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Acanthaster plancias a Potential Source of Protein and Amino Acids for Fish Feed Ingredients

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ABSTRACT

Acanthaster planci becomes a pest for coral reef ecosystems if its presence is excessive. Knowing the nutrient and amino acid content of Acanthaster planci as fish feed ingredients is the goal of this study. The test sample was taken in the waters of Tolo Bay, Process that was dried for 5 days and then ground until smooth. Samples were taken and analyzed for their nutrient and amino acid content. A duplo test was performed for each sample. The results showed that the nutrient content of Acanthaster planci flour included crude protein, crude fat extract without nitrogen and ash, respectively, at 28.58, 8.79, 2.94, and 45.56%. In addition, Acanthaster planci contains high essential amino acids including leucine, valine, isoleucine, methionine, and tryptophan respectively at 29888.85, 16142.82, 14805.09, 3272.04 and 2267.67 mg/kg dry weight. High protein and essential amino acids indicate Acanthaster planci flour has potential as fish feed ingredients.

Key word : *Acanthaster planci, Essential amino acids, Protein*

Introduction

Tolo Bay is one of the bays in the province of Central Sulawesi, Indonesia. This water area has a coral reef ecosystem that is classified as good. However, at a certain time it will experience a decline due to *Acanthaster planci* experiencing an increase in population (Mansyur *et al*., 2018). *Acanthaster planci* under normal conditions (10-20 individuals/m^2) act as controllers of coral ecology (Alustco *et al*., 2011) and become prey for reef fish, molluscs and lobsters (Alustco *et al*., 2011). Population explosions (>20 individuals/m^2) of these organisms become predators of corals (Ruli *et al*., 2020), and can kill corals with an area of 78 % within 6 months (Suharsono, 1991).

Efforts were made to overcome the population explosion of *Acanthaster planci* such as catching, drying and stockpiling or burning it on land (Suharsono, 1991). These efforts provide ecological value to the waters because coral damage can be minimized, on the other hand *Acanthaster planci* has not been utilized so that it has no economic value, especially at the sampling location. Sampling locations in coastal areas and which have the potential to increase fish volume. Currently, research on fish feed raw materials leads to local resources (Fitriadi *et al.,* 2020; Fitria *et al*., 2020; Amin *et al*., 2020). Local raw materials are used as formulations for human food (Pratama *et al*., 2020) or aquaculture commodity feed (Amin *et al*., 2017; Amin, 2018; Budiman *et al*., 2020) This research was conducted to determine the nutrient and amino acid content of *Acanthaster planci* obtained from Tolo Bay waters as fish feed ingredients.

Materials and Methods

Sampling and Testing Locations

Acanthaster planci samples were obtained from the waters of Tolo Bay, Kolo Bawah Village, Momosalato District, North Morowali Regency, Central Sulawesi Province. Nutrient content analysis of samples was carried out at the Nutrition Laboratory of the Faculty of Animal Husbandry and Fisheries, Tadulako University. Amino Acid Analysis at the Saraswanti Indo Genetech Laboratory, Bogor, Indonesia.

Sample Preparation and Analysis

A total of 30 adult-sized *Acanthaster planci* samples (body diameter >13 cm and weight >300 g), were dried manually using sunlight (Safir *et al*., 2020). The drying process is for 5 days or until the sample looks stiff and hard, then the material is ground using a grinding machine and sieved to separate the particles by volume. 250 g of sieve samples were taken to analyze the nutrient content (50 g) and amino acids (200 g).

The nutrient content of the test samples were analyzed according to Safir *et al*. (2020) includes crude protein, crude fat, ash content, crude fiber, extracts without nitrogen and water content. Proximate analysis referring to the AOAC method (2007). The water content was calculated by comparing the difference between the samples before and after being dried in an oven at 105 °C for 3 hours (Takeuchi, 1998). Protein content was determined by the Kjeldahl method. Fat content was measured using the Soxhlet method. The procedure for analyzing the nutrient content of the ingredients follows Safir *et al*. (2020). Analysis of the amino acid content of valine, alanine, arginine, glycine, lysine, serine, glutamic acid, phenylalanine, isoleucine, aspartic acid, leucine, tyrosine, proline, threonine, histidine using the 18-5-17/MU/SMM-SIG (Ultra) method. Performance Liquid Chromatography/UPLC). Analysis of the amino acid content of cysteine and methionine using the 18-12-38/MU/SMM-SIG (Liquid Chromatography-Mass Spectrophotometer/LC-MS) method and the amino acid tryptophan using the 18-5-63/MU/SMM-SIG method (High Performance Liquid Chromatography/HPLC). Each sample test with *duplo* technique.

Data Analysis

Nutrient and amino acid content of *Acanthaster planci* flour were analyzed descriptively and tables.

Results

Nutrient content and amino acid profile of *Acanthaster planci* flour

The nutrient content of *Acanthaster planci* flour is presented in Table 1. Test results showed that *Acanthaster planci* flour with a moisture content of 3.9% had nutrient content including crude protein, crude fat, crude fat, Nitrogen-Free Extract of 28.58, 8.79 and 2.94%. In addition, *Acanthaster planci* has an ash content of 45.56%.

Table 1. Nutrient content of *Acanthaster planci* flour

Ingridients (%)	Repetition		Avarage±
	I	II	
Crude Protein	28.62	28.54	28.58±0.06
Crude Fat	8.80	8.78	8.79±0.01
Crude Fiber	10.37	10.11	10.24±0.18
Ash	45.61	45.51	45.56±0.07
Nitrogen-Free Extract	2.78	3.09	2.94±0.22
Water	3.82	3.97	3.90±0.11

The amino acid content of *Acanthaster planci* flour is presented in Table 2. The results show that *Acanthaster planci* flour contains 18 types of amino acids including 10 essential and 8 non-essential amino acids. The essential amino acids with the highest to the lowest values were leucine, valine, isoleucine, methionine and tryptophan, and 5 of them were not detected at each detection limit. The non-essential amino acid cysteine has the highest value compared to other amino acids.

Discussion

The highest macronutrients found in *Acanthaster planci* flour were protein (28.58%) then fat (8.79%) and Nitrogen-Free Extract (2.94%). This result is higher than that reported by Luo *et al*. (2011) with a protein content of 21.0% per dry weight of *Acanthaster planci* samples. Differences in nutrient levels of the test sample can be influenced by the size of the weight, phase and condition of the population (population explosion) when sampling. The size of the body weight and is in the reproductive phase, the body's nutrient levels generally increase. *Acanthaster planci* population explosion conditions,

Table 2. *Acanthaster planci* flour amino acid content

Num	Amino Acid (mg/kg)	Limit of detection	Repetition I	Repetition II	Average ± std
Essential amino acids					
1	Methionine	-	3273.34	3270.74	3272.04
2	Arginie*	45.99	*Nd*	*Nd*	*Nd*
3	Threonine	71.88	*Nd*	*Nd*	*Nd*
4	Triptophan	-	2289.12	2246.21	2267.67
5	Histidine	40.86	*Nd*	*Nd*	*Nd*
6	Isoleusine	-	14750.51	14859.67	14805.09
7	Lysine	46.95	*Nd*	*Nd*	*Nd*
8	Leucine	-	29764.49	30013.2	29888.85
9	Phenylalanine	35.22	*Nd*	*Nd*	*Nd*
10	Valine	-	16081.04	16204.59	16142.82
Non-essential amino acids					
1	Aspartic acid	119.93	*Nd*	*Nd*	*Nd*
2	Glutamic acid	118.35	*Nd*	*Nd*	*Nd*
3	Tyrosine	-	264.21	261.52	262.865
4	Proline	-	338.11	339.64	338.875
5	Serine	-	<830.17	<830.17	-
6	Alanin	-	<338.66	<338.66	-
7	Cystine	-	6722.01	6717.05	6719.53
8	Glycine	-	<402.00	<402.00	-

Ket: Nd =Not detection; * semi-essential amino acids

illustrates that water conditions such as high levels of nutrients from land entering the sea, loss of predators, decreased salinity and increased water temperatures are all suitable for the growth of *Acanthaster planci* (Ikhsan *et al*., 2013). These three factors are thought to be the cause of differences in the nutrient content of *Acanthaster planci*. The results of this study, as evidenced by the ash content (45.56%) is higher than the results of research by Luo *et al*. (2011) which is 21.6%. High ash content has a positive correlation with the size of *Acanthaster planci*. The larger the size, the higher the inorganic mineral content because the main structure of the shell and spines (Arifin, 2008).

The content of essential amino acids such as leucine, valine, isoleucine, methionine and tryptophan from *Acanthaster planci* flour was higher than Luo *et al*. (2011) for *Acanthaster planci* and fish meal. The high levels of amino acids in this study were related to the high protein content of *Acanthaster planci* because amino acids are the simplest form of protein. Levels of non-essential amino acids such as cysteine in the study were high (6719.53). Cysteine is an amino acid that can be formed from mentionine as its precursor, so that high cysteine is thought to be influenced by the high content of methionine. Cysteine contains sulfur like methionine. One of the functions of sulfur from these amino acids is as a precursor of carnitine and glutathione which play a role in protecting cells against oxidative stress (Fang *et al*., 2002; Andri *et al*., 2020). The presence of high amino acids from *Acanthaster planci* flour indicates this material has potential as a fish ingredient. As reported by Luo *et al*. (2011) that the amino acids tryptophan, lysine, histidine, arginine, threonine, valine, methionine, iso-leucine, leucine, phenylalanine and tyrosine are essential amino acids for aquatic organisms including tilapia.

References

Alustco, S., Wardiatno, Y. and Setyobudiandi, I. 2011. Kajian keterkaitan ekologi *Acanthaster planci* dan ekosistem terumbu karang di Kabupaten Bintan. *Jurnal Ilmu-Ilmu Perairan dan Perikanan Indonesia.* 17 (1) : 177–185.

Amin, M. 2018. Marine protease-producing bacterium and its potential use as an abalone probiont. *Aquaculture Reports*. 12 : 30–35.

Amin, M., Bolch, C. C. J., Adams, M. B. and Burke, C. M. 2017. Isolation of alginate lyase-producing bacteria and screening for their potential characteristics as abalone probionts. *Aquaculture Research.* 48(11) : 5614–5623.

Amin, M., Adams, M.B., Burke, C.M. and Bolch, C.J.S. 2020. Isolation and screening of lactic acid bacteria associated with the gastrointestinal tracts of abalone at various life stages for probiotic candidates. *Aquaculture Reports.* 17 : 100378

Andri, Harahap, R.P. and Tribudi, Y.A. 2020. Estimation and Validation of Methionine, Lysine, and Threonine Amino Acids from grain feedstuff as protein source. *Jurnal Nutrisi Ternak Tropis.* 3 (1) : 18-22.

AOAC [Association of Official Analytical Chemists], 2007 *Official Methods of Analysis,* 18th edition, 2nd revision. AOAC International, Gaithersburg, Maryland, USA, 2451 pp.

Arifin, Z. 2008. Beberapa Unsur Mineral Esensial Mikro dalam Sistem Biologi and Metode Analisisnya. *Jurnal Litbang Pertanian.* 27 (3) : 99-105

Budiman, Y.G., Lamid, M., Rahardja, B.S. and Amin, M. 2020. Utilization of fermented Seligi leaf flour *Phyllanthus buxifolius* toward the specific growth rate, daily growth rate and survival rate of siam catfish (*Pangasius pangasius*). *IOP Conf. Ser.: Earth Environ. Sci.* 679 012040

Fang, Y.Z., Yang, S. and Wu, G. 2002. Free radicals, antioxidants, and nutrition. *Nutrition.* 18 (10) : 872-879.

Fitriadi, R., Hasan, V., Palupi, M., Kusuma, B., Soedibya, P.H.T. and Putra, J.J. 2020. The effect of drying expired sausage waste on its. *Eco. Env. & Cons.* 26 (4): 1744-1746.

Fitria, P. D., Amin, M., Lokapirnasari, W. P. and Lamid, M. 2020. Supplementation of fermented coffee-peel flour to increase high-density lipoprotein (HDL) cholesterol, docosahexaenoic acids (DHA) and eicosapentaenoic acids (EPA) deposition in tilapia fillet. *Biocatalysis and Agricultural Biotechnology* 101502.

Ikhsan, N., Baru, B. and Romy, K. 2013. Kelimpahan *Acanthaster planci* pada perairan terumbu karang di Pulau Bero, Selat Tiworo, Kabupaten Muna, Sulawesi Tenggara. *Jurnal Mina Laut Indonesia.* 2 (6) : 59-68.

Luo, P., Hu C., Xia, J., Ren, C. and Jiang, X. 2011. Chemical constituent analysis of the crown-of-thorns starfish *Acanthaster planci* and potential utilization value of the starfish as feed ingredient for animals. *African Journal of Biotechnology.* 10 (62) : 13610-13616

Mansyur, K., Rizal, A., Tis'in, M., Nurdin, M.S. and Susanti, N. 2019. Growth and survival rate of coral transplantation at Tiaka Oil Field, Tolo Bay,Central Sulawesi. *Prosiding Simposium Nasional Kelautan dan Perikanan VI Universitas Hasanuddin, Makassar.*

Pratama, W.W., Nursyam, H., Hariati, A.M., Islamy, R.A. and Hasan, V. 2020. Short Communication: Proximate analysis, amino acid profile and albumin concentration of various weights of Giant Snakehead (*Channa micropeltes*) from Kapuas Hulu, West Kalimantan, Indonesia. *Biodiversitas.* 21 : 1196-1200

Ruli, F., Alik, R., Polnaya, D., Nurjirana, N., Sufardin, and Afrisal, M. 2020. Kelimpahan *Acanthaster planci* dan Tutupan Karang Hidup Di Perairan Pulau Saparua, Provinsi Maluku. *Jurnal Penelitian Perikanan Indonesia.* 26 (2): 125-133.

Safir, M., Tobigo, D.T., Mansyur, K., Livia, and Nur'aidah. 2020. Potensi Ikan *Osteochilus hasselti* Sebagai Bahan Baku Lokal Untuk Pakan Dalam Kegiatan Budidaya Ikan Di Danau Rano. Kauderni. *Journal of Fisheries, Marine and Aquatic Science.* 2 (2) : 114-118.

Suharsono. 1991. Bulu Seribu (*Acanthaster planci*). *Oseana.* XVI (3) : 1-7.

Takeuchi, T. 1988. *Laboratory work-cheical evaluation of dietary nutrients. In: Fish Nutrition and Mariculture* (ed. by T. Watanabe). Kanagawa International Fisheries Training Center, Japan International Cooperation Agency, Kanagawa. Hal. 179-233.