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Lipid intake in children under 3 years of age in France. A position paper by the Committee on Nutrition of the French Society of Paediatrics

Les apports en lipides chez l'enfant de moins de 3 ans en France. Mise au point et recommandations du Comité de nutrition de la Société française de pédiatrie

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Summary

Lipids are an important source of energy for young children and play a major role in the development and functioning of nervous tissue. Essential fatty acids and their long-chain derivatives also fulfill multiple metabolic functions and play a role in the regulation of numerous genes. The Food and Agriculture Organization of the United Nations (FAO), the World Health Organization (WHO), and the French Agency for Food, Environmental and Occupational Health & Safety (Agence nationale de sécurité sanitaire de l'alimentation, de l'environnement et du travail [ANSES]) have recently recommended a minimum daily intake in preformed long-chain polyunsaturated fatty acids (LC-PUFAs): arachidonic acid (ARA), eicosapentaenoic acid (EPA), and docosahexaenoic acid (DHA). Mother's milk remains the only reference, but the large variability in its DHA content does not guarantee that breastfed children receive an optimal DHA intake if the mother's intake is insufficient.

Résumé

Les lipides représentent une source d'énergie importante pour le jeune enfant et jouent un rôle majeur dans le développement et le fonctionnement du tissu nerveux. Les acides gras essentiels et leurs dérivés à longue chaîne ont aussi des fonctions métaboliques multiples et interviennent dans la régulation de nombreux gènes. La Food and Agriculture Organization of the United Nations (FAO), l'Organisation mondiale de la santé (OMS) et l'Agence nationale de sécurité sanitaire de l'alimentation, de l'environnement et du travail (ANSES) ont recommandé récemment un apport minimal en acides gras polyinsaturés à longue chaîne (AGPI-LC) préformés : acide arachidonique (ARA), acide eicosapentaénoïque (EPA) et acide docosahexaénoïque (DHA). Le lait maternel reste la seule référence, mais la grande variabilité de son contenu en DHA ne permet pas de garantir que les enfants allaités aient un apport optimal en DHA en cas d'apport insuffisant chez la mère. Pour les enfants recevant une

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For children fed with infant formulas, ARA and DHA intake is often below the recommended intake because only one-third of infant formulas available on the market in France are enriched in LC-PUFAs. For all children, linoleic acid (LA) intake is on average higher than the minimal recommended values. The consequences of these differences between intake and recommended values are uncertain. A cautious attitude is to come close to the current recommendations and to advise sufficient consumption of DHA in breastfeeding women. For bottle-fed children, infant formulas enriched in LC-PUFAs and with moderate levels of LA should be preferred. LC-PUFA-rich fish should be consumed during breastfeeding, and adapted vegetable oils when complementary foods are introduced.

préparation pour nourrissons (PPN), les apports en ARA et en DHA sont souvent inférieurs aux apports conseillés car seulement un tiers des PPN sont enrichies en AGPI-LC. Pour tous les enfants, les apports en acide linoléique (AL) sont en moyenne supérieurs aux valeurs minimales recommandées. Les conséquences de ces différences entre les apports et les valeurs recommandées sont incertaines. Une attitude prudente est de se rapprocher des recommandations actuelles et de conseiller une consommation suffisante de DHA chez les femmes allaitantes. Pour les enfants nourris au biberon, il faudrait préférer les PPN enrichies en AGPI-LC et avec des niveaux modérés en AL. La consommation de poissons riches en AGPI-LC lors de l'allaitement, et d'huiles végétales adaptées lors de la diversification sont également recommandées.

1. Introduction

Our knowledge on the structure and metabolism of lipids has considerably progressed over the past 30 years. It is now acknowledged that beyond their role as an energy source, fatty acids (FAs) are essential to the development and functioning of the brain. Through the synthesis of eicosanoids (prostaglandins, thromboxanes, and leukotrienes) and docosanoids (protectin, neuroprotectin), FAs are also involved in the regulation of inflammation and immunity. More broadly, they participate in the regulation of a number of genes intervening in highly diverse metabolic functions. These developments have led different committees, notably the FAO (Food and Agriculture Organization of the United Nations), the World Health Organization (WHO), the EFSA (European Food Safety Authority), and the Agence nationale de sécurité sanitaire de l'alimentation, de l'environnement et du travail (French Agency for Food, Environmental and Occupational Health & Safety [ANSES]) to recently revise their recommendations on the daily intake for lipids [1–3]. After a review of the physiology and a summary of the current recommendations, this article, written by the Committee on Nutrition of the French Society of Paediatrics (Comité de nutrition de la Société française de pédiatrie), will analyze lipid intake in children under 3 years of age in France and will also issue new recommendations.

2. Structure, metabolism, and physiological roles of lipids

The structure and metabolism of lipids are described in detail in a number of reference documents [1–3]. The contribution of lipids to energy intake is very high in infants. Their lipid intake, in relation to body weight, is three to five times higher than in adults [4].

The constituent FAs are organic acids, most having an even number of carbon atoms (C) (4 to 28). Saturated FAs (SFAs) do not include any double bonds. Monounsaturated FAs (MUFAs) have a single double bond and the polyunsaturated fatty acids (PUFAs) contain several. The PUFAs are said to be long-chain (LC-PUFAs) when their number of C atoms is greater than 18. The PUFAs are designated by their number of C atoms followed by the number of double bonds, and, if necessary, the position of the first double bond from the methyl end (in parentheses) [e.g., C18:2 (n-6) or (ω 6)] *(fig. 1)*. The characteristics of the most current FAs are described in *table I*.

Ninety to 95% of the FAs in the common adult diet and 98% of the FAs in human milk are in an esterified form, linked to the glycerol in triglycerides, the main form of lipid storage in fat tissue. In the phospholipids, the FAs are linked to an esterified glycerol molecule by a phosphate group, most often to an alcohol function such as with choline, ethanolamine, serine, and inositol. The phospholipids are predominantly found in membranes.

In triglycerides, the FAs can be bound to the external C of glycerol (position *sn*-1,3) or to central C (position *sn*-2) (*sn*-, stereospecific number). In the phospholipids, only one external position and one internal position are available for bonding with the FAs. Absorption of FAs and their metabolism can depend on their *sn* position.

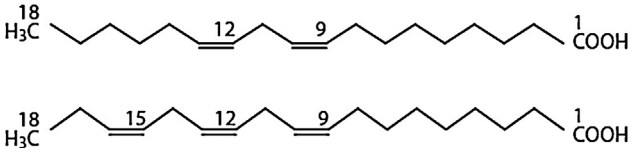

Figure 1. Structure and nomenclature of unsaturated fatty acids. Linoleic acid (LA) (top) has 18 carbon atoms and two double bonds with the first on the sixth carbon from the methyl group end (left). It is written C18:2 (n-6) or C18:2 ω-6. Linolenic acid (ALA) (bottom) has 18 carbon atoms and three double bonds with the first on the third carbon from the methyl group end (left). It is written C18:3 (n-3) or C18:3 ω-3. The numeration of carbon atoms from the carboxyl end (right) is used to describe where desaturase action takes place.