OMEGA-3 AND OMEGA-6 FATTY ACIDS' EFFECT ON FETUS AND NEONATAL IN INTRAUTERINE PERIOD

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ABSTRACT

The relevant literature is searched this article was aimed to give information about the fetus and newborn effect of Omega-3, Omega-6 Fatty Acids in Intrauterine Period. For this reason, a literature search was made and an article of review type was written. Review of the subject has been made and the effects of omega-3, omega-6 fatty acids during pregnancy, fish consumption during pregnancy have been emphasized. As a result, consumption of omega-3 and omega-6 fatty acids during pregnancy is very important for fetal development.

Keywords: *Omega-3, omega-6, fetus, neonatal, fatty acids*

INTRODUCTION

Omega-3 fatty acids are not synthesized by the fetus and this requirement is met by the mother (Sahingoz, 2007). Omega-3 fatty acids are crucial for growth and development in pregnancy and the postpartum period, and especially in the last trimester of pregnancy, omega-3 fatty acids substantially pass from mother to baby. For this reason, healthy and balanced alimentation of pregnant women is very important for the baby health (Garipoglu 2010). Because of this importance, in this study, it was aimed to give information about omega-3, and omega-6 fatty acids effect on fetus and neonatal in the intrauterine period.

Omega-3 Fatty Acids (ω-3, n-3): The main ω-3 fatty acids are alfa-linolenic acid (ALA), eicosapentaenoic acid (EPA), docosahexaenoic (DHA) (Gebauer et al., 2006), and docosapentaenoic acid (DPA) (Ozturk 2014).

Alfa-Linoleic Acid (ALA): It is mainly found in greasy fishes such as salmon, trout, herring and tuna fish; and in fish oil, shellfish, canola oil, linseed oil, walnut, (Kris-Etherton et al., 2003), pumpkin seeds, soya oil, purslane, green-leafy vegetables, legume, and breast milk as well (Sensoz, 2016).

Eicosapentaenoic Acid (EPA), Docosahexaenoic Acid (DHA), Docosapentaenoic Acid (DPA): EPA, DPA, DHA fatty acids are firstly synthesized in some aquatic algae. Then these fatty acids pass to mussel, fish, and oysters with various zooplanktons in the food chain; and accumulates in increasing rates. Thereby; fishes have a great quantity of EPA, DPA, and DHA, which are ω-3 fatty acids (Ozturk, 2014). DHA provides renewal of the brain cell and augmentation of

the retinal cell. The inadequate amount of DHA results in diseases such as depression, memory loss, Alzheimer, visual impairment, schizophrenia (Kaya et al. 2004).

Omega-6 (ω-6/n-6) Fatty Acids: Omega-6 fatty acids are essential for maintaining a healthy life and for body metabolism (Baysal, 2004). Linoleic acid (LA), arachidonic acid (AA) and gamma linoleic acid (GLA) are the main ω-6 fatty acids (Ozmen, 2013). LA has a primary place in the synthesis of polyunsaturated fatty acids. The oil of plant seeds is quite rich in terms of LA (Watkins and German, 2002).

Linoleic acid (LA): Linoleic acid which can be taken in sufficient quantities with nourishment, is the main source of omega-6 acids (Akbulut, 2016a). Safflower is found in grape seed, corn, wheat seed, cottonseed and soybeans (Kocatepe and Turan 2018).

Gamma Linolenic Acid (GLA): It is quite rich in breast milk. Phalsa, evening primrose oil (Konukoglu, 2008), marvel-of-peru, and blackcurrant (Ozmen, 2013) are the sources of GLA.

Arachidonic Acid (AA): Breastmilk (small amount), meat, egg yolk, algae, and shrimp contain high AA (Konukoglu, 2008).

Omega-3, and Omega-6 Fatty Acids Effect in Pregnancy Period: Omega-3 fatty acids have been shown to have a significant role in preventing and treat certain cancers, especially breast and colon cancers, womb, skin, postnatal depression, manic-depressive psychosis, dementia (Alzheimer's disease and others), hypertension, diabetes, menstrual syndrome, and vasomotor symptoms (Bourre 2007). In addition, it has serious supportive effects on brain and eye development of neonatal and pregnancy period. Moreover, it has essential effects on preventing some allergic diseases as well as heart diseases, immune and inflammatory diseases, multiple sclerosis, migraine-type pain, joint rheumatism, diabetes, high cholesterol, and blood pressure (Cakmakci, and Kahyaoglu, 2012). During pregnancy, the mother transfers significant amounts of omega-3 fatty acids to the baby and the mother's omega-3 deposits decrease. Unless enough reinforcements are made, it is indicated that this condition results in postnatal depression (Akbulut, 2016b).

It has been stated that omega-3 fatty acids have a crucial role in the development of the brain, retina during fetal development and postnatal infancy (Connor, 2000). Of these fatty acids, especially EPA and DHA have an important place (Mahaffey, 2004). DHA is a natural component of phospholipids that are involved in the membrane structures of related tissues and have vital functions for the cell (Heird, 2001). DHA has an important role in the memory renewal of the brain (Hassimoto et al., 2002) and has a direct influence on the retinal development and vision functions. This is due to the fact that 60% of the phospholipids in the cell structure and 50% of the photoreceptors are DHA (Garipoglu, G., 2010). In addition, DHA has a role in the visual acuity of infants during the first months (Agostoni et al., 1995). In neuronal growth and development, both ω-3 and ω-6 fatty acids play an important role in the synaptic transmission of the nervous system (Uauy and Dangour, 2006). In the study in which the effects of adding fish oil as a food supplement to the cognitive level, it

was found that the cognitive level of the ones who had ω-3 adding was better (Whalley et al., 2004).

During the third trimester, approximately 67-75 mg/day DHA passes from the mother to the baby through the placenta (Rogers et al., 2013). For this reason, it is reported that the low levels of DHA in the blood of premature infants born in the last trimester of pregnancy may be related to abnormal eye and brain functions (Duttaroy, 2009). In the literature, low fish consumption is a strong risk factor for preterm delivery and low birth weight (Olsen and Secher, 2002; Ho et al., 2016).

In a study based on omega-3 fatty acid level and weight gain of the baby, it has been determined that there is a positive correlation between ω-3 fatty acid and weight gaining; Linoleic acid and total essential fatty acids positively affect height, BMI, and head circumference measurement (Tinoco et al., 2009). A study conducted in the Faroe Islands with mothers fed with aquaculture products rich in omega-3 fatty acids has shown that the length of the pregnancy has prolonged, the fetal development increased and consequently the birth weight increased (Lewin et al., 2005).

Particularly, it has been found that the proportion of DHA decreases with repeated pregnancies and that the amount of DHA in the umbilical cord of the first babies is higher than that of the mother who has previously delivered. For this reason, it is indicated that mothers should increase omega-3 and DHA intake with each subsequent birth (Sahingoz, 2007). It has also been reported that DHA addition to pregnant diets is important in pregnancy diabetes (Thomas et al., 2006).

Recommended Intake Amount: With industrialization, the food consumption habits of the community have changed and the consumption of ω-6 fatty acids increases with the decrease of ω-3 fatty acid consumption (Eliacik, K., Yenigun, A., 2012). Averagely, women intake 1,1 gr. LA and 0.1 gr DHA + EPA with food per day. If too much saturated fatty acid and LA are taken with food, only 3% of ALA turns into EPA and 2% into DHA. However, it is recommended that 650 mg/day of unsaturated fatty acid should be taken during pregnancy, which means that at least 300 mg of DHA and the consumption of fatty fish species should be increased for 4 times (Garipoglu, 2010). In addition, the Turkish Food Codex informs that at least 250 mg of DHA should be taken with the daily diet and that 200 mg of DHA is taken in addition to the recommended daily intake for adults to produce a beneficial effect in pregnant or lactating mothers (Turk Gida Kodeksi, 2017). It is emphasized in the literature that breast milk should have a DHA content of at least 0.3% (Jackson and Harris, 2016). In general, at least 200 mg DHA / day is required for the requirement of pregnant and lactating mothers (Koletzko et al., 2008).

ω-6: ω-3 Ratio: In the western diet which is richer than added substances (Gultekin, 2014), consumption of animal origin oil is low and consumption of ω-6 is increased. The ratio of ω-6: ω-3 is also in the level of 15: 1 to 20: 1 (Akbulut, 2016b).

In the caveman diet which prohibits sugar, white flour, and salt (Olmez, 2015), the omega-6: omega-3 ratio is found approximately as 1: 1 (Aydin, 2004). The United Nations Food and Agriculture Organization recommends that this ratio is kept between 4: 1 and 2: 1 (FAO, 2008). In a 2000 calorie adult diet, 0.65 g of

EPA and DHA, 2.22 g ALA (omega-3) and 4.44 g LA (omega-6) are taken per day, ω-6: ω-3 ratio is 1.5:1 (Simopoulos et al., 2000).

Fish Consumption during Pregnancy: Fish which has high protein digestibility is an important nutrient due to its content of n-3 fatty acids, vitamins, and minerals, it can be consumed in every period of life (Oksuz et al., 2017). Fish oil is the primary source in terms of EPA and DHA which are fatty acids (Kocatepe and Turan, 2018).

The fact that over-consumption of some fish species with a certain level of organic mercury causes adverse effects on both the development of the fetus and the mother can be considered as a disadvantage of fish consumption in the pregnant (Dovydaitis, 2008). Methylmercury (MeHg), a harmful mercury compound, can pose a risk for the fetus because it can easily cross the placental barrier (McKean et al., 2015), so the United States Food and Drug Administration (FDA) recommends limiting fish consumption especially those with high levels of MeHg during pregnancy. (FDA 2018).

Table 1. *FDA's fish consumption recommendations for women in reproductive age group and pregnant women (FDA, 2018)*

Recommended Fish Species and Consumption during the Pregnancy
Some Fish Species which can be consumed 2-3 portions* every week
Anchovy, Mackerel, Haddock, Codfish, Hake, Halibut, Sardine, Shad, Grey Mullet, Seabass, Flounder, Salmon, Thornback, Tilapia, Trout
Some Fish Species which can be consumed 1 portion* every week
Bluefish, carp, striped sea bass, tuna fish, white tuna fish (fresh and frozen)
Not-Recommended Fish Species Due to High Mercury Ingredient
King Mackerel, Shark, Swordfish, Big Eye Tuna fish

In conclusion, the use of omega-3 and omega-6 fatty acids during pregnancy is very important for fetal development. For this reason, nurses and health professionals should educate both pregnant and women in reproductive age group on the issue, and health managers should be encouraged to support the necessity and importance of these training and to contribute to the establishment of appropriate training areas.

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