Mulberry Fruit Extract Consumption is Inversely Associated with Hyperlipidemia in Middle-aged Men

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오디 추출물이 중년 남성의 항고지혈증에 미친 효과

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Abstract

In a previous study, a mulberry fruit extract(MFE) supplement exhibited anti-inflammatory activity and improved serum lipid profiles in arthritic rats. The objective of this study was to determine whether dietary MFE could ameliorate inflammatory parameters and serum lipid levels in humans. Twenty-six middle-aged subjects(mean body mass index=27 kg/m²) consumed MFE(100 ml/day) after lunch for 4 wks. Anthropometric measurements, serum oxidative stress markers and serum lipid profile analyses were performed at baseline and then at 4 wk following the study. There were no significant differences in anthropometric measurements, including BMI, WHR, and body fat composition. After the 4 wk-intervention, serum levels of C-reactive protein(CRP), ferric-reducing ability of plasma(FRAP), serum triglyceride(TG) and LDL-cholesterol had significantly decreased(p<0.05), whereas serum levels of HDL-cholesterol significantly(p<0.05) increased. These findings suggest the consumption of mulberry extract may be protective against inflammation and the atherosclerotic state in elderly obese men at high risk for cardiovascular disease(CVD).

Key words: mulberry fruit extract(MFE), CRP, FRAP, triglyceride, HDL-cholesterol, LDL-cholesterol.

INTRODUCTION

Diets rich in fruits and vegetables have been of interest because of their potential health benefits against chronic diseases such as cardiovascular disease(CVD) and cancer. It has been reported that anthocyanin rich berry varieties including blueberry, cherry, strawberries have anti-inflammatory effect of more than 10 times than aspirin without any stomach troubles and also have better antioxidant effect.

Mulberry fruit, specifically, has been clinically used for the treatment of inflammatory conditions traditionally in oriental medicine. In our recent study, anti-inflammatory efficiency of mulberry fruit intake was described in experimental arthritic rats. The findings support a protective role of mulberry fruit supplements in hyperlipidemia and inflammatory conditions, although the results were inconsistent. Only a few previous studies, however, have been performed in which an association between intake of mulberry and bioactivity was observed. Furthermore, the increase in the prevalence of obesity, hyperlipidemia and dyslipidemia has been a major health concern in adult and elderly population in current. Confirmation of the association between foods and disease risk therefore will improve the

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recommendations made for healthy diet.

Based on the previous observation, the aim of this study was to examine the effect of mulberry fruit extract intake on serum inflammatory parameters and serum lipid profiles in middle-aged Korean men.

MATERIALS AND METHODS

1. Preparation of Mulberry Fruit Extracts (MFE)

Mulberry fruits [Morus ibou(Ser.) Koid.] were obtained from a breed registrar, NIAST(National Institute of Agricultural Science and Tech, Suwon, Korea) in June 19, 2006. Fully matured mulberry fruits were harvested and stored at −20°C until further studies. Mulberry fruits were extracted according to the process by Insil Herbal Medicine(Seoul, Korea) to minimize the damage of anti-oxidative substances.

Briefly, after adding 3 times water than mulberry fruits’ weight, the substance was filtrated using by hydrothermal extractor(Jin Young Machinery Co. Ltd, Seoul, Korea) at 55°C for 100 minutes. After the primary filter(pore size: 1 µm filter, Jin Young Machinery Co. Ltd, Seoul, Korea), filtrated material went through enzyme decomposition with adding pectinase (Duscan Co Ltd, Daejeon, Korea) of 0.3%. These were then concentrated in a vacuum decompression until the solid content became 12%. The second filter(Misung Scientific Co. Ltd, Seoul, Korea) was taking by the same filtering machine(Misung Scientific Co. Ltd, Seoul, Korea). After the second filtration, citric acid(Duscan Co. Ltd, Daejeon, Korea) of 0.01% to promote the stability and storage of anthocyanin pigment and functional oligosaccharide(Duscan Co. Ltd, Daejeon, Korea) of 0.01% for sweeteners was added in filtrated material. It was then mixed and sterilized at 90°C for 30 minutes. This mulberry fruit extract was then frozen after filling in pouch at 85°C. The frozen mulberry fruit extracts were stored in a freezer(Deep Freezer, NuAire, Plymouth, MN, USA) of ~70°C for 4 weeks to minimize the decrease of anti-oxidative activity and to maintain the stability of subjects.

2. Subjects

Thirty five voluntary healthy individuals aged 30–60 years were recruited for the study and 3 weeks before the start they were invited to the screening visit. Among them, 26 subjects completed the study. All participants did not report any of the following exclusion criteria: hypertension, diabetes mellitus, coronary heart disease(CHD), alcoholic liver disease, malnutrition, acute infectious diseases, fasting serum glucose(120 mg/dL), BMI<30 kg/m², LDL-C>160 mg/dL, HDL-C<40 mg/dL, and no alcohol abuse(less than 60 g ethanol/day). At baseline, all individuals were subjected to a medical evaluation by a physician, including a full medical history and physical examination. In addition, none were receiving any medication or taking any vitamin supplements. The procedures followed were in accordance with Good Clinical Practice. The protocol was approved by the research ethics committee of Hoejun Medical center, and the informed consent was obtained from each subject.

3. Clinical Study Design

The study was based on an open, prospective, and single blinded design, and carried out from October 20 to November 17 in 2006. During the intervention period for 28 days, each subject consumed 300 ml MFE(200 g for fresh fruit) per day after lunch. All subjects were allowed to eat their normal diet and encouraged to maintain their lifestyle and dietary habits.

4. Anthropometric Measurements

Anthropometric measurements were taken by Inbody 3.0(Bio-electrical Impedance Fatness Analyzer, Biospace Co, Seoul, Korea) while the subjects were dressed in light clothing, before and after the final intervention period. Height and weight were measured by an automatic height-weight scale. Waist circumference was measured at the mid point between the lower border of the rib cage and the iliac crest, and hip circumference was measured at the widest part of the hip region. All anthropometric measurements were checked by one person throughout the study to minimize interpersonal variations.

5. Biochemical Analysis

Blood samples were taken three times, at the beginning of the experimental period(day 0), in the middle of the study(day 15th) and at the end of the experimental period(day 28th) after 12 h fast. Subjects were not allowed to drink alcohol or to smoke in the morning of the blood sampling day. Serum was obtained by centrifugation at 3,000 rpm for 10 min at 4°C directly after blood sampling then stored at −70°C until other tests were done. Serum levels of triglyceride(TG), total cholesterol(TC), HDL-cholesterol(HDL-c), LDL-cholesterol(LDL-c) were measured using commercial kits(Sigma Co. Ltd, NY, USA) according to