

## LIQUID NUTRITIONAL COMPOSITIONS COMPRISING SLOWLY ABSORBED GLUCIDES

### STATE OF THE ART

Many products based on glucides used in dietetics or therapeutics and more particularly in therapeutic nutrition already exist on the market. These products possess a glucide fraction containing, in variable proportions, polymer poly-saccharides of glucose of variable molecular weight in the form of dextrin maltose, disaccharides (maltose, saccharose, lactose), mono-saccharides (glucose) and all these glucides are easily and quickly absorbed.

The usefulness of the ingestion of slowly absorbed sugars to avoid night-time hypoglycemias has already been demonstrated in the case of type 1 glycogen disease by Chen. et al., Cornstarch therapy in type 1 glycogen-storage disease., *New England Journal of Medicine*, 1984; Vol. 310, p 171 to 175. These authors used, however, raw, native starch, which is put in suspension extemporaneously. Treatment by heating was impossible because the slow sugar character was then lost.

### OBJECTS OF THE INVENTION

It is an object of the invention to provide novel liquid nutritional compositions containing a slowly absorbed glucide fraction as a major amount of the total weight of the composition.

It is another object of the invention to provide an improved nutritional method.

These and other objects and advantages of the invention will become obvious from the following detailed description.

### THE INVENTION

The novel liquid nutritional compositions of the invention are comprised of a lipid fraction, a protein fraction and a glucide fraction comprising at least both glucose polymers and slowly absorbed glucides.

Liquid nutritional compositions did not exist until now since it was known that slowly absorbed glucides such as modified starches or pectin gave rise after cooking in aqueous solutions to stable gels, which increased the viscosity of the compositions containing them and did not allow liquid compositions to be obtained which are more suitable for the nutritional use of products for example by digestive probe.

Glucose polymers means mainly dextrin maltoses and slowly absorbed glucides means products having a significantly lower glycemie index than glucose and than the glycemie indices published for normal constituents: i.e., dextrin maltose, disaccharides such as maltose, saccharose. The slowly absorbed glucides are glucides which bring about a slower and weaker glycemie response than so-called rapid glucides and this slower and weaker response results from a slower digestive absorption.

The slowly absorbed glucides can be for example modified starches or soluble fibers. Modified starches are currently widely used in the agro-food and pharmaceutical industry because of their functional properties. They allow stable gels to be obtained after cooking in aqueous suspension and the gelling properties and the viscosity are increased as a result. What generally is an advantage is, on the contrary, a disadvantage for the liquid compositions of the invention.

The modified starches might be slowly absorbed sugars, which is desirable for the invention, but the phenomenon of furthering the formation of viscous gels in aqueous solution is not compatible with the final nutritional use of the product. Contrary to the teaching of the prior art, applicants have tried to determine if nevertheless certain starches and manufacturing processes could permit the implementation of the invention.

A certain number of modified starches were selected to respond to the technological constraints, namely, to be included in a ready-to-use preparation which is liquid and able to be sterilized in an industrial manner. For this, four functional criteria are indispensable: resistance to U.H.T. type heat treatment, that is retaining fluidity when hot, stable viscosity with pH and temperature variations, good solubility in water; and resistance to retrogradation and shearing.

Three modified starches were retained after these functional property studies, Cleargum CB 90 (Roquette Freres S.A.), Snowflake 6090 (Cerestar S.A.) and Encapsol 855 (National Starch and Chemical S.A.).

Among the soluble fibers, there can be mentioned, for example, pectin or certain other soya fibers. As indicated previously, pectin normally also has a gelling action in a complex solution during sterilization treatments by heating and increases the viscosity of finished ready-to-use products, and because of this, impedes the flow of nutritional products by digestive probe. It is for this reason that it is not at present used in sterilizable artificial nutritional products, which can be administered by probe, although the usefulness of soluble fibers, notably of pectin, has been emphasized by some authors. Pectin is, in fact, slowly metabolized by the colon and leads to an energy intake spread over 24 hours (Pomare et al., Carbohydrate fermentation in the human colon and its relation to acetate concentrations in venous blood, *Journal of Clinical Investigation*, 1985, Vol. 75, p. 1448 to 1454). The ingestion of soluble fibers is also recommended for patients suffering from sugar diabetes.

The present invention consisted of researching and testing various fibers and pectins to see if they meet the constraints of a liquid product, ready-to-use and sterilizable, and contribute to a nutritional effect.

The influence of various pectins and fibers on the rheological behaviour of the liquid product to be sterilized was studied. By physical and physico-chemical tests, fibers and pectins corresponding to the following criteria: low sensitivity to calcium ions, not forming gels in a slightly or moderately sugared medium and not giving a very firm gel at pH's of between 6.0 and 7.5 when the solution contains at least 60% sugars, and being compatible with glucose polymers such as modified starches after a sterilization treatment by heating were selected.

It is therefore also a very important and unexpected characteristic of the present invention to be able to contain starches and soluble fibers such as pectin and nevertheless undergo sterilization by heating and retain a viscosity of less than  $0.05 \text{ kg} \times \text{m}^{-1} \times \text{sec}^{-1}$  (50 centipoises). A particular subject of the present invention is compositions characterized in that they are in a stable sterilized ready-to-use form.

Contrary to the compositions of the prior art described notably by Chen. et al., the present invention allows the use of modified starches such as Cleargum CB 90. which can be sterilized without physical modifi-