



ELSEVIER

LETTER TO THE EDITOR**The effects of consumption of ω 3 fatty acid-enriched eggs on insulin and CRP**

Dear Editor,

Coronary heart disease (CHD) is the major cause of death in Iran. Approximately 70,000 people die from CHD every year in Iran. Recent studies emphasize the importance of insulin resistance and hyperinsulinemia as a risk factor for CHD and its aggravating effect on other risk factors such as diabetes and obesity [1]. In addition, cardiovascular events, insulin resistance and diabetes are associated with high C-reactive protein (CRP) concentration that serves as an index of inflammatory state of the body [2,3]. Consumption of ω 3 fatty acids slows atherosclerosis progression and daily intake of 2–4 g of ω 3 fatty acids lowers the risk of cardiovascular disease [4]. However, the association of dietary consumption of ω 3 fatty acids and its relation to CRP and insulin levels remains unknown.

Egg is a common food item and a standard egg contains a ratio of ω 3 fatty acid to total fat less than 1%. By feeding laying hens with a vegetarian diet having moderate concentration of grains, soybean and flaxseed rich in alpha-linolenic acid (ALA), ω 3 content per egg can be increased to 6 times than the standard eggs. In addition, the ω 3 fatty acid/total fat ratio in these ω 3PUFA eggs is nearly 13% [5]. In this study, we report the effect of ω 3PUFA-enriched eggs consumption on fasting serum insulin and C-reactive protein (CRP) of the Iranian volunteers.

We carried out a randomized double blind controlled clinical trial to compare the effects of standard and ω 3 fatty acid-enriched eggs on fasting insulin and CRP. The investigators and laboratory personnel were unaware of the kind of eggs, which the volunteers had consumed. Forty-two healthy volunteer students between 18 and 25 years were recruited from the science faculty of Tehran University. Those with total cholesterol \geq 200 mg/dl, TG \geq 200 mg/dl or FBS \geq 110 mg/dl

were excluded from the study. Informed consent was taken and the volunteers were then divided into two groups with 21 students in each group. This project was approved by the ethics committee of the Endocrinology and Metabolism Research Center of the Tehran University of Medical Sciences.

The period of the study was 8 weeks. In the first and eighth weeks of the study, 12 h fasting venous blood sampling, anthropometric, blood pressure, metabolic and hsCRP measurements were performed using standard methods. In addition, 3-day food records were taken from all of the individuals. Subjects were asked not to change their usual daily diet except for addition of eggs, which were provided. They were asked to consume two eggs daily for 6 weeks; the first (intervention) group two ω 3PUFA-enriched eggs and the second (control) group two standard eggs, both of which were similar in appearance and taste. At the first day of every week subjects received 14 eggs to be used during that week according to the design of the study. To make sure of regular intake of the eggs, the team made regular contacts with the volunteers by phone call and personal visits in dormitories. Total daily energy and nutrient consumption of the subjects were estimated by food processor software.

The ω 3PUFA-enriched eggs (Columbus[®], Belovo SA, Belgium) were supplied by Beheshti Poultry farm (Tehran). These eggs contain a balanced concentration of ω 6 and ω 3 fatty acids (1.32 mg of each) per 1000 g.

Serum insulin was measured by monoclonal immunoradiometric assay (IRMA, Biosource Europe SA, Belgium). The lowest limit of detection for this instrument was 0.156 ng/ml. HsCRP was measured quantitatively using particle-enhanced immunoturbidometric assay (Roche) on Hitachi 902 auto-analyzer. Statistical data analysis was performed using paired *t*-test to compare the changes in

Table 1 Alterations of insulin and CRP levels in the intervention and control groups

Variable	Group 1			Group 2		
	Baseline	8 wk	<i>p</i> value	Baseline	8 wk	<i>p</i> value
Insulin (ng/ml)	0.32 ± 0.03	0.23 ± 0.02	0.02	0.37 ± 0.03	0.41 ± 0.03	ns
hsCRP (mg/dl)	0.36 ± 0.02	0.31 ± 0.01	0.03	0.41 ± 0.02	0.43 ± 0.01	ns

ns, not significant.

examined parameters before and at the end of the experiment by SPSS version 10 software.

Consumption of ω 3PUFA-enriched eggs significantly reduced systolic blood pressure but it had no effect on BMI, WHR, waist circumference and diastolic blood pressure of the participants. There was no change in the daily intake of energy, protein, carbohydrate, total fat, saturated fatty acids and monounsaturated fatty acids before and after the study. Daily intake of polyunsaturated fatty acids increased significantly (from 9.6 ± 1.1 to 12.9 ± 1.2 g) in the intervention group ($p < 0.05$); while there was no significant change (from 10.1 ± 1.2 to 9.9 ± 1.1 g) in the control group. Daily intake of cholesterol increased significantly in both groups (from 181.2 ± 11.8 to 606.1 ± 12.3 g, $p < 0.0001$ in the intervention group and from 201.9 ± 14.7 to 616.3 ± 16.8 g, $p < 0.001$ in the control group).

Table 1 shows alterations of insulin and CRP levels before and after consumption of the eggs. Fasting plasma insulin and CRP were significantly reduced in the intervention group without any change in the control group.

Our results indicate that the consumption of ω 3PUFA-enriched eggs decreases plasma fasting insulin and CRP levels; however, further studies are recommended to confirm this initial finding definitely. Atherosclerosis is associated with inflammatory response and since ω 3PUFA compounds have considerable anti-inflammatory and immunoregulatory effects, they can slow the rate of progression of atherosclerosis [6]. This is indicated by a significant reduction of CRP levels in our study. Replacement of a small percentage of total fatty acids with long-chain ω 3 fatty acids from fish oil has previously been shown to reverse insulin hypersecretion [7]. As consumption of one ω 3PUFA enriched-egg supplies 50–75% of daily recommended intake of ω 3 fatty acids, reduction in fasting insulin secretion in normal subjects of this study is further suggestive of role of ω 3 fatty acids in effecting insulin secretion and need further investigation in diabetic human subjects [8].

We conclude that ω 3 fatty acids have favourable effects on CRP and fasting insulin secretion in normal subjects.

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