SERUM LIPID EFFECTS OF A MONOUNSATURATED (PALMITOLEIC) FATTY ACID-RICH DIET BASED ON MACADAMIA NUTS IN HEALTHY, YOUNG JAPANESE WOMEN

Junko Hiraoka-Yamamoto,†‡ Katsumi Ikeda,*† Hiroko Negishi,*†‡ Mari Mori,*‡ Akiko Hirose,* Sayuri Sawada,* Kazuya Kitamori,*† Yuko Onobayashi,*†‡ Satoko Kitano,*†‡ Misao Tashiro,* Tomohiro Miki* and Yukio Yamori†‡§

*Frontier Health Science, †Department of Food Science and Nutrition, School of Human Environmental Science, §School of Pharmaceutical Sciences, Mukogawa Women’s University, Nishinomiya, ‡Department of Food and Nutritional Environment, College of Human Life and Environment, Kinjo Gakuin University, §Research Institute for Production Development, Kyoto and †International Center for Research Primary Prevention of Cardiovascular Diseases, Kyoto, Japan

SUMMARY

1. Recent studies have identified potential beneficial effects of eating nuts, most of which have substantial amounts of monounsaturated fatty acids (MUFA). Macadamia nuts consist of 75% fat by weight, 80% of which is MUFA (palmitoleic acid).

2. To examine variations in serum lipid levels in response to a high-MUFA diet based on macadamia nuts, 3 week inter-
ventions of macadamia nuts, coconuts and butter were
determined in young, healthy Japanese female students.

3. After 3 weeks intervention, serum concentrations of total cholesterol and low-density lipoprotein–cholesterol were significantly decreased in the macadamia nut and coconut diets and bodyweight and body mass index were decreased in the group fed macadamia nuts, although there were no statistically significant changes in the group fed butter.

Key words: fatty acid, human, intervention, macadamia nuts, palmitoleic acid, serum cholesterol.

INTRODUCTION

Experimental and epidemiological evidence has been reported that dietary monounsaturated fatty acids (MUFA) may have a beneficial health effect. Cholesterol Education Program (NCEP) guidelines to liberalize total fat intake, especially MUFA, related to its health effect.

Experimental and epidemiological evidence has been reported that dietary monounsaturated fatty acids (MUFA) may have a beneficial health effect. Cholesterol Education Program (NCEP) guidelines to liberalize total fat intake, especially MUFA, related to its health effect. Macadamia nuts are one of the most popular nuts in the world. Macadamia nuts contain 75% fat by weight, 80% of which is MUFA (palmitoleic acid). The aim of the present study was to investigate the effects of a MUFA-rich diet on serum total cholesterol levels and serum fatty acid profiles in young healthy subjects. In the present study, we compared the effects of three types of diet containing macadamia nuts, coconuts and butter, rich in MUFA, saturated fatty acids and cholesterol, respectively.

METHODS

Seventy-one young, healthy Japanese women were recruited from the students at Mukogawa Women’s University (age range 19–23 years). After the study had been approved by the Ethics Committee of the Mukogawa Women’s University, written informed consent was obtained from all volunteers.

Macadamia nuts were supplied by Horticulture Australia (Sydney, Australia).

Three types of bread were prepared, each bread containing 10 g macadamia nuts, coconut or butter.

Subjects were divided at random into three groups. Group C (n = 24) was assigned coconuts breads, group B (n = 23) was assigned butter bread and group M (n = 24) was assigned macadamia nut bread. Subjects consumed two loaves of bread daily for 3 weeks.

Before and after the dietary intervention, fasting blood samples were collected and serum lipids were measured. Serum total cholesterol, HDL–cholesterol and low-density lipoprotein (LDL)–cholesterol, triglycerides and free fatty acids were measured by enzymatic methods (SRL, Hamamatsu, Japan). Physical parameters, including height, bodyweight, percentage body fat (In body 3.0; Biospace, Tokyo, Japan) and blood pressure (with subjects seated) were measured.

Statistical analysis was performed using SPSS 11.5 J software (SPSS, Chicago, IL, USA). All data are presented as the mean±SEM. Mean differences between each group were evaluated by one-way ANOVA. Changes within each group were analysed using Student’s t-test (paired). Atherogenic index (AI) changes from baseline were analysed by Wilcoxon matched pairs signed-rank test. P < 0.05 was considered significant.

RESULTS

The energy content and lipid profile of each bread were as follows: (i) coconuts breads: 418 kcal/100 g, saturated fatty acids (SFA) 59.4%, MUFA 24.7% (palmitoleic acid 0.04 g/100 g), polyunsaturated fatty acids (PUFA) 15.1%, unknown (UN) 0.8%; (ii) butter bread: 480 kcal/100 g, SFA 55%, MUFA 32.3% (palmitoleic acid 0.34 g/100 g), PUFA 10.5%, UN 2.2%; and (iii) macadamia nut bread: 483 kcal/100 g, SFA 18.8%, MUFA 70.5% (palmitoleic acid 2.85 g/100 g), PUFA 10.1%, UN 0.6%.
The mean age of the 71 subjects in the present study was 19.5 ± 0.1 years (range 18–24 years). There were no significant differences in age or any physical and serum lipid parameters examined among the three groups prior to dietary intervention (Table 1). Compliance was regarded as good based on the following percentages of the prescribed bread consumed: group C, 91.7%; group B, 78.3%; and group M, 91.7%. There were no significant differences in compliance among the three groups.

Compared with the percentage of palmitoleic acid in the blood prior to intervention, there was an increase in this parameter in group M subjects after intervention (1.6 ± 0.1 vs 1.9 ± 0.1%, respectively; P < 0.05). There were no significant differences in palmitoleic acid before and after intervention in either group C (1.5 ± 0.1 vs 1.7 ± 0.1%, respectively; NS) or group B (1.4 ± 0.1 vs 1.6 ± 0.2%, respectively; NS).

Physical parameters and serum lipid profiles before and after intervention are given in Table 1. Serum total and LDL–cholesterol concentrations after intervention in groups C and M were significantly decreased compared with baseline levels, although there were no significant changes in group B. There were no significant changes in HDL–cholesterol in any group. The AI after intervention in group C was significantly decreased. Bodyweight and body mass index (BMI) were decreased significantly in group M. There were no significant changes in HDL–cholesterol in any group. The AI after intervention was decreased significantly compared with baseline levels in group M. These effects observed in the present study are similar to in other intervention studies of MUFA or macadamia nuts. Furthermore, the bodyweight and BMI in group M were significantly decreased during intervention, although bodyweight and BMI in groups C and B did not change. Wien et al. reported that low calorie diet (LCD) supplementation with almonds (high MUFA), in contrast with complex carbohydrates, was associated with greater reductions in weight/BMI. The present study did not include an LCD programme, but the mechanism responsible for the significant decrease in bodyweight and BMI in group M may be the same.

In conclusion, we have found that moderate modification of a natural diet through intervention with nuts that contain MUFA (palmitoleic acid) decreased serum total cholesterol and LDL–cholesterol levels and reduced bodyweight in healthy, young Japanese women.

Whether these differences may be due to differences in fatty acid composition remains to be resolved.

ACKNOWLEDGEMENTS

The authors thank Ms K Nakahigashi, Ms Y Kajimoto, Ms M Nakamura, Ms R Yamauchi, Ms Y Nakata and Ms R Wakatake, who provided excellent technical assistance.

REFERENCES


