

ORIGINAL PAPER

Nutritional, antioxidant, and glycaemic characteristics
of new functional bread[‡]

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New wheat–rye bread fortified with cereal dietary fibre, β -glucan hydrogel, and sourdough starter culture was designed in this study. The impact of these additives on nutritional composition and antioxidant properties was investigated. Functional bread with extruded wheat bran (10.0 %), cereal β -glucan hydrogel (12.5 %), and lactobacilli starter culture was compared with traditional wheat–rye bread (control). The contents of basic nutrients (protein, fat, etc.), dietary fibre, biologically active compounds (polyphenols and flavonoids), qualitative and quantitative analysis of simple saccharides and phenolic acids (by HPLC) were analysed in both bread types. Antioxidant activity, measured by two spectrophotometric methods (2,2'-azinobis-(3-ethylbenzthiazoline-6-sulphonic acid); ABTS and di(phenyl)-(2,4,6-trinitrophenyl)iminoazanium (2,2-diphenyl-1-picrylhydrazyl); DPPH, was also evaluated. The effect of the addition of the above ingredients, as compared with traditionally prepared bread, was examined in the postprandial study, in which glucose and insulin levels were determined. In comparison with the control bread, higher amounts of dietary fibre, flavonoid content, and antioxidant activity were attained in the designed bread. Consumption of the designed bread led to reduced glucose levels in healthy males ($n = 10$) 120 min after the ingestion of the functional bread compared with the control ($p < 0.048$). No statistically significant change in the insulin response in the volunteers was observed after consumption of the designed bread compared with the control.

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Introduction

Whole grain cereals are known to prevent many chronic conditions, such as cardiovascular disease, type two diabetes, and obesity (Smith & Tucker, 2011; Slavin et al., 2001). The health benefits of including various types of fibre into a balanced diet have long been recognised (Papathanasopoulos & Camil-

leri, 2010). Moreover, soluble fibres, such as β -glucans, have been reported as positively affecting glucose, insulin, and lipid response (Brennan & Cleary, 2005). This is due not only to the vitamins, and minerals occurring in the fibre, but also to other beneficial phytochemicals present in the outer layer of the grain, including polyphenolic compounds and flavonoids (Mikušová et al., 2011; Fardet, 2010). How-

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