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Physico-Chemical Properties and Fatty Acids Profile of Skipjack (*Katsuwonus pelamis*) Fish Oil

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Abstract : Fish oil has a wide variation of fatty acids and the high content of unsaturated fatty acids are very important for consumers health. However very little publication on the physico-chemical properties and fatty acids profile of skipjack fish oil originated from Manado North Sulawesi. The research results showed that skipjack fish oil has moisture content of 4.2%, acidity number 15.20, peroxide value of 2.85, iodine number 90.10, saponfication number of 172.85 and cholesterol content of 2.5%. The fatty acids found in these samples were C_{16}:0, C_{16}:1, C_{18}:0, C_{18}:1, C_{20}:5 and C_{22}:4. Whilst the glyseride consist of triglyceride 65%, diglyceride 20% and monoglyceride 15%.
Keywords : Fish Oil, Physico-Chemical Properties, Fatty Acids Profile.

Introduction

Fish oil is known as source of *poly unsaturated fatty acid* (PUFA) amongst those are DHA and EPA, which is known as omega-3 fatty acid. The fish oil reappears along with the knowledge about nutrient and health aspect of omega-3 fatty acid. This omega-3 is a fatty acid with multiple position of double bounds, and it is an indicator of the unsaturated level of fatty acid. Fish oil as source of omega-3 fatty acid play an important role to health, and amongst those are to prevent heart disease, decreasing blood cholesterol, diabetes, cancer, brain and eye membranes forming, which in general it affected the blood circulation system.[1,2,3]

According to[4] Tuna fish has many species which are Albacore (Thunus gemo) blue finn (thunnus thynnus), yellow finn (Neothunnus macopterus) and skipjack (Katsuwonus pelamis).

In general skipjack fish (tuna) has two types of meat namely red and white meat, [5].The oil content of some types of skipjack fish are shown in Table 1.

Skipjack (*Katsuwonus pelamis*) meat is one of the sea fish meat preferred by consumers as it has a good texture, slightly sweet taste and especially as a source of protein. In Indonesia, skipjack fish is one of the essential commodity because these fish can be processed and utilized as frozen product or traditionally processed such as wooden fish (*ikan kayu*–local product name), smoked fish, steam salted fish (*pindang*) and shreded meat (*abon*), an in japan as *sasimi* and *kamaboko*. In North Sulawesi this kind of fish could be found in large numbers, and its way of living bunches up and despitefully on a certain season it is so abundant. Skip jack can live at temperature range between 9 – 31^{o}C but they like more at temperature between 26 – 28^{o}C, therefore skipjack fish could be found in large numbers along year-around and along equator. This fish can reach 1 meter in length, but in general the one caught just reaches 30 – 60 cm, an their weight was around 0.3 – 0.5 kg. The red meat of skipjack fish contained protein of 28.7 %, fat up to 17% and moisture of 64.6 %[6]Physiologically

and biochemically red meat considered as an important one, because it contained high fat content, fatty acid, *myoglobin* and enzymes such as succinase, dehydrogenase, lectinase [7].

Table 1. Oil content of many species of skipjack fish

Fish species	Oil content (% w/w)	
	White meat	Red meat
Albacore	7.5	4.3
Blue finn	5.0	5.0
Yellow finn	0.6	0.7
Skipjack	0.9	1.0

Fish fat has a special feature properties than another animal fat, which was shown by its fatty acids composition, particularly more double unsaturated fatty acids compared to the others. According to [8]tuna species have more higher omega 3 fatty acid content, namely EPA 7.5% and DHA 26.4%.

As there are very limited publication on the physico-chemical and fatty acid profile of fish from Indonesia, therefore this study is to determine the physico-chemical and fatty acid profile of North Sulawesi skipjack fish meat

Material and Methods

Fish meat samplesin this research was obtained from 2 kg skipjack fish of Northern Sulawesi, with 50cm in lenght. The whole part of this fish was extracted using hexane as described by [9], and the fish oil obtained were then analyzed for its physico-chemicalproperties of oil include moisture content , acidity number , saponification number and Iodnumber according to the methods that described in [10]while the proxide number was measured according to the method of [11]and cholesterol content using the method described by [12]

The glyceride composition was determined using Thin Layer Chromatography according to the method described by [13].The fatty acid profile were analyzed on GC-MS-QP2010S SHIMADZU with polar conditions length of column 30m iner diameter 0,25 mm.

Result and Discussion

Skipjack fish oil extraction were analysed its physico-cehmical properties to understand the condition of unpurified oil and the results were shown in table 2.

Table 2. Skipjack fish oil physico-chemical properties.

Parameters	Number
Moisture content (%)	4.20
Acidity number (mg/g)	15.20
Peroxide number (meq/kg)	2.85
Iod number	90.10
Saponification number	172.85
Cholesterol content (%)	2.50

Data in Table 2 showed that the moisture content of the samples were 4.2% and it means that the oil samples were quite safe to be stored and latter can be used as substrate for interesterification enzymatic reaction. According to [14],the optimum moisture content for inter esterification reaction was in the range of 6.04% up to 11%.

The acidity number of skipjack fish oil extraction was 15.20 mg/g. This acidity number indicate the initial free fatty acid of oil. Good quality oil is indicated by the low free fatty acid content. According to [15] acceptable oil has a free fatty acid content ranging from 3.0 to 5.0%.

The peroxide number of skipjack fish oil samples was 2.85 meq/kg. Peroxide number indicate the spoilage level of oil due to oxidation and stated in meq oil for each 1000 grams of oil. According to [16] the best peroxide number of fish oil for inter esterification reaction should has a value of less than 5 meq/kg.

In these samples the Iod number was 90.10. the evaluation of the unsaturated fatty acid, usually being measured by iod numbers, the longer the carbon chains the more double bounds (unsaturated). Generally, the high iod number indicated the high level of unsaturated [17]

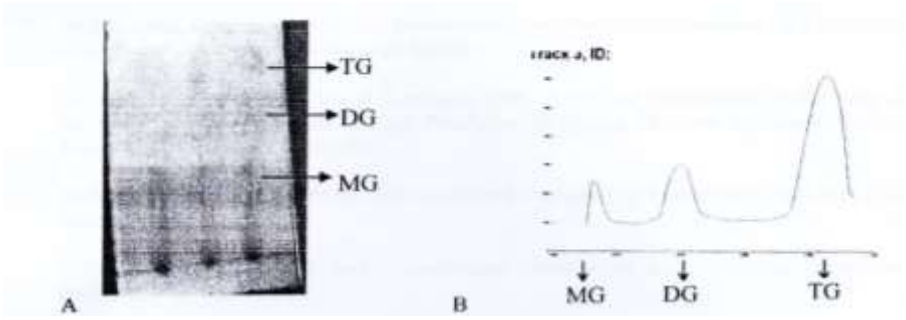
Saponification number of skipjack fish oil samples was 172.85 mg/grams, where for saponification number of fish oil there is no standard or maximum rate. The saponification number indicate the average molecular weight of a lipid[18]. Oil with high number of saponification means that the fatty acid molecule is scarcely react with a large amount of KOH, in other words, the molecules were in small sizes or reltively low molecular weight.

Cholesterol content on skipjack fish oil samples was 2.5%, its just fine for health. Cholesterol will interact with protein and soluble in water and transported to a variety body tissues. If LDL/VLDL are more high and HDL is inferior compared with to its normal level, there will be a plaque formed in the veined, due to the deposition of cholesterol.

Glyseride's profile composition

The glyceride profile composition of skipjack fish oil samples was consisted of 65% triglyceride, 20% diglyceride and 15% monoglyceride. The fish oilwhich contain large amount of monoglyceride and diglyceride components, possibly due to the fish oil extraction process. Monoglyceride and diglyceride fractions are tied-up with triglyserida, because in general, the extraction is carried out to take the gliceride component (asilglycerol), whitout differentiates whether it is mono-, di- or tri glyceride.

Triasilglycerol hydrolysis more easier compared to diasilglycerol and diasilglycerol hydrolysed more faster than monoasilglycerol. Thus it can be stated that triasilglycerol is a lot easier to hydrolyse whereas monoasilglycerol a lot easier to esterificated so that the direction of its reaction goes to the formation of diasilglicerol either through partial hydrolysis of trigliceride or partial esterification of monogliceride.



Gliceride TG DG & MG
A. = visualisation with iodin **B. TLC Scanner Camag**

Fatty acid Composition

The fatty acid profile of the skipjack fish oil samples analysed using GC MS were shown in Table 3.

Table 3. Fatty acid profile of skipjack fish oil samples.

Fatty acids	Concentration (% w/w)
C_{16}:0	26.69
C_{16}:1	3.26
C_{18}:0	12.19
C_{18}:1	21.62
C_{20}:5	21.34
C_{22}:4	3.75

Data in Table 3 showed that skipjack fatty acid as long chain saturated of fatty acid and unsaturated, namely with different concentration were C_{16}, C_{18}, C_{20} and C_{22}. The most abundant omega 3 fatty acid was EPA rather than DHA. Saturated fatty acids in these samples differentiated to *monoenoat* acids with C_{10} until C_{24} carbon chains and *polyenoat*acids with carbon chain from C_{16} until C_{26}, and majority fatty acids with carbon atom C_{20} and C_{22} [19].

Fat content variation and fatty acids composition of fish are affected by a lot of factors such as sex, body size, age, feed variation, geographycal positions, and season [20].

Conclusion

In conclusions it can be stated that skipjack fish oil from North Sulawesi have a physico-chemical properties that qualifies as food material and also as substrate for inter esterification reaction. The most abundant glyceride content of skipjack fish oil samples were triglyceride, followed by diglyceride and monoglyceride. While the fatty acids content in these samples mainly dominated by long chain bound of omega 3 unsaturated fatty acid (EPA).

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