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Omega-3 Consumption During Pregnancy to Support Optimal Outcomes

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ABSTRACT

Long-chain omega-3 polyunsaturated fatty acids (n-3 LCPUFA), including docosahexaenoic acid, are components of cellular membranes that affect biological functioning. Most pregnant women consume inadequate amounts of n-3 LCPUFA and inadequately convert linolenic acid into docosahexaenoic acid. The purpose of this article is to educate nursing professionals on the importance of n-3 LCPUFA consumption during pregnancy and highlight the critical role of nursing professionals in supporting optimal consumption for improved metabolic, antioxidant, and anti-inflammatory potential.

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Omega-3 fatty acids are generally well accepted as beneficial to health and health outcomes. It is especially important that nurses who care for pregnant women are able to differentiate between food sources of omega-6 and omega-3 fatty acids and across different types of omega-3 fatty acids, including linolenic acid (ALA), eicosapentaenoic acid (EPA), and docosahexaenoic acid (DHA). Therefore, the purpose of this article is to educate nursing professionals on the importance of omega-3 long-chain polyunsaturated fatty acid (n-3 LCPUFA) consumption during pregnancy and to highlight their critical role in support of optimal consumption. In this article I provide fundamental knowledge that serves as a basis to optimize educational strategies in nursing through discussion of fatty acid classifications, food sources, consumption recommendations, and associated implications for clinical outcomes in the obstetric population.

A search was conducted to identify the current literature regarding omega-3 knowledge, attitudes, and recommendation practices of nurses. I searched the PubMed database for articles published between 2000 and 2017. Search terms included *nursing practice, knowledge, attitudes, prescribing, omega-3, prenatal recommendations,* and *obstetrics.* I found no related articles. This gap in the literature reflects a need for a formalized needs assessment of the attitudes, knowledge, and recommendation patterns of nurses in relation to dietary n-3 LCPUFA. As an initial step, in this article I provide nurses with fundamental information with which to build a knowledge base about the clinical significance and key considerations that surround n-3 LCPUFA consumption during pregnancy.

Overview of Dietary Fats

Contrasting Saturated and Unsaturated Fats

Most dietary fats are in the form of triglycerides, which comprise a glycerol backbone and three fatty acids. The composition of fatty acids in triglycerides is dependent on the food source and varies widely. Once triglycerides undergo digestion, absorption, and eventual transport, fatty acids are cleaved for use by tissue or incorporated into cellular membranes. Fatty acids differ in structure, and an abundance of a particular type can affect cellular membrane structure and function. Fatty acids considered to be beneficial to health that promote optimal membrane function are commonly referred to as *unsaturated.* In contrast, the potentially problematic fatty acids that impede membrane function are classified as *saturated* fats. In brief, fatty acids are classified by the number of carbons along the fatty acid chain, the degree of saturation representative of the number of carbon Q2 double bonds, and the positioning of these double bonds along the fatty acid chain.

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Most pregnant women consume inadequate long-chain omega-3 polyunsaturated fatty acids for optimal pregnancy outcomes.

Fatty acids are classified as saturated if there is an absence of double bonds along the fatty acid chain; this causes a fatty acid chain that is more saturated with hydrogen. In contrast, unsaturated fatty acids that contain double bonds require less hydrogen to stabilize the carbons along the fatty acid chain, and they are classified as *monounsaturated* (one double bond) or *polyunsaturated* (two or more double bonds; Gropper & Smith, 2013). Omega-3 and omega-6 fatty acids are two major classes of polyunsaturated fatty acids, and they differ with regard to the position where the first double bond appears along the fatty acid chain. Fatty acids with the first double bond appearing on the third carbon are classified as omega-3, and those with the first double bond appearing on the sixth carbon are classified as omega-6. Given that humans cannot synthesize fatty acids with double bonds on the third or sixth carbon and that we must obtain a dietary source to prevent deficiency, omega-3 and omega-6 fatty acids are considered essential fatty acids.

LCPUFA Biosynthesis

Once consumed, the precursors linolenic acid (omega-3) and linoleic acid (omega-6) undergo biosynthesis whereby they are further elongated (i.e., additional carbons are added to the fatty acid chain) and desaturated through forming additional double bonds to the chain to synthesize more bioactive forms involved in cellular membrane function and signaling (Gropper & Smith, 2013). As outlined in Table 1, eicosapentaenoic acid and DHA, two bioactive forms, are longer-chain derivatives of the 18-carbon omega-3 precursor linolenic acid and are referred to herein as n-3 LCPUFA. Arachidonic acid is a longer-chain derivative of the 18-carbon omega-6 precursor linoleic acid. In general, EPA, DHA, and arachidonic acid are all considered long-chain polyunsaturated fatty acids and are further characterized by their omega-3 or omega-6 classification.

Types of Omega-3 Fatty Acids

Dietary sources of omega-3 fatty acids are not equivalent based on the length of the fatty acid chain and number of double bonds. ALA, obtained in flaxseed, soy, and canola, is the metabolic precursor to n-3 LCPUFA and once consumed requires further elongation and desaturation to produce a form that is bioactive. Bioactive n-3 LCPUFA, and not the shorter-chain precursors, are essential to mediate inflammation, oxidation, and neurotransmission (Dyall, 2015). The bioactive products of fatty acid biosynthesis are the n-3 LCPUFAs DHA and EPA. Although DHA and EPA can be synthesized by the body, foods such as fish contain DHA and EPA and are referred to as preformed sources. Pregnant women should be advised to consume a preformed source of DHA because of limited biosynthesis or formation by the body from the shorter-chain precursor that limits the ability to meet increased rates of placental maternal–fetal transfer and fetal use of DHA during pregnancy (Calder, 2016).

Table 1: Comparison of Omega-3 and Omega-6 Fatty Acids by Chain Length

Shorter-Chain Polyunsaturated Fatty Acid (18-carbon chain)	Long-Chain Polyunsaturated Fatty Acid (20 or more carbons on chain)
Omega-3	Omega-3
Linolenic acid (ALA)[a]	Eicosapentaenoic acid (EPA)[b]
	Docosahexaenoic acid (DHA)[b]
Omega-6	Omega-6
Linoleic acid (LA)	Arachidonic acid (AA)

[a]Found in plant oils. [b]Found in fish oil.

Limited biosynthesis is explained in part by diets laden with processed foods and corn oil that cause high circulating levels of omega-6 fatty acids. Omega-6 and omega-3 fatty acids compete for the same enzymes in their respective biosynthetic pathways. Overconsumption of omega-6 fatty acids can result in mobilization of enzymes that can impede n-3 LCPUFA biosynthesis. Hence, reduced desaturation and elongation of omega-3 precursors is impeded because of competition of the omega-6 biosynthetic pathway for similar enzymes necessary for the omega-3 biosynthetic pathway (Calder, 2016). In addition to biosynthetic limitations, preformed n-3 LCPUFA is a preferred source because of a predominant maternal–fetal transfer of DHA and associated bioactivity compared with other fatty acids during pregnancy (Calder, 2016).

Researchers report a link between n-3 LCPUFA and maternal and fetal health outcomes; however,