

学位論文の要旨

氏名 王 莉

学位論文名 Antiobesity Effect of Polyphenolic Compounds from
Molokheiya (*Corchorus olitorius* L.) Leaves in LDL
Receptor-Deficient Mice
発表雑誌名 European Journal of Nutrition (in press)
著者名 Li Wang, Masayuki Yamasaki, Takuya Katsube,
Xufeng Sun, Yukikazu Yamasaki, Kuninori Shiwaku

論文内容の要旨

INTRODUCTION

The prevalence of obesity is closely associated with lifestyle and becomes an urgent worldwide public health problem. Oxidative stress increases in obese humans and mice, and obesity is the causal component in metabolic disorders, including hyperglycemia, dyslipidemia and hypertension. Polyphenolic compounds in edible plants possess health-promoting properties such as antioxidative, antiatherogenic, antiobesity effects. Many researches have showed that polyphenolic compounds can prevent and improve oxidative stress through reducing gene expression of NADPH oxidase, and attenuate diet-induced hyperglycemia and hyperlipidemia through changing gene expression of certain enzymes related to lipid and glucose metabolisms in the liver, accounting for antiobesity effects. Molokheiya (*Corchorus olitorius* L.) leaves contain plenty of polyphenolic compounds, so we hypothesized that molokheiya leaves possess similar antiobesity effects through the mechanisms of reducing oxidative stress and regulating gene expression of enzymes related lipid and glucose metabolism.

MATERIALS AND METHODS

Experimental diet was a high-fat (HF) diet supplemented with 0% (control), 1% (w/w) or 3% (w/w) molokheiya leaf powder (MLP). The main polyphenolic compounds in MLP included 450 mg hyperoside, 310 mg quercetin 3-glucoside and 1200 mg quercetin 3-(6-malonylglucoside). Three groups of LDL receptor-deficient mice were fed with HF (control group), 1% MLP (1% MLP group) and 3% MLP (3% MLP group) diet, respectively. After 8 weeks feeding, the mice were dissected, and concentrations of plasma glucose, triglyceride (TG), total cholesterol, free fatty acid (FFA) and HDL-cholesterol were measured. Liver lipids were extracted, and triglyceride levels were examined. We also conducted morphological analysis of the liver. Total RNA was extracted from the liver and reverse transcription was performed to synthesize cDNA. Quantitative RT-PCR was performed to evaluate the gene expression of PPAR α , GK, FAS, CPT1A, ACOX1, EHHADH, and GP91phox. SPSS software version 12.0J was used in the present study.

RESULTS AND DISCUSSION

Our study showed that body weight gains and liver weights were significantly lower in the two MLP groups, and epididymal adipose tissue weight was significantly lower in the 3% MLP group, compared to the control group. Concentrations of fasting plasma glucose and TG were significantly lower in the 3% MLP group than in the control group. Plasma HDL-cholesterol levels showed significantly higher values in the two MLP groups, while plasma FFA concentrations were significantly lower than in the control group. Lipid droplets were abundant around the center vein in the liver of the control group, but less so in the MLP groups. Liver TG levels were significantly lower in the two MLP groups. These results suggest that the polyphenolic compounds from molokheiya

leaves were responsible for antioxidative activities stimulating lipid metabolism in the liver, suppressing fat accumulation in adipose tissue and the liver and reducing plasma and hepatic lipid levels, leading to the antiobesity effect.

Gene expressions of enzymes in the liver regulate lipid and glucose metabolism. The gene expression of PPAR α , related to fatty acid oxidation was significantly up-regulated in the 3% MLP group, and that of CPT1A, related to β -oxidation in mitochondria, was also significantly up-regulated in the 3% MLP group, compared to the control group. These results suggest that polyphenolic compounds in molokheiya leaves promote β -oxidation. The NADPH oxidase system is an important source of reactive oxygen species (ROS) generation and ROS induces cell dysfunction. In the present study, the gene expression of GP91phox, a key subunit of NADPH oxidase, was significantly down-regulated in the 3% MLP group than in the control group. This suggests that ROS generation and hepatic cell dysfunction may be attenuated, contributing to maintain the mitochondrial β -oxidation. We believe that molokheiya leaf polyphenolic compounds prevent or attenuate oxidative stress, contributing to the antiobesity effect.

CONCLUSION

The present study shows that MLP prevents obesity in HF diet mice, and suggests that the effects of the polyphenolic compounds, the suppression of oxidative stress and enhancement of β -oxidation in the liver, are involved. The present study raises the possibility that polyphenolic compounds in molokheiya leaves may have potential value as a health supplement to help reduce obesity.