Workshop 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 (RDI) for Omega-6 and Omega-3 Fatty Acids' was held at The Cloisters, National Institutes of Health (NIH) in Bethesda, Maryland, USA, 7–9 April 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. It was cosponsored by several industry groups: 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.; OmegaTech Inc.; Pronova Biocare; and Roche Vitamins Inc.

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 have generated extensive studies involving animal models, clinical intervention trials, and biochemical and physiological mechanisms and their function 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 as it brought together scientists from academia, government, international organizations and industry, and who hailed from Australia, Canada, Denmark, France, Italy, Japan, Norway, Switzerland, the United Kingdom and the United States.

The first 2 days of the workshop consisted of presentations and extensive discussions. The format of the workshop was a 'round table' one which permitted extensive discussion following individual presentations and at the completion of each session. The first day consisted of the following: Session I. Principles to be Considered in Determining Essentiality and DRIs; and Session II. Essential Fatty Acids and Central Nervous System Function. The second day 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 (linoleic acid (LA), alpha-linolenic acid (LNA), arachidonic acid (AA), eicosapentaenoic acid (EPA), docosahexaenoic acid (DHA)), industry representatives reported on studies, supported by their companies, on clinical interventions and product development. Representatives from the US Department of Agriculture (USDA), the Pan American Health Organization/World Health Organization (PAHO/WHO) and the Food and Agriculture Organization (FAO) of the United Nations 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 (PUFA) even as recommendations are being made for an increase in the omega-3 PUFA in the diet of adults and newborns for optimal brain and cardiovascular health and function. This is necessary in order 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, and simultaneously, the omega-3 PUFA need to be increased in the diet. Linoleic acid can be converted to arachidonic acid and the enzyme, δ-6 desaturase, necessary to desaturate it, is the same one that is 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. This has been the case with the diets of Western industrialized countries in which the levels of dietary plant oils rich in omega-6 PUFA (e.g. corn, safflower and soybean oils) are too high. An increase of LNA, together with EPA and DHA, and a reduction of vegetable oils with high LA content are necessary to achieve healthier diets in such 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 focused on

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specific recommendations for the following groups: (i) healthy adults; (ii) pregnant and lactating women; and (iii) the composition of infant formula that will support the growth and development of the formula-fed infant to the same extent as the breast-fed infant.

With regard to category of healthy adults, the working group recognized that there are not enough data to determine dietary reference intakes (DRI), but that there are enough good data to make recommendations for adequate intakes (AI) for adults as shown in Table 1.

For pregnancy and lactation, the recommendations are the same as those for adults but with the additional recommendation (see Table 1, footnote 2) that during pregnancy and lactation women must ensure a DHA intake of 300 mg/day.

It was considered of the utmost importance to focus on the composition of the infant formula/diet given the large number of premature infants around the world, the low number of women who breast-feed, 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 formula-fed infants in manners similar to those of breast-fed infants (Table 2).

Table 1. Adequate intakes (AI)[a] for adults

Fatty acids	g/day (8360 kJ diet)	Energy (%)
LA	4.44	2.0
Upper limit[b]	6.67	3.0
LNA	2.22	1.0
DHA + EPA	0.65	0.3
DHA to be at least[c]	0.22	0.1
EPA to be at least	0.22	0.1
TRANS-FA		
Upper limit[d]	2.00	1.0
SAT		
Upper limit[e]	–	< 8.0
MONO[f]	–	–

[a]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.[b]Although the recommendation is for AI, the Working Group felt that there was enough scientific evidence to also state an upper limit (UL) for LA of 667 g/day based on a 2000 kcal diet or of 30% of energy. [c]For pregnant and lactating women, ensure 300 mg/d of DHA. [d]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). [e]Saturated fats should not comprise more than 8% of energy. [f]The Working Group recommended that the majority of fatty acids be 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 the reduction of obesity. LA, linoleic acid; LNA, alpha-linolenic acid; DHA, docosahexaenoic acid; EPA, eicosapentaenoic acid; TRANS-FA, trans fatty acids; SAT, saturated fatty acids; MONO, monounsaturated fatty acids.

Table 2. Adequate intake (AI)[a] for infant formula/diet

Fatty acids	Percentage of fatty acids
LA[b]	10.00
LNA	1.50
AA[c]	0.50
DHA	0.35
EPA[d]	
Upper limit	< 0.10

[a]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. [b]The Working Group recognizes that in countries like Japan, the breast milk content of LA is 6–10% of fatty acids and the DHA is higher, approximately 0.6%. The formula/diet composition described here is patterned on infant formula studies in Western countries. [c]The Working Group endorsed the addition of the principal long chain polyunsaturates, AA and DHA, to all infant formulas. [d]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. LA, linoleic acid; LNA, alpha-linolenic acid; AA, arachidonic acid; DHA, docosahexaenoic acid; EPA, eicosapentaenoic acid; TRANS-FA, trans fatty acids; SAT, saturated fatty acids; MONO, monounsaturated fatty acids.

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