INTRODUCTION

Chlorella 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. 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). 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. According study showed that catfish which are processed into fish protein concentrates contain 79.6% protein, while the research of states that the fat content of catfish is rich in omega-9 fatty acids. On the other hand, microalgae Chlorella, is an organism from freshwater green algae of the type Chlorella pyrenoidosa, is dark green and contains nutritional components such as carbohydrates, chlorophyll, Chlorella 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. Thus, to produce a superior product, is needed functional components of food from other sources, especially catfish. so, it is necessary combined by encapsulation, 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 nutritional health food from Chlorella 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 Chlorella 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 hypopthalmus), 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 Chlorella by encapsulation. These materials were obtained from microalgae dried Chlorella cultivated for Chlorella 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, Chlorella 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 Chlorella (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. 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, Chlorella 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. As 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.

DISCUSSION

Formulations B there was raw materials for protein sources, Chlorella and fish protein concentrates. While other formulations are dominated by fat content. Furthermore according to 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

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

| Formulation | MC (%) | MI (%) | KPI (%) | DT (%) | TW (%) | Water (%) |
|-------------|--------|--------|---------|--------|--------|-----------|
| A           | 2      | 2      | 25      | 3      | 68     |           |
| B           | 2      | 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 Chlorella, MI = patin fishoil, KPI= Fish concentrate, DT= Dextrin
TW= Twinn 80,
A= Fish oils + Chlorella (60: 40)
B= patin fish oil + Chlorella + KPI (20: 40)
C= Fish oil + Chlorella + KPI (30:35)
D= Fish oil + Chlorella (40:60)
E= Fish oil + = KPI (40:60)

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

| Nutrition | A       | B       | C       | D       | E       |
|-----------|---------|---------|---------|---------|---------|
| Protein   | 5.83 ± 0.5  | 16.9 ± 0.56  | 14.69 ± 0.35  | 9.93 ± 0.5  | 10.32 ± 0.5  |
| Fat       | 13.24 ± 0.4  | 11.88 ± 0.32  | 12.44 ± 0.25  | 13.19 ± 0.15  | 12.99 ± 0.5  |

Noted:
A= Fish oils + Chlorella (60: 40)
B= patin fish oil + Chlorella + KPI (20: 40)
C= Fish oil + Chlorella + KPI (30:35)
D= Fish oil + Chlorella (40:60)
E= Fish oil + = KPI (40:60)
Valine is useful for growth, in the nervous and digestive systems, helps disorders 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)₇C=C. It is an omega-9 group because it has a double bond structure of 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: Anlayzed 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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Table 3: The essential amino acid content of food supplements with various formulations.

| Amino acids | A     | B     | C     | D     | E     | F     |
|-------------|-------|-------|-------|-------|-------|-------|
| Threonine   | 0.7 ± 0.4 | 2.21 ± 0.3 | 2.04 ± 0.5 | 0.14 ± 0.4 | 0.61 ± 0.4 | 1.8   |
| Methionine  | 0.31 ± 0.35 | 0.96 ± 0.4 | 0.88 ± 0.6 | 0.02 ± 0.5 | 0.32 ± 0.5 | 1.44  |
| Valine      | 0.92 ± 0.3 | 3.26 ± 0.5 | 3.52 ± 0.4 | 0.20 ± 0.7 | 0.79 ± 0.6 | 2.7   |
| Phenylalanine| 0.74 ± 0.2 | 2.23 ± 0.7 | 2.41 ± 0.3 | 0.16 ± 0.5 | 0.62 ± 0.3 | 1.8   |
| Isoleucine  | 0.96 ± 0.6 | 3.28 ± 0.2 | 3.54 ± 0.2 | 0.21 ± 0.4 | 0.82 ± 0.2 | 2.7   |
| Leucine     | 1.48 ± 0.1 | 4.42 ± 0.1 | 3.82 ± 0.5 | 0.31 ± 0.3 | 1.27 ± 0.3 | 3.06  |
| Lysine      | 1.44 ± 0.4 | 3.22 ± 0.2 | 3.61 ± 0.3 | 0.14 ± 0.1 | 1.24 ± 0.6 | 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 (60: 40)
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 | A     | B     | C     | D     | E     | F     |
|------------|-------|-------|-------|-------|-------|-------|
| Oleate     | 35.68 ± 0.2 | 43.57 ± 0.2 | 39.88 ± 0.3 | 39.77 ± 0.3 | 38.23 ± 0.1 |
| Linoleate  | 9.57 ± 0.1  | 11.63 ± 0.4 | 11.04 ± 0.4 | 11.27 ± 0.3 | 10.65 ± 0.3 |
| Linolenate | 0.3 ± 0.3   | 0.99 ± 0.5  | 0.84 ± 0.5  | 0.3 ± 0.5   | 0.89 ± 0.4  |
| Arachidonate| 0.39 ± 0.5 | 0.49 ± 0.5  | 0.46 ± 0.5  | 0.31 ± 0.3  | 0.25 ± 0.5  |
| Eicosatrienate| 0.41 ± 0.4 | 0.41 ± 0.4  | 0.40 ± 0.4  | 0.41 ± 0.5  | 0.41 ± 0.6  |
| Docosahexaenoate| 0.19 ± 0.3 | 0.24 ± 0.2  | 0.15 ± 0.3  | 0.09 ± 0.4  | 0.07 ± 0.4  |
| Eicosadienate | 0.26 ± 0.5 | 0.35 ± 0.1  | 0.33 ± 0.3  | 0.31 ± 0.2  | 0.32 ± 0.3  |

A= Fish oils + Chorella (60: 40)
B= patin fish oil + Chorella + KPI (20: 40)
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GRAPHICAL ABSTRACT
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ABOUT AUTHORS

Prof. Dr. Ir Dewita
Birth: T. Bonai L. Buu, 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 Ekspress. 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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