

Royal Jelly Supplementation Improves Lipoprotein Metabolism in Humans

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Summary Royal jelly (RJ) has several physiological effects and is widely used in commercial medical products and health foods. We examined the effects of RJ supplementation on serum lipoprotein metabolism in humans. Fifteen volunteers were divided into an RJ intake group ($n=7$) and a control group ($n=8$). The RJ group took 6 g per day for 4 wk. Their serum total cholesterol (TC) and serum low-density lipoprotein (LDL) decreased significantly compared with those of the control group ($p<0.05$). There were no significant differences in serum high-density lipoprotein (HDL) or triglyceride concentrations. Moreover, the relationship between the serum cholesterol and lipoprotein levels was investigated. Among the lipoprotein fractions, small very-low-density lipoprotein was decreased ($p<0.05$) after RJ intake. Our results suggest that dietary RJ decreases TC and LDL by lowering small VLDL levels.

Key Words royal jelly, serum lipoprotein metabolism, small VLDL

Royal jelly (RJ), which is secreted by the hypopharyngeal and mandibular glands of worker honeybees, is a necessary food for the growth of the queen honeybee. RJ contains a mix of proteins (12–15%), sugars (10–16%), lipids (3–6%), free amino acids, vitamins, minerals, and fatty acids. Several researchers have found that RJ has anti-tumor (1), anti-inflammatory (2), antioxidant (3), and cell proliferative activities (4). RJ reduces total cholesterol levels in experimental animals (5) and atherosclerosis in humans (6). RJ significantly affects lipid metabolism in rats and prevents the development of atherosclerosis in rabbits fed a cholesterol-rich diet (7, 8). Moreover, both oral administration and injection of RJ significantly reduce serum lipid and cholesterol levels in atherosclerosis patients with moderately high cholesterol levels (9, 10). A high blood cholesterol level is considered a health risk factor in cardiovascular diseases (11). To elucidate the effects of RJ supplementation on serum lipoprotein metabolism in humans, we focused on the relationship between serum cholesterol and lipoprotein levels.

MATERIALS AND METHODS

Subjects. All subjects were healthy adult volunteers, recruited mainly among the staff of the Research and Development Center of Nippon Meat Packers. The purpose and expectations of the study were fully explained

to each volunteer. All subjects gave their informed consent before admission. Subjects showed no evidence of any chronic disease (hepatic, renal, or cardiac dysfunction) or obesity, and were not participating in unusually high levels of physical activity (e.g., sports training). None of the subjects took medications or vitamin supplements before or during the study. The study was approved by the Ethics Committee of the Research and Development Center of Nippon Meat Packers, and written informed consent was obtained from all participants.

Experimental design. Fifteen healthy adult volunteers were randomly separated into two groups: one group (5 males and 2 females, 39.0 ± 9.9 y) was given royal jelly (RJ); the other group was assigned as control (6 males and 2 females, 36.9 ± 12.3 y). The RJ group was given 6 g RJ (Maruwa Co. Ltd., Tokyo, Japan) daily for 4 wk. The control group received nothing. Each participant was instructed to maintain the same dietary pattern the evening before each test and the same lifestyle pattern the evening and morning before each test. Blood for biochemical analyses and serum TC, HDL, and LDL analyses was obtained from each subject immediately before and after the experimental period. To study the relationship between serum cholesterol and lipoprotein levels before and after supplementation with RJ, we analyzed each lipoprotein fraction by high-performance liquid chromatography (HPLC) (12).

Laboratory analyses. Blood samples were collected for biochemical tests. Hematological variables (white blood cells, red blood cells, and hemoglobin) were measured with an SE-9000 analysis system (Sismex, Kobe, Japan) using blood with anticoagulant (EDTA). Serum was obtained by centrifuging the blood without anticoagulant at $1,250\times g$ for 15 min at 4°C. Biochemistry

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Abbreviations: A/G, albumin to globulin ratio; GOT, glutamic-oxaloacetic transaminase; GPT, glutamic-pyruvic transaminase; γ -GTP, gamma-glutamyl transpeptidase; HDL, high-density lipoprotein; LDL, low-density lipoprotein; RJ, royal jelly; TC, total cholesterol; VLDL, very-low-density lipoprotein; sVLDL, small VLDL.

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