product to non-digestible oligosaccharides to reduce the intrinsic sugar content of the food product and form a more nutritional food product.

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 shows an HPLC chromatogram from glucooligosaccharides (GOS) formation with dextransucrase in orange juice concentrate (OJC) by using a HPAEC Dionex system. A: Sugar content in OJC before enzymatic reaction. B: Sugar content in OJC after enzymatic reaction. Peaks: 1 = glucose; 2 = fructose; 3 = sucrose.

Figure 2 shows an HPLC chromatogram showing fructooligosaccharides (FOS) and glucooligosaccharides (GOS) formation before and after enzymatic reaction with fructosyltransferase and dextransucrase in a model solution of example 4. A: Sugar content in the model solution before enzymatic reaction. B: Sugar content in the model solution after enzymatic reaction. Peaks: 1 = glucose; 2 = fructose; 3 = sucrose.

Figure 3 shows an HPLC chromatogram showing fructooligosaccharides (FOS) formation after enzymatic reaction with fructosyltransferase in orange juice concentrate (OJC) by using a refractive index detector.

DETAILED DESCRIPTION OF THE INVENTION

The following definitions are used in this disclosure:

~~The singular forms "a", "an", and "the" include plural referents unless the context clearly dictates otherwise.~~

Unless the context clearly requires otherwise, throughout the specification, the words "comprise", "comprising" and the like are to be construed in an inclusive sense as opposed to an exclusive or exhaustive sense; that is to say, in the sense of "including, but not limited to".

~~The word "about", as used in the specification, should generally be understood to refer to both numbers in a range of numerals. Moreover, all numerical ranges herein should be understood to include each whole integer within the range.~~

Unless noted otherwise in the specification, all percentages refer to dry weight percents.

The term "sucrose" means a disaccharide comprised of 1 mole of D-glucose and 1 mole of D-fructose wherein the C-l carbon atom of the glucose and the C-2 carbon atom of the fructose participate in the glycoside linkage.

The term "endogenous" as used herein with reference to sucrose or fiber refers to sucrose or fiber that is naturally contained in a food product (native sucrose or fiber).

The term "disaccharide" as used herein refers to any compound that comprises two covalently linked monosaccharide units. The term encompasses but is not limited to such compounds as sucrose, lactose and maltose.

invention produces a food product with a dextrose (glucose) level that is at least 25%, 50%, 75%, 100%, 125% or greater than the dextrose level of the corresponding food product. In some embodiments, the glucose level of a food product contacted with a fructosyltransferase according to the invention will be between 0.1 to 20% w/v (weight/volume). In some embodiments, the amount of fructose produced in the food product will be less than 5%, less than 2%, less than 1% and also in some embodiments less than 0.5%. In some embodiments, the production of FOS according to the methods of the invention is stable meaning that there is essentially no reversion of naturally occurring sucrose. In some embodiments, FOS, which is produced according to methods of the invention is not substantially hydrolyzed to yield glucose and fructose. In some embodiments, the in situ FOS formation may be directly correlated with dextrose production.

In some embodiments, the glucose level in the food product may be reduced by at least 5%, 10%, 15%, 20%, 25%, 30%, 35%, 40%, 45%, 50%, 55%, 60%, 65%, 70%, 75%, 80%, 85%, 90%, and 95% as compared to the corresponding food product after contacted with dextransucrase.

In some food products, the reduced intrinsic sugar content may affect the taste of the product that consumers would otherwise expect. In some situations, to provide added sweetness, a natural or artificial sweetener can be added. Typical sweeteners for this purpose include a natural sweetener such as stevia is preferred but other natural and artificial sweeteners (e.g., sucralose) that are generally known to skilled artisans can be used. Of course, the final taste characteristics of any particular food product can be altered as desired by routine testing using such sweeteners or other conventional additives.

EXAMPLES

The invention is described in some detail below for purposes of clarity and understanding. The following examples are intended to illustrate the preferred embodiments of the invention without limiting the scope ~~as a result~~of the present invention. It will be appreciated by one skilled in the art, from a reading of the disclosure, that various changes in form and detail can be made without departing from the ~~true~~ scope of the invention in the appended claims.

Example 1 Sucrose reduction in model solution by using dextransucrase

The sucrose reduction was studied in model solution with the same sugar ratio and concentration of sugars present in orange juice concentrate. The sugar solution was treated with 0.014% (w/w) dextransucrase from *Leuconostoc mesenteroides* B-512F (Sigma, Franklinton NC) for 28h. The reaction was carried out at 30°C and the pH was adjusted to 5.2. Samples were drawn at appropriate time intervals and heated at 90°C during 5-10 min

THE CLAIMS

What is claimed is:

1. A method of reducing intrinsic sugar content of a food product which comprises:

contacting the food product with a sufficient amount of at least one ~~transglycosidase~~first enzyme under conditions sufficient to enzymatically convert intrinsic sugars in the food product to non-digestible oligosaccharides ~~to reducing intrinsic sugar content of the food product and forming a more nutritional food product~~; and

further reducing the intrinsic sugar content of the food product by contacting the food product with a sufficient amount of a ~~fructosyltransferase~~second enzyme under conditions sufficient to enzymatically convert further intrinsic sugars in the food product to non-digestible oligosaccharides ~~to further reduce the intrinsic sugar content of the food product~~;

wherein the first and second enzymes are selected from the group of fructosyltransferase and the glucosyltransferase

characterized in that ~~a glucosyltransferase and~~ the fructosyltransferase and the glucosyltransferase contact the food product sequentially by:

forming a reduced sucrose food product by first contacting the food product with a sufficient amount of the fructosyltransferase under conditions sufficient to enzymatically convert at least some of the intrinsic sugars in the food product to non-digestible fructo-oligosaccharides while also forming glucose; and

then contacting the reduced sucrose food product with a sufficient amount of the glucosyltransferase under conditions sufficient to enzymatically produce glucooligosaccharides while reducing glucose and further reducing sucrose therein, thus reducing the intrinsic sugar content of the resulting food product and forming a more nutritional food product.

~~2. The method of claim 1, wherein the at least one transglycosidase is a glucosyltransferase.~~

~~3. The method of claim 1, wherein the fructosyltransferase and the glucosyltransferase contact the food product sequentially by:~~

~~forming a reduced sucrose food product by first contacting the food product with a sufficient amount of the fructosyltransferase under conditions sufficient to enzymatically convert at least some of the intrinsic sugars in the food product to non-digestible fructo-oligosaccharides while also forming glucose; and~~

~~then contacting the reduced sucrose food product with a sufficient amount of the glucosyltransferase under conditions sufficient to enzymatically produce gluco-oligosaccharides while reducing glucose and further reducing sucrose therein, thus reducing the intrinsic sugar content of the resulting food product.~~

~~4. The method of claim 1, wherein the fructosyltransferase and the glucosyltransferase contact the food product sequentially by:~~

~~forming a reduced sucrose food product by first contacting with a sufficient amount of the glucosyltransferase under conditions sufficient to enzymatically convert at least some of the intrinsic sugars in the food product to gluco-oligosaccharides while reducing glucose and sucrose therein; and~~

then contacting the reduced sucrose food product with a sufficient amount of the fructosyltransferase under conditions sufficient to enzymatically convert at least some of the intrinsic sugars in the food product to non-digestible fructo-oligosaccharides while also forming glucose, thus reducing the intrinsic sugar content of the resulting food product.

5

52. The method of claim 3 or 41, which further comprises terminating the first enzymatic reaction by applying heat or conducting pasteurization before contacting the food product with the second enzyme.

10 63. The method of claim 51 or 2, which further comprises terminating the second enzymatic reaction after the nutritional food product, is obtained.

7. The method of any preceding claim, which further comprises immobilizing the enzymes on a support prior to the contacting steps such that the enzymatic reaction can be
15 terminated by removing the immobilized enzymes from contact with the food product.

8. The method of any of claims 1 to 7, wherein the glucosyltransferase is a dextransucrase.

20 9. The method of claim 8, wherein the dextransucrase is derived from a strain of lactic bacteria.

104. The method of any of claims 91 to 3, wherein the glucosyltransferase is a dextransucrase derived from a strain of lactic bacteria is selected from *Leuconostoc mesenteroides*,
25 *Leuconostoc citreum*, *Streptococcus mutans*, and *Lactobacillus*.

11. The method of any of claims 1 to 10, wherein the fructosyltransferase is derived from a plant or microbial source.

30 12. The method of any preceding claim which further comprises contacting the food product with a levansucrase to produce non-digestible carbohydrates in the food product.

135. The method of any preceding claim, wherein the food product is a juice or a ready to drink product that contains sugars.

35

146. The method of claim 135, wherein the sucrose content of the juice or ready to drink product is reduced by at least 10%, preferably by at least 40%, after exposure to

dextransucrase as compared to a corresponding juice or ready to drink product which is not subjected to such exposure.

~~15~~7. The method of claim ~~13~~5, wherein the sucrose content of the juice or ready to drink product is reduced by at least 30%, preferably by at least 70%, after exposure to fructosyltransferase and dextransucrase as compared to a corresponding juice or ready to drink product which is not subjected to such exposure.

~~16~~8. The method of claim ~~15~~5, wherein the sugar conversion to non-digestible oligosaccharides is at least 10% after exposure to fructosyltransferase and dextransucrase as compared to a corresponding juice or ready to drink product which is not subjected to such exposure.

~~17~~9. A nutritional food product produced by the method of any preceding claim, wherein the food product is a fruit juice or a ready to drink product.

~~18. The nutritional food product of claim 17, wherein the food product is a fruit juice or a ready to drink product.~~

~~19. The nutritional food product of claim 18, wherein the fruit juice is orange juice, peach juice or mango juice.~~

~~20~~10. The nutritional food product of ~~any of~~ claim~~s 17, 18 or 1~~ 9, wherein the food product contains at least 10% non-digestible oligosaccharides based on the dry weight of the food product after exposure to fructosyltransferase and dextransucrase.

~~21~~11. Sequential ~~U~~use of fructosyltransferase and glucosyltransferase ~~either simultaneously or sequentially~~ to enzymatically convert intrinsic sugars in a food product to non-digestible oligosaccharides to reduce the intrinsic sugar content of the food product and form a more nutritional food product.