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FISH BIOMOLECULES IN FIGHTING MALNUTRITION

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Malnutrition can be a serious condition that develops when the diet doesn't contain adequate amount of vital nutrients such as vitamins, minerals, proteins, carbohydrates, lipids etc. In general, malnutrition can be of two types: (1) overnutrition wherein the body gets extra nutrition leading to symptoms like obesity (2) undernutrition wherein the body is deprived of essential nutrients. Undernutrition is often reported to have a significant impact on people's health including stunted growth, low body weight and muscle wasting than the former one. Several factors contribute to malnutrition such as health status, body function, ageing, education, health state, food security, economic and environmental condition, political situation etc. This all combinedly may contribute to the suboptimal dietary intake causing malnutrition. Reports state that there is an increased risk of malnutrition among children and the elderly. It has been shown that deficiencies of vitamin A and zinc result in deaths. Further deficiencies of microelements such as iodine and iron are reported to contribute to the delayed growth and mental development in children. It also results in deteriorating health, increased morbidity, and mortality in elderly and chronically ill patients. In this regard, several strategies and nutrition related programmes are being undertaken nationally and internationally to curb malnutrition. The important programme among this is specifically focusing on the first 1000 days of life, as stunting often begins in utero and continues for at least the first 2 years of postnatal life.

Functional foods offer a potential opportunity to fully meet food needs. Hence, development of tailor-made functional foods to address various nutritional requirements is one of the promising ways to address malnutrition. In this context, fish/marine-derived molecules can be of significant importance as they are reported to be rich in essential nutrients in adequate proportions. Further, globally there is an increase in awareness among the consumers about seafood and its health/nutritional benefits. Hence, scientists constantly explore these bioactive constituents/therapeutic potentials to improve populace health and quality of life.

Fish is considered as a good source of high quality, easily digestible protein rich in essential aminoacids. Moreover, fats and oils from fish is an excellent dietary sources of long chain highly unsaturated fatty acids of omega-3 type such as as Eicosapentaenoic acid (EPA C20:5) and Docosahexaenoic acid (DHA C22:6). Omega-3 fats are long chain polyunsaturated fats

containing methylene-separated double bonds starting from the third carbon atom counted from the methyl-terminus. These fatty acids are required by humans, but cannot be synthesized endogenously and hence considered as essential fatty acids. Therefore, the requirements for these fatty acids must be obtained from the diet. The International Society for the Study of Fatty Acids and Lipids (ISSFAL) recommends an adequate intake of omega-3 LC PUFA to be 0.65 g of DHA plus EPA per person per day (as minimum 0.22 g of each). The American Heart Association recommends adults eat fish (in particular fatty fish) at least two times per week

The two important omega-3 fatty acids -EPA and DHA play a key role in: (1) cell membrane formation, integrity, and functions; (2) functioning of brain, retina, liver, kidney, adrenal glands, and gonads; and (3) local hormone production for the regulation of blood pressure and immune and inflammatory responses. EPA and DHA play a major role in maintaining health of the young children by modulating the lipid metabolism. These ω-3 fatty acids also regulate prostaglandin metabolism, which regulates the vascular functions in growing children. They also have influence on kidney function by modulating the retention of water and removal of excess sodium, which plays a major role in the behavior of kids. DHA is critical to normal eye and vision development in the early and later parts of the human beings. Along with linoleic acid it makes > 1/3rd of FA in human brain and retina. DHA also increases memory power of young children. A person can expect good health if he or she consumes 0.5-1g of PUFA/day.

Further, fish and seafood are also reported to be rich in easily digestible proteins. The amount of protein in fish and seafood muscle is usually between 15 and 22%. The types of proteins found in fish muscle can be categorized into three groups: (1) Myofibrillar proteins (Structural protein such as actin, myosin and regulatory protein such as tropomyosin, troponin, and actin) (2) Water-soluble sarcoplasmic proteins (myoalbumin, globulin, and enzymes) (3) Stroma proteins (collagen and elastin). It is reported that fish-based protein could modulate several regulatory factors including lowering insulin resistance, leptin, and tumor necrosis factor-(TNF-) α, improving hyperglycemia, and decreasing adipose tissue oxidative stress in animal models. Further, in terms of nutrition, the human body readily digests and absorbs fish proteins, so as to deliver important biological effects. Bioactive peptides (called hydrolysates) have been isolated from different species of fish which possess important metabolic activities, from antioxidant, antimicrobial, to antihypertensive aspects.

Apart from this, fish are also an important source of vitamins and minerals, such as vitamin D, selenium, zinc, phosphorus, and calcium. They are reported to be rich source of minerals such as sodium, potassium, calcium, phosphorus and magnesium. Fish bone which is often discarded after the removal of protein is an excellent source of calcium and hydroxy apatite. Being rich in minerals, fish bone powder can be fortified into several food products. However, for fortification, the fish bone should be converted into an edible form by softening its structure

by pre-treatment with hot water or hot acetic acid or superheated steam. Calcium powder processed from the backbone of tuna is a potential nutraceutical. It can be used to combat calcium deficiency in children. Other than fish bone calcium, certain other minerals such as selenium, potassium, iodine, zinc, magnesium are more abundant in seafood than in meats.

Conclusion

Because of their high nutritional value, marine fish consumption is associated with many health benefits from foetal life to adulthood. These benefits include neurodevelopment at the embryonic stage, cognitive and visual development during infancy and childhood, and lowering the risk of cardiovascular diseases during adulthood. In this context, fisheries and aquaculture programs can address and mitigate issues of malnutrition in the world by increasing the access to fish due to its nutritional value. Therefore, increasing fish production could increase the access to fish products and improve the nutritional status in children which has the potential to end malnutrition and food insecurity.

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