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The soluble fiber NUTRIOSE induces a dose-dependent beneficial impact on satiety over time in humans

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Abstract

Strong evidence supports the ability of dietary fibers to improve satiety. However, large variations in the physical and chemical characteristics of dietary fiber modulate the physiologic responses. We hypothesized that a nonviscous soluble dietary fiber may influence satiety. This randomized, double-blind, placebo-controlled clinical study in 100 overweight healthy adults in China investigated the effect of different dosages of dietary supplementation with a dextrin, NUTRIOSE (ROQUETTE frères, Lestrem, France), on short-term satiety over time. Subjects were randomized by body mass index and energy intake and then assigned to receive either placebo or 8, 14, 18, or 24 g/d of NUTRIOSE mixed with orange juice (n = 20 volunteers per group). On days −2, 0, 2, 5, 7, 14, and 21, short-term satiety was evaluated with a visual analog scale, and hunger feeling status was assessed with Likert scale. NUTRIOSE exhibits a progressive and significant impact on short-term satiety, which is time and dosage correlated. Some statistical differences appear for the group 8 g/d from day 5, and from day 0 for the groups 14, 18, and 24 g/d. The hunger feeling status decreases significantly from day 5 to the end of the evaluation for the group 24 g and from day 7 for the groups 14 and 18 g. By day 5, the group 24 g showed significantly longer time to hunger between meals compared with placebo. These results suggest that dietary supplementation with a soluble fiber can decrease hunger feeling and increase short-term satiety over time when added to a beverage from 8 to 24 g/d with time- and dose-responses relationship.

Keywords: Dietary fiber; Dextrin; Satiety; Hunger; Clinical trial
Abbreviations: BMI, body mass index; VAS, visual analog scales.

1. Introduction

Obesity is a major contributor to the global burden of chronic disease and disability. Worldwide, at least 300 million adults are clinically obese [1]. By 2015, an estimated 2.3 billion adults will be overweight and more than 700 million will be obese [2]. Governments and other key stakeholders are making prevention and treatment of obesity a public health priority to prevent concomitant epidemics of diabetes, heart disease, and other chronic illnesses. Evidence shows that a high intake of dietary fiber supports the regulation of energy intake and satiety and could contribute favorably to the fight against obesity [3].

Dietary fiber is an essential constituent of a healthy diet and is well known for its satiety impact [4]. It had been recommended by the Scientific Panel on Dietetic Products, Nutrition and Allergies of the European Food Safety

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Authority that dietary fiber should include all nondigestible carbohydrates in accordance with the proposal for a CODEX definition of dietary fiber. According to the Annex II of the Commission Directive 2008/100/EC of 28 October 2008 (European Commission, 2008), dietary fiber is now defined in the European Union as follows: "carbohydrate polymers with three or more monomeric units, which are neither digested nor absorbed in the human small intestine and belong to the following categories:

-edible carbohydrate polymers naturally occurring in the food as consumed;
-edible carbohydrate polymers which have been obtained from food raw material by physical, enzymatic or chemical means and which have a beneficial physiological effect demonstrated by generally accepted scientific evidence;
-edible synthetic carbohydrate polymers which have a beneficial physiological effect demonstrated by generally accepted scientific evidence."

Large variations that exist in the physical and chemical characteristics of dietary fiber influence physiologic responses in humans [5,6]. Lyon and Reichert [7] have found that certain types of dietary fiber might promote satiety by reducing postprandial glycemia. Similarly, Bodinham et al [8] found that short-term consumption of resistant starch type 2 dietary fiber improves postprandial glucose metabolism in healthy individuals. Beneficial effects have been demonstrated with use of fiber from diverse sources, some traditional, others novel [5]. For example, data suggest that the viscosity-forming capacity of water-soluble fibers, such as guar gum and oat β-glucan, is crucial for their impact on satiety-related attributes [9]. Lyon and Reichert [7] recently tested a soluble, highly viscous polysaccharide manufactured by reacting glucomannan with other soluble polysaccharides using a proprietary process. They found that the fiber might help sedentary overweight and obese adults lose weight when combined with lifestyle modifications.

In addition, the addition of dietary fiber to foods as well as beverages has been associated with greater satiety [10-13] and reduced energy intake in the short term [14]. Although fibers tend to show good correlation to satiety [14-17], results are variable most likely because of the diverse physicochemical and gastrointestinal transit behavior of these materials. For example, nonviscous insoluble fibers, such as soy fiber and oat hull fiber, did not show efficacy in promoting satiety [18-22].

Although many dietary fibers are known to affect satiety, not all are equally effective, and comparative assessments require careful attention. Few studies have been performed on the effect of a nonviscous soluble fiber formulation on short-term satiety over time with chronic supplementation of fibers. We hypothesized that a nonviscous soluble dietary fiber, NUTRIOSE (ROQUETTE frères, Lestrem, France), may improve short-term satiety and hunger feeling when chronically administered to overweight adults. The objective of the present study was to investigate the impact of different dosages of NUTRIOSE on short-term satiety and on hunger feeling status.

2. Methods and materials

2.1. Subjects

One hundred healthy overweight male and female factory workers between the ages of 35 and 55 years were recruited from a single-center manufacturing plant in the region of Jinhua China. Inclusion criteria included body mass index (BMI) of 24 to 28 kg/m^2 with no acute/terminal or chronic diseases and working 7 days a week at the manufacturing plant. Exclusion criteria included current or past use (during the past 3 months) of any dietary fiber or probiotic supplementation, except from food sources; known allergic reaction to wheat products (eg, gluten intolerance, celiac disease); use of an antibiotic either currently or within the past 3 months; enrollment in another clinical trial within the past 3 months; or contraindications to dietary fiber supplementation, that is, chronic diarrhea, irritable bowel syndrome, chronic use of laxatives, cirrhosis of the liver, inflammatory bowel disease, ulcerative colitis, or Crohn disease. The study protocol was reviewed by a local institutional review board and carried out in accordance with the Declaration of Helsinki. All study subjects gave written informed consent.

2.2. Study design

This 3-week evaluation was a substudy of a larger 9-week study and was performed according to a randomized, double-blind, placebo-controlled, dose-response design. The satiety parameters were evaluated on a 3-week period, whereas the anthropometric parameters that are long-term parameters were measured on a 9-week period. The aim of the present study was to present the satiety evaluation. Weight, BMI, body fat, and energy intake will be the subject of a second article.

The primary objective of the study was to investigate whether dietary supplementation with NUTRIOSE at different dosages was associated with an increase of short-term satiety over time and a decrease in energy intake (data not shown). The secondary objective was to investigate whether dietary supplementation with NUTRIOSE at different dosages was associated with a decrease in body-weight, BMI, and body fat (data not shown) and a modulation of the hunger feeling status. The study included a 2-day run-in period in which all subjects received placebo (250 mL of orange juice) twice daily. They were then randomized by baseline energy intake and BMI and assigned to 1 of 5 groups of 20 Chinese male and female (1:1) volunteers. Each subject received 250 mL of orange juice twice daily either alone (placebo) or supplemented with NUTRIOSE at different dosages (8 g/d [4 g × 2], 14 g/d