

Fish as a Major Source of Vitamin D in the Japanese Diet

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OBJECTIVES: We investigated the amount and sources of vitamin D in the Japanese diet by analyzing diet records collected over a 4-mo period.

METHODS: Dietary data for this study were provided by a nursing home in Niigata, Japan. Diet records, written by the nursing home's dietitian, for 122 consecutive days between September and December 1999, were used. The amount of food for an individual was weighed before cooking and recorded on the diet record. Vitamin D-containing foods, including fish, eggs, meat, and mushrooms, were selected from the diet records, and their vitamin D (vitamin D₂ plus D₃) per day was calculated by referring to the *Standard Tables of Food Composition in Japan*.

RESULTS: The overall average vitamin D intake per day was 7.10 μg (284 IU), which is about 70% of the recommended dietary allowance of 10 μg (400 IU). There were no significant differences in vitamin D values over the 4 mo ($P = 0.822$). Overall, the contribution of vitamin D from fish to total vitamin D intake was 90.7%, followed by mushrooms (4.4%), eggs (3.2%), and meat (1.7%).

CONCLUSIONS: Frequent fish intake appears to be an advisable health practice in terms of preventing vitamin D insufficiency in the elderly. *Nutrition* 2002;18:415–416. ©Elsevier Science Inc. 2002

KEY WORDS: diet, fish, Japanese, vitamin D

INTRODUCTION

Vitamin D insufficiency, i.e., low serum 25-hydroxyvitamin D (25[OH]D) concentrations, in the elderly can enhance age-related bone loss via secondary hyperparathyroidism.¹ Thus, maintaining an appropriate vitamin D nutrition status is an important component in the prevention of osteoporosis in the elderly.

Nakamura et al.^{2–4} recently reported adequate 25(OH)D levels (i.e., a low prevalence of hypovitaminosis D) in elderly Japanese, even during the winter. The high levels of fish consumption in the subjects were thought to play a crucial role in explaining such findings.^{3,4} This hypothesis was made on the basis of results from a questionnaire on eating habits. Thus, stronger evidence was needed to confirm this theory.

The aim of the present study was to investigate the amount and sources of vitamin D in the Japanese diet by analyzing diet records collected over a 4-mo period. Our main interest focused on the degree to which the consumption of fish contributes to total vitamin D intake.

METHODS

Data for this study were provided by a nursing home in Niigata, Japan. The diet in the nursing home is a traditional Japanese diet, with a low-fat and high-carbohydrate content.⁵ Diet

records, written by the nursing home's dietitian, for 122 consecutive days between September and December 1999, were used for the study.

The amount of food for an individual was weighed before cooking and recorded on the diet record. Vitamin D-containing foods, including fish, eggs, meat, and mushrooms, were selected from the diet records, and their vitamin D content (D₂ from mushrooms and D₃ from fish, eggs, and meat) was calculated by referring to the *Standard Tables of Food Composition in Japan*.⁶ The table provides detailed information on nutritional data, including vitamin D content, and covers a wide range of foods available in Japan. Regarding fish, for example, information on 95 kinds of fish prepared in different ways (raw, dried, boiled, etc.) is available, for 276 items. Because milk and dairy products naturally contain very small amounts of vitamin D, they were excluded from the analysis. Vitamin D fortification to foods has not been practiced in Japan. The total intake of vitamin D (vitamin D₂ plus D₃) per day was calculated by adding all vitamin D values for vitamin D-containing food items. Statistical computations were performed with SAS 6.03 (SAS Institute, Inc, Cary, NC, USA). A one-way analysis of variance was used to compare the mean vitamin D values for each of the 4 mo. $P < 0.05$ was judged to be statistically significant.

RESULTS AND DISCUSSION

The average dietary vitamin D intake per day from fish, eggs, meat, and mushrooms for each month is shown in Table I. The overall average vitamin D intake per day was 7.10 μg (284 IU), which is about 70% of the recommended dietary allowance of 10 μg (400 IU).⁷ This value seems to be adequate for healthy elderly subjects, but not for sunlight-deprived elderly subjects.⁷

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TABLE I.

AVERAGE VALUES OF DIETARY VITAMIN D INTAKE FROM FISH, EGGS, MEAT, AND MUSHROOMS ACCORDING TO MONTH*					
Food sources	Fish	Eggs	Meat	Mushrooms	Total
September (<i>n</i> = 30)	6.30 (5.32)	0.26 (0.24)	0.09 (0.12)	0.33 (0.26)	6.97 (5.27)
October (<i>n</i> = 31)	5.85 (4.66)	0.21 (0.17)	0.14 (0.16)	0.34 (0.27)	6.54 (4.70)
November (<i>n</i> = 30)	6.34 (5.29)	0.20 (0.18)	0.15 (0.22)	0.29 (0.23)	6.98 (5.25)
December (<i>n</i> = 31)	7.27 (7.84)	0.26 (0.17)	0.10 (0.14)	0.29 (0.22)	7.92 (7.82)
All (<i>n</i> = 122)	6.44 (5.86)	0.23 (0.19)	0.12 (0.16)	0.31 (0.24)	7.10 (5.85)

* Seasonal differences in vitamin D values for each food source and total intake were not observed. Values are micrograms per day; standard deviations appear within parentheses.

An analysis of variance showed no statistically significant differences in vitamin D values for each food type and the total vitamin D intake among the data for the 4 mo ($P = 0.822$; Table I). Overall, the contribution of vitamin D from fish to the total vitamin D intake was 90.7%, followed by mushrooms (4.4%), eggs (3.2%), and meat (1.7%).

Fish is the major source of vitamin D in the Japanese diet. The most frequently consumed fish was salmon (10 to 32 μg of vitamin D/100 g), which was consumed for 43 d during the study period. The second most frequently consumed fish was flat fish (3 to 18 μg of vitamin D/100 g), consumed on 17 d. Considering the high content of vitamin D in these fish, their contribution to the total vitamin D intake is considerable. For example, Chum salmon, the most common type of salmon consumed in Japan, contains 32 μg of vitamin D per 100 g. Other frequently consumed fish included sea bream and related fish (1 to 8 μg of vitamin D/100 g), *shirasuboshi* or baby sardines (46 μg of vitamin D/100 g), mackerel (11 μg of vitamin D/100 g), and cod (1 μg of vitamin D/100 g). Approximately 31 kinds of fish were consumed during the study period.

The data used in this study were obtained from a nursing home, where the diet is supervised by a dietitian and therefore thought to be relatively balanced. Elderly people in Japan generally prefer fish to meat, and the diet at this institution seemed to be in accordance with their taste. In contrast, the diet of young Japanese has been westernized, and younger people usually consume more meat.⁸ Therefore, the data in this study may not apply to people with westernized diets. The results may apply to elderly people in the community whose diets are not supervised by a dietitian. We have little information to address the questions, but expect that vitamin D-rich fish, such as salmon and flat fish, are commonly consumed throughout the year.

SUMMARY

Diets that do not include fish are usually deficient in vitamin D, but the traditional Japanese diet contains a large quantity of fish and provides a considerable amount of vitamin D; e.g., 7.10 μg (284 IU) in the present study. Frequent fish intake is thought to be an advisable health practice in terms of preventing of vitamin D insufficiency in active elderly people. It may not, however, be sufficient for sunlight-deprived elderly, and these people may require vitamin D supplementation.

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