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EDIBLE LOW CALORIE COMPOSITION AND PROCESS OF PRODUCTION

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The present invention relates generally to an edible composition of matter and more particularly to an edible flour having a low calorie content for use in the preparation of dietetic foods and to a process for the preparation thereof.

Among the diseases which make it imperative for the patient to observe a strict dietary regimen, diabetes and obesity are the most unpleasant. The diabetic's diet should be more or less free from glucose-containing foods, whereas in obesity only a limited number of calories should be absorbed. Hence, sugar and starchy food products, primarily confectionery and bakery products prepared from conventional flour, must be excluded from the diet.

As a sweetener, sugar can easily be substituted by non-caloric chemical sweetening agents, such as saccharine, cyclamate, and the like. On the other hand, no product is known to be capable of satisfactorily replacing the starch polysaccharide for use in food products which is not converted into glucose or other assimilable sugars during the digestive process.

There are many polysaccharides which do not release assimilable sugars during digestion following ingestion by living animals, including humans. In this group of polysaccharides, for example, belong the polysaccharides composed of non-assimilable sugars, the polysaccharides that are composed of assimilable sugars but which cannot be broken down, and, lastly, the polysaccharides that are composed of non-assimilable sugars and which cannot be broken down. While natural starch is insoluble at low temperature and merely swells by absorbing water at 60°–70° C., the foregoing polysaccharides often dissolve readily in cold water forming gels or highly viscous pastes which are very unpleasant to the taste, and therefore are unsuitable for the manufacture of food products.

It has now been found that these polysaccharides which do not yield assimilable sugars during the digestive process, when suitably treated by the process of the present invention, become insoluble in cold water, and merely swell in warm water by water absorption in the same manner as natural starch and, when mixed with the suitable binding agent, yield a flour which is eminently suitable for production of food stuffs.

The process of the present invention is characterized by the preparation of a substantially homogeneous mixture, in the presence of or with the subsequent addition of a liquid to form a paste consistency, of at least one polysaccharide which does not yield assimilable sugar during digestion with at least one protein which becomes insoluble under the action of heat. The paste thus produced is preferably formed into bodies having a large surface area and then dried and heated to a temperature between about 100° C. and 250° C. The drying and heating is, of course, terminated before any impairment of the edibility properties of the product results. The resultant polysaccharide-protein product is thereafter ground and, when the occasion arises, mixed with at least one edible binding agent which holds the polysaccharide-protein in an agglutinated form, such as a protein having the physical properties of gluten, to produce an edible flour. The polysaccharide which does not release assimilable sugar during digestion is perferably mixed with an aqueous mixture of the protein which becomes insoluble under the action of heat to form a substantially homogeneous mixture having the consistency of a paste.

A quantity of protein which becomes insoluble under the action of heat ranging from about 2% to 15% by weight of the total solids is sufficient to achieve the desired results. This low protein requirement is astonishing and naturally of considerable practical importance because a product having a high protein content would to some extent lose its value as a dietetic flour. The protein which becomes insoluble under the action of heat is preferably used in quantities ranging from about 3% to 10%, by weight, but preferably in quantities of about 5%.

The lowering of the water solubility of the polysaccharides which do not release assimilable sugar is effected by mixing them with a solution of at least one protein which becomes insoluble under the action of heat. The drying and heating of a mixture of this kind makes the protein become insoluble and then brings about the formation of a net of protein insolubilized in situ inside the polysaccharide mass. Further, the free amine groups of the protein react with the sugar moieties of the polysaccharide in accordance with Maillard's reaction, forming new insoluble macromolecules. There are thus obtained, depending upon the quantity and kind of the protein used as well as on the temperature and duration of the heating, products which have limited water solubility at low temperature but which swell in warm water by water absorption. If, after grinding, such products are mixed with an edible binding agent, such as a protein which possesses the physical properties of gluten, there is obtained a flour with a low calorie content which can be used for the production of dietetic food products in the conventional manner.

As polysaccharides, any number of substances of the above mentioned three types can be employed. As a polysaccharide which is composed of non-assimilable sugars, polymannan, carubin, guar, agar, alginate, polygalactane or pectin, for example, can be used. Certain soluble cellulose derivatives may be used as non-decomposable polysaccharides composed of assimilable sugars, for example cellulose, inuline, dextran, caragenate, chitine. As a polysaccharide which is composed of non-assimilable sugars and is not broken down, one may use for example carboxymethylcellulose, methylcellulose, ethylhydroxyethylcellulose or tragacanth.

Carubin, that is, carob seed flour, is of great practical importance as a source of polysaccharide. It has been found that the most satisfactory results are obtained with this cheap starting material only when it has previously been subjected to weak acid hydrolysis. Hydrolysis can be performed with an aqueous carubin paste or with a suspension of carubin in ethanol, isopropyl alcohol, acetone or any other suitable solvent which can be easily removed. Hydrochloric acid or any other strong acid is added as required to this paste or suspension and the latter heated until the desired degree of hydrolysis is reached, where-