

# , a resistant dextrin, and MALTISORB<sup>®</sup>, a sugar alcohol, two key products for healthy diets and obesity management

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## INTRODUCTION

NUTRIOSE<sup>®</sup> 06 is a soluble fibre, produced from wheat or maize starch through dextrinization followed by a chromatographic fractionation step. NUTRIOSE<sup>®</sup> 06 includes about 85 % fibres, which induces a lower post-prandial glycaemic response in foods where it can be incorporated.

MALTISORB<sup>®</sup> maltitol is a sugar alcohol, obtained by hydrogenation of maltose. MALTISORB<sup>®</sup> can partially or fully substitute sugar in foods, maintaining sweetness whilst producing a significant reduction in the glycaemic response (low GR).

In 1981, Jenkins *et al.*<sup>1</sup> proposed a method of assessing and classifying the glycaemic response to foods, known as the Glycaemic Index (GI) : “the incremental area under the blood glucose response curve of a 50 g carbohydrate portion of a test food expressed as a percent of the response to the same amount of carbohydrate from a reference food taken by the same subject”.

It is sometimes preferable to test the glycaemic response, which may be more representative of the effect of a complex food system on post-prandial glycaemia, rather than the GI, which measures the glycaemic impact of the available carbohydrates present in food. The different studies reported here aimed to assess the glycaemic responses when incorporating NUTRIOSE<sup>®</sup> 06 and/or MALTISORB<sup>®</sup> in different types of foods.

## MATERIAL AND METHODS

### Subjects

- ➔ 8-10 healthy subjects,
- ➔ aged 18 - 55 years old,
- ➔ BMI ≤ 30 kg/m<sup>2</sup>,
- ➔ fasting blood glucose value < 6.1 mmol/l.

### Design and methodology

- ➔ randomised, repeated-measures with each subject serving as their own control,
- ➔ overnight fasting,
- ➔ tests at the Nutrition and Food Science Research Centre, Oxford Brookes University,
- ➔ blood was sampled by finger-prick after fasting at 0 minutes (baseline value), and then at 15, 30, 45, 60, 90, 120, 150 and 180 minutes after starting to eat. Blood glucose was measured using the Hemocue Glucose 201+ analyser.
- ➔ samples : all test products (tested once) compared with a reference food (tested three times) with at least a one-day gap between measurements to minimise carry over effects.

**Main outcome measure :** glycaemic response (GR) (procedure outlined by FAO/WHO<sup>2</sup>). The incremental area under the blood glucose response curve (IAUC), ignoring the area beneath the baseline, was calculated geometrically.<sup>2</sup> GR was calculated as follows: GR = (IAUC Test sample / IAUC Reference) \* 100

**Products :** the ingested amounts were chosen taking into account the percentage of available carbohydrates and the size of a common individual portion (compositions : see *Table 1*).

- ➔ **Study 1:** 50 g “NUTRIOSE<sup>®</sup> pasta” including NUTRIOSE<sup>®</sup> FB 06 was compared with a reference food = 25 g anhydrous glucose.
- ➔ **Study 2:** one glass of diluted “NUTRIOSE<sup>®</sup> based syrup”, based on concentrated fruit syrup, including 18.3 g/100 g NUTRIOSE<sup>®</sup> FB 06, was compared with a reference food = a commercial syrup (both products being diluted the same way as prescribed by the manufacturer) and with 50 g anhydrous glucose.
- ➔ **Study 3:** 50 g “N + M biscuits” including NUTRIOSE<sup>®</sup> FB 06 and MALTISORB<sup>®</sup> were compared with a reference food = 25 g anhydrous glucose.

**Table 1: Composition of the tested samples**

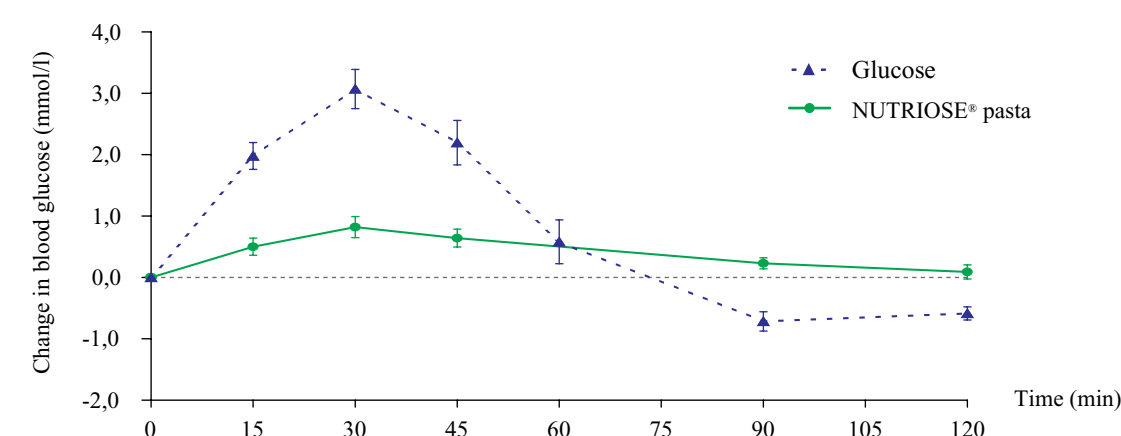
	NUTRIOSE <sup>®</sup> pasta	NUTRIOSE <sup>®</sup> based syrup	N + M biscuits
Proteins (%)	44.9	-	7.6
Lipids (%)	5.6	-	16.5
Available Carbohydrates (%)	27	2.7	45
MALTISORB <sup>®</sup> (%)	-	-	9.3
NUTRIOSE <sup>®</sup> (%)	8	18.3	9.3

## RESULTS

### Study 1: Glycaemic response of NUTRIOSE<sup>®</sup> pasta (Figure 1)

The glycaemic response following NUTRIOSE<sup>®</sup> pasta ingestion was low. Peak glycaemia was 7.6 ± 0.3 mmol/l for glucose versus 5.3 ± 0.2 mmol/l for NUTRIOSE<sup>®</sup> pasta (p = 0.034). Mean blood glucose levels were significantly different (p < 0.05) at 15, 30, 45 and 90 min after ingestion between NUTRIOSE<sup>®</sup> pasta and glucose. Mean IAUC for glucose (123.6 ± 17.1) was significantly higher (p < 0.01) than the mean IAUC for NUTRIOSE<sup>®</sup> pasta (42.0 ± 6.2). The mean GR value was calculated to be 37 ± 6 for NUTRIOSE<sup>®</sup> pasta.

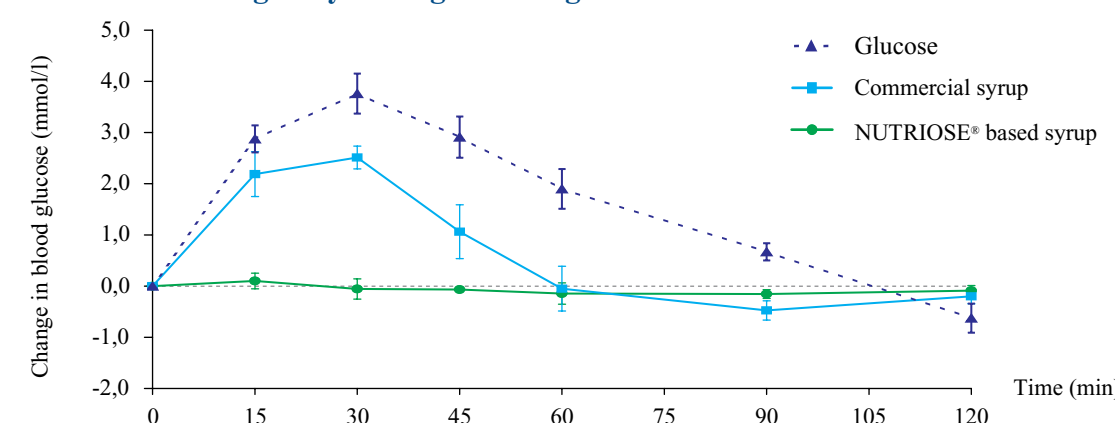
**Figure 1 : Mean change in blood glucose concentrations following NUTRIOSE<sup>®</sup> pasta and 25 g anhydrous glucose ingestion**



### Study 2: Glycaemic response for NUTRIOSE<sup>®</sup> based syrup (Figure 2)

The glycaemic response following NUTRIOSE<sup>®</sup> based syrup ingestion was low. At 15 min, mean glycaemia was 4.9 mmol/l for NUTRIOSE<sup>®</sup> based syrup versus 6.8 mmol/l for the commercial syrup reference (p = 0.002). At 30 min, the glycaemia was 4.6 mmol/l for NUTRIOSE<sup>®</sup> based syrup versus 7.1 for the commercial syrup reference (p < 0.001). Mean IAUC for the commercial syrup (99.6 ± 8.8) was significantly higher (p < 0.001) than the mean IAUC for NUTRIOSE<sup>®</sup> based syrup (9.8 ± 4.2). The GR of the NUTRIOSE<sup>®</sup> based syrup was calculated to be 10 % of that of the commercial syrup reference. Compared to glucose, the mean GR value for the commercial syrup (51 ± 6) was significantly higher (p = 0.001) than the mean GR value for the NUTRIOSE<sup>®</sup> based syrup (6 ± 3).

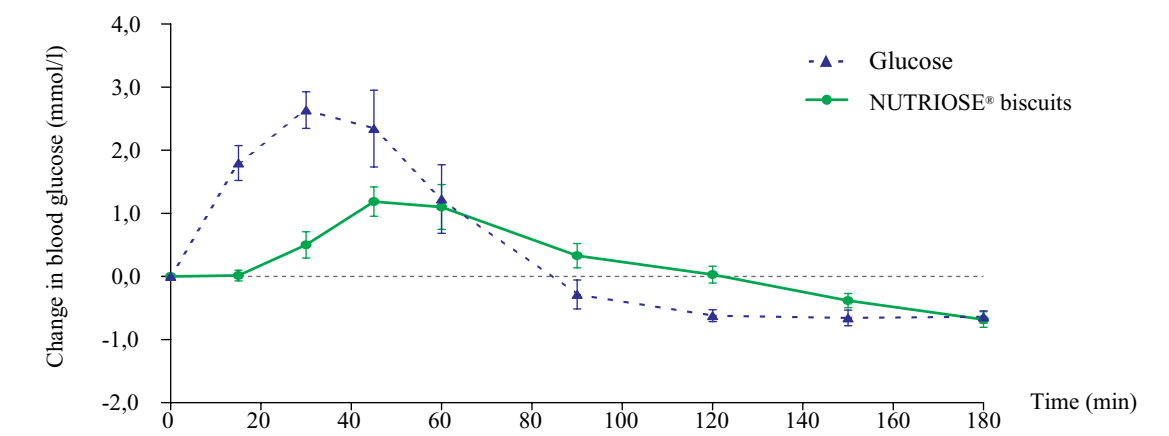
**Figure 2: Mean change in blood glucose concentrations following NUTRIOSE<sup>®</sup> based syrup, commercial syrup reference and 50 g anhydrous glucose ingestion**



### Study 3: Glycaemic response for NUTRIOSE<sup>®</sup> biscuits (Figure 3)

The glycaemic response following NUTRIOSE<sup>®</sup> biscuits ingestion was low. Peak glycaemia was 6.1 mmol/l for the NUTRIOSE<sup>®</sup> biscuits at time 45 min, whereas peak glycaemia was 7.4 mmol/l at time 30 min for glucose. Mean IAUC for glucose (137.0 ± 22.6) was significantly higher (p = 0.041) than the mean IAUC for NUTRIOSE<sup>®</sup> biscuits (66.6 ± 17.3). The mean GR value for NUTRIOSE<sup>®</sup> biscuits was 56 ± 13.

**Figure 3: Mean change in blood glucose concentrations following NUTRIOSE<sup>®</sup> biscuits and 25 g anhydrous glucose ingestion**



## DISCUSSION

- The glycaemic response for NUTRIOSE<sup>®</sup> pasta was very low. The glycaemic response of pasta is likely to have been attenuated by the high percentage of proteins present. This formulation has been specifically designed for sport and/or elderly people who may require a higher protein intake.
- In the beverage study, the glycaemic response was compared with a commercially available syrup, diluted in a glass of water as consumed by children and teenagers. The use of NUTRIOSE<sup>®</sup>, whilst maintaining the taste and sensorial properties, not only reduced the amount of sucrose used but also provided 2.3 g of dietary fibres per glass. It also had little or no effect on the post-prandial glycaemia.

- The glycaemic response of NUTRIOSE<sup>®</sup> biscuits is very interesting to examine in context of type 2 diabetes prevention because :
  - the biscuits are sugar-free,
  - they contribute to the daily recommended intake of dietary fibres in soluble form (about 4 g for 50 g biscuits consumed),
  - they induce a weak post-prandial glycaemic response with a delayed return to baseline likely to be associated with delayed hunger feeling,
  - the shape of the curve makes one speculate that the insulin response of the biscuits may be low as the glycaemia goes down very slowly to baseline.

## CONCLUSION

Diabetes prevention is a major health concern in the field of obesity management. Obese people are up to 80 times more likely to develop type 2 diabetes. Our results show that the incorporation of NUTRIOSE<sup>®</sup> or MALTISORB<sup>®</sup>, or both, in different foods can significantly reduce the glycaemic response. These carbohydrates can be added in food formulations because they are easy to use and modify taste minimally.

NUTRIOSE<sup>®</sup> and MALTISORB<sup>®</sup>, due to their outstanding digestive tolerance, are two key ingredients enabling post-prandial glycaemic response to foods to be low. Moreover, the dietary fibre content of these foods can have a positive impact on satiety, possibly delaying the hunger feeling between meals.

NUTRIOSE<sup>®</sup> and MALTISORB<sup>®</sup> show great promise in the formulation and development of ranges of foods for type 2 diabetics and obesity prevention. Their versatility of use and excellent taste profile make them highly suitable for a range of foods.

### Bibliographic references

1. Jenkins DJA, Wolever TMS, Taylor RH, Barker H, Fielden H, Baldwin JM, Bowling AC, Newman HC, Jenkins AL, Goff DV. Glycemic index of foods: a physiological basis for carbohydrate exchange. *Am J Clin Nutr* 1981;34:362-366.
2. FAO/WHO. Carbohydrates in Human Nutrition. Report of a Joint FAO/WHO Expert Consultation. FAO, Rome, 1998.