Eggshell membrane powder lowers plasma triglyceride and liver total cholesterol by modulating gut microbiota and accelerating lipid metabolism in high-fat diet-fed mice

ABSTRACT

Obesity is a major global lifestyle disorder associated with gut microbiota. The health benefits of eggshell membrane (ESM) have been shown in previous reports, particularly as regards gut microbiota composition. Here, we investigated whether ESM improves lipid metabolism and alters gut microbiota in high-fat diet-fed mice. A total of 20 C57BL/6J mice aged 6 weeks were given either a control diet (CON), high-fat diet (HFD), or high-fat diet + 8% ESM powder (HESM) for 20 weeks. ESM supplementation in HFD-fed mice reduced plasma triglycerides (TG) and liver total cholesterol (TC) and upregulated the expression of lipid metabolism genes carnitine palmitoyltransferase 1A and suppressor of cytokine signaling 2. Microbiota analysis showed increased relative abundance of the anti-obesity bacterium, Lactobacillus reuteri, at 4, 12, and 16 weeks and reduced the abundance of inflammation-related Blautia hydrogenotrophica, Roseburia faecis, and Ruminococcus callidus at 12 and 20 weeks. ESM-supplemented mice had increased cecal isobutyrate, negatively correlated with B. hydrogenotrophica and Parabacteroides goldsteinii abundance. The results indicate that ESM supplementation in HFD-fed mice reduced plasma TG and liver TC, possibly through alteration of lipid metabolism gene expression and gut microbiota composition, suggesting that ESM may be effective in obesity management.

Keyword: Cholesterol; Eggshell membrane; Gut microbiota; High-fat diet; Lipid metabolism; Triglycerides