Conference Report

Workshop on the Essentiality of and Recommended Dietary Intakes for Omega-6 and Omega-3 Fatty Acids

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The Workshop on the Essentiality of and Recommended Dietary Intakes (RDIs) for Omega-6 and Omega-3 Fatty Acids was held at The Cloisters, National Institutes of Health (NIH) in Bethesda, Maryland, USA, April 7–9, 1999. The workshop was sponsored by the National Institute on Alcohol Abuse and Alcoholism-NIH, the Office of Dietary Supplements-NIH, The Center for Genetics, Nutrition and Health, and the International Society for the Study of Fatty Acids and Lipids; and cosponsored by several industry groups[1].

The workshop participants consisted of investigators of the role of essential fatty acids in infant nutrition, cardiovascular disease, and mental health. The first two areas were selected because they are the ones where extensive studies involving animal models, clinical intervention trials, and biochemical and physiologic mechanisms and their function have been carried out relative to omega-6 and omega-3 fatty acids. The role of essential fatty acids in mental health is a new, but promising research area.

The workshop was truly international in nature bringing together scientists from academia, government, international organizations, and industry, from Australia, Canada, Denmark, France, Italy, Japan, Norway, Switzerland, United Kingdom, and the United States.

The first two days of the workshop consisted of presentations and extensive discussions. The format of the workshop was Round Table permitting extensive discussion following individual presentations and at the completion of each session. The first day consisted of Session I. Principles to be Considered in Determining Essentiality and DRIs and Session II. Essential Fatty Acids and Central Nervous System Function. Day two began with Session III. Cardiovascular Disease and ended with Session IV: Relationship of Essential Fatty Acids to Saturated, Monounsaturated, and Trans Fatty Acids. On the morning of the third day, during Session V. Dietary Recommendations and Omega-6:Omega-3 Ratio (LA, LNA, AA, EPA, DHA), industry representatives reported on studies supported by their companies, on clinical interventions, and product development. Representatives from the U.S. Department of Agriculture (USDA), the Pan American Health Organization/World Health Organization (PAHO/WHO) and the Food and Agriculture Organization of the United Nations (FAO) presented their agencies' scientific studies or policies on the dietary intake of fatty acids, especially essential fatty acids, and their activities in the field.

One recommendation deserves explanation here. After much discussion consensus was reached on the importance of reducing the omega-6 polyunsaturated fatty acids (PUFAs) even as the omega-3 PUFAs are increased in the diet of adults and newborns for optimal brain and cardiovascular health and function. This is necessary to reduce adverse effects of excesses of arachidonic acid and its eicosanoid products. Such excesses can occur when too much LA and AA are present in the diet and an adequate supply of dietary omega-3 fatty acids is not available. The adverse effects of too much arachidonic acid and its eicosanoids can be avoided by two interdependent dietary changes. First, the amount of plant oils rich in LA, the parent compound of the omega-6 class, which is converted to AA, needs to be reduced. Second, simultaneously the omega-3 PUFAs need to be increased in the diet. LA can be converted to arachidonic acid and the enzyme, Δ-6 desaturase, necessary to desaturate it, is the same one necessary to desaturate LNA, the parent compound of the omega-3 class; each competes with the other for this desaturase. The presence of LNA in the diet can inhibit the conversion of the large amounts of LA in the diets of Western industrialized countries which contain too much dietary plant oils rich in omega-6 PUFAs (e.g. corn, safflower, and soybean oils). The increase of LNA, together with EPA and DHA, and reduction of vegetable oils with high

[1]BASF Corp., USA; BASF Health and Nutrition A/S; Bestfoods; ENRECO; F. Hoffmann-La Roche, Ltd.; Groupe Danone; Kraft Foods, Inc.; Martek Biosciences Corporation; Mead Johnson Nutritionals; Ocean Nutrition Canada, Ltd.; Omega Tech, Inc.; Pronova Biocare; and Roche Vitamins, Inc.

Journal of the American College of Nutrition, Vol. 18, No. 5, 487–489 (1999)
Published by the American College of Nutrition

LA content, are necessary to achieve a healthier diet in these countries.

The afternoon of the third day was devoted to discussion of the omega-6 and omega-3 essential fatty acids and their relationship to other fatty acids. The discussion focussed on specific recommendations for healthy adults, pregnant and lactating women, and the composition of infant formula that will support the growth and development of the formula-fed infant no differently than the breast-fed infant.

I. Adults

The working group recognized that there are not enough data to determine Dietary Reference Intakes (DRI), but there are good data to make recommendations for Adequate Intakes (AI) for Adults as shown in Table 1.

Table 1. Adequate Intakes (AI)* for Adults

Fatty Acid	Grams/day (2000 kcal diet)	% Energy
LA	4.44	2.0
(Upper limit)[1]	6.67	3.0
LNA	2.22	1.0
DHA + EPA	0.65	0.3
DHA to be at least[2]	0.22	0.1
EPA to be at least	0.22	0.1
TRANS-FA		
(Upper limit)[3]	2.00	1.0
SAT		
(Upper limit)[4]	—	<8.0
MONOs[5]	—	—

1. Although the recommendation is for AI, the Working Group felt that there is enough scientific evidence to also state an upper limit (UL) for LA of 6.67 g/day based on a 2000 kcal diet or of 3.0% of energy.
2. For pregnant and lactating women, ensure 300 mg/day of DHA.
3. Except for dairy products, other foods under natural conditions do not contain trans-FA. Therefore, the Working Group does not recommend trans-FA to be in the food supply as a result of hydrogenation of unsaturated fatty acids or high temperature cooking (reused frying oils).
4. Saturated fats should not comprise more than 8% of energy.
5. The Working Group recommended that the majority of fatty acids are obtained from monounsaturates. The total amount of fat in the diet is determined by the culture and dietary habits of people around the world (total fat ranges from 15 to 40% of energy) but with special attention to the importance of weight control and reduction of obesity.

* AI=Adequate Intake. If sufficient scientific evidence is not available to calculate an Estimated Average Requirement, a reference intake called an Adequate Intake is used instead of a Recommended Dietary Allowance. The AI is a value based on experimentally derived intake levels or approximations of observed mean nutrient intakes by a group (or groups) of healthy people. The AI for children and adults is expected to meet or exceed the amount needed to maintain a defined nutritional state or criterion of adequacy in essentially all members of a specific healthy population. LA=linoleic acid, LNA=alpha-linolenic acid, DHA=docosahexaenoic acid, EPA=eicosapentaenoic acid, TRANS-FA=trans fatty acid, SAT=saturated fatty acids, MONOs=monounsaturated fatty acids.

II. Pregnancy and Lactation

For pregnancy and lactation, the recommendations are the same as those for adults with the additional recommendation seen in footnote 1 (Table 1), that during pregnancy and lactation women must ensure a DHA intake of 300 mg/d.

III. Composition of Infant Formula/Diet

It was thought of utmost importance to focus on the composition of the infant formula considering the large number of premature infants around the world, the low number of women who breastfeed, and the need for proper nutrition of the sick infant. The composition of the infant formula/diet was based on studies that demonstrated support for both the growth and neural development of infants in a manner similar to that of the breastfed infant (Table 2).

The following workshop participants have agreed to this summary statement. The copyright of this statement is held by the working group in order to publish it worldwide. The views expressed in this statement do not reflect any official position of the U.S. Department of Health and Human Services.

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Table 2. Adequate Intake (AI)* for Infant Formula/Diet

Fatty Acid	Percent of Fatty Acids
LA[1]	10.00
LNA	1.50
AA[2]	0.50
DHA	0.35
EPA[3]	
(Upper limit)	<0.10

1. The Working Group recognizes that, in countries like Japan, the breast milk content of LA is 6 to 10% of fatty acids and the DHA is higher, about 0.6%. The formula/diet composition described here is patterned on infant formula studies in Western countries.
2. The Working Group endorsed the addition of the principal long chain polyunsaturates, AA and DHA, to all infant formulas.
3. EPA is a natural constituent of breast milk, but in amounts more than 0.1% in infant formula may antagonize AA and interfere with infant growth.

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Received July 1999.