

# Fish: important source of essential fatty acids for human nutrition

## Introduction

There are two series of essential fatty acids which are necessary for both animal and human life. They are built up only by plants and cannot be synthesized by animals or humans. Therefore, they must be supplied in the diet. The n-6 series originate in the linoleic acid (LA, 18:2n-6), and the n-3 series in the  $\alpha$ -linolenic acid (ALA, 18:3n-3). Physiologically more important than these parental fatty acids are their elongated and desaturated derivatives or metabolites. These fatty acids affect the fluidity, flexibility and permeability of the membranes, are precursors of the eicosanoids and necessary for maintaining the impermeability barrier of the skin.<sup>1,2</sup>

Since the 1970s knowledge concerning the significance of the long-chain polyunsaturated fatty acids (PUFAs) of the n-3 type, especially eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA), for human health has increased considerably.<sup>3</sup> Excellent source of these fatty acids are fish oils.<sup>4</sup> High levels of n-3 fatty acids are present not only in lipid rich marine fish like herring (*Clupea harengus*) or mackerel (*Scomber scombrus*) but also in several freshwater fish species. Well known for their high content of n-3 PUFAs are e.g. silver carp (*Hypophthalmichthys molitrix*) and bighead carp (*Aristichthys nobilis*), which are reared mainly in Asia.<sup>5</sup>

The fatty acid composition of fish is based on that of their food, and the typical high levels of PUFAs in fish lipids result of the fatty acid composition of the phytoplankton.<sup>6,7</sup> Since fatty acid content of fish reflects, to a large extent, that of their feed, in aquaculture it is possible to influence the fatty acid levels of cultured fish by suitable composition of the diets.<sup>8,9</sup>

Today in modern diets for fish culture the necessary n-3 PUFAs are supplied mainly by adding fish oil. In future oils of yeast, microalgae and genetically modified oilseed plants will be used to a great extent in fish feed.<sup>10,11</sup> In evaluating the value of fish as wholesome human diet it is necessary to consider not only the percentage of n-3 PUFAs in the lipid but also the lipid level in the muscle.<sup>12</sup> That means, lipid rich fish generally are more suitable for sound nutrition than lean fish.

Many authors have demonstrated that n-3 PUFAs have antiatherosclerotic efficacy and can reduce disease of the circulating system.<sup>13,14</sup> Recommended consumption levels of EPA and DHA for humans lie within the range of 300-400mg per day.<sup>15</sup> With two portions of lipid rich fish per week it is possible to satisfy this demand.<sup>16</sup> But there is evidence that long-chain polyunsaturated n-3 fatty acids may have also beneficial effects on diseases other than those of the heart and the blood vessels. These are inflammatory diseases,<sup>17</sup> arthritis,<sup>18</sup> nephritis,<sup>19</sup> lupus erythematosus,<sup>20</sup> multiple sclerosis,<sup>21</sup> strokes,<sup>22</sup> cancer,<sup>23</sup> skin diseases,<sup>24,25</sup> asthma,<sup>26</sup> Alzheimer disease,<sup>27</sup> and age-related macular degeneration.<sup>28,29</sup>

Consumption of fish containing n-3 PUFAs by pregnant women is very important for the development and health of the foetus and the newborn infant.<sup>30-34</sup> In a study with about 1500 middle-aged and elderly participants it was shown, that high intake of EPA and DHA was positively associated with brain volume, visual memory and abstract thinking, even in persons free of clinical dementia.<sup>35</sup>

Meanwhile many comprehensive studies were published which clearly demonstrate the general cardioprotective value of fish consumption or the so-called Mediterranean diet (DASH: Dietary approaches to stop hypertension).<sup>36-40</sup>

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In an extensive paper the effect of dietary pattern and individual foods on mortality and cancer recurrence among cancer survivors was studied.<sup>41</sup> In this investigation more than 200000 cancer survivors were included. It was shown that higher intakes of fish and vegetables were inversely associated with overall mortality. Thus high quality diet with regular intake of fish can contribute to human health.

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## Conflict of interest

Author declares that there is no conflict of interest.

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