Available online at www.sciencedirect.com
ScienceDirect
Nutrition Research 31 (2011) 169 – 177
Nutrition Research
www.nrjournal.com

The ratio of fish to meat in the diet is positively associated with favorable intake of food groups and nutrients among young Japanese women

Hitomi Okubo[a,b], Satoshi Sasaki[a,c,*], Kentaro Murakami[c], Yoshiko Takahashi[d] the Freshmen in Dietetic Courses Study II group[1]

[a]Department of Social and Preventive Epidemiology, Graduate School of Medicine, the University of Tokyo, Tokyo 113-0033, Japan
[b]Research Fellow of the Japan Society for the Promotion of Science, Japan
[c]Department of Social and Preventive Epidemiology, School of Public Health, the University of Tokyo, Tokyo 113-0033, Japan
[d]Department of Health and Nutrition, School of Home Economics, Wayo Women's University, Chiba 272-8533, Japan

Received 25 October 2010; revised 16 February 2011; accepted 23 February 2011

Abstract

Although fish and meat may exert opposing influences on chronic disease, information on the balance of intake between fish and meat to overall diet quality is limited, particularly in Japanese, who have a much higher fish intake than Western populations. The objective of this cross-sectional study was to test the hypothesis that intake balance between fish and meat is associated with food and nutrient intakes in young Japanese women. The subjects were 3716 Japanese dietetic students aged 18 to 20 years. Diet was assessed by a validated, self-administered diet history questionnaire. The dietary ratio of fish to meat was calculated from fish and meat intakes as a temporal indicator of overall intake balance. The ratio of fish to meat intake was associated positively with intakes of vegetables, fruits, pulses, dairy products, and alcohol, and negatively with those of energy-containing beverages and fat and oils. At the nutrient level, the ratio of fish to meat intake was associated negatively with intakes of energy, total fat, saturated fatty acids, n-6 polyunsaturated fatty acids, vitamin B_1, and zinc, and positively with those of protein, n-3 polyunsaturated fatty acids, dietary fiber, and key vitamins and minerals. After limiting analysis to nutrients derived from foods other than fish and meat, the ratio of fish to meat intake was positively associated with intakes of almost all vitamins and minerals examined. In conclusion, women who consumed more fish than meat (ratio >1) tended to choose more favorable food groups that included higher amounts of vegetables and fruits, resulting in a better profile of nutrient intake patterns.

Keywords: Fish; Meat; Dietary intake; Intake balance; Japanese women
Abbreviations: DHQ, diet history questionnaire; PUFA, polyunsaturated fatty acids; SFA, saturated fatty acids.

1. Introduction

The food groups of fish and meat are important sources of protein and key vitamins and minerals. However, because of the different fat contents and profiles of fatty acids (eg, saturated fatty acids [SFA], n-6 and n-3 polyunsaturated fatty acids [PUFA]), a great number of studies have suggested that they have opposing effects on the etiology and pathology of chronic diseases [1,2]. According to accumulating evidence [3-6], fish and meat are important aspects of the diet that have been linked favorably and unfavorably to the risk of chronic diseases such as cardiovascular disease and several cancers, respectively.

Such evidence has been translated into dietary recommendations to "choose more fish, beans, peas, nuts, and

* Corresponding author. Department of Social and Preventive Epidemiology, School of Public Health, the University of Tokyo, Bunkyo-ku, Tokyo 113-0033, Japan. Tel.: +81 3 5841 7872; fax: +81 3 5841 7873.
E-mail address: stssasak@m.u-tokyo.ac.jp (S. Sasaki).
[1] Other members of the Freshmen in Dietetic Courses Study II Group have been listed previously in Eur J Clin Nutr 2007;61:616-22.

0271-5317/$ – see front matter © 2011 Elsevier Inc. All rights reserved.
doi:10.1016/j.nutres.2011.02.005

seeds" in the US MyPyramid food guide [7] and to "select lean meats and use meat alternatives" in Eating Well with Canada's Food Guide [8], although fish and meat are categorized into the same food group as a main source of protein. In contrast, no recommendation about balance and the food choice of fish and meat is indicated in guides such as the Japanese Food Guide Spinning Top [9,10]. Information on intake balance between fish and meat in relation to overall dietary quality therefore appears to be an important and necessary consideration when making recommendations for the prevention of chronic disease.

In contrast to Western populations, fish consumption by Japanese is the highest in the world [11,12]. Furthermore, mean intake of total meat (75.2 g/d) among Japanese adults is almost the same as that of total fish (84.1 g/d) [13], which is a characteristic seldom observed in Western populations, who eat more meat than fish [12,14]. We speculated that the difference in eating pattern, either fish or meat eaters, in relation to overall diet quality may therefore differ between Western and Japanese populations.

The purpose of this cross-sectional study was to examine the difference in fish and meat intakes in relation to food group and nutrient intakes among 3716 Japanese women aged 18 to 20 years. We hypothesized that a higher intake of fish than meat is associated with better profile of food and nutrient intakes.

2. Methods and materials

2.1. Subjects

The present study was based on data from the Freshmen in Dietetic Courses Study II, a cross-sectional, self-administered questionnaire survey of dietetic students (n = 4679) from 54 universities, colleges, and technical schools in 33 of 47 prefectures in Japan. A detailed description of the study design and survey procedure has been published elsewhere [15,16]. Briefly, a set of 2 questionnaires on dietary habits and other lifestyle behaviors during the preceding month was distributed to all students at orientation sessions or first lectures for freshmen students who entered dietetic course in April 2005, in most institutions within 2 weeks after the course began. In accordance with the survey protocol, answered questionnaires were checked at least twice for completeness by trained survey staff (mostly registered dietitians) and, when necessary, reviewed with the subjects to ensure clarity. Most surveys were completed by May 2005. A total of 4394 students (4168 women and 226 men) completed both questionnaires (response rate = 93.9%).

In the present analysis, we selected female participants aged 18 to 20 years (n = 4060). We then excluded subjects who reported energy intake less than 3556 kJ/d (half the Estimated Energy Requirement at physical activity level I [low] in this age class) or intake equal to or higher than 14121 kJ/d ([1.5 times the Estimated Energy Requirement at physical activity level III [high]) after judging them as severe under- or overreporters, respectively (n = 85) [17]. We also excluded subjects enrolled in one institute in which the survey was not conducted within 2 weeks of entry (n = 98), those who were currently receiving dietary counseling from a physician or dietitian (n = 105), and those with missing information on the variables used (n = 12). To remove the influence of extremely low fish and low meat eaters, we excluded subjects who ate both less than one-half serving per day of fish and that of meat (n = 48). As some participants were in more than one exclusion category, the final analysis comprised 3716 women in 53 institutions.

This study was approved by the Ethics Committee of the National Institute of the Health and Nutrition, Japan. Participants indicated their informed consent by completing survey questionnaires.

2.2. Dietary assessment

Dietary habits during the preceding month were assessed using a comprehensive self-administered diet history questionnaire (DHQ) [18-21]. The DHQ is a structured 16-page questionnaire that asks about the consumption frequency and portion size of selected foods commonly consumed in Japan, general dietary behavior, and usual cooking methods [20]. Estimates of daily intake for foods (150 items in total), energy, and selected nutrients were calculated using an ad hoc computer algorithm developed for the DHQ, which was based on the Standard Tables of Food Composition in Japan [22]. We included 15 food items for fish (dried fish; small fish with bones; canned tuna; eel; fish with white meat such as sea bream, flatfish, cod, and others; fish with a blue back such as mackerel, sardine, herring, and others; fish with red meat such as tuna, salmon, and skipjack; ground fish meat products; shrimp and crab; squid and octopus; oysters; other shellfish; fish eggs; boiled fish in soy sauce; and salted offal) and 7 food items for meat (ground meat, chicken, pork, beef, liver, ham and sausage, bacon, and salami) in the DHQ. Daily intake of fish and meat, as the total amount (in grams per day) of intake, was calculated as the sum of these 15 and 7 food items, respectively. Intake of selected nutrients derived from fish and meat were also calculated as the sum of each nutrient included in these 22 food items. Values of nutrient and food intake were energy adjusted using the density method (ie, percentage of energy for energy-providing nutrients and amount per 4184 kJ for food and other nutrients) to minimize the influence of dietary misreporting, an ongoing controversy in studies that collect dietary information using self-reported instruments [23].

The validity of the DHQ and its structure and the methods used to calculate dietary intake have been detailed elsewhere [18-21]. Briefly, Pearson correlation coefficients between the DHQ and 3-day dietary records among 47 women were 0.37 to 0.75 for energy-providing nutrients and 0.19 to 0.68 for other nutrients [20]. In addition, in another previous study of 92 women aged 31 to 69 years, Spearman correlation coefficients between the DHQ and 16-day weight dietary records were 0.20 to 0.74 for energy-providing nutrients, 0.30 to 0.68 for other nutrients, 0.54 for fish, 0.66 for meat, and 0.13 to 0.77 for other food groups (Sasaki S, unpublished observation, 2010).