

FISH protein hydrolysates: Their potential application for prevention of stunting

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Stunting or a growth disorder in children bringing about their height being not match their age is still a problem in many countries in the world. The global prevalence of child stunting in 2016 reached about 22.9% or 154.8 million children under 5 years old [1]. It has become a major obstacle in human development due to the long effect of stunting which results in retardation of physical and mental growth; decreased health, intelligence and productivity; as well as risk of degenerative disorder [2]. Further impact of the stunting is reduction of income per capita [3]. Child stunting is related to many factors, however, inadequate nutrition with long-term insufficient nutrient intake is identified as the main cause [4]. The World Health Assembly targets to reduce the number of stunted under-5 children by 40% in 2025.

Recent studies showed that children with high risk of stunting may have insufficient intake of nutrition, particularly protein. Less amino acids were found in the serum of stunted children compared with normal-growth children, which influenced in repression of mTORC1 (mammalian target of rapamycin complex 1) to synthesize proteins and lipids [5], in which mTORC1 is a protein complex working as a nutrient/energy/redox sensor and regulating in synthesis of protein [6]. In addition, stunted children have limitation of choline, a substance for the synthesis of sphingolipids and glycerophospholipids [5] which have important role in human health [7]. Animal-based foods was known as a good source of sphingolipids and glycerophospholipids [8], however, for low income people these foods cannot be consumed all the time due to the price which is relatively higher than plant-based foods. Thus, the intervention in the provision of food rich in animal protein is expected to reduce the risk of stunting.

Fish protein hydrolysate (FPH) is a hydrolysis product of fish protein containing peptides and amino acids which are more digestible and absorbable compared to an intact protein. FPH has received great attention recently in solving the problem of malnutrition because of its high protein content with complete and good amino acid balance as well as bioactive peptides and lower prices than other animal protein sources. Amino acids act as a regulator of key metabolic pathways and a precursor for synthesis important biological materials. They perform the function of a cell signaling, and control in gene expression and protein phosphorylation cascade [9]. Meanwhile, number of peptides have been reported as potential nutritional with pharmaceutical capacity which is then called as nutraceutical. The bioactive peptides, usually 2-20 amino acid residues in length or sometime >20 amino acid residues, have generally functioned in enhancing the immune system, preventing chronic diseases, managing condition of stress, controlling body weight as well as the blood glucose level, improving cognitive function, hindering the aging process or improving life expectancy, etc. They are transferred to the vascular system in active form after gastrointestinal digestion and absorption process through

the intestine [10]. These bioactive peptides can be found as natural bioactive peptides which are obtained by extracting from the sources, usually using organic solvents, and as derivative products which may be acquired from hydrolysis of proteins of the marine organisms.

In most country, fish protein is more affordable compared to other animal proteins, due to the lower price and abundance resources, such as Indonesia. However, the level of fish consumption per capita per year in some developing countries and even countries that have huge potential of fish resources has not been optimally achieved. This is probably due to fishy odor which some people do not like it. By processing fish into FPH, the fishy odor may be reduced and the product can be applied to various foods. Besides, the functional properties of protein are enhanced, more protein may be absorbed as amino acids, and allergic reaction of protein reduced which is shown by increasing the serum amino acids and muscle protein synthetic response [11]. In addition, different size of peptides and numbers of bioactive peptides are retrieved which give the positive effect on increasing the body endurance.

FPH can be processed from both marine and freshwater fish, by chemical or biological methods. However, biological method using proteolytic enzymes is preferable, because the process takes place under mild condition and environmentally friendly. It also produces high product specificity and preserves the functionality and nutritive values [12]. A study on the effects of FPH on the immune status of malnourished children showed that there was a significant improvement in the children. It seems that di/tri peptides along with essential and nonessential amino acids, micronutrients and vitamins as a valuable composition of the FPH contributes in that achievement [13]. They reported that the values of immunoglobulin's and CD4/CD8 ratios of malnourished children (India) are in the normal range and are in accordance with the reported values of various ethnic groups. Nowadays, a number of fish protein hydrolysate have been produced commercially, some of them are claimed as nutraceuticals which are considered a potential nutrient and safe as well as demonstrated therapeutic effects. FPH for prevention of stunting is recommended to be introduced since the first 1000 days (starting from the fetus to two years old children) through pregnant women and infants over 6 months as complementary food for breast milk, such as baby porridge.

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Government intervention is appealed to overcome the problem of stunting by providing nutritious food products as needed for the growth of children, particularly in developing countries.

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