The role of DHA in pregnancy

How to satisfy fetal needs

DHA is a polyunsaturated fatty acid (PUFA) belonging to the omega-3 series. Its biological activity is carried out in the membranes of all the cells of the organism where it is present in variable proportions depending on the cell type, reaching about 7% in the neuronal membranes and 20% in the retina.

Although our cells have the enzymes for the synthesis of DHA, **the production** by our body is **highly inefficient** and therefore DHA is considered a **semi-essential fatty acid that must be intake with food**. The main source of DHA is fish as it feeds on algae and, for this reason, acts as an accumulator of lipids that the algae themselves biosynthesize.

FATTY ACIDS REQUIRED for and by the FETUS

All fatty acids are necessary for the development and growth of the fetus, both as a source of energy and as constituents of the membranes, without which the new cells in the process of formation would not exist. During pregnancy, the woman must provide both her own needs for fatty acids and that of the fetus and placenta.

The requirement changes according to the **stage of gestation,** reaching the highest levels

in the last trimester, when the demand for growth and formation of the organs of the fetus is highest. Polyunsaturated fatty acids, omega-3 and omega-6, in addition to their structural role, as necessary components of cell membranes, play a crucial metabolic role as signalers and precursors of **effector molecules**.

The **availableness during pregnancy** of PUFA fatty acids for all these biological processes depends on the set of:

- levels assumed before conception (**maternal reserves**);
- levels taken during pregnancy (**direct intake from the diet**).

It is referred to factors that the (future) pregnant woman can control with an adequate nutritional approach. To these must be added the normal biological mechanisms that regulate:

- the correct functionality and selectivity of the placenta in the passage from mother to fetus;
- the placental and fetal synthesis of long-chain PUFA.

DHA during the trimesters of pregnancy

Although the mother's energy needs increase as the pregnancy progresses, this does not mean that the expectant mother has to "eat for two". In fact, it is certainly more important **to guarantee the adequate type of fat** taken, precisely because of their structural and functional role in the formation of the new organism.

It has been estimated that the total amount of DHA in the fetus up to birth is 10 g, of which 60-70% is mainly accumulated during the last 10 weeks of pregnancy.

To this quantity, which must be made bioavailable during 9 months, with a peak in the last quarter, must be added the daily requirement of the mother, which, to date, is estimated to be satisfied with a daily intake of 250 mg of DHA (for an adult individual according to EFSA recommendations).

How can the mother ensure adequate levels of DHA for herself and to accompany the growth of the fetus?

Pre-conception DHA reserves and dietary intake

The fetal need for DHA is satisfied both by the **nutritional contribution** and by the **mobilization** of **pre-existing maternal reserves** from the adipose tissue.

On the other hand, the contribution of the maternal, placental or fetal synthesis of DHA, starting from its precursor, alpha-linolenic acid (18: 3, omega-3), is not considered relevant.

- **pre-conception diet: formation of maternal reserves**

  The woman's usual diet before conception determines the composition of the maternal reserves that will be mobilized mainly during the last trimester of gestation.

  It has been shown that the lipid structure of women immediately before conception (maturation of the ovum) and in the very early stages of pregnancy (implantation of the embryo) has a greater effect on the fetus than the nutritional intake in the last two trimesters of pregnancy. One of the explanations lies in the correct formation of the **placental barrier** which will determine the effective entity and selectivity of the mother-fetus exchanges, a factor that cannot be directly controlled and influenced during pregnancy.

  Last but not least, adequate maternal reserves at the time of increased fetal DHA demand represent an evolutionary advantage since they allow a constant supply to the fetus, regardless of dietary fluctuations.

- **diet in pregnancy: DHA directly from the nutrition of the pregnant woman**

The DHA taken with the diet by the pregnant woman must be sufficient so that the pre-existing reserves are not depleted, compromising both the psycho-physical health of the woman that the lactation phase and/or subsequent pregnancies.

Of the "quantity" of DHA taken during pregnancy with the diet, it must be taken into consideration that a percentage will not reach the fetus (nor the cell membranes of the mother) in the event that **tissue inflammation** or conditions of **cellular oxidative stress** exist. Furthermore, it has been shown that a diet rich in omega-6 determines a decrease in the levels of omega-3 measurable in the umbilical cord at birth, indicating the establishment of a **competition** phenomenon between PUFA lipid elements transferred to the fetus.

Supplements in pregnancy

During pregnancy, depending on the stage of gestation, the mother will fulfil the fetus's DHA needs by drawing from its reserves (fat deposits and cell membranes) and with the daily intake from the usual diet.

Numerous studies have shown the correlation between levels of circulating maternal DHA with those encountered in the umbilical cord at birth and with a longer duration of gestation, greater length and weight at birth and reduced risk of pre-term birth.

A balanced diet regarding omega-3 fatty acids provides that the daily requirement of DHA for an adult is 250 mg per day [1] which can be satisfied taking into account that in 100 grams of fish there can be up to 500 mg of omega-3 (EPA and DHA) (link parole sottolineate con https://www.lipinutragen.it/en/fish-omega3-rich-food/).

If the intake is adequate from before conception, the transfer of DHA to the fetus, whether it comes from pre-existing stores or directly from the diet, will be sufficient and will not deplete the maternal reserves. In fact, it has been seen that, since placental and fetal synthesis is negligible, the DHA reaching the fetus depends exclusively on the circulating maternal concentrations.

If, after a careful evaluation of the levels of DHA in the cell membranes of the mature erythrocyte, integration is considered necessary, it should not be forgotten that:

a. **Excessive levels of omega-3**, due for example to non-personalized supplementation, can decrease the levels of omega-6, which are also necessary for the fetus and for the good course of pregnancy. Furthermore, they can predispose cells to oxidative stress and the formation of toxic lipid species;
b. **omega-3 supplements not adequately protected** by a suitable antioxidant formulation, are "lost" before reaching their biological destinations, thus resulting in an ineffective supplement;
c. **low quality omega-3 supplements**, may contain high concentrations of elements, such as trans fatty acids and environmental contaminants (PCBs, dioxins, heavy metals).

References:

[1] EFSA Journal 2010 8(3): 1461
[2] Wynn M, Wynn A. The case for preconception care of men and women. Bichester, United Kingdom: AB Academic, 1991:64–84
[3] Al MDM, van Houwelingen AC, Badart-Smook A, Hornstra G. Some aspects of neonatal essential fatty acid status are altered by linoleic acid supplementation of women during pregnancy. J Nutr 1995;125:2822–30.

Further information on our LipiMagazine BLOG:

Polyunsaturated fatty acids: "The essentiality of polyunsaturated fatty acids"

DHA: "omega-3 DHA: "when fats become our best allies for health"

Integration of DHA: "onDHA lights up the essence of Omega-3 DHA"

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