

4th International Conference on Polyphenols and Health. 2009 (ICPH2009)
From 7th-10th December 2009

Preventive effects of black soybean seed coat extract on obesity and hyperglycemia in high-fat diet-fed mice

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Much attention has focused on food having beneficial effects on the prevention of diet-induced fat accumulation and the reduction of the risk of diabetes and cardiovascular diseases. Black soybean (*Glycine max* L.) seed coat (BSSC) extract is polyphenol-rich food material: it contains 9.2% cyanidin 3-glucoside, 6.2% catechins and 39.8% procyanidins. In this study, we attempt to make clear whether BSSC prevents obesity in C57BL/6 mice fed a high-fat diet containing 30% (w/w) lard for 14 weeks. Body weight gain was significantly lowered in the mice fed the high-fat diet containing 1.0% BSSC compared with the mice fed the high-fat diet alone. BSSC decreased abdominal white adipose tissue weight in a dose-dependent manner. Moreover, BSSC was effective in improving glucose tolerance and insulin sensitivity. BSSC significantly reduced the levels of blood glucose, insulin, and leptin in the mice fed the high-fat diet. In oral glucose tolerance test, BSSC improved impaired glucose tolerance at 15, 30, 60, and 120min in the mice fed the high-fat diet. The area under the curve was significantly lowered in the mice fed the high-fat diet containing 1.0% and 2.0% BSSC compared with the mice fed the high-fat diet alone. Obesity and diabetes mellitus type 2 are accompanying by the chronic low-grade inflammation in which pro-inflammatory markers, such as tumor necrosis factor-alpha (TNF-alpha) and monocyte chemoattractant protein-1 (MCP-1), are up-regulated. The gene expression levels of TNF- alpha and MCP-1 in mesenteric adipose tissue was remarkably decreased in the mice fed the high-fat diet containing BSSC compared with the mice fed the high-fat diet alone. These results indicate that BSSC prevents obesity and hyperglycemia through the down-regulation of the TNF-alpha and MCP-1 expressions.

5th International Workshop on Anthocyanins 2009, Japan

From 15th-18th September 2009

Black soybean seed coat prevents obesity in high-fat diet-fed mice.

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Much attention has focused on food that is beneficial in preventing diet-induced fat accumulation in the body and reducing the risk of diabetes and cardiovascular diseases. Black soybean (*Glycine max* L.) seed coat (BSSC) contains procyanidins, catechins and anthocyanins abundantly. The preventive effect of BSSC on obesity was evaluated in C57BL/6 mice fed a high-fat diet (HFD) containing 30% (w/w) lard for 14 weeks. Body weight gain was significantly lowered in the mice fed the HFD containing 1.0% BSSC compared with the mice fed the HFD alone. BSSC decreased abdominal white adipose tissue weight in a dose-dependent manner. Moreover, BSSC was effective in improving glucose tolerance and insulin sensitivity. BSSC significantly reduced the levels of plasma blood glucose, insulin, and leptin in the mice fed HFD. In oral glucose tolerance test (OGTT), 2.0% BSSC improved impaired glucose tolerance at 15, 30, 60, and 120min in the mice fed the HFD. The area under the curve during OGTT was significantly lowered in the mice fed the HFD containing 1.0% and 2.0% BSSC compared with the mice fed the HFD alone. Obesity and type 2 diabetes are accompanying by chronic low-grade inflammation in which pro-inflammatory markers are up-regulated. The gene expression levels of tumor necrosis factor- α (TNF- α) and monocyte chemoattractant protein-1 (MCP-1) in mesenteric adipose tissue was remarkably decreased in the mice fed the HFD containing BSSC compared with the mice fed the HFD alone. These results indicate that BSSC prevents obesity and hyperglycemia through the down-regulation of TNF- α and MCP-1.

5th International Workshop on Anthocyanins 2009, Japan

From 15th-18th September 2009

Safety assessment of extract of black soybean seed coat: Acute and chronic toxicity studies.

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Extract of black soybean seed coat (BSSC) is a food material containing rich polyphenols, such as procyanidins, catechins, and anthocyanins. Though BSSC is expected to show antiobesity and suppression of hyperglycemia, the safety assessment has not been performed yet. In this study, acute and chronic oral toxicity studies of extract of BSSC were investigated. In the acute toxicity study, extract of BSSC was once administered orally to male and female SD rats and C57BL/6 mice at 2.5 g/kg body weight. There was no change in general conditions, body weight gains, and organ and tissue weights in both sexes on day 14. The oral LD₅₀ value of the extract was not determined because no deaths were observed in all groups. On clinical chemistry analysis in serum, aspartate aminotransferase (AST) was lowered in male rats and triglyceride was elevated in male mice, but these values are within the normal ranges. In the chronic toxicity study, male and female C57BL/6 mice were fed with AIN-93M containing 0% (control), 2% and 5% BSSC for 182 days. The average intake of BSSC in each group was 0, 39 and 131 mg/kg/day, respectively for male, and 0, 65 and 191 mg/kg/day, respectively for female. In all groups, no treatment-related changes in general conditions, organ and tissue weights, and hematology parameters were observed. In the male 5% group, body weights, serum triglyceride and total cholesterol levels, and percent of abdominal fat were significantly lowered. From the pathological examination, accumulation of the pigment derived from BSSC was observed in duodenum and liver of male and female mice in the 2% and 5% groups. From these results, a no-observed-adverse-effect-level (NOAEL) for BSSC was determined as 131 mg/kg/day for male and 191 mg/kg/day for female, the highest dose tested.