

The role of poultry in human nutrition

The omega-3 fatty acids

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TWO GROUPS OF POLYUNSATURATED FATS

There are two families of the polyunsaturated fatty acids (PUFAs) that are essential in human diets: omega (n)-3 fats and omega (n)-6 fats. Linoleic acid (LA), an n-6 fatty acid, is quite common in foods and in most seeds containing vegetable oil, and a LA deficiency is unlikely. Very few plant foods contain the n-3 fats, however, although some oilseeds (rape seed, soybean, walnuts) contain small amounts, while flax seed is rich in alpha-linolenic acid (n-3, ALA), which makes up 22 percent of the oil. Most people living in developing countries are likely to have insufficient n-3 PUFAs in their diet.

The importance of n-3 PUFAs in human health has only recently been recognized. It ranges from protection against some forms of cancer, several specific diseases and conditions (heart disease, brain development, learning ability, and inflammatory diseases such as asthma and rheumatoid arthritis) to general well-being (Anonymous, 2002).

SOME N-3 FATS ARE MORE POTENT THAN OTHERS

To be effective, ALA must first be converted into active forms (eicosapentaenoic acid, [EPA] and docosahexaenoic acid [DHA]) in the body. This is done inefficiently or not at all in the elderly and the very young. Human breastmilk contains significant but variable amounts of EPA and DHA, which can be increased by providing the mother with an n-3 fatty acid-enriched diet to the benefit of the suckling infant. Infant formula, unless supplemented with these fats (which is uncommon in developing countries), contains few or none of them.

THE RATIO OF N-6 TO N-3 IS IMPORTANT

An important feature of these essential fats is the ratio of n-6 to n-3 in the diet. Ideally, this should be less than 4:1 (as in human milk) but in practice it is usually more than 20:1 and probably much higher in developing countries, especially where there may be no access to seafoods, the major source of EPA and DHA. In the human body, this imbalance results in the rapid conversion of linoleic acid into the active form arachidonic acid (n-6), resulting in the production of pro-inflammatory compounds. High levels of linoleic acid elevate thromboxane, which stimulates platelet aggregation, leading to arterial blockage and a possible heart attack.

ELONGATION OF N-3 FATS AND THEIR ENRICHMENT IN EGGS

Chickens have the unusual ability of rapidly converting ALA into DHA in significant quantities, and to EPA in lesser amounts. This means that eggs can be enriched with these important fats, provided that there is an adequate supply of ALA in the hens' diet.

The diet of hens usually contains some of the n-3 fats, and 100 g of edible egg typically contains 150 mg of total n-3; of this, DHA + EPA is about 20 mg. By adding 10 percent flax seed (2 percent ALA) to the diet of layers, the total n-3 will rise to more than 600 mg/100 g. About one-third of this will be DHA + EPA. Rape seed oil and rape seeds can also be used to enrich eggs with n-3 PUFAs, but result in lower concentrations. These oil and flax seeds are grown in many developing countries. When included in layer diets, fishmeal, fish waste and fish oil can also increase the n-3 PUFAs in eggs, almost exclusively as EPA and DHA, but if used in too high amounts may cause a fishy taint in the eggs.

HOW MUCH OF THE N-3 FATS DO WE NEED?

Although there is no agreed recommended dietary intake (RDI) for the n-3 fats, some suggest an intake for adults of 2 to 3 g of total n-3 fats per day, of which DHA + EPA should be 0.6 to 0.8 g. An enriched egg can therefore make a significant contribution to these requirements. Requirements for children are not known, but are likely to be considerably less than those suggested for adults. One difficulty is maintaining the critical n-6 to n-3 balance. This normally means reducing the intake of foods containing significant levels of the most commonly used vegetable oils that contain n-6 PUFAs.

CONCLUSIONS

An increasing body of information highlights the importance of the n-3 fats in human health. They are especially important during pregnancy and early infant development. Seafood, the main source of the important EPA and DHA, is becoming expensive, and its consumption is falling. There is generally a severe dietary deficiency of these n-3 fats in both developing and developed countries worldwide, causing a gross imbalance with the n-6 fats and leading to adverse health consequences. The contribution of enriched eggs will become increasingly important, especially to vegetarians, whose diet has only ALA and little or no EPA and DHA.

REFERENCES

Anonymous. 2002. Essential fatty acids in human nutrition and health. Proceedings International Conference, Shanghai, China, 24–27 April 2002

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