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Survey of Omega-3 Fatty Acids in Diets of Midwest Low-Income Pregnant Women

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ABSTRACT. The objectives of this project were to determine the omega-3 fatty acid (ω-3 FA) consumption of low-income pregnant women, and to identify food sources of ω-3 FA in their diets. Thirty women provided three days of dietary intake that were analyzed using the Food Processor Plus computer program. Mean daily consumption of ω-3 FA was 1.060 ± 0.030 g/day. The major form of the ω-3 FA was α-linolenic acid (α-LNA; 93%), with less from eicosapentanoic acid (EPA; 2%), and docosahexanoic acid (DHA; 5%). Foods that provided the most α-LNA were fats, oils, salad dressings, and milk products. EPA and DHA were provided in fish, seafood, chicken, and eggs. Nearly one-half of the women in this study consumed < 75% of the Canadian Recommended Nutrient

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Intakes for ω-3 FA. We conclude that some low-income pregnant women in the Midwest consume diets low in ω-3 FA. There is a need for agriculture and nutrition research on the development of new food products that provide ω-3 FA. *[Article copies available from The Haworth Document Delivery Service: 1-800-342-9678.]*

KEYWORDS. Omega-3 fatty acids, pregnancy, dietary intake, eggs, flaxseed

INTRODUCTION

Omega-3 (ω-3) fatty acids (FA) are required for the development and function of the retina and nervous system,[1] and women who consume diets high in ω-3 FA experience improved pregnancy outcomes.[2-5] However, pregnant and lactating women in the United States, particularly women of low socioeconomic status,[6] may consume diets that are low in ω-3 FA.[7] A Recommended Dietary Allowance (RDA) for ω-3 FA consumption during pregnancy has not been established in the United States;[8] however, Canadian Recommended Nutrient Intakes (RNI) are 1.2 g/day (0.5% of energy) for women aged 19-24 years and 1.1 g/day for women aged 25-49 years. This increases during the second and third trimesters of pregnancy to 1.36 g/day for women 19-24 years and 1.26 g/day for women 25-49 years.[9]

Foods that are typically considered to be major contributors of ω-3 FA in the diet are seafoods and some plant sources (i.e., canola and soybean oil, soybean margarine, nuts and green vegetables).[10] Dietary intake surveys indicate that some of the foods high in ω-3 FA are eaten infrequently in the midwestern part of the United States.[11,12]

The purpose of this study was to determine the ω-3 FA consumption of low-income pregnant women and to identify food sources of the ω-3 FA. We also compared the ω-3 FA intake of Caucasian women with those of women from other racial groups.

METHODS

The project was approved by the Institutional Review Board for the Protection of Human Subjects in Research. Thirty low-income pregnant women were chosen at random and referred to the project by the local County Health Department. The women were interviewed by a nutritionist in their homes during their second trimester and they were taught to estimate serving sizes. Each participant provided one 24-hour recall completed by the nutritionist and a two-day food record. Food records were checked by the nutritionist for accuracy. The three days of dietary intake were alternate days and included one weekend day.[13] Diets were analyzed using the Food Processor Plus computer program (version 5, 1992, ESHA Research, Salem, OR). Mean daily consumption of ω-3 FA was determined, and foods providing ω-3 FA were listed in rank order. Omega-3 FA intakes of Caucasian women were compared with the intakes of women from other racial groups using a t-test.[14]

RESULTS

Twenty-three of the participants were Caucasian and seven were from other racial groups (one black, five Asian or Pacific, and one Native American). The women's ages ranged from 18 to 37 years ($\bar{x}$ = 23.4 ± 5.3 y), and the majority had incomes less than $14,999/year.

Overall evaluation of the women's diets indicated that they were adequate except for iron consumption, which was 71% of the RDA (21.1 ± 10 mg).

Total mean ω-3 FA consumption was 1.060 ± 0.300 g/day. α-LNA provided 93% of the total ω-3 FA (0.989 ± 0.301 g/day). EPA provided 2% (0.023 ± 0.060 g/day) and DHA provided 5% (0.048 ± 0.081 g/day) of the daily ω-3 FA intake. Mean ω-3 FA consumption was 78% of the Canadian RNI. Approximately one-half of the women (47%) consumed < 75% of the Canadian RNI, and two women (7%) consumed < 50% of the RNI. Five women (17%) met or exceeded the Canadian RNI for ω-3 FA. When diets of Caucasian women were compared with diets of women from other racial groups, no differences were found in total ω-3 FA or α-LNA consumption; however, the women from other racial groups consumed more EPA and DHA than the Caucasian women ($P < 0.05$; Figure 1).

Foods providing the most ω-3 FA in the women's diets are listed

in rank order in Tables 1, 2, and 3. Dairy products provided 22% of the ω-3 FA, while fats, oils, and salad dressings provided 17%. White vegetables provided 7% of the ω-3 FA. Fish and seafood (includes fresh fish, deep sea fish, and shell fish) only provided 2% of the total ω-3 FA consumed, but provided 83% of the EPA and 65% of the DHA intakes. Other foods that contributed EPA and DHA were chicken (13% of EPA and 15% of DHA) and eggs (4% of EPA and 19% of DHA). The higher intakes of EPA and DHA by women from other racial groups were mainly attributable to their higher consumption of fish and seafood. They consumed seafood slightly more than twice a week while the Caucasian women consumed seafood approximately once every two weeks.

DISCUSSION

Results of this dietary survey of low-income pregnant women in the Midwest indicate that the majority of them are consuming diets that are relatively low in ω-3 FA. This was also shown by Crawford et al.[6] who reported ω-3 FA intakes of low-income women similar to intakes reported here. Holman et al.[7] have also provided evidence of poor ω-3 FA status in pregnancy.

Omega-3 FA play multiple roles in pregnancy. EPA and DHA are needed for the synthesis of brain and retina tissue, and women who consume diets high in EPA and DHA during pregnancy experience longer gestations, increased birth weights, and improved fetal survival.[2,3] Prenatal dietary supplementation with fish oil, a source of ω-3 FA, may also lower the incidence of pre-eclampsia.[4,5] Holman et al.[7] have suggested that diets be supplemented with ω-3 FA before, during, and after pregnancy. Because of the increased need for ω-3 FA during pregnancy, mother and fetus may become deficient in these essential fatty acids. Therefore, women of child-bearing age may be a potential target group for the development of designer foods high in ω-3 FA.

Recent agricultural research on ω-3 FA has resulted in products that provide more of these fatty acids. For example, increasing fish meal in the diets of poultry increases the EPA and DHA content of chicken flesh, and food intake surveys indicate that chicken is a

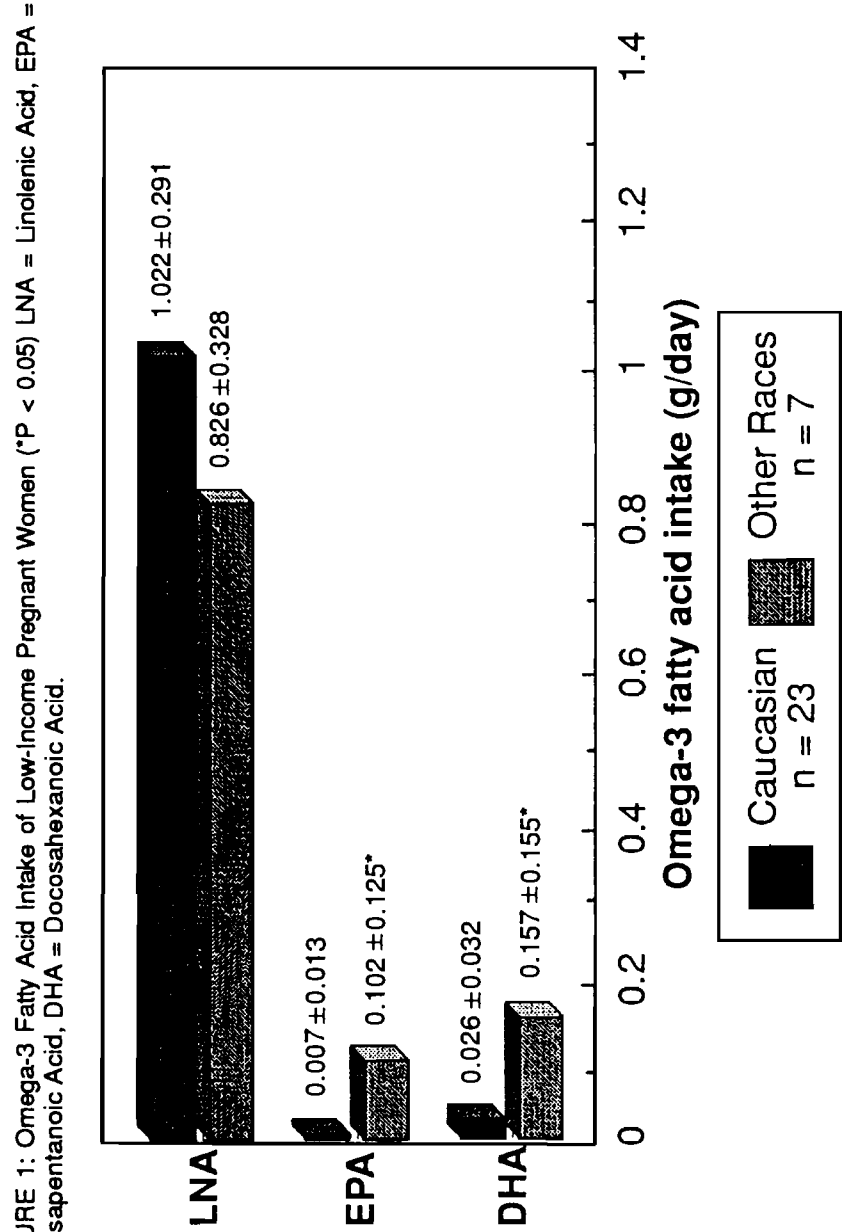

FIGURE 1: Omega-3 Fatty Acid Intake of Low-Income Pregnant Women (*P < 0.05) LNA = Linolenic Acid, EPA = Eicosapentanoic Acid, DHA = Docosahexanoic Acid.

TABLE 1. Foods that provide Linolenic Acid (LNA) in the diets of low-income pregnant women.[¶]

FOOD	LNA (g/day)[†]	RANGE	% OF TOTAL LNA
Fats, oils, and salad dressings	0.181	0-0.675	18
Milk	0.128	0-0.472	13
Dairy products other than milk (i.e., cheese, yogurt, and sour cream)	0.110	0-0.323	11
White vegetables (i.e., potatoes,[‡] cauliflower, cabbage, and cucumbers)	0.073	0-0.358	7
Frankfurters and lunch meats	0.057	0-0.282	6
Breads	0.052	0-0.232	5
Pork	0.049	0-0.235	5
Beef	0.043	0-0.183	4
Chicken	0.036	0-0.320	4
Eggs	0.019	0-0.082	2
Fish and Seafood	0.015	0-0.210	2

[¶] Food groups listed in rank order of LNA content.
[†] Source: Food Processor Plus Database (ESHA Research. The Food Processor Plus User's Manual. 1992, Sources & References, pp. 161-180.)
[‡] Includes french fries, potato salad, mashed, baked, augratin, roasted, and hash browns.

significant contributor of EPA and DHA in the American diet.[15] In the United States, chicken is eaten more often than fish and, therefore, poultry may be a major dietary source of EPA and DHA in the diets of those who seldom eat fish.[11] Recently, eggs with increased ω-3 FA content have been produced by feeding hens diets high in flaxseed or fish oil.[16,17] One designer egg produced by hens fed 15% flaxseed provides 0.300 g of ω-3 FA, as compared to 0.050 g from a regular egg.[17] Therefore, one ω-3 FA enriched egg from hens fed flaxseed could provide approximately one-fourth of the Canadian RNI for pregnant women. Eggs produced by hens fed this

TABLE 2. Foods that provide Eicosapentanoic Acid (EPA) in the diets of low-income pregnant women.[¶]

FOOD	EPA (g/day)[†]	RANGE	% OF TOTAL EPA
Fish and Seafood	0.019	0-0.300	83
Chicken	0.003	0-0.017	13
Eggs	0.001	0-0.003	4

[¶] Food groups listed in rank order of EPA content.
[†] Source: Food Processor Plus Database (ESHA Research. The Food Processor Plus User's Manual. 1992, Sources & References, pp. 161-180.)

TABLE 3. Foods that provide Docosahexanoic Acid (DHA) in the diets of low-income pregnant women.[¶]

FOOD	DHA (g/day)[†]	RANGE	% OF TOTAL DHA
Fish and Seafood	0.031	0-0.339	65
Eggs	0.009	0-0.030	19
Chicken	0.007	0-0.032	15

[¶] Food groups listed in rank order of DHA content.
[†] Source: Food Processor Plus Database (ESHA Research. The Food Processor Plus User's Manual. 1992, Sources & References, pp. 161-180.)

15% flaxseed diet also contain twice as much EPA and an increased amount of DHA (0.091 g from 0.003 g in the regular egg). Other fatty acid components remain similar between the two eggs.

This study has implications for community-based low-fat nutrition education programs that may include pregnant women. Typically these programs focus on reducing total fat consumption to no more than 30% of kilocalories from fat. If pregnant women follow such recommendations, they may be inadvertently reducing their ω-3 FA intake. Counseling during pregnancy should emphasize maintaining or increasing sources of ω-3 FA in the diet. Since fish, seafood, chicken, and eggs are the only sources of EPA and DHA in the recommended low-fat diet, it may also be critical to emphasize the consumption of these types of food during pregnancy.

Results of this survey indicate there is a need for additional data using larger sample sizes in multiple locations to determine the ω-3 FA consumption in prenatal diets. There is also a need for agricultural food scientists to continue to analyze foods for their ω-3 FA content so that up to date and complete tables of ω-3 FA content of foods are available.

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