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Potential of yellow velvetleaf (*Limnocharis flava*) as protein source for fish feed

Potensi tanaman genjer (*Limnocharis flava*) sebagai sumber protein pada pakan ikan

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Abstract

Yellow velvetleaf (Limnocharis flava) is one of aquatic plant which lives by floating on the water. This plant is recognized as vegetable and source of bioactive components. This experiment was purposed to analyze proximate composition of yellow velvetleaf leaves and stems for some parameters such as water content, ash, fat, protein, fibre, and total carotenoid. The methods of this experiment were proximate analysis and total carotenoid analysis of fresh yellow velvetleaf's leaves and stems. Result of the experiment showed that fresh yellow velvetleaf's leaves contained water content at 91.76% (wet basis), ash at 12.4% (dry basis), fat at 7.95% (dry basis), protein at 22.96% (dry basis), fibre at 11.93% (dry basis), and total carotenoid at 219.01 µg/g. While stems of yellow velvetleaf plant had contents of water at 95.33% (wet basis), ash at 16.38% (dry basis), fat at 5.62% (dry basis), protein at 13.23% (dry basis), fibre at 16.12% (dry basis), and total carotenoid at 92.99 µg/g. Based on its protein and total carotenoids component, yellow velvetleaf leaves had potential as protein source and carotenoid source for fish feed.

Keyword: Yellow velvetleaf; Proximate composition; Leaves; Stems; Total carotenoids

Abstract

Tanaman genjer (*Limnocharis flava*) merupakan salah satu tanaman air yang hidup mengapung di air. Tanaman ini dikenal sebagai sayuran dan sumber komponen bioaktif. Penelitian ini bertujuan untuk menganalisa komposisi proksimat dari daun dan batang genjer untuk beberapa parameter, yaitu kadar air, abu, lemak, protein, serat, dan total karotenoid. Metode penelitian ini adalah analisis proksimat dan analisis total karotenoid dari daun dan batang genjer segar. Hasil penelitian menunjukkan bahwa daun genjer segar mengandung kadar air 91,76% (basis basah), abu 12,4% (basis kering), lemak 7,95% (basis kering), protein 22,96% (basis kering), serat 11,93% (basis kering), dan total karotenoid 219,01 µg/g. Sedangkan batang dari genjer segar mengandung kadar air 95,33% (basis basah), abu 16,38% (basis kering), lemak 5,62% (basis kering), protein 13,23% (basis kering), serat 16,12% (basis kering), dan total karotenoid 92,99 µg/g. Berdasarkan komponen protein dan total karotenoidnya, daun tanaman genjer memiliki potensi sebagai sumber protein dan karotenoid untuk pakan ikan.

Kata kunci: Genjer; Komposisi proksimat; daun; batang; Total karotenoid

1. Introduction

Yellow velvetleaf (Limnocharis flava) is an aquatic plant which is involved into family Limnocharitaceae (Haynes and Les, 2004). This plant is a native plant of tropical and subtropical region in America. The existence of yellow velvetleaf is influenced by land uses or land cover pattern, water depth, nutrient, and association with another species (Abhilash et al., 2008).

The utilization of yellow velvetleaf can be implemented for human, environment, and livestock. Commonly, this plant is consumed by human as vegetable due to its fibre. Furthermore, yellow velvetleaf is also used as livestock feed and fish feed, phytofiltration plant for eliminating pollution in the water, an ornamental plant in pond, and fertilizer (Abhilash et al., 2009). According to Maisuthisakul et al. (2008) and Ogle et al. (2001), yellow velvetleaf has high content of bioactive compounds and total carotenoid, whereas total carotenoid of yellow velvetleaf was 50 µg/g.

As livestock and fish feed, yellow velvetleaf can provide some nutrients needed by livestock especially fish. The first nutrient that is important in fish feed is protein. Protein is used by fish as the main energy source in where the protein necessary of fish diverses in each fish. Moreover, protein has important role

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in increment of fish growth. Feedstuff as protein source should have protein content higher than 20% and fibre content is less than 18%. However, the use of feedstuff as protein source arises some problem related to high price and availability of stuff. Limitation of plant protein sources which are cheap and easy tobe found become an obstacle for fish farmer and feed maker. Therefore, exploration of an alternative plant protein source has tobe done as solution of protein availability in feed.

Carotenoids are pigment compounds that are yellow, orange, yellowish red and have properties to dissolve in lipid. Those coumpounds are existed in chloroplast of leaf (0.5%) and being with chlorophyll (9.3%) (Winarno, 2008). Carotenoids have been applicated traditionally in food and animal feed whereas it can increase color properties of them. The carotenoids are also used to reinforce fish color purposed to increase consumer's perception. Evaluation of total carotenoids in yellow velvetleaf should be done to explore carotenoids source and to increase its value as fish feed.

This experiment was done to evaluate proximate composition and total carotenoids in yellow velvetleaf as fish feed, primarly in leaf and stem of plant. Furthermore, it can be useful to provide information related to protein source and total carotenoids source for farmer and feed maker.

2. Material and method

This experiment was conducted on April 2010 to August 2010. The experiment took place at Laboratory of Aquatic Product Technology Department, Bogor Agricultural University, Indonesia. Location of taking samples was at Situ Gede District, Bogor-Indonesia.

The main materials were fresh yellow velvetleaf's leaves and stems. Some materials used in proximate analysis and total carotenoid analysis were water, K_2SO_4, selenium, H_2SO_4, H_2O_2, boric acid 4%, NaOH, $Na_2S_2O_3$, HCl 0.2 M, n-hexane, alcohol, KOH 5% in methanol, acetone, N_2 gas, Na_2SO_4. The instruments of this experiment were oven, boiler, porcelen, desicator, balance, furnace, filter paper, cotton, sample cover, soxhlet equipments, erlenmeyer, glass, kjeldahl equipments, measurement glass, volumetric pipette, Buchner funnel and spectrophotometer.

The methods conducted in this experiment consisted of two parts namely proximate analysis and total carotenoid analysis. Proximate analysis was carried out to water content, ash content, protein content, fat content, and fibre. Proximate analysis was referred to AOAC (2007). Furthermore, total carotenoid was conducted by referring to Parker (1996). Proximate analysis was done in four replications while total carotenoids analysis was in 3 replications. Statistical analysis used descriptive statistic through tabulating data in table. Percentage of proximate composition and total carotenoid value were analyzed by using Microsoft Excel 2007.

3. Result and discussion

Proximate composition of fresh yellow velvetleaf's leaves and stems were shown in Table 1.

Proximate compositions analyzed were water content, ash, fat, protein, and fibre. The important nutrient being found was protein. According to the result, both of leaves and stems had high content of water. Naturally, as its habitat, yellow velvetleaf lives in aquatic environment by floating on the water.

Yellow velvetleaf had high content of water especially in its stem at 95.33% (wet basis). Water content in its stems was higher than in its leaves. This plant can form aerenchyma tissue which is the tissue characterized by connected gas column. This gas column provide the way to transport oxygen from offshoot to root of plant (Schussler and Longstreth, 2000). Stem of yellow velvetleaf had bigger earenchyma tissue than leaf had, in accordance with the thickness of stem. Quantity of gas difused in the water was transported through this gas column. Bigger gas column, higher quantity of transported water.

Content of ash was higher in stems than in leaves of yellow velvetleaf whereas stems had 16.38% (dry basis) while leaves had 12.40%. Mineral contained in plant organ relates to fibre content which composites cell wall of plant tissue. According to Winarno (2008), pectic acid can form mineral in plant tissue primarly calcium and magnesium, while pectinoic acid also can form mineral called pectinoic mineral. Thickening and enlargement of stem can lead forming of cell wall. Therefore, increment cell wall forming of yellow velvetleaf's stems would increase pectic acid and pectinoic acid quantity in where they could cause high content of ash (mineral).

Fat content showed different result from ash and water. This component was higher in leaves of yellow velvetleaf than in stems. Percentage of fat content in leaves was 7.95% (dry basis) while in stems was 5.62% (dry basis). According to Ramadan *et al.*, (2008), glycolipid is main component of chloroplast membrane. The number of chloroplast in leaves of this plant was higher than in stems and surely it affected the content of fat in leaves and stems.

In same line with fat content, protein content was also higher in leaves than in stems of yellow velvetleaf. Protein in leaves of this plant reached 22.96 % (dry basis) while in stems was 13.23% (dry basis). Chloroplast organel in cell of leaves is responsible to photosynthetic and assimilation activity of nitrogen and sulphur (Sun *et al.*, 2009). Actually, protein is synthesized by ribosom in cytoplasm then it will be transported to mitochondria and chloroplast (Lakitan, 2007). Therefore, more chloroplast was in leaves, more protein content was in those parts of plant. High content of protein (22.96%) in leaves of yellow velvetleaf positively had potential for fish feed. Feedstuff can be categorized as protein source if it contains protein content unless 20% and fibre content less than 18%.

Fibre content of yellow velvetleaf was higher in stems of plant than in leaves. Fibre content in stems could reach 16.12% while in leaves was only 11.93%. Based on Lamb *et al.* (2007), stem had high cell wall amount whereas maturation of stem produced the accumulation of xylem tissue which is rich of cellulose, xylans, and lignin. Growth of yellow velvetleaf's stem caused the accumulation of fibre content. Both of leaves and stems of yellow velvetleaf had potential tobe fish feed whereas their fibre content was less than 18%.

Table 1
Proximate composition of yellow velvetleaf's leaves and stems.

Proximate composition	Leaves		Stems	
	Wet basis	Dry basis	Wet basis	Dry basis
Water content	91,76 ±0,14%		95,33 ± 0,07 %	
Ash	1,02 ± 0,05 %	12,40 ± 0,84 %	0,76 ± 0,08 %	16,38 ± 1,72 %
Fat	0,65 ± 0,01 %	7,95 ± 0,25 %	0,26 ± 0,00 %	5,62 ± 0,09 %
Protein	1,89 ± 0,03 %	22,96 ± 0,71 %	0,61 ± 0,01 %	13,23 ± 0,14 %
Fibre	0,98 ± 0,03 %	11,93 ± 0,23 %	0,75 ± 0,00 %	16,12 ± 0,23 %

Vitamin A content of yellow velvetleaf's leaves and stems was measured through total carotenoid content. Result of total carotenoid in this the experiment is shown on Table 2.

Table 2
Total carotenoid content of yellow velvetleaf.

Part of yellow velvetleaf	Fresh
Leaves	219,01 μg/g
Stems	92,99 μg/g

According to the result, leaves had high content of total carotenoid than stems. Whereas Van het Hof *et al.*, (2000) stated that β-caroten exists in chloroplast and some organels of plant. β-caroten is also found in chromoplast organel. Dietary supply of carotenoids can improve the skin colour as well as market value of ornamental fish. Besides improving the skin colour, astaxanthin (part of carotenoids group) can increase survival rate of fish (Gupta *et al.*, 2007). Yellow velvetleaf's leaves had more chloroplast which was proved by strong green color of leaves. Therefore, leaves of yellow velvetleaf also had potential as carotenoid source for increasing fish performance.

4. Conclution

Yellow velvetleaf's leaves had potential as protein source and carotenoid source for fish feed. Protein content and total carotenoid in leaves were higher than in stems of plant. Beside of high protein content, yellow velvetleaf's leaves also had fibre content less than maximum fibre content in feed (18%).

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