Beverages containing a soluble fiber

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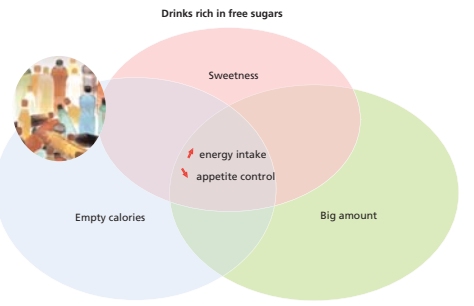
Is it possible to draw up a strategy that allows launching foodstuffs, specifically drinks and beverages, in total agreement with the WHO/FAO nutritional recommendations[1] ?

WHO/FAO recommends as a goal that total dietary energy intake be brought by:

• Total carbohydrates	55 – 70 %
➔ from which	< 10 % from free sugars
• Total fat	15 – 30 %
• Total proteins	10 – 15 %



WHO/FAO mentions that "drinks rich in free sugars increase overall energy intake by reducing appetite control"

- Rich in free sugars (sweetness) → possible "addiction" to sweet taste
- Empty calories (low dry matter) → weaker satiety and dietary compensatory responses than with additional foods of equivalent energy content
- Consumed in big amounts (easy to drink) → increase trend to overweight and obesity[2]

(a) Agreement with the WHO/FAO nutrional recommendations
→ have an objective of bringing less sugars, more fibers, less calories...

(b) Keep the organoleptical properties for pleasure
→ palability, mouthfeel, sweetness

(e) Launching foodstuffs with authorized nutritional claim on packaging

(d) Keep the nutritional properties after industrial food processes
→ resistance to heat treatment, to acidic pH, solubility
→ demonstration of accordance with nutrional requirements through human clinical trials

(c) Bring nutritional properties through ingredient
→ enrichment in soluble fibers
→ lower glycemic and insulinemic responses
→ lower in calories
→ not reducing appetite control

Two examples of applications responding to demand

1. Concentrated dilutable fruit drink with soluble fiber (or dextrin)

The glycemic response (GR)* of the soluble fiber based syrup was calculated to be 10 % of that of the commercial syrup reference. Compared to glucose (Figure 1), the mean GR value for the commercial syrup (51 ± 6) was significantly higher (p = 0.001) than the mean GR value for the soluble fiber based syrup (6 ± 3)[3]. The use of the soluble fiber allowed maintaining the taste and sensorial properties and not only reduced the amount of sucrose used but also provided 2.3 g of dietary fibers per glass. It also had little or no effect on the post-prandial glycaemia.

* The main outcome measure was the glycemic response (GR) according to the procedure outlined by FAO/WHO[4]. The incremental area under the blood glucose response curve (IAUC), ignoring the area beneath the baseline, was calculated geometrically. GR was calculated as follows:
GR = (IAUC Test sample / IAUC Reference) * 100

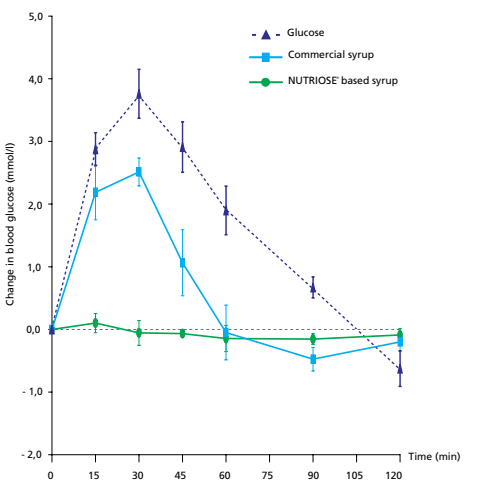


Figure 1: Changes in blood glucose concentrations following NUTRIOSE® based syrup, commercial syrup reference or 50 g anhydrous glucose ingestion.

	Soluble fiber based syrup
Proteins (%)	-
Lipids (%)	-
Available Carbohydrates (%)	2.7
Soluble fiber (%)	18.3

2. Mid-calorie fruit drink with dextrin

The GR** of the "Mid-calorie beverage" was calculated to be 64% of that of the reference beverage. The mean GR value for "Reference beverage"(98.4 ± 43.5) was significantly higher ($p<0.05$) than the mean GR for "Mid-calorie beverage"[5] (63.3 ± 31.1) (Figure 2). Moreover, the caloric value obtained for the "Mid-calorie beverage" was almost half the one obtained for the "Reference beverage", together with fiber enrichment and simple sugars content reduction.

** The main outcome measure was the glycemic response (GR) according to a procedure derived from that outlined by FAO/WHO[4]. The incremental area under the blood glucose response curve (IAUC), ignoring the area beneath the baseline, was calculated geometrically. GR was calculated as follows:
GR = (IAUC Test sample (ii) / IAUC Reference (i)) * 100

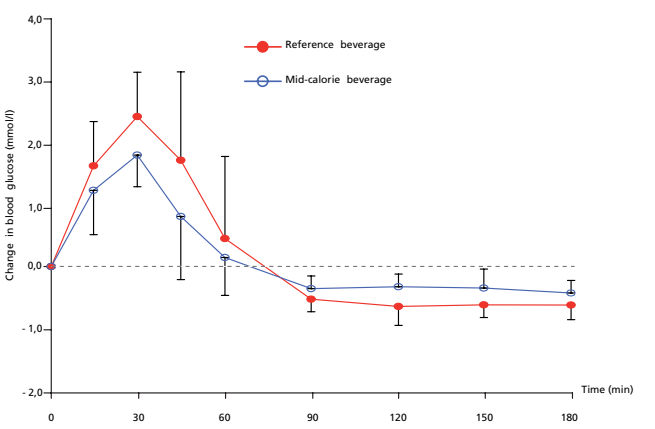


Figure 2: Mean change in blood glucose concentrations following soluble fiber based "Mid-calorie beverage" and "Reference beverage" ingestion.

LABEL	*Reference beverage (i)*	*Mid-calorie beverage (ii)*
Sucrose (g)	33.0	13.3
Soluble fiber (g)	-	6.7
Ascorbic acid (g)	0.07	0.07
Citric acid (g)	1.00	1.00
Fruit aroma (g)	0.330	0.330
Sucralose (g)	-	0.034
Potable water to add (g)	295.6	308.6
Caloric value per serving (Kcal)	136	69

Discussion

According to the previously described examples, it is possible to launch beverages claiming for demonstrated nutritional benefits:

- **goal (a) = to be in agreement with the WHO/FAO nutritional recommendations → reached (bringing more fibers, less sugars, less calories)**
- **goal (b) = to keep the organoleptical properties for pleasure → reached (the soluble fiber is neutral in taste, completely soluble, brings bulk and pleasant mouthfeel to beverages)**
- **goal (c) = to bring nutritional properties through ingredient → reached (soluble fiber with less than 0.5% simple sugars, 85% of fibers content, low in calories≈1.7kcal/g of fiber)**
- **goal (d) = to keep the nutritional properties after industrial food processes → reached (the dextrin is resistant to heat and acidic treatment and very soluble therefore soluble fiber based syrup induced a low glycemic response and "Mid-calorie beverage" had a reduced caloric value compared to the reference)**
- **goal (e) = to launch a beverage with authorized nutritional claim → reached for the concentrated dilutable fruit drink with soluble fiber ("without sugars") and reached for the "Mid-calorie beverage" ("25% less sugars")**

Conclusion

Roquette Group owns and launches various food ingredients, and put at the disposal of customers expertise and services in order to allow reaching marketing claims while respecting nutritional recommendations of WHO/FAO.

(1) Diet, Nutrition and the Prevention of Chronic Diseases. Report of a Joint WHO/FAO Expert Consultation on Diet, Nutrition and the Prevention of Chronic Diseases. Geneva, 28 January-1 February 2002
(2) Malik VS, Schulze MB and Hu FB. Intake of sugar-sweetened beverages and weight gain: a systematic review. *American Journal of Clinical Nutrition*, 2006; 84(2): 274-288.
(3) Lefranc-Millot C, Wils D, Henry J, Lightowler H and Saniez-Degrave M-H. NUTRIOSE®, a resistant dextrin, and MALTISORB®, a sugar alcohol, two key ingredients for healthy diets and obesity management. *Obesity Reviews*, 2006, 7 (Suppl. 2): p.269.
(4) FAO/WHO. Carbohydrates in Human Nutrition. Report of a Joint FAO/WHO Expert Consultation. FAO, Rome, 1998.
(5) Glycemic response to two different beverages. Collaborative study, Nutrition and Food Science Research Centre, Oxford Brookes University. Unpublished data (2005).