ABSTRACT

Marine cyanobacteria are a rich source of structurally diverse polysaccharides that could potentially be exploited as prebiotics functional ingredient for health applications. The exopolysaccharide (EPS) from *Aphanothece* sp. was separated into two fractions by anion exchange chromatography. The major fraction obtained was named as EPS-I and was found to have a molecular weight of approximately 470 kDa. GC-MS analysis of derivatized fraction 1 of EPS (EPS-I) revealed presence of glucuronic acid, glucose, galactose, mannose and rhamnose in a molar ratio of around 4:2:1:1:1. Methylation and NMR studies of EPS-I indicated the presence of →4) - α-D-glcpA6Me-(1→, →4) -2-OAc-α-D-glcpA6Me-(1→, →4) -2-SO_4-α-D-manp- (1→, β-D-glcp-(1→, →2, 4)-β-D-galp-(1→, →2, 3)-β-D-manp-(1→, →3)-β-L-rhamp-(1→, β-D- glcp-(1→ from which the probable structure of repeating unit was proposed. Prebiotic activity tested using EPS-I as the carbon source showed a significant increase in the growth of probiotic strains, *Lactobacillus acidophilus*, *Lactobacillus casei*, *Lactobacillus plantarum*, *Lactobacillus rhamnosus*, *Bifidobacterium longum* and *Bifidobacterium animalis* while the growth of *Escherichia coli* was suppressed significantly ($p < 0.05$) in presence of EPS-I. Short chain fatty acid profile of tested probiotic strains (*Lactobacillus rhamnosus*, *Bifidobacterium longum* and *Bifidobacterium animalis*) *in vitro*, showed that the concentration of total SCFA significantly ($p < 0.05$) increased in EPS-fortified medium compared to control. In addition, oral administration of EPS-I to C57BL/6J mice for 8 weeks at a daily dosage of 100 mg kg^{-1} body weight of EPS-I, significantly increased total SCFA production of major SCFAs (acetate, propionate and butyrate) as compared to control mice. Furthermore, a decrease in acetic acid to propionic acid ratio was also observed, indicating a possible hypolipidemic effect. The propiogenic property of EPS could be attributed to the presence of deoxy sugar rhamnose in the structure of EPS, as deoxy sugars reduce the carbon skeleton via the intermediate1, 2-propanediol in certain probiotic strains. EPS displayed potent antioxidant activity when tested against DPPH, ABTS, OH radical; resulting in 0.385 mg/ml as EC30 value for DPPH radical scavenging, 0.666 mg/ml as EC50 value for ABTS radical scavenging activity and 0.881 mg/ml as EC50 value for OH radical scavenging activity. The supplementation of diet with 100 mg kg^{-1} body weight of EPS-I for 8 weeks in C57BL/6J mice, with diet induced obesity, significantly ameliorated the cafeteria diet induced reduction in the level of propionate and butyrate in colon of obese mice by 59.82% and 43.95% respectively. The anti-obesity potential of EPS-I was exhibited by suppressed weight gain, improved levels of serum glucose, serum endotoxin, liver enzymes and gut hormone GLP-1. Taken together, these results suggest that *Aphanothece* EPS (EPS-I) has a potential for utilization as novel nutraceuticals resource.