STRESZCZENIE W JĘZYKU ANGIELSKIM

The growing consumer awareness of the influence of the gut microflora on human health has resulted in increased interest in prebiotics. Prebiotics are selectively fermented ingredients inducing specific changes in the composition and/or activity of the gastrointestinal microbiota that confer benefits to host health and well-being. Prebiotics include a group of oligosaccharides, i.e. low molecular weight carbohydrates containing from two to several monosaccharide units. Among oligosaccharides with prebiotic properties, there are fructooligosaccharides (FOS), galactooligosaccharides (GOS), isomaltooligosaccharides (IMO), xylooligosaccharides (XOS), lactulose, and soy oligosaccharides (SBOS). Due to the increasing demand for prebiotics, new sources are constantly being sought. Currently, scientists are increasingly turning to mushrooms, which are a vast and yet largely untapped source of new prebiotic compounds.

The aim of this study was to prepare (1→3)-α-D-glucooligosaccharides via controlled hydrolysis of (1→3)-α-D-glucans isolated from the fruiting bodies of *Laetiporus sulphureus* and to perform initial evaluation of their prebiotic potential.

Structural analyses (methylation analysis, GC-MS, FT-IR, FT-Raman, ^{1}H NMR, ^{13}C NMR, and XRD) have indicated that the water-insoluble polysaccharides isolated by alkaline extraction from 29 fruiting bodies of *Laetiporus sulphureus* are linear low branched (1→3)-α-D-glucans. The starting point for further research was an attempt to answer the question whether preparations obtained via the hydrolysis of (1→3)-α-D-glucans from different fruiting bodies of *Laetiporus sulphureus* have a similar oligosaccharides composition. A comparison of HPLC chromatograms of (1→3)-α-D-glucan hydrolysates indicated that glucans isolated from *Laetiporus sulphureus* fruiting bodies classified into groups B, C, and D (according to the data in Table 2) should be used to obtain a preparation with a similar oligosaccharide composition.

(1→3)-α-D-Glucooligosaccharides ((1→3)-α-GOS) were obtained via controlled acid hydrolysis of (1→3)-α-D-glucans. The hydrolysate contained a mixture of glucose (14.4%) and (1→3)-α-D-glucooligosaccharides with a degree of polymerization (DP) of 2 to 9 (84.2%). Assessment of the cariogenic potential of the hydrolyzate showed a weak stimulation of growth of cariogenic bacteria. (1→3)-α-GOS did not affect mutan synthesis and plaque formation; therefore, it can be used as a dietary supplement. In the next stage of the research, the prebiotic potential of (1→3)-α-GOS was evaluated. It was demonstrated that (1→3)-α-GOS are partially resistant to digestion in the upper gastrointestinal tract (i.e.

digestive enzymes and low pH). The (1→3)-α-D-glucan hydrolyzate selectively stimulated the growth of LAB. In addition, it was shown that (1→3)-α-GOS did not promote the growth of pathogenic bacteria (i.e. *Escherichia coli* and *Enterococcus faecalis*). Additionally, the sugars present in the hydrolyzate were selectively fermented by potentially beneficial lactic acid bacteria, and their use was correlated with the observed three types of growth of the tested microorganisms. Moreover, the investigated oligosaccharide mixture showed a beneficial effect on host's health through increased production of lactic acid and SCFA short-chain fatty acids by *Lactobacillus* and *Bifidobacterium* strains. The chemopreventive properties of (1→3)-α-GOS were confirmed against human cell lines. The studies showed that the (1→3)-α-D-glucan hydrolyzate reduced the viability and division of colon cancer cells lines (LS180 and HT-29) but was non-toxic to normal colon epithelial cells represented by the CCD 841CoN line. The studies revealed immunomodulatory properties of (1→3)-α-GOS, which increased the ability of human NK-92 cells to recognize and eliminate colon cancer cells (LS180 and HT-29). The high stability of the sugar composition during 6-month storage at various temperatures (i.e. -20°C, 5°C, ambient temperature, and 40°C) suggests that (1→3)-α-GOS can be stored and used as a food additive.

In conclusion, the conducted studies have shown that (1→3)-α-D-glucooligosaccharides meet the main criteria for prebiotics and can therefore be an alternative to reference prebiotics. The obtained (1→3)-α-GOS has a good chance of implementation; however, further detailed analyses are necessary.

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