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Total n-3 polyunsaturated fatty acid intake is inversely associated with serum C-reactive protein in young Japanese women

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Abstract

Little is known about the relation of dietary factors to circulating C-reactive protein (CRP) concentrations in young adults and non-Western populations. We cross-sectionally examined associations between dietary intake and serum CRP concentrations in young Japanese women. The subjects were 443 female Japanese dietetic students aged 18 to 22 years. Dietary intake was assessed with a validated, self-administered, comprehensive, diet history questionnaire. Serum CRP concentrations were measured by highly sensitive nephelometry. The prevalence of elevated CRP (≥1 mg/L) was 5.6%. After adjustment for possible confounding factors including body mass index, a significant inverse association was seen between total n-3 polyunsaturated fatty acid intake and elevated CRP. The multivariate adjusted odds ratios of elevated CRP for women with intake below and above the median (1.1% of energy) were 1.00 and 0.33 (95% confidence interval, 0.13-0.82; P = .02), respectively. Intake of eicosapentaenoic acid + docosahexaenoic acid and α-linolenic acid was not associated with elevated CRP concentrations (P = .62 and P = .27, respectively). Vitamin C intake was independently inversely associated with elevated CRP, although the association was nonsignificant (P = .10). No clear associations were observed for other dietary factors examined including total fat, saturated fatty acids, monounsaturated fatty acids, polyunsaturated fatty acids, total dietary fiber, soluble dietary fiber, insoluble dietary fiber, and magnesium; fruits, vegetables, and fish and shellfish; and dietary glycemic load (P = .27 to P = .99). In conclusion, total n-3

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polyunsaturated fatty acid intake showed an independent inverse association with elevated serum CRP concentration in a group of young Japanese women.

Keywords: n-3 polyunsaturated fatty acid; C-reactive protein; Diet; Young Japanese women; Epidemiology
Abbreviations: ALA, α-linolenic acid; BMI, body mass index; CRP, C-reactive protein; DHA, docosahexaenoic acid; DHQ, diet history questionnaire; EPA, eicosapentaenoic acid; MUFA, monounsaturated fatty acid; PUFA, polyunsaturated fatty acid; SFA, saturated fatty acid.

1. Introduction

C-reactive protein (CRP) is a sensitive marker of inflammation that is independently and directly associated with cardiovascular disease [1], type 2 diabetes [2], and metabolic syndrome [3]. Identification of modifiable lifestyle factors that influence circulating CRP concentrations (eg, dietary habits) is thus vitally important from a prevention perspective. Nutrients suggested to be associated with CRP concentration in epidemiologic studies include fat and several fatty acids [4-8], dietary fiber [4,9,10], magnesium [11,12], and vitamin C [13,14]. At the food level, associations have been reported for fruits [14-16], vegetables [14-16], and fish [17]. An association with dietary glycemic load (a measure of carbohydrate quality and quantity) has also been suggested [18]. However, almost all these studies have been conducted in middle-aged and elderly populations in Western countries [4-6,9-18], and evidence from non-Western countries [7,8] and young adult populations [7] is extremely limited.

Here, we conducted a cross-sectional study of associations between selected dietary factors, that is, intake of total fat, saturated fatty acid (SFA), monounsaturated fatty acid (MUFA), polyunsaturated fatty acid (PUFA), total n-3 PUFA, eicosapentaenoic acid (EPA) + docosahexaenoic acid (DHA), α-linolenic acid (ALA), total dietary fiber, soluble dietary fiber, insoluble dietary fiber, magnesium, and vitamin C; intake of fruits, vegetables, and fish and shellfish; and dietary glycemic load, with serum CRP concentration in a group of young Japanese women.

Research among Japanese populations is important because the differences in dietary habits between Japanese and Western populations (particularly, higher intake of fish and, hence, n-3 PUFA in Japanese than in Western populations [19,20]) hamper the extrapolation of findings in Western countries to Japanese. Research among young adult populations is also important from the standpoint of prevention. We hypothesized that dietary habits (particularly n-3 PUFA intake) influence serum CRP concentrations in young Japanese women.

2. Methods and materials

2.1. Subjects

The present study was based on a multicenter survey conducted from February to March 2006 among female dietetic students from 10 institutions in Japan. All measurements at each institution were conducted according to the survey protocol. Staff at each institution provided an outline of the survey to potential subjects. Those responding positively were then provided detailed written and oral explanations of the general purpose and procedure of the survey. The protocol of the study was approved by the Ethics Committee of the National Institutes of Health and Nutrition, and written informed consent was obtained from each subject and also from a parent for subjects younger than 20 years. A total of 474 women took part. We excluded subjects whose CRP concentrations had not been measured (n = 22), those with CRP concentrations of 10 mg/L or greater (n = 2) on the basis that such high concentrations were likely caused by infection or an underlying medical problem not related to diet [21], and those aged younger than 18 years or aged 23 years or older (n = 7). The final sample thus comprised 443 women aged 18 to 22 years. All women were free from diabetes, hypertension, and cardiovascular disease, and all reported energy intakes within the relatively strict range used in our previous study (775-3450 kcal/d) [22].

2.2. Dietary assessment

Dietary habits during the preceding month were assessed using a previously validated self-administered comprehensive diet history questionnaire (DHQ) [23-25]. Responses to the DHQ as well as to an accompanying lifestyle questionnaire were checked at least twice for completeness and reviewed with the subject when necessary to ensure the clarity of answers. Estimates of dietary intake for a total of 150 food and beverage items, energy, and selected nutrients were calculated using an ad hoc computer algorithm for the DHQ based on the *Standard Tables of Food Composition in Japan* [26,27]. Although dietary supplement use was queried in the DHQ, intake from supplements was not included in the calculation because of the lack of a reliable composition table of dietary supplements in Japan. Dietary glycemic load was calculated according to a procedure described elsewhere [28,29]. Pearson correlation coefficients between the DHQ and 3-day estimated dietary records were 0.55 for total fat, 0.75 for SFA, 0.50 for MUFA, 0.37 for PUFA, and 0.45 for vitamin C in 47 women [23]. In addition, Pearson correlation coefficients between the DHQ and serum concentrations were 0.66 for EPA + DHA and 0.36 for ALA in 44 women [25].