

The Potential Role of Seluang Fish Oil (*Rasbora Spp*) in Improving Calcium, Zinc and Vitamin D3 Deficiencies

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Abstract

Background Seluang fish (*Rasbora sp.*) is a freshwater fish which famous and common consumed among South Sumatera community. This is a potential opportunity to do research of nutritional compound from South Sumatera Seluang fish. In riparian and coastal areas with rich fish resources in developing countries, fish and fisheries play an important role in the diets, livelihoods, and income of many poor population groups who suffer from vitamin and mineral deficiencies.

Methods Seluang Fishes oil were processed by wet rendering method. The Seluang fish oil were analyzed the concentration of calcium and zinc by acid digestion in Atomic Absorption Spectrophotometry. The concentration of cholecalciferol were analyzed by high performance liquid chromatography (HPLC).

Results The aqueous extract were contain calcium (65,96 mg/L), zinc (1,8 mg/L) and cholecalciferol (2043,34 IU/mL).

Conclusion Seluang fish extract has a potentation in improving calcium, zinc and vitamin D3 deficiencies.

Keyword : Seluang fish-calcium-zinc-cholecalciferol

BACKGROUND

Fish provides the main source of animal protein to about one billion people globally. Fisheries are an important part of food security, particularly for many poor people in developing countries. In developing and under developed countries, they make up about 22% of overall animal protein consumption. Fish is a source of protein, micro-nutrients and essential fatty acids, providing an important complement to the predominantly carbohydrate based diet of many poor people in developing countries. Fish and fisheries contribute to food security in a variety of ways and the importance of small-scale fisheries, in particular, for food security is emphasised by Food and Agriculture Organization (FAO,2003; Ajiro et al., 2000; Academy of Science, 2000).

Seluang fish (*Rasbora* sp.) is a freshwater fish which famous and common consumed among South Sumatera community. This is a potential opportunity to do research of nutritional compound from South Sumatera Seluang fish. In riparian and coastal areas with rich fish resources in developing countries, fish and fisheries play an important role in the diets, livelihoods, and income of many poor population groups who suffer from vitamin and mineral deficiencies (Burger-Lux et al., 1998; Burk et al.,1999). As official data on fish catch, production, and consumption often exclude fish caught, consumed, and traded within these groups, the benefits derived from fish are not well documented and can be grossly underestimated. It is well accepted that fish are a good source of animal protein; however, their role as a source of vitamins and minerals in developing countries is often over- looked (Zuraini et al., 2006). Thus, quantification of the nutritional contribution from fish in poor, rural households is necessary to assess the role fish can play in food-based strategies to combat vitamin and mineral deficiencies in developing countries (Gopakumar et al.,1997; Grof et al., 1995; Halwart et al., 2008).

This article describes results from research, focusing on seluang fish intake in South Sumatera. The vitamin D, calcium, and zinc contents of commonly consumed fish species, nutrient bioavailability, and the contribution of these fish to the intakes of these essential,limiting nutrients are described. Vitamin D is the most significant nutrient for the proper absorption of calcium (De luca et al.,2001; Edward et al.,1998; Holick et al., 2004). Vitamin D and calcium work together to slow down or even reverse osteoporosis. Vitamin D is essential in helping the body absorb and use calcium; in fact, the body cannot absorb calcium at all without some vitamin D. Vitamin D comes from two sources. It is made in the skin through direct exposure to sunlight, and it comes from the diet. The body's ability to produce vitamin D from exposure to sunlight and to absorb calcium and vitamin D decreases with age. Getting enough vitamin D helps the body absorb calcium and also helps the kidneys break down and incorporate calcium that would otherwise be excreted (Kongsbak, et al., 2008; Kris-Etherton et al.,2002). Vitamin D is found in eggs, butter, fatty fish, liver, and fortified foods such as milk, orange juice, and cereal. Elderly individuals who are not exposed to sunlight and may not eat a variety of food containing vitamin D may

need vitamin D supplements to maintain adequate levels to help calcium absorption. Since its first discovery in an Iranian male in 1961, zinc deficiency in humans is now known to be an important malnutrition problem world-wide. It is more prevalent in areas of high cereal and low animal food consumption. Epidermal, gastrointestinal, central nervous, immune, skeletal, and reproductive systems are the organs most affected clinically by zinc deficiency.

MATERIAL & METHODS

Seluang Fish

Seluang fishes were collected from The Musi River Palembang, South Sumatera, Indonesia at May 10th 2016. Seluang fishes had been determined by Biology Laboratory, Faculty of Mathematics and Science, Sriwijaya University, South Sumatera, Indonesia.

Preparation of Seluang Fish Oil

The preparation process began with the seluang fish processing. Seluang fishes were washed with running water, then cleaned from the dirt, including the fish's contents. The fish was then boiled using wet rendering method, where the milled fish was mixed with water at a ratio of 1:10. Next, the fish were cooked with a double jacket at a temperature of 85°C-95°C (optimum temperature 90°C) for 60 minutes. Fish oil located on the surface of the decoction was separated. Then fish oil that had been obtained, carried out purification by screening. Subsequently, the filtered fish oil was subjected to cooling by storing in the coolant temperature 4°C for 12 hours. The cooled oil would form three layers, the most basic layer was water, the second layer was free fatty acid and phosphatide and the top layer was fish oil.

Analysis of Calcium and Zinc in Seluang Fish Oil

An acid digestion procedure was used for sample preparation (Seluang Fish oil). Sample was put into a digestion tube. Add 5 mL of HNO₃ and then 5 ml of H₂SO₄ to the sample. Allow the reaction to proceed. When the reaction slows, place the tubes in a hot-block digestion apparatus and heat at low temperature (60°C) for 30 minutes. Remove the tubes from the hot block, allow to cool, add 10 mL of HNO₃, return tubes to digestion rack and heat slowly to 120°C, increase the temperature to 150°C. Remove the tubes when the samples go black, allow to cool, then add 1 mL of H₂O₂ additions until the samples were clear. Remove the tubes and make up to 50 mL with deionized water. Standard of Calcium and Zinc were treated in the same way as samples. The wavelength of Atomic Absorption Spectrophotometry for Calcium was

422,7 nm and for Zinc was 213, 8 nm.

Analysis Vitamin D3 (Cholecalciferol) in Seluang Fish Extract

Samples were added aquadest (1:10) and sample in group 3 and 4 were added ethanol (1:10). Around 15 uL sample was injected to HPLC (Shimadzu), column sperical C 18, mobile phase methanol : aquadest (90:10), flow rate 0,8 ml/min, detector UV $\lambda = 254$ nm.

RESULTS

Table 1 showed the concentration calcium, zinc and vitamin D3 (Cholecalciferol) in group 1-4. Group 2 (dry seluang fish in aquadest) was higher concentration of calcium, zinc and vitamin D (cholecalciferol) than others group.

Table 1: The Concentration of Calcium, Zinc and Vitamin D3 in Every Group

No.	Concentration	Group 1	Group 2	Group 3	Group 4
1.	Calcium (mg/L)	32,34	65,96	-	-
2.	Zinc (mg/L)	1,25	1,8	-	-
3.	Vitamin D (Cholecalciferol) (IU/mL)	64,33	2043,34	23,44	34,56

DISCUSSION

Fish is a rich source of vitamins, particularly vitamin A, B1,B2,B3, D and E. Vitamin D is known as the ‘sunlight vitamin’ because the body synthesizes it when the sun’s ultraviolet B (UV-B) ray strike the skin. This vitamin is very essential for the absorption and metabolism of the calcium. Until recently, little attention has been focused on its important role for bone health and for the prevention of many chronic diseases. It is now recognized that everyone is at risk for vitamin D deficiency. Vitamin D deficiency in childhood produces

rickets, which is characterized by inadequate calcification of cartilage and bone.

The body cannot absorb calcium from food or supplements without an adequate intake of vitamin D. There are two forms of the vitamin D. They are vitamin D2 (ergocalciferol) and D3 (cholecalciferol). Plants synthesize ergocalciferol (vitamin D2), which also has vitamin D activity in the humans. Vitamin D3 (cholecalciferol) is derived from animal sources. This vitamin is synthesized in the skin from 7-dehydrocholesterol via photochemical reactions using ultraviolet B (UV-B) radiation from sunlight. Fortified foods are the major dietary sources of vitamin D. Very little vitamin D is naturally present in our food. Milk, fatty fish, such as salmon, mackerel,

and herring, cod liver oil, fish liver oil typically provide 400-500 IU of vitamin D per 100gm. Vitamin D is vital for the control of the levels of calcium in blood and also controls the rate at which the body excretes calcium in the urine. The active form of this vitamin is calcitriol which is synthesized from either D2 or D3 in the kidneys. Ageing decreases the amount of 7-dehydrocholesterol on the skin, so elders are incapable of making enough cholecalciferol from sunlight to satisfy their needs. Barger-Lux *et al.*, (1998) have estimated that the daily requirement of vitamin D for body ranged from 3000-5000 IU. This is critically important for the maintenance of calcium metabolism and good skeletal health, throughout the life. The recent research reveals that vitamin D regulates the blood pressure hormone renin and has a role in the prevention of hypertension and cardiovascular disease. It also regulates the autoimmune system and controls some forms of cancer cell growth and hence provides an explanation for why vitamin D sufficiency is beneficial in the prevention of many chronic illnesses in children and adults (DeLuca and Cantorna, 2001; Holick,2004).

Fishes are excellent sources of calcium, phosphorus and fluorine as these fish are generally eaten with bones, whereas in large fish most or all bones are discarded as plate waste. Every cell of the body is dependent on the presence of ionic calcium. It is required for strong teeth and bones (formation and mineralization) and for the normal functioning of muscles and the nervous system. It is also indispensable for the blood clotting process at the time of cuts, injuries etc. Deficiency of calcium may be associated with rickets in young children and osteomalacia (softening of bones) in adults and older people (Mat Jais *et al.*, 1994; Mazumder *et al.*, 2008; Singleton *et al.*,2000).

Zinc is one of the most important trace elements necessary for the synthesis of proteins, DNA formation, and the replication of the genetic material which is transferred during cell division and cell growth. It acts as a cofactor in many important biochemical reactions in the organism. This element plays an important role in the process of blood formation, proper functioning of the immune system, normal development and functioning of the reproductive organs and the endocrine glands. It is necessary for maintaining the acid-base balance and homeostasis in the organism. Zinc deficiency is associated with poor growth, skin problems and loss of hair. It also causes fatigue, tiredness, loss of appetite, loss of smell and taste sensations and one of the probable reasons for infant retinal disorders (Prasad *et al.*, 2002).

CONCLUSION

Seluang fish-aquadest extract has a potentiation in improving calcium, zinc and vitamin D3 deficiencies.

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