

Blending of *Chorella Patin* And Microalga Fish Oil as an Associated *Chorella* as Potential Health Food

Dewita^{1,*}, Syahrul¹, Taufik Hidayat², Mery Sukmiwati¹

Dewita^{1,*}, Syahrul¹, Taufik Hidayat², Mery Sukmiwati¹

¹Department of Aquatic Product Technology
Faculty Fisheries and Marine Science,
University of Riau, INDONESIA.

²Center of Agroindustry Technology,
Agency of Assessment and Application of
Technology, Puspiptek Serpong, INDONESIA.

Correspondence

Dewita

Department of Aquatic Product Technology
Faculty Fisheries and Marine Science,
University of Riau, INDONESIA.

E-mail: dewi_58@yahoo.co.id

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ABSTRACT

Objective: The use of health food supplements based on functional food components at this time has become a necessity for the community to maintain their health at optimum level. Functional food from fishery products is a food that is considered effective, because in addition to alternative food sources, the nutritional content is very good for health. This study aimed to produce high nutritional health food supplements from raw materials of *Chorella* enriched with catfish oil. The method used in making high nutritional health food supplements is a microencapsulation experimental method with different formulations. **Methods:** The experiment used organoleptic test, chemical component test with amino acids (HPLC) and Fatty acids (GC). **Result:** The results showed that the best formulations based on the profiles of amino acids, fatty acids and standard AAE per day, especially oleic and linoleic essential fatty acids were B formulations (2% *Chorella*, and 1% fish oil). **Conclusion:** The formulations B from the sample conducted in this research was the best formulations based on protein content, fat, essential amino acid profiles and essential fatty acids.

Key words: *Chorella*, Catfish oil, Health food supplements.

INTRODUCTION

Chorella sp. is one of microalgae that can grow in fresh water, brackish and salty and has a very good nutrient content. In dry conditions, it contains 55-60% protein, depending on the source.^{1,2} Microalgae is also rich gamma-linolenic (GLA), alpha-linolenic acid (ALA), linolenic acid (LA), stearidonic acid (SDA), eicosapentaenoic (EPA), docosahexaenoic acid (DHA), and arachidonic acid (AA).^{3,4} In addition, it is also a source of vitamins (vitamins B1, B2, B3, B6, B9, B12, vitamin C, vitamin D and vitamin E) and minerals (potassium, calcium, chrome, copper, iron, magnesium, manganese, phosphorus, selenium, sodium, and zinc). Considering the function of microalgae is very useful be used as a source of raw materials for health food supplements. Health Food Supplements have become a necessity for the community to maintain their health at the optimal level. However, health food supplements that circulating in the market today are relatively expensive, only affordable for the people of the group middle class and difficult for the lower classes of society.

Although the nutritional content is good, it still needs to be improved through fortification with other sources of nutrients such as catfish, because catfish are rich in amino acids and fatty acids, especially omega-9 fatty acids. According⁵⁻¹³ study showed that catfish which are processed into fish protein concentrates contain 79.6% protein; while the research of¹⁴ states that the fat content of catfish is rich in omega-9 fatty acids. On the other hand, microalgae *Chorella*, which is an organism from freshwater green algae of the type *Chorella pyrenoidosa*, is dark green and contains nutritional

components such as carbohydrates, chlorophyll, *Chorella* growth factor, vitamins and fiber.

Microalgae have great potential to produce various important biochemical compounds for food, medical treatment, research, and other uses and there are still many important undiscovered biochemical compounds from microalgae.¹² Thus, to produce a superior product, is needed functional components of food from other sources, especially catfish. so, it is necessary combined by encapsulation⁸, and the results of this combination are expected will form a high nutritional health food product and provide sensation comfortable for consumers. This study was to produce supplements high nutritious health food from *Chorella* enriched raw materials fish protein concentrate and catfish oil. This research was expected to produce the best formula for enriched microalgae-based health food supplements functional components of food from catfish which are good and appropriate. So, this research aimed to study to produce health food supplement products that can accepted by consumers and highly nutritious so that they can improve health *society*.

MATERIALS AND METHOD

Material and tools

The raw material used *Chorella* powder from Research and Development in from the government Riau province and catfish from farmers with catfish cultivation in Kampar district, Riau. The ingredients used for the manufacture of fish protein concentrate (KPI) are catfish (*Pangasius hypophthalmus*), 0.5 N NaHCO₃, 70% isopropyl alcohol (food grade), and packaging materials (aluminum paper and capsules). The materials used for analysis are ingredients for proximate analysis, amino acid profiles and fatty acids.

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The main tools needed in this study are 100 mesh sieves, oven (Memmert), Soxhlet tools, and spray drier instruments.

Research procedure

This research was carried out by an experimental method, which is to conduct experiments in making health food supplements by fortifying fish protein concentrates and catfish oil, on *Chorella* by encapsulation.⁴ These materials were obtained from microalgae dried *Chorella* cultivated for *Chorella* powder, while fish protein concentrates and catfish oil from the waste processing of catfish fillets in the form of flake meat, head, bone, tail and belly fat.

Food supplements produced from this study were processed by microencapsulation using a spray drier. Thus, this food supplement is a blend raw material for catfish, *Chorella* microalgae and encapsulated catfish protein concentrates. The coating material used was maltodextrin and twinn 80 (Table 1). The formulations used to produce health food supplements are functional components of fish protein concentrate food, fish oil and *Chorella* (Table 1).

Characterization of health food supplements

Characterization of health food supplements including analysis of protein, fat, amino acid profile and fatty acid profile were analyzed according to the.^{1,2} Data obtained from the results of this study were experimental design for analyzed Analysis of Varians (ANOVA).

RESULT

Nutritional content of food supplements

The nutritional content of health food supplements as a result of catfish oil blending, *Chorella* microalgae and encapsulated catfish protein concentrate can be seen in Table 2.

In Table 2 it can be seen that based on protein content, the best formulations were formulations B and C.

Profile amino acids food supplement

The essential amino acid content of health food supplements formulations B and C meets the standard AAE intake per day. All essential amino acids contained in health food supplements have their respective functions. As¹⁶ stated, methionine serves to help remove toxic substances in the liver, stimulate liver regeneration and reduce blood cholesterol levels; while leucine serves to help break down muscle proteins, helps healing fractures. Profile of essential amino acid health food supplements with various formulations can be seen in Table 3.

Profile of essential fatty acid health food supplements

Essential fatty acids are a type of fatty acid that is needed by the body for biological processes but cannot be produced by the body so it needs to be consumed through food. The essential fatty acid content of health food supplements produced from this study can be seen in Table 4.

Table 4 showed that the essential fatty acid content of health food supplements formulations B and C are higher than other formulations, especially oleic and linoleic fatty acids, because catfish oil is rich in fatty acids.³

DISCUSSION

Formulations B there was raw materials for protein sources, *Chorella* and fish protein concentrates. While other formulations are dominated by fat content. Furthermore according to^{6,15} Isoleucine is needed in the production and storage of protein by the body and the formation of hemoglobin, and the function of the thymus gland and pituitary gland, for optimal growth, maintaining nitrogen balance in the body, forming other non-essential amino acids, important for formation of

Table 1: Formulation (%) encapsulation of fish oil, *Chorella* and fish protein concentrates become health food supplements.

Formulation	MC (%)	MI (%)	KPI (%)	DT (%)	TW (%)	Water (%)
A	--	2	2	25	3	68
B	2	1	1	25	3	68
C	2	2	-	25	3	68
D	3	1	-	25	3	68
E	-	1	3	25	3	68

Noted: MC = Microalgae *Chorella*, MI = patin fishoil, KPI= Fish concentrate, DT= Dextrin TW= Twinn 80,

A= Fish oils + *Chorella* (60: 40)
 B= patin fish oil + *Chorella* + KPI (20: 40)
 C= Fish oil + *Chorella* + KPI (30:35)
 D= Fish oil + *Chorella* (40: 60)
 E= Fish oil + = KPI (40: 60)

Table 2: Nutritional value of food supplements made from catfish, *Chorella*, and catfish protein concentrates based on the formulation.

Nutrition	Formulation food supplement				
	A	B	C	D	E
Protein	5.83 ± 0.5 ^c	16.9 ± 0.56 ^a	14.69 ± 0.35 ^a	9.93 ± 0.5 ^b	10.32 ± 0.5 ^b
Fat	13.24 ± 0.4 ^a	11.88 ± 0.32 ^c	12.44 ± 0.25 ^b	13.19 ± 0.15 ^a	12.99 ± 0.5 ^b

Noted:

A= Fish oils + *Chorella* (60: 40)
 B= patin fish oil + *Chorella* + KPI (20: 40)
 C= Fish oil + *Chorella* + KPI (30: 35)
 D= Fish oil + *Chorella* (40: 60)
 E= Fish oil + = KPI (40: 60)

Table 3: The essential amino acid content of food supplements with various formulations.

Amino acids	Formulation Food Supplement					
	Essential	A	B	C	D	E
Threonine	0.7 ± 0.4 ^a	2.21 ± 0.3 ^b	2.04 ± 0.5 ^b	0.14 ± 0.4 ^c	0.61 ± 0.4 ^c	1.8
Methionine	0.31 ± 0.5 ^b	0.96 ± 0.4 ^a	0.88 ± 0.6 ^a	0.02 ± 0.5 ^c	0.32 ± 0.5 ^b	1.44
Valine	0.92 ± 0.3 ^b	3.26 ± 0.5 ^a	3.52 ± 0.4 ^a	0.20 ± 0.7 ^c	0.79 ± 0.6 ^b	2.7
Phenylalanine	0.74 ± 0.2 ^b	2.23 ± 0.7 ^a	2.41 ± 0.3 ^a	0.16 ± 0.5 ^c	0.62 ± 0.3 ^b	1.8
Isoleucine	0.96 ± 0.6 ^b	3.28 ± 0.2 ^a	3.54 ± 0.2 ^a	0.21 ± 0.4 ^c	0.82 ± 0.2 ^b	2.7
Leucine	1.48 ± 0.1 ^b	4.42 ± 0.1 ^a	3.82 ± 0.5 ^a	0.31 ± 0.3 ^c	1.27 ± 0.5 ^b	3.06
Lysine	1.44 ± 0.4 ^b	3.22 ± 0.2 ^a	3.61 ± 0.3 ^a	0.14 ± 0.1 ^c	1.24 ± 0.6 ^b	2.7

A= Fish oils + *Chorella* (60: 40)B= patin fish oil + *Chorella* + KPI (20: 40)C= Fish oil + *Chorella* + KPI (30: 35)D= Fish oil + *Chorella* (40: 60)

E= Fish oil + = KPI (40: 60)

Different notations show real differences (P<0.05).

Table 4: The essential fatty acid content of health food supplements with various formulations.

Fatty Acid	Formulation Food Suplemen				
	A	B	C	D	E
Oleate	35.68 ± 0.2 ^c	43.57 ± 0.2 ^a	39.88 ± 0.3 ^b	39.77 ± 0.3 ^b	38.23 ± 0.1 ^b
Linoleate	9.57 ± 0.1 ^c	11.63 ± 0.4 ^a	11.04 ± 0.4 ^a	11.27 ± 0.3 ^a	10.65 ± 0.3 ^b
Linolenate	0.3 ± 0.3 ^c	0.99 ± 0.5 ^a	0.84 ± 0.5 ^b	0.3 ± 0.5 ^c	0.89 ± 0.4 ^b
Arachidonate	0.39 ± 0.5 ^b	0.49 ± 0.5 ^a	0.46 ± 0.5 ^a	0.31 ± 0.3 ^b	0.25 ± 0.5 ^c
eikosatrienate	0.41 ± 0.4 ^a	0.41 ± 0.3 ^a	0.40 ± 0.4 ^a	0.41 ± 0.5 ^a	0.41 ± 0.6 ^c
Dokosaheksanoate	0.19 ± 0.3 ^b	0.24 ± 0.2 ^a	0.15 ± 0.3 ^b	0.09 ± 0.4 ^c	0.07 ± 0.4 ^c
Eikosadienate	0.26 ± 0.5 ^c	0.35 ± 0.1 ^a	0.33 ± 0.3 ^a	0.31 ± 0.2 ^b	0.32 ± 0.3 ^b

A= Fish oils + *Chorella* (60: 40)B= patin fish oil + *Chorella* + KPI (20: 40)C= Fish oil + *Chorella* + KPI (30: 35)D= Fish oil + *Chorella* (40: 60)

E= Fish oil + = KPI (40: 60)

Different notations show real differences (P<0.05).

hemoglobin and stabilize blood sugar levels. Phenylalanine is needed to improve mood, endocrine levels and aphrodisiacs.^{7,14}

Valina is useful for growth, in the nervous and digestive systems, helps disorders of the muscles of the muscles, mental, emotional, insomnia and nervousness, stimulates muscle coordination, repair damaged tissue, and maintains nitrogen balance in the body.^{9,11} Oleic Acid is a fatty acid MUFA group (mono unsaturated fatty acid) which has a structure of 18: 1 D9 with the formula molecule CH₃ (CH₂)₇ C = C (CH₂)₇ COOH, and is an omega -9 group because it has a double bond at position 9 from the end of the chain.¹⁰

CONCLUSION

The results of the research have concluded that the nutritional content of health food supplements as a result of catfish oil blending, catfish and *Chorella* protein concentrates encapsulated with several formulations showed that formulations B combination patin fish oils, *Chorella*, dan KPI were the best formulations based on protein content, fat, essential amino acid profiles and essential fatty acids.

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CONFLICTS OF INTEREST

The authors declare no conflicts of interest.

AUTHOR CONTRIBUTION

Dewita: Analyzed of formulation.

Syahrul: contributed about technology formulation.

Taufik Hidayat: contributed about amino acid analysis, fat analysis, statistical analysis, and edit manuscript.

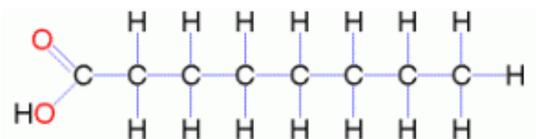
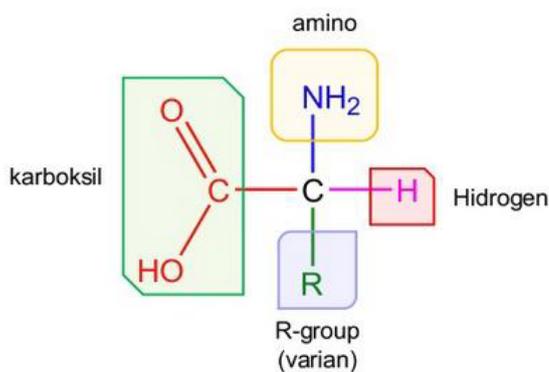
Merry Sukmiwaty: contributed about technology formulation and make KPI.

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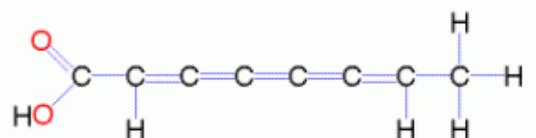
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GRAPHICAL ABSTRACT



Saturated



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ABOUT AUTHORS



Prof. Dr. Ir Dewita

Birth: T. Bonai L. Buo, 22-5-1957
E-mail: dewi_58@yahoo.co.id
Study:
S1 (University of Riau)
S2 (IPB UNiversity)
S3 (Hassanudin University)
Bidang: Handling Aquatic Product/ Fish Processing



Ir. SYAHRUL, MS

NIP: 19590214 198603 1 002
Birth: Jakarta, 14-2-1959
E-mail: syahrul_roel59@yahoo.com
Study:
Bachelor's degree (Fak.Perikanan Unri)
Magister of Science (Ilmu Pangan IPB)
Focus: Food Microbiology



Taufik Hidayat, MSc

Taufik Hidayat MSc, is the engineer of the Agency for the Assessment and Application of Technology working in the field of Fishery Product Processing. At the time of writing, Taufik Hidayat was one of the founders and commissioners of Seaweed House, a technology-based industrial company. It has a strong relationship in the world of fisheries processing. He was once the strong coastal village study team of the Ministry of Maritime Affairs and Fisheries. At present, he is Deputy Secretary General of the Indonesian Fisheries Product Processing Society (MPHPI).

After completing his Master of Science at Bogor Agricultural University, he did a lot of research and teaching in the field of raw materials for aquatic products, especially seaweed. He has also written 5 books, 45 national and international reputable articles, and 5 newspaper articles published by Padang Ekspres. In addition, he is also an editor and reviewer in several scientific journals. He can be contacted via email: taufik.hidayat@bppt.go.id



Dr. Mery Sukmiwaty

TTL Pekanbaru, 28-7-1964
e-mail: merysarmin@yahoo.com
Study:
Bachelor's degree S1 University of Riau
Magister S2 Andalas University
Doctor: S3 Andalas University
Bidang: Bioactive Compound

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