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***Cirsium brevicaule* A. GRAY leaf inhibits adipogenesis in 3T3-L1 cells and C57BL/6 mice**

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Abstract

Background

Various flavonoids obtained from the genus *Cirsium* have been reported to exhibit beneficial effects on health. The present study evaluated the antiobesity effects of *Cirsium brevicaule* A. GRAY leaf (CL) by using 3T3-L1 cells and C57BL/6 mice that were fed a high-fat diet (HFD).

Methods

Dried CL powder was serially extracted with solvents of various polarities, and these extracts were tested for antiadipogenic activity using 3T3-L1 adipocytes. Mice were fed experimental HFD supplemented with dried CL powder for 4 wk. Lipid levels and mRNA levels of genes related to lipid metabolism were determined in 3T3-L1 adipocytes and the white adipose tissue (WAT) and liver of mice fed on a HFD.

Results

Treatment of 3T3-L1 adipocytes with a hexane extract of CL significantly reduced cellular lipid accumulation and expression of the fatty acid synthase (FASN) gene. Dietary CL reduced the serum levels of non-esterified fatty acids in HFD-fed mice. Significant decreases in subcutaneous WAT weight and associated FASN gene expression were observed in the mice fed the experimental CL diet. Dietary CL also reduced the hepatic lipid and serum levels of a hepatopathic indicator in the HFD-fed mice. A significant reduction in mRNA levels of FASN and HMG-CoA reductase were observed in the livers of the CL-diet group. Dietary CL, on the other hand, increased in the hepatic mRNA levels of genes related to β -oxidation, namely peroxisome proliferator-activated receptor α , carnitine palmitoyltransferase 1A, and uncoupling protein 2. Expression of the insulin receptor gene was also significantly increased in the livers of mice-fed the CL diet.

Conclusions

The present study therefore demonstrated that CL suppresses lipid accumulation in the WAT and liver partly through inhibiting mRNA levels of FASN gene and enhancing the lipolysis-related gene expression.

Keywords

Cirsium brevicaulle A. GRAY, Anti-adipogenesis, Obesity, Non-alcoholic fatty liver disease

Background

Obesity, a natural consequence of over-nutrition and irregular living habits, contributes to the pathogenesis of metabolic syndrome. Metabolic syndrome, which comprises a cluster of metabolic abnormalities such as hyperlipidemia, type 2 diabetes mellitus (T2DM), and hypertension, is a widespread and an increasingly prevalent disease in industrialized countries, and it has contributed to an increase in cardiovascular morbidity and mortality [1,2]. Nonalcoholic fatty liver disease (NAFLD) is also often associated with metabolic syndrome [3,4]. Several therapeutic agents have been developed for treating obesity by reducing nutrient absorption [5] or by enhancing thermogenesis and lipid turnover [5,6]. However, practical use of these drugs has been hampered by their side effects and because of the rebound weight, which is gained upon termination of these therapies. In this context, it has been considered that supplementation of the daily diet with natural anti-obesity agents would be effective for managing obesity, as well as calorie control and exercise. From viewpoint of safety, the medicinal plants and their active compounds merit investigation for development of natural antiobesity agents.

During recent decades, many studies reported the beneficial effects of flavonoids on health, and these effects were either dependent or independent of their antioxidant activities. Increasing evidence indicates that flavonoid-rich food, beverages, and extracts, as well as pure flavonoids, could ameliorate the symptoms of metabolic syndrome and its associated diseases [7]. Various flavonoids have been isolated as naturally occurring compounds from the genus *Cirsium* [8,9]. It was reported that pectolinarin and 5,7-dihydroxy-6,4'-dimethoxyflavone (DDMF) isolated from *C. japonicum* DC inhibits the growth of implanted

論文内容の大まかな説明

研究の背景

植物アザミ種に含まれるフラボノイドは健康維持に有用であることが知られている。この研究はシマアザミ（学名）の抗肥満作用を脂肪細胞および高脂肪食を与えたマウスで評価した。

実験方法

シマアザミの葉凍結乾燥粉末（C Lと略す）を種々の溶媒で抽出し、これらから得た抽出物の脂肪細胞における脂肪生成抑制効果を調べた。さらに高脂肪食とともにC Lを与えて、与えていない高脂肪食のみを与えたマウスとで肝臓の脂肪量、血中の脂肪酸値、皮下脂肪の量などについて比較した。また、脂肪代謝に関連する遺伝子のメッセンジャーRNA量を脂肪細胞やマウスの肝臓や脂肪組織で測定した。

実験結果

脂肪細胞をC Lのヘキサン抽出物で培養すると、この細胞での脂肪の蓄積量が有意に減少し、脂肪酸合成酵素の発現が抑えられた。また、高脂肪食のマウスにC Lを同時に与えると脂肪酸の血中濃度が低下し、皮下脂肪量も有意に減少し、脂肪酸合成酵素の発現も抑えられた。さらに、肝臓の脂質量もC Lを与えることにより、有意に減少し、肝臓障害の程度も有意に抑えられた。高脂肪食とC Lを同時に与えたマウスの肝臓での脂肪酸合成に関連する酵素系（mRNA）が抑えられ、脂肪酸酸化の系（mRNA）が促進された。

結論

この研究結果は、C Lは肝臓と皮下脂肪組織での脂質の蓄積を脂肪酸合成酵素の遺伝子発現の抑制などにより抑えていることを示している。