Glycogen Production by Modulating Glycogen Metabolism in *Escherichia coli*

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Glycogen, a homopolysaccharide consisting of glucose linked by an α-1,4-glucosidic (90%) or an α-1,6-linkage (10%) is a universal energy storage material in various microorganisms and animals. Glycogen is not only an energy source for exercise in mammalian muscles, but also has an antitumor effect probably through its immunomodulating activity in the human gut. Some bacteria accumulate glycogen as an energy source for specific cellular events mostly under growth static conditions such as depletion of the nitrogen source, and accumulate glycogen in an amount more than half of the cell mass under optimal conditions. This study developed glycogen as a functional food carbohydrate. Mutants with deletion mutations in the glycogen synthesis gene and maltodextrin (mal) utilization gene clusters of *Escherichia coli* MC 4100 were used to gain insight into glycogen and mal metabolism. We tested the amounts of glycogen by deleting several key enzymes involved in glycogen metabolism in *E. coli*. Glycogen content, molecular mass and branch chain distribution were analyzed in wild-type and mutant strains. When a maltodextrin phosphorylase (Mal P)-deleted strain was grown on maltose, the glycogen content was 20 times higher in the mal P strain (0.9 mg/mg protein) than that in the wild type (0.05 mg/mg protein) when the Mal P mutant was grown on maltodextrin (1.31 mg/mg protein). Finally we discuss the potential application of glycogen production to the biological and food industries.