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(54) Title of the Invention: **A composition for reducing fat absorption**  
Abstract Title: **Opuntia ficus indica, powdered psyllium husk and chitosan composition for reducing fat absorption**

(57) A composition for oral ingestion comprising powdered plant material from *Opuntia ficus indica*, powdered *Psyllium* (*plantago ovata*) husk and chitosan. Preferably, the composition comprises 1 to 4 parts by weight (100mg to 400mg) powdered plant material from *Opuntia ficus indica*; 0.5 to 1.5 part by weight (50mg to 150mg) powdered psyllium husk and 0.5 to 1.5 parts by weight (50mg to 150mg) chitosan. Preferably the powdered plant material from *Opuntia ficus indica* is derived from leaves of cladodes of the plant in which at least 75% by weight of the powder particles have sizes 230 to 280µm. Preferably the composition is contained within a capsule and is useful for binding lipids passing through the gastrointestinal tract and thereby preventing or reducing absorption of the lipids.

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## **A COMPOSITION FOR REDUCING FAT ABSORPTION**

This invention relates to a composition for reducing the absorption of fats from the gastrointestinal tract.

### **Background of the invention**

5 The incidence of obesity has increased dramatically over the past few decades in most developed countries and one reason for this has been a very large increase in the amount of fat consumed by the average member of the public. A great many solutions to this problem have been proposed ranging from special diets and exercise regimes, lipid-reducing food supplements and diet-suppressing drugs to  
10 surgical interventions such as gastric bands.

Various natural, semi-synthetic and synthetic substances have been developed and used for the purpose of binding lipids in the gastrointestinal (GI) tract in order to reduce or prevent absorption of the lipids. For example, synthetic polymer resins which may be polyamines or anionic polymeric resins have been proposed and  
15 used for binding to bile acids thereby preventing their reuptake and use in the biosynthesis of cholesterol. Examples of substances of this type are disclosed in GB929391 (Merck). A problem with bile acid sequestering resins has been their lack of palatability. Consequently, much research has been expended in finding combinations of the resins with agents that improve the palatability of the resins.  
20 For example, US5601837 discloses combinations of psyllium husk and cholestyramine for treating hypercholesterolemia. US5286481 discloses combinations of an anion-exchange resin such as cholestyramine, colestipol or polidexide and bran for use in weight-reduction.

Other examples of substances for use in binding bile acids or other lipids such as  
25 triglycerides are disclosed in DE4136325 (Hoechst), which discloses cyclodextrins as bile acid adsorption agents useful for treating hyperlipidaemia, and US2004/0126444 (Dallas *et al.*), which discloses the use of powdered plant material from the cladodes of cacti for binding dietary fats.

Chitosan has been used for binding and preventing the absorption of dietary fats.  
30 Chitosan is a deacetylated form of chitin, an amino polysaccharide (poly-N-acetyl glucosamine) found in the exoskeleton of arthropods (e.g., crustaceans such as

lobsters and crabs) and also found in some plants and fungi. Chitosan is similar in structure and properties to dietary fibre (e.g., vegetable bran, cellulose) but, unlike like bran and cellulose, chitosan has the ability to bind fat and other lipids in the intestine. A known problem with chitosan, as disclosed in WO99/21566 (Rexall  
5 Sundown), is that when chitosan is consumed in the quantities required for dietary fat reduction, constipation can result. Indeed, WO99/21566 discloses that the use of chitosan as a dietary supplement must be of short duration or other ingredients or supplements added to combat the undesirable effects of the chitosan. WO99/21566 proposes the addition of aloin, which contains aloe saponins, in order  
10 to offset the constipating effect of chitosan. US4999341 discloses the use of soy saponins to offset the constipating effect of the chitosan. US2007/0048392 (Oben) discloses the use of combinations of chitosan and a plant extract from a plant of the *Cissus*, *Vernonia* or *Brillantasia* families.

Psyllium seed husks are portions of the seeds of the plant *Plantago ovata*, (genus  
15 *Plantago*), a native of India. They are soluble in water, expanding and becoming mucilaginous when wet. Psyllium seed husks have also been used for binding dietary fats and preventing their absorption. However, although Psyllium seed husks act as a laxative in relatively small amounts, they can cause constipation when administered in the larger amounts needed for dietary fat removal.

20 Thus, at present, although numerous substances and combinations of substances have been used for binding dietary lipids in the GI tract so as to prevent uptake of the lipids, many are associated with problems that can limit their effectiveness and the extent to which they are used in many sections of the general population.

### **Summary of the invention**

25 The present invention provides an improved composition for binding dietary lipids in the GI tract and thereby preventing or reducing absorption of the lipids. In this way, the compositions provide a means of combatting obesity and hyperlipidaemia.

Accordingly, in a first aspect, the invention provides a composition for oral  
30 ingestion comprising powdered plant material from *Opuntia ficus indica*; powdered Psyllium husk and chitosan.

The composition may contain from 1 to 4 parts by weight of the powdered plant material from *Opuntia ficus indica*; from 0.5 to 1.5 parts by weight of powdered Psyllium husk and from 0.5 to 1.5 parts by weight of chitosan.

5 More particularly, the composition may contain from 100 mg to 400 mg of the powdered plant material from *Opuntia ficus indica*; from 50 mg to 150 mg of the powdered Psyllium husk and from 50 mg to 150 mg of the chitosan.

For example, the composition may contain from 200 mg to 300 mg of the powdered plant material from *Opuntia ficus indica*; from 75 mg to 125 mg of the powdered Psyllium husk and from 75 mg to 125 mg of the chitosan.

10 In one preferred embodiment, the composition contains from approximately 250 mg of the powdered leaf material from *Opuntia ficus indica*; approximately 100 mg of the powdered Psyllium husk and approximately 100 mg of the chitosan.

The compositions of the invention may be presented in the form of capsules.

15 The compositions of the invention may also be presented as medical devices, the term medical device as used herein referring to a substance which whilst providing a medical benefit to a subject, is not absorbed significantly from the subject's GI tract and does not exert its actions by pharmacological means.

20 The composition, capsule or medical device of the invention as defined herein may be used for binding lipids passing through the gastrointestinal tract and thereby preventing or reducing absorption of the lipids.

Psyllium seed husks are portions of the seeds of the plant *Plantago ovata*, (genus *Plantago*), a native of India. They are soluble in water, expanding and becoming mucilaginous when wet.

25 In the compositions of the present invention, the Psyllium seed husks may be presented in powder form wherein at least 99.5% by weight of the particles forming the powder have a particle size (e.g. diameter) of 600  $\mu\text{M}$  or less. Such particles will pass through a 30 mesh sieve. In one embodiment, at least 99.5% by weight of the particles have a particle size (e.g. diameter) of 400  $\mu\text{M}$  or less. Such particles will pass through a 40 mesh sieve. In another embodiment, at least 99.5% by  
30 weight of the particles have a particle size (e.g. diameter) of 300  $\mu\text{M}$  or less. Such

particles will pass through a 50 mesh sieve. In a further embodiment, at least 95% by weight of the particles have a particle size (e.g. diameter) of 210  $\mu\text{M}$  or less.

Such particles will pass through a 70 mesh sieve. In another embodiment, at least 75% by weight of the particles will pass through a 50 to 60 mesh sieve and have particle sizes in the range from 230 to 280  $\mu\text{M}$ .

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The chitosan used in the compositions of the present invention is produced commercially by deacetylation of chitin, which is the structural element in the exoskeleton of crustaceans (crabs, shrimp, etc.) and cell walls of fungi. The degree of deacetylation is typically in the range 60-100 %, for example from 50-90% or 60-80%. The average molecular weight of the chitosan is typically between 3,800 and 20,000 daltons, for example from 5,000 to 15,000 daltons, or from 5,000 to 10,000 daltons, or from 7,500 to 12,500 daltons..

10

The chitosan is presented in the form of a powder. The chitosan may be presented in powder form wherein at least 99.5% by weight of the particles forming the powder have a particle size (e.g. diameter) of 600  $\mu\text{M}$  or less. Such particles will pass through a 30 mesh sieve. In one embodiment, at least 99.5% by weight of the particles have a particle size (e.g. diameter) of 400  $\mu\text{M}$  or less. Such particles will pass through a 40 mesh sieve. In another embodiment, at least 99.5% by weight of the particles have a particle size (e.g. diameter) of 300  $\mu\text{M}$  or less. Such particles will pass through a 50 mesh sieve. In a further embodiment, at least 95% by weight of the particles have a particle size (e.g. diameter) of 210  $\mu\text{M}$  or less. Such particles will pass through a 70 mesh sieve. In another embodiment, at least 75% by weight of the particles will pass through a 50 to 60 mesh sieve and have particle sizes in the range from 230 to 280  $\mu\text{M}$ .

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*Opuntia ficus indica* is a cactus found in Central and South America. The cactus produces "cladodes" or truncated branches of the stem that contain chlorophyll and are adapted to carry out photosynthesis. The cladodes have a leaf-like appearance but are not true leaves. In the present context, the term "leaf material from *Opuntia ficus indica*" refers to the cladodes.

25

The term "plant material" includes material derived from the cladodes or from other parts of the plant such as the plant stem.

30

In one preferred embodiment, the plant material is derived from the cladodes or leaves of the plant.

The cladodes or other parts of the plant are dried and then ground to a powder in which at least 99.5% by weight of the particles have a maximum dimension (e.g. diameter) of less than 300  $\mu\text{M}$ . More typically, at least 70% by weight of the particles have a maximum dimension (e.g. diameter) of less than 100  $\mu\text{M}$ .

Further details of the preparation of powdered plant material from *Opuntia ficus indica* may be found in US2004/0126444.

The powdered plant material is presented in the form of a powder. The plant material may be presented in powder form wherein at least 99.5% by weight of the particles forming the powder have a particle size (e.g. diameter) of 600  $\mu\text{M}$  or less. Such particles will pass through a 30 mesh sieve. In one embodiment, at least 99.5% by weight of the particles have a particle size (e.g. diameter) of 400  $\mu\text{M}$  or less. Such particles will pass through a 40 mesh sieve. In another embodiment, at least 99.5% by weight of the particles have a particle size (e.g. diameter) of 300  $\mu\text{M}$  or less. Such particles will pass through a 50 mesh sieve. In a further embodiment, at least 95% by weight of the particles have a particle size (e.g. diameter) of 210  $\mu\text{M}$  or less. Such particles will pass through a 70 mesh sieve. In another embodiment, at least 75% by weight of the particles will pass through a 50 to 60 mesh sieve and have particle sizes in the range from 230 to 280  $\mu\text{M}$ .

The compositions of the invention are typically administered with or without (but preferably with or shortly before or after) meals one or more times per day. For example, the compositions may be administered from two to four times per day.

The compositions may be administered so that the daily intakes of the three components are as follows:

Powdered plant material from *Opuntia ficus indica*: 100 mg to 1600 mg

Powdered Psyllium husk: 50 mg to 600 mg

Chitosan: 50 mg to 600 mg

The compositions of the invention bind fats and other lipids in the GI tract and carry them through so that they are excreted with the faeces. In this way, the fats and

other lipids cannot be absorbed by the body. By mopping up a large proportion of the fats in food consumed by a subject, obesity and hyperlipidaemia may be prevented.

5 The invention will now be illustrated but not limited, by reference to the following specific example.

#### EXAMPLE 1

##### Capsule formulation 1

10 Into a two part capsule shell formed from hydroxypropyl methylcellulose is filled a mixture of powdered *Opuntia ficus indica*, *Psyllium* husk and chitosan in the following proportions:

Opuntia ficus indica powder	250 mg
Psyllium husk powder	100 mg
chitosan powder	100 mg

15 The capsules are taken as a food supplement, two capsules being administered with each meal up to a total of six capsules per day.

It will readily be apparent that numerous modifications and alterations may be made to the specific embodiments of the invention described above without departing from the principles underlying the invention. All such modifications and alterations are intended to be embraced by this application.

**CLAIMS**

1. A composition for oral ingestion comprising powdered plant material from *Opuntia ficus indica*; powdered Psyllium husk and chitosan.
- 5 2. A composition according to claim 1 comprising from 1 to 4 parts by weight of the powdered plant material from *Opuntia ficus indica*; from 0.5 to 1.5 parts by weight of powdered Psyllium husk and from 0.5 to 1.5 parts by weight of chitosan.
- 10 3. A composition according to claim 2 containing from 100 mg to 400 mg of the powdered plant material from *Opuntia ficus indica*; from 50 mg to 150 mg of the powdered Psyllium husk and from 50 mg to 150 mg of the chitosan.
- 15 4. A composition according to claim 3 containing from 200 mg to 300 mg of the powdered plant material from *Opuntia ficus indica*; from 75 mg to 125 mg of the powdered Psyllium husk and from 75 mg to 125 mg of the chitosan.
- 20 5. A composition according to claim 4 containing from approximately 250 mg of the powdered plant material from *Opuntia ficus indica*; approximately 100 mg of the powdered Psyllium husk and approximately 100 mg of the chitosan.
- 25 6. A composition according to any one of claims 1 to 5 wherein the powdered plant material from *Opuntia ficus indica* is derived from leaves or cladodes of the plant.
7. A composition according to any one of claims 1 to 6 wherein the powdered plant material from *Opuntia ficus indica* is presented in the form of a powder in which at least 75% by weight of the particles have particle sizes in the range from 230 to 280  $\mu\text{M}$ .
8. A composition according to any one of claims 1 to 7 wherein the powdered Psyllium husk is presented in the form of a powder in which at least 75% by weight of the particles have particle sizes in the range from 230 to 280  $\mu\text{M}$ .



9. A composition according to any one of claims 1 to 8 wherein the chitosan is presented in the form of a powder in which at least 75% by weight of the particles have particle sizes in the range from 230 to 280  $\mu\text{M}$ .
10. A capsule containing a composition according to any one of claims 1 to 9.
- 5 11. A medical device comprising a composition according to any one of claims 1 to 9.
12. A composition, capsule or medical device according to any one of claims 1 to 11 for use in binding lipids passing through the gastrointestinal tract and thereby preventing or reducing absorption of the lipids.



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**Examiner:** Dr Natalie Cole

**Claims searched:** 1-12

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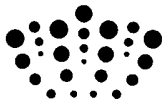
**Patents Act 1977: Search Report under Section 17**

**Documents considered to be relevant:**

Category	Relevant to claims	Identity of document and passage or figure of particular relevance
Y	1-6, 10, 12 at least	US2002/137729 A1 (BABISH) See whole document especially abstract and examples
Y	1-6, 10, 12 at least	Journal of Medicine, vol. 33, No 1-4, 2002, pages 209-225 ARANDA et al. "Efficacy of a novel chitosan formulation on fecal fat excretion: A double-blind, crossover, placebo-controlled study". See whole document
Y	1-6, 10, 12 at least	US2004/126444 A1 (D'HUART) See whole document especially abstract and examples
Y	1-6, 10, 12 at least	<a href="http://web.archive.org/web/20081026094448/http://www.neopuntia.com/uk/Lipophilic-properties_2_9.html">http://web.archive.org/web/20081026094448/http://www.neopuntia.com/uk/Lipophilic-properties_2_9.html</a> available online 26 October 2008 (wayback machine) accessed 2 August 2012 See internet page NeOpuntia for reducing fat absorption
Y	1-6, 10, 12 at least	US2010/323045 A1 (PISCHEL) See whole document especially paragraph [0008]
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Y	1-6, 10, 12 at least	KR20100084027 A (UNIV SEJONG IND ACAD COOP GR) See WPI abstract Accession No. 2010-M37621 [82]
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**Categories:**

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date



earlier than, the filing date of this application.

**Field of Search:**

Search of GB, EP, WO & US patent documents classified in the following areas of the UKC<sup>X</sup> :

Worldwide search of patent documents classified in the following areas of the IPC

A61K; A61P

The following online and other databases have been used in the preparation of this search report

CAS ONLINE, EPODOC, WPI, MEDLINE, BIOSIS, TXTE

**International Classification:**

Subclass	Subgroup	Valid From
A61K	0036/33	01/01/2006
A61K	0031/722	01/01/2006
A61K	0036/68	01/01/2006
A61P	0003/04	01/01/2006
A61P	0003/06	01/01/2006