<td>12,5</td>
</tr>
<tr>
<td>Sum</td>
<td>4,5</td>
<td>99</td>
</tr>
</tbody>
</table>

Approximately energy content:
- Energy content apple 192 kJ pr. 100 g wet.
- Energy content apple juice 179 kJ pr. 100 g wet.
- Energy content apple pulp 205 pr. 100 g wet.

EXAMPLE 3

Figure 3 illustrates a flow diagram 300 showing the preparation of an extract from a whole aromatic plant.

A whole aromatic plant 302 is subjected to an aqueous extraction step 304 optionally with addition of heat. Thereafter the extract is subjected to a wet milling step 306. Leaves and hulks 310 are separated in a sieving step 308 to obtain an aromatic extract 312.

Thus a method for the preparation of extracts from a whole aromatic plant may be performed as follows.

Method for lavender extracts

1. 1 spoon of dried Lavender is mixed with 1 dl. boiling water
2. The extraction time is 10 minutes.
3. After extraction the solutions sieved and cooled.
4. 20 drops is added to 1. L of final beverage.

Method for lemongrass extracts

1. Lemongrass, *Cymbopogon*, is mixed with juice of rhubarb, 20 sticks of lemongrass per 1. rhubarb juice.
2. The blended solution is sieved.
3. The aqueous extract is used as ingredient of beverage
4. The solids are used in biscuits

Example 3
Aroma extract
EXAMPLE 4

Method for the combination of at least one whole cereal grain with at least one whole fruit, berry or vegetable to produce a whole food drink or a whole food fibre product is shown in figure 4..

In general the method with reference to figure 4 may be outlined as follows:

For the preparation of a drink blend 400 a whole oat extract 402 is mixed with a whole fruit or berry extract 404. Flavor is adjusted by addition of an extract from a whole aromatic plant 406. The blend is mixed 408 and heat treated 410.

Thus a method for the preparation of a drink blend may be performed as follows:

Method for mixing oat extract, apple juice, lavender beverage:

1. 40% fresh apple juice is mixed with 60% oat extract
2. The flavour is adjusted with approximately 20 drops of lavender extract.
3. The beverage is heat treated 60 seconds at 80 °C

Approximately content pr. 100 g beverage:

Dry matter content is 5.36 g, here of;

- 5.00 g dry weight apple juice
- 0.36 g dry weight oat extract, here of;
  - > 10 mg β-glucan

Energy content < 80 kJ

Method for mixing oat extract, strawberry juice and apple juice beverage

1. 25% fresh strawberry juice is mixed with 25 fresh apple juice and 50% oat extract
2. The beverage is heat treated 60 seconds at 80 °C
Method for mixing oat extract, fresh pear juice, rhubarb juice and lemongrass

1. 30% fresh pear *Concorde* juice is mixed with 10% fresh rhubarb/lemongrass extract and 60% oat extract
2. The beverage is heat treated 60 seconds at 80 °C

Method for baking biscuits:

In general the method with reference to figure 4 may be outlined as follows:

For the preparation of a baking blend 450, solids from whole oat extract 452 is mixed with solids from whole fruit or berry extract 454. Flavor is optionally adjusted by addition of solids from a whole aromatic plant 456. The blend is mixed 458 and baked by dry air drying 460.

Thus a method for the preparation of a baking blend may be performed as follows:

1. 81 g wet solids from oat extraction is mixed with 14 g oat flour and 133 g wet apple pulp
2. Dough is made by mixing.
3. The dough is spread out in a thin layer with a height of 0.2 cm and cut in appropriate forms i.e. 4x10 cm.
4. The dough is baked at 200 °C until it is light brown in color.
5. The biscuits are air dried at room temperature.

Approximately content pr. 100 g biscuit fruit and oat fibres:

Dry matter content 95 g, here of;

- 46 g apple pulp
- 23 g oat extract solids
- 26 g oat flour

β-glucan content > 2 g
Energy content < 1400 kJ
Example 4
Drink blends

- Whole oat extract
- Whole blueberry
  1+... extracts
- Whole aromatic
  1+... extracts

Blends
Mixing

Heat treatment
Regenerative

Example 5
Baking blends

- Whole oat
  Starch/ fibres
- Whole blueberry
  1+... fibres
- Whole aromatic
  1+... fibres

Blends
Mixing

Baking
Dry air drying
EXAMPLE 5

Example for preparing dry flour or powder from fruit pulp and oat solids from oat extraction

1. 81 g wet solids from oat extraction is mixed with 14 g oat flour and 133 g wet apple pulp

2. The mixture is dried in a continuous drier such as a disintegration type and/or fluid bed type of drier, or the mixture is wet milled before spray drying, to make a dried flour or powder.

3. The powder can be applied as ingredients in food industries such as in bread and cakes.

Approximately content pr. 100 g dried fruit and oat fibres:

Dry matter content 95 g, here of:
- 46 g apple pulp
- 23 g oat extract solids
- 26 g oat flour

β-glucan content > 2 g
Energy content < 1400 KJ

Example 6.

Purified oat bran can preferably be heat treated in aqueous solution before adding juice of fruit and vegetables, and aromatic extracts. The purified oat bran solution can preferably be used as a whole without further separations.

1. Oat bran is milled by disc milling and fractionated by sieving over 100 urn. The fraction under 100 urn is a starch rich fraction used for biscuits or chips.

2. The fraction over 100 urn is further milled by disc milling

3. The milled fraction is added cold water to 50 % w/w solution.

4. The 50% solution is added hot water to form a 1 % w/w solution

5. The solution is heated to 90 °C for 60 seconds.

6. Apple juice is added 1:1 to the solution
7. Flavor is adjusted with lavender extract
8. The solution is heat treated 30 seconds at 80 °C and cooled to 15 °C.

Example 7.

5 The baking blend can contain other whole grains than oat such as whole barley, wheat etc.

Further the baking dough is preferably added aqueous denaturized starch rich flour such as the starch rich fraction obtained from example 1 or other starch rich whole grain flours such as barley, corn, rice etc. were the starch has been denaturized by aqueous heat treatment or alternatively gluten containing whole wheat flour, which does not need aqueous heat treatment to form a dough.

1. 200 g apple mesh is mixed with 50 g oat bran (aqueous heat denaturized)
2. Dough is formed and spread out in a thin layer, 2-3 mm.
3. The dough is baked in a vacuum oven at initially 50 C reaching 90 C at 50-100 mbar.

Further the baking sequence preferably is made in a vacuum oven at 20 °C raising it to 90 °C at 10 - 100 mbar pressure to minimize heat induced formation of acryl amides, which potentially takes place at 120 C or more.

The final product can be in form as biscuits, chips or snacks.

Example 8.

Polyphenol analysis of drink produced by example 6 and raw appel used for preparation of the same drink.

The results of capillary electrophoresis separation illustrated by figures 5 and 6 indicate a high level of similarity between the two extracts. The analysis has been carried out at three different wave length (235, 280 and 320 nm) by capillary electrophoresis separation.
Comparing the net area (NA) of chlorogenic acid peak relatively to the NA of compound found at migration time (MT) 11.5 minutes fig. 5 and MT 12.1 minutes fig. 6 at 280 nm, a small deviation is found, respectively (46.9/15.5) / (14.7/11.5) = 3.02/1.28 = 2.36 for drink prepared by example 6 and 86.4/16.6)/ (22.0/12.1) = 5.20/1.82 = 2.86 for the whole apple. The compounds with MT at 11.5 and 12.1 are considered to be the identical according to electroferograms figure 5 and 6.

The compound migrating at 15.5 minutes, figure 5 and the compound migrating at 16.7 minutes, figure 6, is the same compound despite the different migration time. The compound is most likely chlorogenic acid which is one of the significant phenolic compounds in apples.

Chlorogenic acid are clearly intact in the drink produced as described in example 6. Generally there are concentration differences between the results in figure 5 and 6, due to the dilution of a factor 2 in the drink prepared as described in example 6 and the raw apple extract. The results strongly indicate that the group of antioxidants is well preserved in the drink compared to the raw apple extract, as identical detections are made from the two extracts.

In some embodiments the enzymes in oat are inactivated as described in example 6 at 90 °C for 60 seconds and the enzymes and microbial activity of the whole food drink at 80 °C for 30 seconds. The food drinks are then distributed at 4 °C.

Introducing a combination of fruit antioxidants and cereal fibers, such as dietary fibres and beta-glucans, is further considered to have a significant influence on the stability of the health promoting natural compounds, such as beta-glucans and antioxidants, in the whole food products and consequently a significant influence on the potential health benefits.
CLAIMS

1. Food product obtainable by a process comprising the steps of
   a) Disintegration of at least one whole cereal grain;
   b) Disintegration of at least one whole fruit, berry or vegetable;
   c) Separation into a soluble and an insoluble fraction of said at least one whole cereal grain;
   d) Separation into a soluble and an insoluble fraction of said at least one whole fruit, berry or vegetable; and
   e) Combination of said soluble or insoluble fractions obtained in steps c) and d) in a predetermined ratio to produce a whole food drink or a whole food fibre product, respectively.

2. Food product according to claim 1, wherein one or more steps independently selected from a), b), c), d) and e) are performed simultaneously.

3. Food product according to claim 1, wherein one or more steps a), b), c), d), and e) are performed as separate steps.

4. Food product according to any one of claims 1-3, wherein one or more step independently selected from a), b), c), d), and e) are performed in the presence of water.

5. Food product according to any one of claims 1-4, wherein said process is performed in the absence of addition of exogenous water.

6. Food product according to any one of claims 1-5, wherein said process is performed in the absence of addition of any exogenous compound other than water.
7. Food product according to any one of claims 1-6, wherein one or more steps a), b),
c), d), and e) are performed in the presence of an endogenous liquid obtained in a
separate step.

8. Food product according to any one of claims 1-7, wherein the only solid material
removed in the process from said at least one whole fruit, berry or vegetable is selected
from the group consisting of the fruit seeds, stalk, and endocarp.

9. Food product according to any one of claims 1-8, wherein said separation into a
soluble and an insoluble fraction of at least one whole fruit, berry or vegetable is by
sieving, pressing, and/or centrifugation.

10. Food product according to any one of claims 1-9, wherein said separation into a
soluble and an insoluble fraction of at least one whole cereal grain is by sieving and/or
centrifugation.

11. Food product according to any one of claims 1-10, wherein said disintegration of at
least one whole cereal grain is by milling, such as dry or wet milling.

12. Food product according to any one of claims 1-11, wherein said disintegration of at
least one whole fruit, berry or vegetable is by milling, such as wet milling, blending
and/or pressing.

13. Food product according to any one of claims 1-12, wherein said process comprises
a step of heat treatment to inactivate endogenous enzyme activity and/or to reduce
microbial activity in said food product.

14. Food product according to any one of claims 1-13, wherein said at least one whole
fruit, berry or vegetable is a fruit selected from the list consisting of apples, grapes,
mangos, bananas, pears, lemons, lime fruits, oranges, tomatoes, and cucumbers.

15. Food product according to any one of claims 1-14, wherein said at least one whole
fruit, berry or vegetable is a berry selected from the list consisting of strawberries,
cherries, cranberries, blackcurrants, and plums.
16. Food product according to any one of claims 1-15, wherein said at least one whole fruit, berry or vegetable is a vegetable selected from the list consisting of carrots, beet roots, sugar beets, cabbage, and broccoli.

17. Food product according to any one of claims 1-16, wherein said whole cereal grain is selected from the list consisting of maize, rice, wheat, barley, sorghum, millets, oats, rye, triticale, buckwheat, fonio, and quinoa.

18. Food product according to any one of claims 1-17, which food product only comprises one type of a cereal grain.

19. Food product according to claim 18, which cereal grain is oat.

20. Food product according to any one of claims 1-4, 6-19, which food product does not comprise exogenously added products selected from oils and sweetening compounds.

21. Food product according to any one of claims 1-20, which food product is characterized by having a colour derived from the at least one whole fruit, berry or vegetable.

22. Food product according to claim 21, wherein said colour is used as an indicator for the oxidation state of said food product.

23. Food product according to any one of claims 1-22, which food product is a whole food drink.

24. Food product according to any one of claims 1-21, which food product is a whole food fibre product selected from a bar, chips, a snack, sticks, biscuits, powder, granulate, and crisp bread.

25. Food product according to claim 24, which whole food fibre product is dewatered.

26. Food product according to any one of claims 24-25, which whole food fibre product contain less than 15 % (w/w), such as less than 10 %, such as less than 8 %, such as less than 5 % of water.
27. Food product according to any one of claims 24-26, which whole food fibre product is dewatered by application of a step selected from pressing and low temperature air drying.

28. Food product according to any one of claims 24-27, which whole food fibre product has been subject to a further step of milling to obtain a granulate or powder.

29. Food product according to any one of claims 1-22, which food product is a whole food drink characterized by having a nutritional value lower than 400 kiloJoule (kJ), such as lower than 300 kJ, such as lower than 200 kJ, such as lower than 150 kJ, such as lower than 100 kJ per 100 gram of food product.

30. Food product according to any one of claims 24-28, which food product is a whole food fibre product characterized by having a nutritional value lower than 2000 kiloJoule (kJ), such as lower than 1800 kJ, such as lower than 1500 kJ, such as lower than 1300 kJ per 100 gram of food product.

31. Food product according to any one of claims 24-28, 30, which food product is a whole food fibre product characterized by having a nutritional value higher than 1000 kiloJoule (kJ), such as higher than 1500 kJ, such as higher than 1800 kJ, such as higher than 2000 kJ per 100 gram of food product.

32. Food product according to any one of claims 1-31, which food product is characterized by having less than 10 % (w/w), such as less than 8 % (w/w), such as less than 5 % (w/w), such as less than 3 % (w/w) of fat.

33. Food product according to any one of claims 1-32, wherein said process further comprises the steps of treating a whole aromatic plant to make an aromatic extract and combining said aromatic extract with said whole food drink and/or said whole food fibre product obtained in step e).

34. Food product according to claim 33, wherein said whole aromatic plant is selected from the list consisting of Chili, genus Capsicum, Lemon grass, genus Cymbopogon, Lemon balm, genus Melissa such as officinalis, Tarragon, genus Artemisia such as dracunculus, Fennel, genus Foeniculum such as vulgare, Geranium, genus Geranium, Spruce, genus Picea, Borage, genus Borago, Elderberry, genus Sambucus, Camille, genus Tripleurospernum, Angelica, genus Angelica such as archangelica, Mint, genus
**Mentha** such as *piperita*, Thyme, genus *Thymus*, Celery, genus *Apium*, Rosemary, genus *Rosmarinus officinalis*, and Tea plant, genus *Camellia sinensis*.

35. Food product according to any one of claims 1-34, which is a whole food drink comprising:

   a) 0.1-30 % (w/v) derived from said whole cereal grain; and

   b) 1-99.9 % (v/v) derived from said whole fruit, berry or vegetable;

and/or a whole food fibre product comprising:

   a) 30-70 % (w/w) derived from said whole cereal grain; and

   b) 30-70 % (w/w) derived from said whole fruit, berry or vegetable.

36. A food product according to any one of claims 1-35, which is a whole food drink comprising:

   chlorogenic acid in a concentration of at least about 1 mg/100 ml, such as at least 5 mg/100 ml of the whole food drink.

37. A food product according to any one of claims 1-36, which is a whole food drink comprising:

   beta-glucan in a concentration of at least about 20 mg/100 ml, such as at least about 50 mg/100 ml, such as at least about 100 mg/100 ml, such as at least about 150 mg/100 ml of the whole food drink.

38. A food product according to any one of claims 1-37, which is a whole food fibre product comprising:

   chlorogenic acid in a concentration of at least about 1 mg/100 ml, such as at least 5 mg/100 g of the whole food fibre product.

39. A food product according to any one of claims 1-38, which is a whole food fibre product comprising:
beta-glucan in a concentration of at least about 3 g/100 g of the whole food fibre product.

40. Process for the production of a food product comprising the steps of

a) Disintegration of at least one whole cereal grain;

b) Disintegration of at least one whole fruit, berry or vegetable;

c) Separation into a soluble and an insoluble fraction of said at least one whole cereal grain;

d) Separation into a soluble and an insoluble fraction of said at least one whole fruit, berry or vegetable; and

e) Combination of said soluble or insoluble fractions obtained in steps c) and d) in a predetermined ratio to produce a whole food drink or a whole food fibre product, respectively.

41. The process according to claim 40, wherein one or more steps independently selected from a), b), c), d) and e) are performed simultaneously.

42. The process according to claim 40, wherein one or more steps a), b), c), d), and e) are performed as separate steps.

43. The process according to any one of claims 40-42, wherein one or more step independently selected from a), b), c), d), and e) are performed in the presence of water.

44. The process according to any one of claims 40-43, wherein said process is performed in the absence of addition of exogenous water.

45. The process according to any one of claims 40-44, wherein said process is performed in the absence of addition of any exogenous compound other than water.
46. The process according to any one of claims 40-45, wherein one or more steps a), b), c), d), and e) are performed in the presence of an endogenous liquid obtained in a separate step.

47. The process according to any one of claims 40-46, wherein the only solid material removed in the process from said at least one whole fruit, berry or vegetable is selected from the group consisting of the fruit seeds, stalk, and endocarp.

48. The process according to any one of claims 40-47, wherein said separation into a soluble and an insoluble fraction of at least one whole fruit, berry or vegetable is by sieving, pressing, and/or centrifugation.

49. The process according to any one of claims 40-48, wherein said separation into a soluble and an insoluble fraction of at least one whole cereal grain is by sieving and/or centrifugation.

50. The process according to any one of claims 40-49, wherein said disintegration of at least one whole cereal grain is by milling, such as dry or wet milling.

51. The process according to any one of claims 40-50, wherein said disintegration of at least one whole fruit, berry or vegetable is by milling, such as wet milling, blending and/or pressing.

52. The process according to any one of claims 40-51, wherein said process comprises a step of heat treatment to inactivate endogenous enzyme activity and/or to reduce microbial activity in said food product.

53. The process according to any one of claims 40-52, wherein said at least one whole fruit, berry or vegetable is a fruit selected from the list consisting of apples, grapes, mangos, bananas, pears, lemons, lime fruit, oranges, tomatoes, and cucumbers.

54. The process according to any one of claims 40-53, wherein said at least one whole fruit, berry or vegetable is a berry selected from the list consisting of strawberries, cherries, cranberries, blackcurrants, and plums.
55. The process according to any one of claims 40-54, wherein said at least one whole fruit, berry or vegetable is a vegetable selected from the list consisting of carrots, beet roots, sugar beets, cabbage, and broccoli.

56. The process according to any one of claims 40-55, which whole cereal grain is selected from the list consisting of maize, rice, wheat, barley, sorghum, millets, oats, rye, triticale, buckwheat, fonio, and quinoa.

57. The process according to any one of claims 40-56, which food product only comprises one type of a cereal grain.

58. The process according to claim 57, which cereal grain is oat.

59. The process according to any one of claims 40-43, 45-58, which food product does not comprise exogenously added products selected from oils and sweetening compounds.

60. The process according to any one of claims 40-59, which food product is characterized by having a colour derived from the at least one whole fruit, berry or vegetable.

61. The process according to claim 60, wherein said colour is used as an indicator for the oxidation state of said food product.

62. The process according to any one of claims 40-61, which food product is a whole food drink.

63. The process according to any one of claims 40-61, which food product is a whole food fibre product selected from a bar, chips, a snack, sticks, biscuits, powder, granulate, and crisp bread.

64. The process according to claim 63, which whole food fibre product is dewatered.

65. The process according to any one of claims 63-64, which whole food fibre product contain less than 15 % (w/w), such as less than 10 %, such as less than 8 %, such as less than 5 % of water.
66. The process according to any one of claims 63-65, which whole food fibre product is
dewatered by application of a step selected from pressing and low temperature air
drying.

67. The process according to any one of claims 63-66, which whole food fibre product
has been subject to a further step of milling to obtain a granulate or powder.

68. The process according to any one of claims 40-62, which food product is a whole
food drink characterized by having a nutritional value lower than 400 kiloJoule (kJ), such
as lower than 300 kJ, such as lower than 200 kJ, such as lower than 150 kJ, such as
lower than 100 kJ per 100 gram of food product.

69. The process according to any one of claims 63-67, which food product is a whole
food fibre product characterized by having a nutritional value lower than 2000 kiloJoule
(kJ), such as lower than 1800 kJ, such as lower than 1500 kJ, such as lower than 1300
kJ per 100 gram of food product.

70. The process according to any one of claims 63-67, 69, which food product is a
whole food fibre product characterized by having a nutritional value higher than 1000
kiloJoule (kJ), such as higher than 1500 kJ, such as higher than 1800 kJ, such as higher
than 2000 kJ per 100 gram of food product.

71. The process according to any one of claims 40-70, which food product is
characterized by having less than 10 % (w/w), such as less than 8 % (w/w), such as
less than 5 % (w/w), such as less than 3 % (w/w) of fat.

72. The process according to any one of claims 40-71, wherein said process further
comprises the steps of treating a whole aromatic plant to make an aromatic extract and
combining said aromatic extract with said whole food drink and/or said whole food fibre
product obtained in step e).

73. The process according to claim 72, wherein said whole aromatic plant is selected
from the list consisting of Chili, genus Capsicum, Lemon grass, genus Cymbopogon,
Lemon balm, genus Melissa such as officinalis, Tarragon, genus Artemisia such as
dracunculus, Fennel, genus Foeniculum such as vulgare, Geranium, genus Geranium,
Spruce, genus Picea, Borage, genus Borago, Elderberry, genus Sambucus, Camille,
genus Tripleurospermum, Angelica, genus Angelica such as archangelica, Mint, genus
Mentha such as *piperita*, Thyme, genus *Thymus*, Celery, genus *Apium*, Rosemary, genus *Rosmarinus officinalis*, and Tea plant, genus *Camellia sinensis*.

74. The process according to any one of claims 40-73, consisting of

   a) 1-20 % (w/v) derived from said whole cereal grain; and
   
   b) 80-99 % (v/v) derived from said whole fruit, berry or vegetable;

and/or a whole food fibre product comprising

   a) 30-70 % (w/w) derived from said whole cereal grain; and
   
   b) 30-70 % (w/w) derived from said whole fruit, berry or vegetable.

75. Use of a food product according to any one of claims 1-39 in the preparation of a further processed food product, such as one selected from bread, ice cream, or cake.

76. Kit comprising

   a) Said whole food fibre product as defined in any one of claims 1-22, 24-28, 30-35, 38-39; and
   
   b) Said whole food drink as defined in any one of claims 1-23, 29, 32-37.

77. Kit according to claim 76, wherein said whole food fibre product and said whole food drink are derived from the same species of a whole cereal grain and whole fruit, berry or vegetable.
Figure 1

100

102

104

106

110

108

112

114

116

120

118

115

112

108

104

102

100
Figure 2

200

202

204

208

210

212

216

220

206

214

218
Figure 4

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INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2010/053997

A. CLASSIFICATION OF SUBJECT MATTER

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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)

A23L

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

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

EPO-Internal, WPI Data, FSTA

C. DOCUMENTS CONSIDERED TO BE RELEVANT

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[ ] Further documents are listed in the continuation of Box C

[ ] See patent family annex

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Special categories of cited documents

'X' later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

'Y' document of particular relevance, the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

'Z' document of particular relevance, the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

'A' document member of the same patent family

Date of the actual completion of the international search: 8 June 2010

Date of mailing of the international search report: 29/07/2010

Name and mailing address of the ISA/Authorized officer

European Patent Office, P B 5818 Patentlaan 2
NL- 2280 HV RUSWIX
Tel (+31-70) 340-2040,
Fax (+31-70) 340-3016

Barac, Dominika
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**INTERNATIONAL SEARCH REPORT**

**International application No**
PCT/EP2010/053997

**C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT**

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Form PCT/ISA/210 (continuation of second sheet) (April 2005)
**INTERNATIONAL SEARCH REPORT**

Information on patent family members

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