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 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 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~~

to stop the enzyme activity. The residual sucrose content was analyzed by HPLC with a pump (Agilent 1100 Series) coupled to a carbohydrate column (Shodex amino column Ashipak NH2P-50 4E). A refractive index detector was used. The mobile phase was 75% (v/v) acetonitrile. The concentration of sucrose was determined from peak areas by using standards of this sugar. Table 1 shows the reduction of sucrose in the model solution for the action of dextransucrase. The amount of sucrose reduced was converted to gluco-oligosaccharides and monosaccharides.

Table 1. Sucrose reduction in a model solution

Treatment time (hours)	Sucrose (g/L)
0	226
2	185
6	162
28	72

Example 2. Sugar reduction in orange juice concentrate by using dextransucrase

The *in situ* sugar reduction was studied in orange juice concentrate (OJC). The sugars present initially in OJC were sucrose, glucose and fructose. The OJC was treated with 0.036% (w/w) dextransucrase from *Leuconostoc mesenteroides* B-512F for 4h. 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 to stop the enzyme activity. The sugar content of the samples was analyzed by a HPAEC Dionex system. This high performance anion exchange chromatography method used a cartridge column C18 coupled with pulse amperometric detector. The eluent was a gradient solution of NaOH. The chromatograms obtained show the formation of different types of oligosaccharides after treatment (figure 1B) when compared with the chromatograms obtained before treatment (figure 1A). The total sugar reduction was assessed by calculating the difference in sugar concentration (glucose, fructose and sucrose) between untreated OJC and the OJC treated with dextransucrase at different time intervals. The concentrations of glucose, fructose and sucrose were determined from peak areas by using standards. Table 2 shows the total sugar reduction for the action of dextransucrase. The amount of sugar reduced was converted to gluco-oligosaccharides (GOS).

Table 2. *In situ* sugar reduction in orange juice concentrate

Treatment time (hours)	Total sugars (g/L)
0	512
2	503
4	426

Example 3. Gluco-oligosaccharides (GOS) formation in model solution by using dextransucrase

The GOS formation was studied in model solution with similar sugar ratio and concentration of sugars present in orange juice concentrate. The reaction conditions were similar as the conditions in example 1. The sugar solution was treated with 0.014% (w/w) dextransucrase from *Leuconostoc mesenteroides* for 20h. 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 to stop the enzyme activity. The sugar content of the samples was analyzed by HPLC. Table 3 shows the reduction of sucrose in the model solution for the action of dextransucrase. The amount of sucrose reduced was converted to gluco-oligosaccharides and monosaccharides. Even though different oligosaccharides peaks were observed in the chromatograms after the enzymatic reaction, due to the lack of GOS standards, the GOS content was calculated from the total sugar reduction. Microbial growth was monitored in the sugar solution during the reaction to ensure that the sugar reduction was not due to the microbial growth.

Table 3. Sugar content for GOS production in model solution

Treatment time (hours)	DP1:fructose+glucose(%)	Sucrose(%)	GOS (%)
0	54	46	0
3	60	37	2
20	66	18	16

Example 41 Fructo-oligosaccharides (FOS) and gluco-oligosaccharides formation in model solution

The sucrose reduction and oligosaccharides formation were studied in a model solution containing initially glucose and fructose and sucrose which are the main sugars present in most juices. The reaction was carried in two steps. The model solution was first

treated with 8% (w/w) fructosyltransferase (Pectinex Ultra SP-L from Novozyme) at 50 C. Then the enzyme was deactivated. Afterwards, 0.036% (w/w) dextransucrase from *Leuconostoc mesenteroides* was added to the model solution at 30C for a combined time of reaction of 6h. At the end of the second reaction, dextransucrase was also deactivated. The pH was kept at 5.2 during both reactions. The enzyme fructosyltransferase was first applied to produce FOS with subsequent sucrose reduction and glucose formation. Then, the enzyme dextransucrase was applied to produce gluco-oligosaccharides, further reducing sucrose content. The sugar content of the samples was analyzed by a HPAEC Dionex system~~using the same methodology as in example 2~~. ~~However, i~~In this case, FOS were calculated by using different standards and GOS were calculated again by mass balance. Figure 2A shows a chromatogram for of the model solution before enzyme treatment. Figure 2B shows a chromatogram of the solution after enzymatic treatment, where FOS and GOS peaks appear, showing the formation of these compounds.

Table ~~4~~ 1 shows that by using both fructosyltransferase and dextransucrase, the total sucrose content, can be reduced to the lowest caloric level, and the highest level of oligosaccharides is produced, as compared to using either enzyme alone.

Table ~~4~~1. Sucrose reduction and NDOs production in model solution

	Treatment time (hours)	Monosaccharides (%)	Sucrose (%)	FOS +GOS (%)
Model solution	0	69	31	0
Model solution treated with β-fructosyl-tranferase and dextransucrase	6	56	15	29

Example ~~5~~2 Fructo-oligosaccharides (FOS) and gluco-oligosaccharides formation in a orange juice concentrate

The sucrose reduction and oligosaccharides formation were studied in samples of orange juice concentrate (OJC). The reaction was carried out in two steps with the same conditions as in example ~~4~~1.The juice concentrate was treated with 8% (w/w) fructosyltransferase and then with 0.014% (w/w) dextransucrase from *Leuconostoc mesenteroides* for 24h. The enzyme fructosyltransferase was first applied to produce FOS with subsequent sucrose reduction and glucose formation in juice. Then, the enzyme dextransucrase was applied to produce gluco-oligosaccharides, further reducing sucrose content. The glucose, fructose, sucrose and FOS content was analyzed by HPLC with a pump (Agilent 1100 Series) coupled to a carbohydrate column (Shodex amino column

Ashipak NH2P-50 4E). A refractive index detector was used. The mobile phase was 75% (v/v) acetonitrile. The concentration of all these sugars was determined from peak areas by using standards. Figure 3 shows a chromatogram for the formation of FOS. The GOS concentration was calculated from mass balance difference between the OJC before and after the enzymatic treatment with dextransucase since no GOS was able to be detected with this methodology. Table ~~5~~ 2 shows that by using both fructosyltransferase and dextransucrase, the total sucrose content, can be reduced to the lowest caloric level, and the highest level of oligosaccharides, as compared to the corresponding food product or using either enzyme alone.

Table ~~5~~2. Sucrose reduction and NDOs production in OJC.

	Treatment time (hours)	monosaccharides (%)	sucrose (%)	FOS+GOS (%)
orange juice concentrate	0	52.1	47.9	0.0
OJC treated with fructosyltransferase	2	61.8	15.5	22.6 (only FOS)
OJC treated with fructosyltransferase + dextransucrase	24	65	5	30

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

7. The method of claim 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.

8. The method of claim 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.

~~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.~~

~~10. The nutritional food product of claim 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.~~

~~11~~9. Sequential use of fructosyltransferase and glucosyltransferase 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.