634469

AUSTRALIA

The Patents Act 1952

CONVENTION APPLICATION FOR A PATENT

WE, ROUSSEL-UCLAF, of 35 Boulevard des Invalides, 75007, Paris, France, hereby apply for the grant of a Patent for an invention entitled:

"USE AS LOW-CALORIE SWEETENERS OF FRUCTOSYL OLIGOSACCHARIDES AND THE FOOD OR DIETETIC PRODUCTS OR DRINKS CONTAINING THEM".

which is described in the accompanying complete specification.

This application is a Convention application and is based on the Application Numbered 88-04944 for a patent or similar protection made in France on 14th April, 1988.

Our address for service is: CALLINANS, Patent and Trade Mark Attorneys, of 48-50 Bridge Road, Richmond 3121, Victoria, Australia.

D A T E D this 13th day of April, 1989.

ROUSSEL-UCLAF

By its Patent Attorneys:

CALLINANS

To: The Commissioner of Patents

Form

AUSTRALIA

Patents Act 1952-1973

2216/AUS

Regulation 11
Regulation 11

Declaration in Support of
(a) A Convention Application
~~(b) An Application~~
for a Patent ~~or Patent of Addition~~

(a) Delete for Non-Convention Application.

(b) Delete for Convention Application.

In support of the ~~Application/~~Convention Application made by

(c) Insert Full Name of Applicant

(c) ROUSSEL-UCLAF (hereinafter termed "the said Company")

for a patent/~~patent of addition~~ for an invention entitled:

(d) Insert Title of Invention.

(d) USE AS LOW-CALORIE SWEETENERS OF FRUTOSYL OLIGOSACCHARIDES AND THE FOOD OR DIETETIC PRODUCTS OR DRINKS CONTAINING THEM

(e) Insert Full Names of Declarant(s).

I/~~We~~ (e) HUBERT FRITEL

(f) Insert Address(es) of Declarant(s).

of (f) 35 BOULEVARD DES INVALIDES, 75005, PARIS, FRANCE

do solemnly and sincerely declare as follows:—

(g) Delete when Applicant is a Company.

1. ~~(g) I am/we are the applicant(s) for the patent/patent of addition~~

~~or~~

(h) Delete when Applicant is an Individual. Fill in Name of Applicant if a Company.

(h) I am/~~we are~~ authorised by

the applicant for the patent/~~patent of addition~~ to make this declaration on its behalf.

(i) For Non-Convention Application, delete. For Convention Application, fill in details of basic application.

2. (i) The basic application~~(s)~~ as defined by Section 141 of the Act was/~~were~~ made in FRANCE on the 14TH day of APRIL 1988 by THE SAID COMPANY

(j) Delete for Non-Convention Application by Assignee of Inventor and for Convention Application.

(k) Delete for Non-Convention Application by Inventor and for Convention Application by Assignee.

3. (j) ~~I am/we are the actual inventor(s) of the invention~~

~~or~~

(k) ~~I am/we are the actual inventor(s) of the invention referred to in the basic application.~~

~~or~~

(l) For Application by Inventor, delete. For Application by Assignee, insert name, address and occupation of Inventor.

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~~is~~/are the actual inventor(s) of the invention and the facts upon which ~~I am/we are/the~~ said Company is entitled to make the application are as follows:

(m) Insert details of Assignment, etc. Date of Assignment only is insufficient.

(m) The said company would, if a patent were to be granted upon an application made by the said actual inventors, be entitled to have the patent assigned to it.

(n) Delete for Non-Convention Application.

(n) The basic application referred to in paragraph 2 of this Declaration was the first application made in a Convention country in respect of the invention the subject of the application.

(n) Insert place and date of signature.

(n) Declared at Paris, France this 24th day of March 19 89

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AU8932744

(12) PATENT ABRIDGMENT (11) Document No. AU-B-32744/89
(19) AUSTRALIAN PATENT OFFICE (10) Acceptance No. 634469

(54) Title
USE AS LOW-CALORIE SWEETENERS OF FRUCTOSYL OLIGOSACCHARIDES AND THE FOOD OR DIETETIC PRODUCTS OR DRINKS CONTAINING THEM

International Patent Classification(s)
(51)[4] A23L 001/236 C07H 003/06 A61K 031/715

(21) Application No. : 32744/89 (22) Application Date : 13.04.89

(30) Priority Data

(31) Number (32) Date (33) Country
88 04944 14.04.88 FR FRANCE

(43) Publication Date : 19.10.89

(44) Publication Date of Accepted Application : 25.02.93

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(57) Claim

1. Method intended to reduce the total daily energy intake in man or in animals, characterized in that one or more fructosyl oligosaccharides, containing from 3 to 8 carbohydrate units joined by beta bonds, replace all or part of the calorific sugars in products intended for food or dietetics in an amount sufficient to reduce the calorie intake of the subject by 5 to 20% in comparison with the calorie intake of the subject consuming the product containing the caloric sugar.

3. Method as defined by claim 2, wherein said trisaccharides are made up of a glucose-fructose pseudo beta linked molecule and a glucose molecule, the glucoside units being joined either by a $beta_{1-2}$ bond so as to form sophorofructose, or by a $beta_{1-3}$ bond so as to form laminaribiofructose, or by a $beta_{1-4}$ bond so as to form cellobiofructose, or by a $beta_{1-6}$ bond so as to form gentiobiofructose.

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Form 10

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COMPLETE SPECIFICATION

(ORIGINAL)

FOR OFFICE USE

Short Title:

Int. Cl:

Application Number:
Lodged:

Complete Specification - Lodged:
Accepted:
Lapsed:
Published:

Priority:

Related Art:

TO BE COMPLETED BY APPLICANT

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Address for Service: CALLINANS, Patent Attorneys, of 48-50 Bridge Road, Richmond 3121, Victoria, Australia.

Complete Specification for the invention entitled: "USE AS LOW-CALORIE SWEETENERS OF FRUCTOSYL OLIGOSACCHARIDES AND THE FOOD OR DIETETIC PRODUCTS OR DRINKS CONTAINING THEM".

The following statement is a full description of this invention, including the best method of performing it known to us:-

Use as low-calorie sweeteners of fructosyl oligosaccharides and the food or dietetic products or drinks containing them.

****

Company named: ROUSSEL-UCLAF

****

The present invention concerns the use as low-calorie sweeteners of fructosyl oligosaccharides and the foods, dietetic products and drinks containing them.

Most of the sugar used in food is made up of saccharose which is a disaccharide containing a glucose and a fructose joined together by their anomeric carbons.

In addition to its role as a sweetening agent in food, saccharose also has a role as an energy-giver, since the burning up of 1 g of saccharose gives our bodies 4 Kcal. Due to its functional properties (melting temperature, solubility, ability to crystallize), it also provides the role of a structural agent and a preservative in food.

Recently, a strong tendency has come about for the reduction of the calorie contribution of foods, in order to prevent obesity ("lightly" cooked meals, "dietetic" drinks ...) and consequently for a demand for sugars which are low-calorie substitutes for saccharose.

It has already been discovered that some fructosyl oligosaccharides possess both an appropriate sweetening capacity and slightly cariogenic and/or anti-caries properties (FP 2 450 876), but no mention has been made of the calorific value of the products quoted.

Now, it has just been discovered, and it is the subject of the present invention, that fructosyl oligosaccharides can also reduce, in an unexpected way, the daily calorie intake in comparison with saccharose. In effect it should be stated that the fact that a sugar is anti-cariogenic or slightly cariogenic does not in any way mean that it is a low-calorie product.

There can be cited, amongst others, the examples of xylitol (J.J. BEEREBOOM CRC Critical Reviews in Food Science and Nutrition, May 1979, p. 401-413), of leucrose or 5-O-alpha-(D-glucopyranosyl)D-fructo-

pyranose (USP 4 693 974) and of "coupling-sugars" (TSUJI Y. et Coll., J. Nutr. Sci. Vitaminol., 32, 93-100, 1986), fructosyl oligosaccharides produced by the HAYASHIBARA company (FP 2 559 490), which are slightly cariogenic but known to be calorific.

A subject of the present invention is therefore a method intended to reduce the total daily energy intake in man or in animals, characterized in that one or more fructosyl oligosaccharides, containing from 3 to 8 carbohydrate units joined by beta bonds, replace all or part of the calorific sugars in products intended for food or dietetics in an amount sufficient to reduce the calorie intake of the subject by 5 to 20% in comparison with the calorie intake of the subject consuming the product containing the caloric sugar.

The object of the method indicated above is in particular to improve man's physical appearance by encouraging weight loss.

The calorific sugars present in food are essentially saccharose but other sugars such as fructose, glucose, and glucose/fructose syrup, optionally enriched with fructose, are also used.

By low-calorific sugars is meant sugars which, in contrast with saccharose, are only slightly or not at all broken down by digestive enzymes: salivary amylases, pancreatic amylase, disaccharidases of the intestinal brush border.

The results given in examples 1 to 3 hereafter show that the oligosaccharides used in the method of the invention are not broken down by salivary and pancreatic amylases and are only slightly or not at all broken down by the disaccharides of the intestinal brush border.

In view of these results, it can be expected that the method of the present invention reduces the total daily energy intake in man by 5 to 20%.

This reduction can be made by a total or partial replacement of the calorific sugars present in food, such as saccharose, by the fructosyl oligosaccharides according to the present invention.

The fructosyl oligosaccharides used in the method of the present invention are made up of simple carbohydrate units joined by beta bonds, the final carbohydrate unit being a fructose molecule.

The invention concerns in particular a method intended to reduce the total daily energy intake in man, characterized in that the fructosyl oligosaccharides used are trisaccharides.

The subject of the invention in particular the method defined above, characterized in that the trisaccharides used are made up of a glucose-fructose pseudo beta linked molecule and a glucose molecule, the glucoside units being joined either by a $beta_{1-2}$ bond so as to form sophorofructose, or by a $beta_{1-3}$ bond so as to form laminaribiofructose, or by a $beta_{1-4}$ bond so as to form cellobiofructose, or by a $beta_{1-6}$ bond so as to form gentiobiofructose.

A subject of the invention particularly the method defined above, characterized in that the trisaccharides used are made up of a glucose-fructose pseudo beta linked molecule and a glucose molecule, the glucoside units being joined either by a $beta_{1-4}$ bond so as to form cellobiofructose, or by a $beta_{1-6}$ bond so as to form gentiobiofructose.

A subject of the invention, more particularly the method defined above, characterized in that the trisaccharides used are made up of a glucose-fructose pseudo beta linked molecule and a glucose molecule, the glucoside units being joined by a $beta_{1-6}$ bond so as to form gentiobiofructose.

Another subject of the invention in particular the method defined above, characterized in that the trisaccharides are made up of a saccharose molecule and one of sophorose, laminaribose, gentiobiose or cellobiose, the glucoside units being joined either by a $beta_{1-2}$ bond so as to form sophorofructose, or by a $beta_{1-3}$ bond so as to form laminaribiofructose, or by a $beta_{1-4}$ bond so as to form cellobiofructose, or by a $beta_{1-6}$ bond so as to form gentiobiofructose.

Another subject of the invention particularly the method defined above, further characterized in that the trisaccharides used are made up of a saccharose molecule and one of cellobiose or gentiobiose, the glucoside units being joined either by a $beta_{1-4}$ bond so as to form cellobiofructose, or by a $beta_{1-6}$ bond so as to form gentiobiofructose.

Another subject of the invention more particularly the method defined above, even further characterized in that the trisaccharides used are made up of a saccharose molecule and gentiobiose, the glucoside units being joined by a $beta_{1-6}$ bond so as to form gentiobiofructose.

The results given in the experimental part show that the fructosyl oligosaccharides according to the present invention have organoleptic and physico-chemical properties which make them suitable for totally or partially replacing saccharose, as regards structuring ability, acid and thermic stabilities, solubility, viscosity, retention of water, sweetening ability. Their non-acute toxicity at a dose of 2 g/kg was demonstrated on a mouse.

On the other hand, like saccharose, they are non-reducing sugars, which do not give rise to Maillards' reactions.

All these properties make them perfectly usable in food or dietetic products.

When used in food, dietetic products or drinks, oligosaccharides can be used alone, or if necessary in combination with other sweeteners, such as for example saccharose, glucose, isomerized sugar, glucose/fructose syrup whether or not enriched with fructose, maltose, sorbitol, maltitol, lactitol, xylitol, aspartame ^{R}, acesulphame ^{R}K, and saccharin. They can also be combined with filling agents such as for example polydextrose ^{R}, starch, maltodextrin, lycasin ^{R} and lactose, colouring substances, perfumes and seasonings.

The invention therefore concerns food or dietetic products or drinks, characterized in that the calorific sugars that they contain are totally or partially replaced by one or more fructosyl oligo-

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saccharides containing from 3 to 8 carbohydrate units joined by beta bonds.

The invention concerns in particular such products or drinks, characterized in that they contain by weight, at least 5% of one or more fructosyl oligosaccharides containing from 3 to 8 carbohydrate units joined by beta bonds.

The invention concerns more particularly such products or drinks, characterized in that they contain by weight from 5 to 70% of one or more fructosyl oligosaccharides containing from 3 to 8 carbohydrate units joined by beta bonds.

The invention especially concerns such products or drinks, characterized in that they contain cellobiofructose, gentiobiofructose, laminaribiofructose and sophorofructose.

The invention concerns in particular such products or drinks, characterized in that they contain cellobiofructose or gentiobiofructose, and quite particularly gentiobiofructose.

The fructosyl oligosaccharides can be used in all foods and drinks, in the form of syrup, powder, in freeze-dried form, in crystal form or in pieces.

The words "food" and "drink" include all food and drink in general, such as sweets, jams, cakes, ice-creams and sorbets, creams, various desserts, pâtés, dressings, everyday dishes, carbonated or still drinks, food for domestic animals and in a general way any products taken orally, as well as sweeteners containing fructosyl oligosaccharides.

In addition the subject of the invention is also the use of fructosyl oligosaccharides containing from 3 to 8 carbohydrate units joined by beta bonds, for preparing pharmaceutical products, with the aim of reducing the total daily energy intake in man, and in particular the use of gentiobiofructose, laminaribiofructose, sophorofructose and cellobiofructose for preparing such pharmaceutical products.

These products are used for example for encouraging weight loss in man, in the treatment of obesity and of diabetes; fructosyl oligosaccharides can also be used an a sweetening excipient in toothpastes, in any medicaments intended to be taken orally, for example, syrups, lozenges, drinkable drops.

The invention concerns fructosyl oligosaccharides containing from 3 to 8 carbohydrate units joined by beta bonds, for their use in a dietetic method consisting in the reduction of total daily energy intake and in particular gentiobiofructose, laminaribiofructose, sophorofructose and cellobiofructose for such a use.

In addition, one of the subjects of the invention is also the use, as slightly calorific sugars, of fructosyl oligosaccharides containing from 3 to 8 carbohydrate units joined by beta bonds, in particular gentiobiofructose, laminaribiofructose, sophorofructose and cellobiofructose.

The fructosyl oligosaccharides used in the method of the invention can be prepared, for example, according to the process described by S. HESTRIN and G. AVIGAD (Biochem. J., 69, 388-398, 1958) by the action of a levanesaccharose (Enzyme Code E.C. 2.4.1.10) (enzyme nomenclature Academic Press. 1984-IUB) on a substrate solution containing saccharose and, alone or mixed, sugars such as gentiobiose, cellobiose, oligosaccharides with a degree of polymerization of 3 to 14 obtained by partial hydrolysis of the carbohydrate polymers, such as cellulose, the simple carbohydrate units of which are joined by beta bonds.

In this way all the fructosyl oligosaccharides used in the method of the invention are obtained, alone or mixed, and in particular gentiobiofructose, cellobiofructose and fructosyl oligosaccharides with a degree of polymerization of 3 to 15.

The fructosyl oligosaccharides can also be prepared according to an inverse enzymatic hydrolysis process carried out in the presence of a strong concentration of substrate.

Patent No. WO 87/05936 describes the enzymatic synthesis of oligosaccharides by the use of such a process. However, the oligosaccharides prepared in the above patent are totally different from the fructosyl oligosaccharides according to the present invention and the patent does not mention the use of saccharose as a carbohydrate residue acceptor.

A mixture made up of a concentrated solution of saccharose, used as a carbohydrate residue acceptor, and of simple sugars or carbohydrate polymers, is submitted to the action of one or more carbohydrolases.

The carbohydrolases used in the process, which belong to the glycosidase family, hydrolyze the beta bonds in carbohydrate polymers (E.C. 3.2.1.X) and more particularly cellulases or cellulolyte complexes (E.C. 3.2.1.4), laminarinases (E.C. 3.2.1.6), beta-glucosidases (E.C. 3.2.1.21), endo-1,3-beta-glucosidases (E.C. 3.2.1.39), glucan-1,3beta-glucosidases (E.C. 3.2.1.58), glucan-endo-1,2beta-glucosidases (E.C. 3.2.1.71), lichenases (E.C. 3.2.1.73), glucan-1,4beta-glucosidases (E.C. 3.2.1.74), glucan-endo-1,6beta-glucosidases (E.C. 3.2.1.75) and oxocellobiohydrolases (E.C. 3.2.1.91), in concentrated solutions of saccharose, glucose, methyl beta-glucoside, cellobiose, gentiobiose, sophorose, laminaribiose, oligo-dextrins the simple carbohydrate units of which are joined by beta bonds, and carbohydrate polymers the simple carbohydrate units of which are joined by beta bonds.

All these carbohydrate residue donors are used alone or mixed.

The analysis of the fructosyl oligosaccharides formed according to one or other of the processes can be carried out for example by HPLC inverse phase on a Nucleosil C18 column.

The structure of the fructosyl oligosaccharides formed can be confirmed, for example, by NMR of the carbon 13 and of the proton after isolation, in a pure state, of these oligosaccharides by HPLC inverse phase on a Nucleosil C18 preparatory column. The eluent for the oligosaccharides which have a degree of polymerization of 3 to 5 is water, and for those which have a degree of polymerization greater than or equal to 5 the eluent is an appropriate mixture of water and methanol.

The fructosyl oligosaccharides used in the method of the invention can be isolated and purified, in a preparatory way, using for example chromatography on activated carbon powder, ion-exchange chromatography, starting with the mixture of sugars obtained by one or other of the processes.

The mixture of oligosaccharides can also be used just as it is.

The examples given hereafter illustrate the invention without however limiting it.

Example 1: Hydrolysis of gentiobiofructose and cellobiofructose by the alpha amylases of human saliva and of the pancreas of a pig

1.1: Preparation of the gentiobiofructose or cellobiofructose solution.

The synthesis of gentiobiofructose or cellobiofructose is carried out by the action of a levane-saccharase on a substrate solution containing saccharose and gentiobiose (cellobiose) according to the process described by S. HESTRIN and G. AVIGAD.

The gentiobiofructose (cellobiofructose) formed is then isolated and purified from the reaction medium by semi-preparatory HPLC in inverse phase (Nucleosil C18 column - eluent: water), concentrated and then lyophilized.

The product is then dissolved in a 0.1M sodium phosphate buffer, (pH 7.0), so as to obtain a final concentration of 3 g/litre of fructosyl oligosaccharide.

1.2: Hydrolysis test with alpha amylase of human saliva.

A mixture containing 2 ml of fructosyl oligosaccharide solution (prepared in 1.1) and 17.8 units of alpha amylase of human saliva (SIGMA Ref. A 0521) is incubated for 2 hours at 37°C.

After 2 hours, the reaction is stopped by heating. The glucose which has appeared is measured by the enzymatic method with glucose oxidase/peroxidase (Boehringer test Ref. 124036). In the same way a control test is carried out with maltodextrins, type glucidex 21 (Société Roquette, France).

The results obtained are given in micromoles of glucose formed per enzyme unit and per hour.

Substrate	Activity of the alpha amylase of human saliva
Maltodextrins	235
Gentiobiofructose	0
Cellobiofructose	0

1.3 Hydrolysis test with alpha amylase of the pancreas of a pig.

A mixture containing 2 ml of fructosyl oligosaccharide solution (prepared in 1.1) and 19 units of alpha amylase from the pancreas of a pig (SIGMA Ref. A1278) is incubated for 2 hours at 37°C.

The reaction is stopped by heating. The glucose which has appeared is measured by the enzymatic method with glucose oxidase/peroxidase (Boehringer test Ref. 124036).

A control test is carried out with maltodextrins, type glucidex 21 (Société Roquette, France).

The results are given in micromoles of glucose formed per enzyme unit and per hour.

Substrate	Activity of the alpha amylase from the pancreas of a pig
Maltodextrins	224
Gentiobiofructose	0
Cellobiofructose	0

Example 2: Hydrolysis of fructosyl oligosaccharides by a homogenate of the jejunum of a rat

2.1: Preparation of the fructosyl oligosaccharides.

The synthesis of the fructosyl oligosaccharides is carried out by the action of a levane-saccharase on a substrate solution containing saccharose and gentiobiose (cellobiose or a cellulose hydrolysate) according to the process described by S. HESTRIN and G. AVIGAD.

The oligosaccharides formed are purified by semi-preparatory HPLC (Nucleosil C18 column - eluent: water), then lyophilized.

Then the products are dissolved in a 0.05M sodium phosphate buffer, pH 6.0, so as to have a molar concentration of 2.924 mmoles per litre.

2.2: Preparation of the homogenate of the jejunum of a rat.

5 cm of jejunum is removed from a male Sprague Dawley rat (previously put on a diet for 24 hours) and rinsed with a solution of physiological serum.

The jejunum (weighing about 150 mg) is pulverized in the presence of 0.9% NaCl (w/v) using a "Polytron" type homogenizer, then the pulverized product is brought to 10 ml (with 0.9% NaCl solution).

2.3: Hydrolysis of the fructosyl oligosaccharides by the homogenate of the jejunum of a rat.

The reaction mixture containing 2 ml of fructosyl oligosaccharide solution and 2 ml of homogenate is incubated for 24 hours at 37°C, under magnetic agitation.

Samples are taken at regular intervals, and the intestinal enzymes are thermally inactivated.

A parallel test is carried out on a control solution containing saccharose.

The glucose released, over a period of time, is measured by the enzymatic method with glucose oxidase/peroxidase.

The degree of hydrolysis is calculated as follows:

$$DH\ \% = \frac{\text{glucose released } (\mu g)}{\text{total releasable glucose } (\mu g)} \times 100$$

TABLE I

Time (hours)	Saccharose DH %	Gentiobiofructose DH %	Cellobiofructose DH %
0	0	0	0
8 hr 30	57.6	0	0
17 hr 30	66.7	0.4	3.7
24 hr 00	92.7	0.4	5.4

In a second series of tests, the evolution of the composition of the fructosyl oligosaccharide is followed over a period of time, by inverse phase HPLC (Nucleosil C18 column - eluent: water), the control sugar still being saccharose.

The results are given in Table II.

TABLE II

Products tested	Time (hours)	Composition in carbohydrate % *1						
		Glucose + Fructose	Saccharose	Gentiobio fructose	Cellobio fructose	DP_3F	DP_4F	
Saccharose	0h	0	100	-	-	-	-	
	8h30	-	-	-	-	-	-	
	24h00	96	4	-	-	-	-	
Gentiobio fructose	0	0	-	100	-	-	-	
	8h30	0	ND *2	100	-	-	-	
	24h00	0.4	ND	99,6	-	-	-	
Cellobio fructose	0h	0	-	-	100	-	-	
	8h30	3.0	ND	-	97.0	-	-	
	24h00	6.4	ND	-	93.6	-	-	
DP_3F	0h	0	-	-	-	100	-	
	24h	5	-	-	-	95	-	
DP_4F	0h	0	-	-	-	-	100	
	24h	5	-	-	-	-	95	

DP = Degree of polymerization

*1 : $\%HPLC = \frac{\text{Surface of peak considered}}{\text{Surface represented by all the peaks}} \times 100$

*2 : undetectable

Example 3: Hydrolysis of fructosyl oligosaccharides by a homogenate of human jejunal mucous

3.1: Preparation of gentiobiofructose or cellobiofructose solutions.

The preparation is identical to that given in example 2, paragraph 2.1.

3.2: Preparation of the homogenate of human jejunal mucous.

The jejunal mucous (about 40 mg) is homogenized in the presence of a 0.9% aqueous solution of NaCl (weight/volume) using a "Polytron" type homogenizer, then the homogenate is brought to 12 ml (with the 0.9% solution of NaCl).

3.3: Hydrolysis of gentiobiofructose or cellobiofructose by the homogenate of human jejunal mucous.

The reaction mixture containing 2 ml of fructosyl oligosaccharide solution and 2 ml of homogenate is incubated for 24 hours at 37°C under magnetic agitation.

Samples are taken at regular intervals, and the intestinal enzymes are thermally inactivated.

A parallel test is carried out on a control solution containing saccharose.

The glucose released over a period of time is measured by the enzymatic method with glucose oxidase/peroxidase.

The degree of hydrolysis is calculated as follows:

$$DH\ \% = \frac{\text{Glucose released } (\mu g)}{\text{Total releasable glucose } (\mu g)} \times 100$$

TABLE III

Time (hours)	Saccharose DH %	Gentiobiofructose DH %	Cellobiofructose DH %
0 hr	0	0	0
10 hr	57.1	0	0
24 hr	88.0	0	0

Conclusion for examples 1 to 3

As can be seen from Tables 1 to 3, the results show that the fructosyl oligosaccharides are very slightly hydrolysed by the enzymes of the intestinal brush border of the rat and of man, unlike saccharose.

In addition the results of example 1 show the total absence of hydrolysis by human salivary alpha amylase, and alpha amylase of the pancreas of a pig.

It can be concluded that the fructosyl oligosaccharides are suitable as sweeteners with a low-calorific capacity.

Example 4:

A control raspberry sorbet containing saccharose was prepared according to the following recipe:

Raspberry sorbet (control):

. 200 g of saccharose
. 200 g of water
. 40 g of Cristal R glucose Trade Mark CPC
. 400 g of raspberries
. 2 g of apple pectin
. 1 tablespoonful of lemon juice
. sugar syrup adjusted to 18 degrees Bé

The same raspberry sorbet as the control sorbet was made, except that the 200 g of saccharose was replaced by cellobiofructose, prepared according to the process described by S. HESTRIN and G. AVIGAD.

The operating conditions were strictly identical for the two tests.

According to a trained panel of 10 people, there is no significant difference, as regards the sweet taste, between the control saccharose and the cellobiofructose sample.

In addition, these people noticed a better consistency in the sorbet according to the invention, which liquefied less quickly than the control sorbet.

Example 5:

A control vanilla ice cream made with eggs, containing saccharose, was prepared according to the following recipe:

Vanilla ice cream made with eggs (control):

- 100 g of saccharose
- 500 ml of semi-skimmed milk
- 20 g of skimmed-milk powder
- 40 g of Trimoline R (invert sugar)
- 1 g of apple pectin
- half a vanilla pod
- 3 egg yolks (60 g eggs)
- 40 g of fresh cream

A test vanilla ice cream made with eggs was prepared according to the same operating method, by simple replacement of the 100 g of saccharose by 100 g of cellobiofructose obtained according to the process described by S. HESTRIN and G. AVIGAD.

According to a trained panel of 10 people, there is no significant difference between the test preparation and the control preparation.

Everyone agreed that a better consistency was found in the test preparation.

Example 6:

A control brioche containing saccharose was prepared according to the following recipe:

Brioche (control):

. 20 g of saccharose
. 7.5 g of bakers' yeast
. 250 g of flour (type 45)
. 5 g of salt
. 2 60 g eggs
. 100 g of butter
. 4 tablespoonfuls of water

A test brioche was prepared according to the same operating method by simple replacement of the 20 g of saccharose by 20 g of cellobiofructose obtained according to the process described by S. HESTRIN and G. AVIGAD.

According to a trained panel of 10 people, there is no significant difference between the test preparation and the control preparation.

Example 7:

A control genoese sponge containing saccharose was prepared according to the following recipe:

Genoese sponge (control):

. 100 g of saccharose
. 3 eggs
. 50 g of flour
. 50 g of Difal biscuit powder

A test genoese sponge was prepared according to the same operating method by simple replacement of the 100 g of saccharose by 100 g of cellobiofructose obtained according to the process described by S. HESTRIN and G. AVIGAD.

Example 8:

A control crème pâtissière containing saccharose was prepared according to the following recipe:

Crème pâtissière (control):

. 100 g of saccharose
. 500 ml of semi-skimmed milk
. 1 60 g egg
. 1 egg yolk
. 20 g of flour
. 20 g of Difal cream powder

A test crème pâtissière was prepared according to the same operating method by simple replacement of the 100 g of saccharose by 100 g of cellobiofructose obtained according to the process described by S. HESTRIN and G. AVIGAD, supplemented by 0.6 g of ASPARTAM.

A trained panel of 10 people observed no significant difference between the 2 preparations.

The claims defining the invention are as follows:

1. Method intended to reduce the total daily energy intake in man or in animals, characterized in that one or more fructosyl oligosaccharides, containing from 3 to 8 carbohydrate units joined by beta bonds, replace all or part of the calorific sugars in products intended for food or dietetics in an amount sufficient to reduce the calorie intake of the subject by 5 to 20% in comparison with the calorie intake of the subject consuming the product containing the caloric sugar.

2. Method as defined by claim 1, wherein said fructosyl oligosaccharides are trisaccharides.

3. Method as defined by claim 2, wherein said trisaccharides are made up of a glucose-fructose pseudo beta linked molecule and a glucose molecule, the glucoside units being joined either by a $beta_{1-2}$ bond so as to form sophorofructose, or by a $beta_{1-3}$ bond so as to form laminaribiofructose, or by a $beta_{1-4}$ bond so as to form cellobiofructose, or by a $beta_{1-6}$ bond so as to form gentiobiofructose.

4. Method as defined by claim 2, wherein said trisaccharides are made up of a glucose-fructose pseudo beta linked molecule and a glucose molecule, the glucoside units being joined either by a $beta_{1-4}$ bond so as to form cellobiofructose, or by a $beta_{1-6}$ bond so as to form gentiobiofructose.

5. Method as defined by claim 2, wherein said trisaccharides are made up of a glucose-fructose molecule pseudo beta linked molecule and a glucose

molecule, the glucoside units being joined by a $beta_{1-6}$ bond so as to form gentiobiofructose.

6. Method as defined by claim 2, wherein said trisaccharides are made up of a saccharose molecule and one of sophorose, laminaribose, gentiobiose or cellobiose, the glucoside units being joined either by a $beta_{1-2}$ bond so as to form sophorofructose, or by a $beta_{1-3}$ bond so as to form laminaribiofructose, or by a $beta_{1-4}$ bond so as to form cellobiofructose, or by a $beta_{1-6}$ bond so as to form gentiobiofructose.

7. Method as defined by claim 2, wherein said trisaccharides are made up of a saccharose molecule and one of cellobiose or gentiobiose, the glucoside units being joined either by a $beta_{1-4}$ bond so as to form cellobiofructose, or by a $beta_{1-6}$ bond so as to form gentiobiofructose.

8. Method as defined by claim 2, wherein said trisaccharides are made up of a saccharose molecule and gentiobiose, the glucoside units being joined by a $beta_{1-6}$ bond so as to form gentiobiofructose.

9. Food or dietetic products or drinks for their use in a method according to any one of claims 1 to 8, wherein calorific sugars are totally or partially replaced by one or more fructosyl oligosaccharides containing from 3 to 8 carbohydrate units joined by beta bonds in an amount sufficient to reduce the calorie intake of the subject by 5 to 20% in comparison with the calorie intake of the subject consuming the product containing the caloric sugar.

10. Food or dietetic products or drinks as defined by claim 9, including by

weight, at least 5% of one or more fructosyl oligosaccharides containing from 3 to 8 carbohydrate units joined by beta bonds.

11. Food or dietetic products or drinks as defined by claim 9 or claim 10, including by weight, from 5 to 70% of one or more fructosyl oligosaccharides containing from 3 to 8 carbohydrate units joined by beta bonds.

12. Food or dietetic products or drinks as defined by any one of claims 9 to 11, wherein said fructosyl oligosaccharides are selected from the group including cellobiofructose, gentiobiofructose, laminaribiofructose and sophorofructose.

13. Food or dietetic products or drinks as defined by claim 12, wherein said fructosyl oligosaccharides are cellobiofructose or gentiobiofructose.

14. Food or dietetic products or drinks as defined by claim 13, wherein said fructosyl oligosaccharides are gentiobiofructose.

15. Food or dietetic products or drinks for their use in a method according to any one of claims 1 to 8 substantially as herein described with reference to any one of Examples 4 to 8 but excluding the comparative examples.

16. A pharmaceutical product for reducing the total daily energy intake in man comprising fructosyl oligosaccharides containing from 3 to 8 carbohydrate units joined by beta bonds.

17. A pharmaceutical product of claim 16, wherein said fructosyl oligosaccharides are selected from the group including gentiobiofructose, laminaribiofructose, sophorofructose or cellobiofructose.



18. A pharmaceutical product of claim 17, wherein said fructosyl oligosaccharides are gentiobiofructose or cellobiofructose.

19. A pharmaceutical product of claim 18, wherein said fructosyl oligosaccharides are gentiobiofructose.

20. A low-calorific sugar including fructosyl oligosaccharides containing from 3 to 8 carbohydrate units joined by beta bonds.

21. A low-calorific sugar of claim 20, wherein said fructosyl oligosaccharides are selected from the group including gentiobiofructose, laminaribiofructose, sophorofructose or cellobiofructose.

22. A low-calorific sugar substantially as herein described with reference to any one of the Examples but excluding any comparative examples.

DATED this 14th day of December 1992.

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