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Effect of Egg Consumption in Overweight and Obese Hypercholesterolemic Women

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Abstract

Background: The objective of this study was to determine the effect of egg consumption on lipid parameters in overweight and obese hypercholesterolemic womentreated with lipid-lowering agents.

Methods: Forty overweight and obese hypercholesterolemic women, mean age of 58 years and mean body mass index of 27 kg/m^2, who had been treated with lipid-lowering agents. Every patient was assigned to consume additional 3 eggs daily with their regular diet for 12 weeks. Lipid parameters and body compositions were measured.

Results: An additional consumption of 3 eggs daily for 12 weeks increased HDL-cholesterol by 4.75 mg/dl (P <0.01) and decreased LDL-cholesterol to HDL-cholesterol ratio by 0.35 (P <0.05). No statistically significant changes were found in other lipid parameters. Body weight, body mass index, body composition and blood pressure were insignificantly changed.

Conclusion: Addition of 3 eggs daily to their regular diet will increase the level of HDL-cholesterol and lower the ratio of LDL-cholesterol to HDL-cholesterol in overweight and obese hypercholesterolemic women who were treated with lipid-lowering agents.

Keywords: Overweight; Obesity; Hypercholesterolemia; Egg consumption

Introduction

Overweight, obesity and hypercholesterolemia have been considered an important health problem worldwide. More than twenty-five percent and sixty percent of Thai adults were considered to be overweight and hypercholesterolemia, respectively [1,2]. The prevalence rates of obesity and overweight were relatively higher than those in other developing countries in Asia [1]. Eggs are an essential source of cholesterol in the diet, restricted egg consumption is often recommended to lower cholesterol and to help prevent coronary heart disease (CHD) and its complications especially in overweight and obese hypercholesterolemic patients [3]. There have been epidemiological studies in USA and Spain were not show association between egg consumption and the incidence of CHD [4,5].

A study consumption of 3 eggs per day (640 mg per day additional diet cholesterol) and carbohydrate-restricted diet in overweight and obese men without hypercholesterolemia demonstrated that serum LDL-cholesterol did not increase while serum cholesterol and HDL-cholesterol did significant increase when compared to placebo group [6].

To the best of our knowledge, no previous report on the effect of egg consumption in overweight and obese hypercholesterolemic women, thus, we try to investigate the relationship between additional 3 eggs daily consumption in these subjects with lipid parameters.

Materials and Methods

Subjects

Forty women who had been diagnosed for overweight or obesity (BMI ≥ 25 kg/m^2) and hypercholesterolemia (serum cholesterol level ≥ 200 mg/dl) and treated with lipid-lowering agents with stable lipid parameters for 12 weeks were enrolled. The patients with egg allergy, documented heart disease, poorly controlled hypertension, diabetes mellitus, and liver or kidney disease were excluded from the study. All patients did not change the dosage of lipid-lowering agents during the 12 weeks of the study. Patients were assigned to intake additional 3 eggs daily for 12 weeks and recorded number of eggs that they intake everyday. Patients were not supported any other foods apart from eggs for their additional diet. Furthermore, energy intake was not limited throughout the study. The biochemical tests including plasma glucose, renal and liver function tests, and hematological parameters were measured before and after the study. The Committee on Human Research of Ramathibodi Hospital, Mahidol University, Thailand, approved the study protocol. All the patients provided written informed consent.

Dietary Assessment

Patients completed 3-day dietary records. The interviewers collected the data and estimated the serving portions with the use of household measuring cups, spoons, and ruler to help the patients in the recall of foods eaten. During the study, the patients were asked to check a daily egg record sheet.

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Lipid Profile

Serum was drawn for lipid assessment after 12 hours overnight fast. The serum lipid profiles included total cholesterol (TC), triglyceride (TG), high-density lipoprotein cholesterol (HDL-C), and low-density lipoprotein cholesterol (LDL-C), which were measured by enzymatic methods (Boehringer Mannheim Corporation, Mannheim, Germany).

Body Composition

Body composition was investigated with the use of the "In Body" 720 body composition analyzer (Biospace Corporation, Seoul, Republic of Korea). Body composition was measured in the morning after an overnight fast. Body mass was recorded to the nearest 100 gram on a calibrated digital scale. The same technician who was unaware of the study details performed analyses.

Statistical Analysis

Baseline characteristics and serum lipid profiles of all subjects were reported by using mean ± standard deviation (SD). Statistical analysis was conducted using SPSS software version 13.0 for windows. All outcome measurements among baseline and each period data were assessed using two-way repeated measures ANOVA. P <0.05 was considered statistically significant.

Results

Forty overweight and obese hypercholesterolemic women participated in this study. The average age of the patients was 58.7 (Table 1). All patients did not smoke or drink alcohol. The compliance to egg consumption among 4th, 8th and 12th week were 97.8%, 98.4% and 98.6%, respectively. Lipid parameters during 12 weeks before the beginning of the study did not show significant change when compared to baseline. Baseline average TC, LDL-C, HDL-C and TG were 186.8, 103.0, 51.1, and 116.8 mg/dl, respectively.

Body weight, body mass index, body fat weight, lean body weight, and total body water were insignificantly changed at the 12th week. Systolic and diastolic blood pressure did not show statistically significant change as well (Table 2).

Additional consumption of 3 eggs daily for 12 weeks increased HDL-C by 4.75 mg/dl (P <0.01) and decreased LDL-C to HDL-C ratio by 0.35 (P <0.05). The study showed no statistically significant change of TG (P = 0.98), TC (P = 0.69), and LDL-C (P = 0.99) (Table 3). The biochemical tests of plasma glucose, renal and liver function tests, and hematological test did not significantly change before and after the study.

Varible	Values
Sex female	40
Age (year)	58.7 ± 7.39
Systolic blood pressure (mmHg)	128.9 ± 13.1
Diastolic blood pressure (mmHg)	77.8 ± 9.55
Body weight (kg)	65.3 ± 5.70
Body mass index (kg/m2)	27.7 ± 2.02
Lipid lowering agents	
Rosuvastatin 5 mg/day	26.7%
Atorvastatin 10 mg/day	13.3%
Simvastatin 20 mg/day	60.0%

Values are mean ± SD except otherwise stated

Table 1: Characteristics of patients at baseline (n = 40).

Variable	Baseline	4th week	8th week	12th week
Body weight (kg)	65.3 ± 5.70	65.9 ± 6.09	65.7 ± 6.19	65.8 ± 6.16
Body mass index (kg/m2)	27.7 ± 2.02	28.1 ± 2.30	28.0 ± 2.37	28.0 ± 2.38
Lean body weight (kg)	43.3 ± 4.56	43.5 ± 4.24	43.1 ± 4.44	43.2 ± 4.89
Lean body (%)	66.4 ± 5.68	66.1 ± 5.25	65.7 ± 5.28	65.6 ± 5.55
Body fat weight (kg)	22.0 ± 4.59	22.4 ± 4.58	22.6 ± 4.57	22.6 ± 4.46
Body fat (%)	33.6 ± 5.68	33.8 ± 5.25	34.3 ± 5.28	34.4 ± 5.55
Total body water (kg)	32.2 ± 3.15	32.4 ± 2.86	32.1 ± 2.99	32.2 ± 3.27
Total body water (%)	49.4 ± 4.22	49.3 ± 3.78	48.9 ± 3.69	48.9 ± 3.78

Values are mean ± SD
*P value < 0.05 compared to baseline value.

Table 2: Body weight, BMI, and body composition at baseline, 4th, 8th, 12th week of patients consuming 3 eggs daily (n = 40).

Variable	Baseline	4th week	8th week	12th week
TC (mg/dl)	186.8 ± 29.5	188.9 ± 23.7	185.9 ± 28.5	184.9 ± 23.1
TG (mg/dl)	116.8 ± 52.6	119.9 ± 55.4	120.1 ± 60.5	117.0 ± 50.4
HDL-C (mg/dl)	51.1 ± 9.96	51.8 ± 9.22	52.3 ± 9.14	55.8 ± 10.8**
LDL-C (mg/dl)	103.0 ± 28.2	104.0 ± 22.1	101.6 ± 25.9	103.0 ± 21.1
LDL-C:HDL-C	3.74 ± 0.70	3.72 ± 0.66	3.62 ± 0.64	3.39 ± 0.58*

Values are mean ± SD
**P* value < 0.05 compared to baseline value.
***P* value< 0.01 compared to baseline value.

Table 3: Serum lipid parameters at baseline, 4th, 8th, 12th week of patients consuming 3 eggs daily (n = 40).

Discussion

In the present study, we found that short-term consumption 3 eggs daily did not increase serum cholesterol, LDL-cholesterol and triglyceride in overweight and obese hypercholesterolemic women who were treated with lipid-lowering agents. In addition, egg consumption led to an increase in HDL-cholesterol as well as a decrease in LDL-cholesterol to HDL-cholesterol ratio.

The large cohort study that has specifically examined the relationship between egg consumption and coronary heart disease included 37,851 healthy men and 80,002 healthy women in the Health Professionals Follow-Up Study and the Nurses' Health Study. After adjusting for multiple confounders, those eating >7 eggs/week (as compared with those consuming <1 egg/week) had no increased risk of coronary heart disease or stroke overall in either healthy men or women [4]. In other cohorts in Japan and Spain, an increase in egg consumption was demonstrated insignificant tendency for a higher mortality due to cardiovascular disease [5,7].

In healthy pre-menopausal women have showed no significant changes in LDL-cholesterol and HDL-cholesterolin hypo-responder while increases in LDL-cholesterol and HDL-cholesterolin hyper-responder after consuming 3 eggs per day for 4 week [8]. In prior study, hypercholesterolemic nonobese women who are on cholesterol-lowering diet, consuming one or three eggs per day did not raise serum cholesterol or LDL-cholesterol levels and did not change in HDL-cholesterol at 4 weeks [9].Clinical trials conducted in 28 overweight or obese men aged between 40 to 70 years have revealed that overweight or obese men had no change in cholesterol, LDL-cholesterol and LDL-cholesterol to HDL-cholesterol ratio while plasma HDL-cholesterol significantly increased 12 mg/dl and body weight significantly decreased about 6 percent after eating 3 eggs per day with carbohydrate-restricted diet for 12 weeks. In our study cannot show benefit on weight reduction because patients in our study did not limit carbohydrate or energy throughout the study [6]. Furthermore, increasing in HDL-cholesterol level by 1 mg/dl may reduce the risk of cardiovascular event by 2 to 3

percent, and decreasing in LDL-cholesterol to HDL-cholesterol ratio by 1 unit may decrease the risk of cardiovascular event by 50 percent [10,11]. In addition, daily intake of 3 eggs for 12 weeks in overweight men significantly increases adiponectin that is both anti-inflammatory and antiatherogenic hormone [12]. Adiponectin decreases adhesion molecule expression that occurs after inflammation and also decreases TNF-α production by macrophages [13,14]. The increased HDL-cholesterol and adiponectin observed in egg consumption may have resulted in elevations of paraoxonase that is an antioxidant carried on HDL [15].

Eggs contain many other nutrients besides cholesterol (~213 mg/egg), including polyunsaturated (~0.7g/egg) and monounsaturated (~1.9g/egg) fatty acids that may provide protection against development of cardiovascular disease [3]. Also, dietary cholesterol is not the main factor affecting serum cholesterol level. The principal dietary determinants of serum cholesterol are saturated fat and trans-fat consumption [16]. Therefore, limitation of egg eating alone may not be sufficient for preventing cardiovascular disease. However, in Thailand, the reported egg consumption in 1995 was 120 for each person per year, which was less than other countries in Asia [17]. Egg consumption is an essential and inexpensive source of amino acids and fatty acids.Thus, care for restriction egg consumption may be more important in Thailand. Limitation of this study, the duration of egg consumption during this study limits the ability to predict the long-term effects. Second, the number of patients in this study is too small and may not represent the large population. Finally, variables potentially confounding the correlation between egg intakes and serum lipid parameters include other dietary consume physical activity, and genetic factors. The nutrient density of eggs and their role in a heart healthy diet need to reevaluate in the changing in overweight and obese patients.

Conclusion

This study was demonstrated that in overweight and obese hyperlipidemic women treated with lipid-lowering agents, the consumption of additional 3 eggs per day to their regular diet significantly increased the HDL-cholesterol and decreased the ratio of LDL-cholesterol to HDL-cholesterol, indicating the egg is a good food and may be beneficial in preventing cardiovascular eventsource for these patients.

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