EXTENDED ABSTRACT

FATTY ACID COMPOSITION AND QUALITY CHARACTERISTICS OF OIL EXTRACTED FROM HEAD OF SHORTFIN SCAD (*Decapterus macrosoma*)

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Abstract

The aim of this study is to investigate the oil yield, the fatty acid composition and physicochemical characteristics (iodine value, acid value and refractive index) of oil extracted from head of Shortfin scad. Oil was extracted using a modified Bligh and Dyer method. Fatty acid composition was determined using gas chromatography mass spectrometry. Total oil content of head of shortfin scad was 5.85 g /100g. The composition of fatty acid showed that saturated fatty acid content 37.97 % was the highest, followed by polyunsaturated fatty acids 35.14 % and monounsaturated fatty acids 13.41 %. Palmitic, Oleic, Linoleic, EPA and DHA acids were the major type of fatty acids observed in the head oil. Highest amount of omega-3 was accounted by 5.28 % of EPA and 15.78 % of DHA. Iodine value, Acid value and Refractive index of head oil were 139.17 I_2 /100g, 18.50 mg KOH/g and 1.4732 at 40 °C, respectively.

Keywords: Head waste, shortfin scad, fatty acid composition, omega-3

1. Introduction

During fish processing it generates about 50 % of the total fish weight as by-products, which are used to produce fish oil, fish meal, fish gelatin and consumable protein powders (Zuta et al., 2003). In fish processing heads, viscera, skin and frames are generally produced by-products which are discarded as waste or used to produce fertilizers or animal feeds. Among these large number of byproducts generates from fish processing industry is discarded as waste which creates both disposal and environmental pollution issues (Sahena et al., 2010).

Fish and fish waste contains adequate amount of lipids vary from 2-30 % depend on the species type, gender, feeding habits, size, geographical, and seasonal variation (Ramakrishnan et al., 2013). In fish species lipids are mainly deposited in the head, under the skin, in the flesh, in the entrails and mostly in livers. The oil from fish by product would be great sources of long chain polyunsaturated fatty acid especially such as docosahexaenoic acid and eicosapentaenoic acid which are categorized as Omega-3 (ω-3) fatty acids (Ferdosh et al., 2015). Avoiding cardiovascular disease and reducing risk of development of cancer are important role of Omega-3 fatty acids (Collett et al., 2001).

The Shortfin scad (*Decapterus macrosoma*) fish which belongs to the family Carangidae is pelagic fisheries resource which has commercial benefit in food supply and the fish processing industry (Ohshimo et al., 2006). Shortfin scad fish which categorised as dark fleshed fish are used directly

for human consumption or used to prepare processed food products like fish cracker, popular in Malaysia.

The Shorfinscad fish composed of myristic acid, stearic acid, palmitic acid and arachidic acid which are categorized as saturated fatty acids and oleic acid, palmitoleic acid, arachidonic acid, eicos-apentaenoic acid are the major unsaturated fatty acid found in fresh Shortfin scad fish (Manduapessy & Kaimudin., 2020). This research study is aimed to investigate the fatty acid composition as well as physicochemical properties of oil obtained from by-products mainly head of Shortfin scad (*Decapterus macrosoma*).

2. Methodology

2.1 Location of the Study

The research study was carried out at the laboratory of Department of Food Science & Technology, Faculty of Applied Sciences, University of Sri Jayewardenepura, Gangodawila, Nugegoda, Sri Lanka and at the Food laboratory of Bureau Veritas Consumer Products Sri Lanka.

2.2 Sample preparation

The Shortfin scad (*D. macrosoma*) was purchased from fish market and immediately de-headed and eviscerated. The heads of shortfin scad were collected and washed with plenty of water to eliminate the blood and impurities. The heads were stored at -18 °C for further analysis. For the experimental analysis, the head thawed and minced using blender to make the sample homogeneous.

2.3 Extraction of fat

Extraction of fat was done according to slightly modified Bligh and Dyer method described by Abd Aziz et al (Aziz et al., 2013).

2.4 Fatty acid analysis

The oil samples were transformed to their fatty acid methyl esters form according to the method used by Chandran et al. (Chandran et al., 2017). About 0.8 g of oil sample was added to the test tube and 3 ml of toluene was added into it. About 2.3g of pure sodium metal was weighted, and it was dissolved in 100 ml of methanol. About 1.5 ml was taken from above prepared solution and it was mixed with oil sample, which was prepared initially with toluene. Immediately the mixture was kept at 50 °C distilled water and 9 ml n-hexane were mixed with the sample. A layer separation was observed, and upper organic layer was removed with a dropper and put it in to test tube with small amount of anhydrous Na_2SO_4. The sample was transferred into GC Vials by using a syringe with filter. Gas chromatography (Model 7890 A, Agilent technologies) Mass Spectrometry (Model 5975 C inert XL El/CI MSD) analysis was done HP-5 ms nonpolar column. Temperature was automated from 80 °C to 200 °C with the increase speed of 5 °C/min. The temperature of injector was 250 °C. Helium was the carrier gas used at 1ml/min. About 100 kPa of pressure was maintained as internal pressure of the instrument.

2.5 Physicochemical properties of oil

Iodine value and Acid value were examined according to method described in AOCS method Cd 1b-87 (Barlow et al., 1997) and Cd 3d- 63 (Zhang et al., 2019); Refractive index was determined by using ISO 6320:2017(E)(Zhang et al., 2019) standard method.

3. Results and Discussion

In this the mean oil yield gained from head of the shortfin scad was 5.85 ± 0.54 %. The physicochemical parameters of oil extracted from head of shortfin scad has presented in Table 1.

Table 1: physicochemical properties of shortfin scad head oil

Quality Parameters	Head oil (Mean ± SD)
Iodine value (I_2 /100g)	139.17 ± 1.26
Acid value (mg KOH/g)	18.50 ± 0.14
Refractive index (At 40 °C)	1.4732 ± 0.00006

Iodine value (IV), acid value and refractive index are the physicochemical parameters which indicates the degree of unsaturation of oil and important to describe the quality of the fish oil.
Fatty acid profile of oil gained from head of shortfin scad has shown in Table 2 and percentage of SFAs, MUFAs and PUFAs of total fatty acids of oil extracted from head shortfin scad (*Decapterus macrosma*) has presented in Table 3.

Table 2: Major fatty acid found in head oil of Shortfin scad.

Fatty Acids	Fatty acid as (%) of total fatty acid
	Head oil
Saturated Fatty Acids (SFA)	
Myristic acid (C14:0)	5.05
Palmitic acid (C16:0)	26.47
Pentadecylic acid (C15:0)	1.37
Arachidic acid (C20:0)	1.64
Stearic acid (C18:0)	0.98
Monounsaturated Fatty Acids (MUFA)	
Oleic Acid (C18:1)	7.75
Palmitoleic acid (C16:1)	1.66
Heptadecenoic (C17:1)	2.68
Polyunsaturated Fatty Acids (PUFA)	
Linoleic acid (C18:2)	10.77
Docosahexaenoic (DHA) (C22:6)	15.78
Eicosapentaenoic (EPA) (C20:5)	5.28
Arachidonic acid (C20:4)	2.18
Eicosadienoic acid (C20:2)	0.16

Table 3 : SFA, MUFA and PUFA % of total fatty acids.

Fatty acid composition	Head Oil (%)
Total SFA	37.97
Total MUFA	13.41
ω3-PUFA	21.22
ω6-PUFA	12.95
Other PUFA	0.97
Total PUFA	35.14
Non identified	13.56
PUFA (ω6/ω3)	0.61

Results obtained from fatty acid composition analysis shows that head of Shortfin scad contained higher amount of total saturated fatty acids (37.97 %) than monounsaturated and polyunsaturated fatty acids. Among these myristic acid, palmitic acid, pentadecylic acid, arachidic acid and Stearic

acids are the major saturated fatty acids extracted from the head oil. The most dominant saturated fatty acid in head of Shortfin scad was Palmitic acid (C16:0, 26.47 %) respectively follows by Myristic acid (C14:0, 5.05 %) and Stearic acid (C18:0, 0.98 %). Head of shortfin scad contains 13.41 % of total monounsaturated fatty acids which is dominated by Oleic acid (C18:1, 7.75%).

Based on table 3 result the total PUFA content of oil extracted from head of Shortfin scad accounts 35.14 % from total fatty acids. Among the PUFAs docosahexaenoic acid, eicosapentaenoic acid, linoleic acid and arachidonic acid were the major constituents included 5.28, 15.78, 10.77 and 2.18% in head oil. The total omega-3 content of oil is based on content of docosahexaenoic acid (DHA), eicosapentaenoic (EPA) and alpha- linolenic acid (ALA). In marine species ω-3 PUFA is higher than the ω-6 (Sahena et al., 2010). This study shows that oil extracted from head of Shortfin scad contains higher amount of ω-3 PUFA than ω-6 PUFA. This occurs due to huge content of plankton in marine diet (Sahena et al., 2010).

4. Conclusion

Based on the result of fatty acid composition analysis it can be concluded that Palmitic acid (C16:0) is the predominant fatty acid in head oil. Next to the Palmitic acid, EPA and DHA have the highest values. Therefore, oil extracted from head of Shortfin scads (*Decapterus macrosma*) is potential source of Omega 3 fatty acids consist with eicosapentaenoic (EPA) and docosahexaenoic acid (DHA).

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