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Review on Beta Glucans

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Beta-glucans are polysaccharides that are structural components of the cell wall of yeasts, fungi, and some cereals. Their differences are due to the type of bond among glucose units in the main chain and by the branches connected to it. These molecules are highly organized [1,4] Considering tri-dimensional structures, β(1-3) glucans presenting a same chemical composition may have the shape of a simple helix, triple helix, or a spiral [22]. These helixes consist of one or three polysaccharide chains that remain bound by hydrogen bonds [14], establishing a helicoidal structure. It seems that at least part of the β(1-3)glucans have a helicoidal structure [9,12,20].

The most important β-glucan source is the cell wall of yeasts, particularly the fermentation yeast *Saccharomyces cerevisiae* [7]. The largest component of the cell wall of this yeast is a β-glucan consisting of a linear central skeleton of approximately 900 glucose units bound at the β(1-3) position, and presenting branched chains of 90 to 200 glucose units bound at the β(1-6) position[2;8;14;22]. According to Klis et al. (2002) [11], the degree of β(1-3) glucan polymerization is influenced by the growth medium and by yeast strain [7, 18, 26] (Figure 1).

During the last few years, several research studies have been carried out to optimize the process of extracting β-glucans from the cell wall of *S. cerevisiae*. Biorigin has developed process technologies to gently extract β-glucans in order to preserve their structural and biological characteristics, allowing the utilization of their full potential.

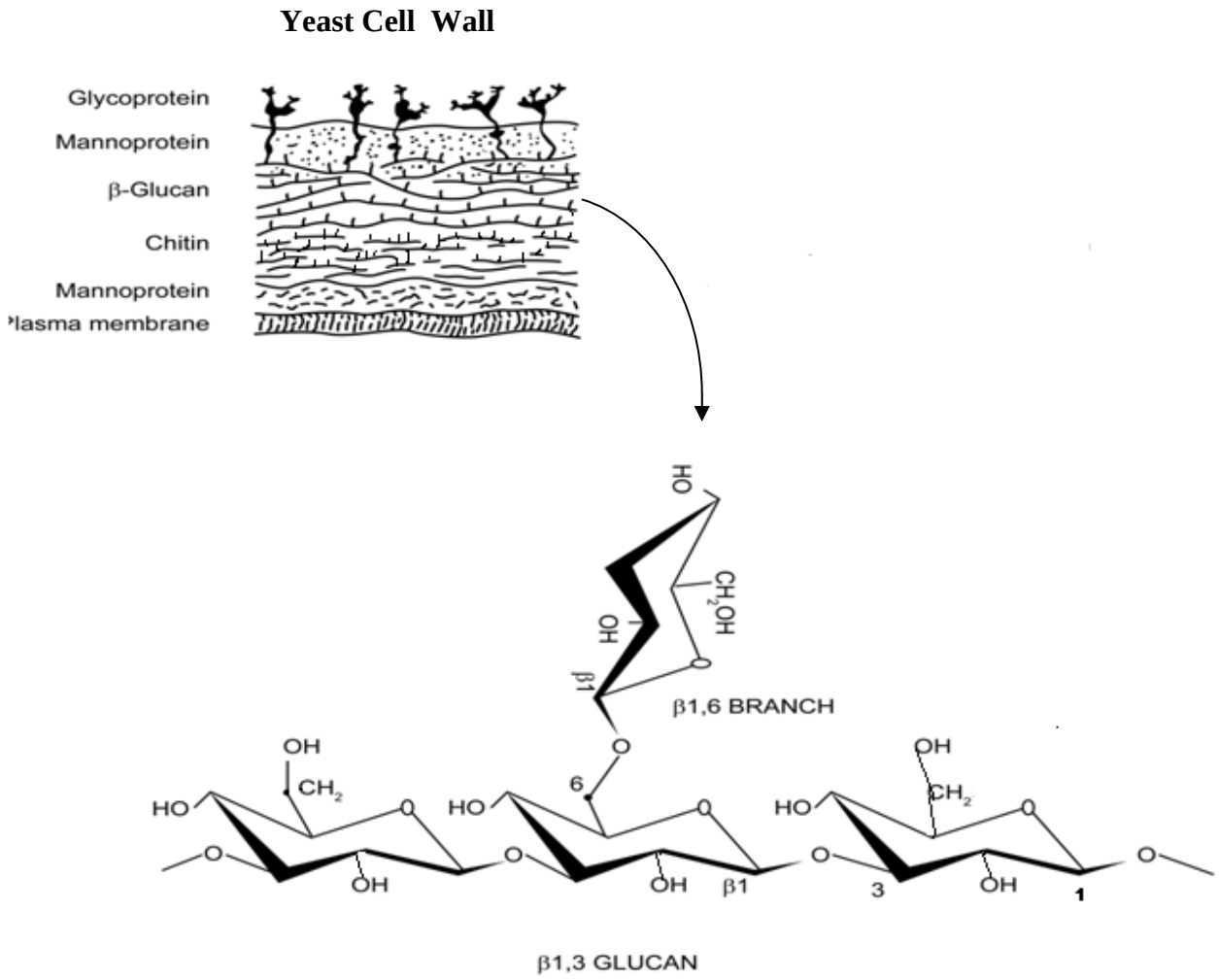

Figure 1. Diagram of the cell wall of *Saccharomyces cerevisiae* and the beta-glucan structural molecule.

These polymers have received special attention of the scientific community and of the market due to its immunomodulation activity. In addition, antitumor, anti-inflammatory, antimutagenic, hypocholesterolemic and hypoglycemic effects have been associated to β-glucans.

Beta-glucans are used for the production of functional foods [29,21]. Used as prebiotics, they selectively stimulate the growth of beneficial bacteria in the intestinal tract, which use them as an energy source [31]. Positive effects, such as the reduction of blood cholesterol and sugar levels, have been demonstrated with the mere addition of beta-glucans in human

diets [10]. Other effects attributed to prebiotics are the modulation of key physiological functions, such as calcium absorption and lipid metabolism, and the modulation of the composition of the intestinal microbiota, which has a crucial role on the gastrointestinal physiology, thereby reducing the risk of colon cancer [23]. Prebiotics fill the stomach, providing a perception of satiety by regulating intestinal transit rate. This is achieved by delaying gastric emptying, which in turn slows down digestion. Moreover, absorption in colon is also slower because of their water-absorption capacity, resulting in softer and larger fecal volume. They are also used as substrates by carbohydrate-fermenting bacteria that promote the formation of a gel in the intestine, consequently reducing the rate of glucose passage to the blood stream, and hence, controlling glycemia. In addition, they reduce lipid absorption, thereby regulating their blood levels. Insoluble fibers bind to bile salts, reducing the absorption of fats and cholesterol [8, 23].

Nicolosi et al. (2007) [17] studied the effects of the addition of *S. cerevisiae* β-glucans in orange juice on blood lipid levels of hypercholesterolemic obese men, and observed a significant drop in total cholesterol and 8% reduction in the blood levels of LDL cholesterol after eight weeks.

Wilson et al. (2004) [25] evaluated a low and a high-molecular weight β-glucan fraction for the reduction of blood cholesterol level using hamsters fed a hypercholesterolemic diet as experimental model. The results did not show any differences in the activity of those fractions; both reduced blood cholesterol levels. Similar results were reported by Matiazi (2004) [16], when evaluated the hypocholesterolemic effect of a β-glucan extracted from *S. cerevisiae* given to mice fed a hypercholesterolemic diet. Chaud et al [5] verified that, when β-glucans were added to a hypercholesterolemic diet of Wistar rats at 10 to 20%, blood triglyceride levels were reduced, and digesta passage rate increased, consequently increasing small intestine length.

In addition of reducing cholesterol, human medicine researchers have studied the anti-oxidant effects of beta-glucans, and demonstrated better immune resistance in patients treated for malignant tumors and in those infected by bacteria and viruses. Beta-glucans

have also been used by the cosmetics industry in the formulation of creams due to their anti-inflammatory effects, reducing skin irritation [28].

Due to their high fiber content, β-glucans have been applied in the formulation of functional and nutraceutic foods to improve the texture of extruded foods, and as non-caloric thickeners and stabilizers in ice-creams and creams because of their ability to form gels [27].

Bekers et al. [3] used beta-glucans in yogurts containing lactic bacteria (*Bifidobacterium* spp) in substitution of unsaturated fatty acids as stabilizers. Studies have reported the use of beta-glucans as stabilizers in foams and emulsions, profiting from their hydro-colloid properties, which increase the surface tension between water and oil. Sidoti et al. [24] described the thickening properties of beta-glucans in foods, mentioning that this non-caloric product can be used as an ingredient in sausages, salad dressings, cheese-analogue products, as well as in desserts and ice-creams. Wahistron and Fugelsang [31] reported the beneficial effects of beta-glucan in fermentation, such as in wine production, as they prevent the formation of lumps in the fermenters, providing a more uniform fermentation process.

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