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Seaweed as a source of carbohydrates in the feed of milk fish (*Chanos chanos* Forsskal)

Siti Aslamyah[1]*, Yusri Karim[1], Badraeni[1], Akbar Marzuki Tahya[1,2.]

[1]Department of Aquaculture, Hasanuddin University, South Sulawesi, Indonesia
[2]Department of Aquaculture, Bogor Agricultural University, West Java, Indonesia.

Abstract : Seaweed is known to have many benefits as a source of nutrients in foods including in fish feed.Seaweed is known to influence the improvement of growth performance, nutrient absorption, the chemical composition of the body, fat metabolism and disease resistance. This study aimed to test several types of seaweed fermentation of the green and brown strains of*Kappaphycusalvarezii*, *Gracillariagigas*, and *Sargasum* sp. as carbohydrates and its role in the growth, survival, digestibility of feed and chemical composition of the body of the fish juvenile.

The results showed an increase in growth, survival, level of digestibility and chemical composition of the body.The highest growth rates shown by seaweed *Sargasum* sp. amounting to 150.45±10.06 provisional highest survival rate seen in the use of green strain *K.alvarezii* 66.67±6.67, the level of digestibility of carbohydrates in the range of 50.22% - 57.19% and protein between 64.88%-66.65%.The highest increase in glycogen in the liver looks at the use of green strain as much as 6.29 ± 0.89, while the muscles seen in the *G. gigas* group as much as 7.29 ± 2.05. These results indicate that the use of seaweed to the diet had a positive influence on fish juvenile.

Keywords: Seaweed, source of carbohydrates, milk fish, *Chanos chanos* Forsskal.

Introduction

Feed is the most fundamental and spend costs in intensive aquaculture systems, in addition to stocking density(1).Sources of nutrients needed by fish farming is almost entirely derived from the feed that makes the feed as a determinant factor in the success of intensive cultivation.Therefore, the nutritional content of feed raw materials must be qualified with a minimum price.Various studies have been conducted in an effort to suppress the price of feed for production costs can be reduced.Since the beginning of seaweed research done and known to be used as a feed additive in fish feed(2),seaweed research and its utilization in the feed kept under review. Some of the results of published studies reported that the addition of seaweed to the diet on growth performance and demonstrated good absorption of protein in carp *Cyprinuscarpio*(3),enhancing nutrient absorption and chemical composition of the body(4), fat metabolism and disease resistance(5).

This study examined the use of some types of seaweed as a source of carbohydrate and its role in the growth, survival, forage digestibility and chemical composition of the body of the milkfish juvenile.

Material and Method

Animals

Test animals used were juvenile of milkfish (*Chanos chanos* forsskal), the weight of 5.57 ± 0.22 g, were obtained from the nursery ponds in Maros.The acclimatization conducted on test fish in aquaculture ponds and fed with artificial form, by at satiation for 1 week. Furthermore, the test fish were fasted for 24 hours to

remove food remains in the stomach.Test fish reared for 60 days in an aquarium (50x40x35cm) with a recirculation system.Percentage of feeding of 5% of body weight were given 3 times a day, ie at 07:00, 12:00 and 17:00.

Table 1. Composition (% dry weight) raw materials and nutritional quality of artificial feed

Raw materials	Treatments (%)			
	KH	KC	GG	SP
Fish flour	26	26	26	26
Shrimp head flour	11	11	11	11
Seaweed flour	20	20	20	20
Soy flour	10	10	10	10
cornstarch	12	12	12	12
Coconut flour	15	15	15	15
Fat	3	3	3	3
Vitamin& mineral mix	3	3	3	3
Total	100	100	100	100
Protein (%)	32.32	32.19	31.12	31.84
Carbohidrate (%)	42.78	42.89	43.24	43.08
Fat (%)	8.87	9.00	9.00	8.98
Crude fiber(%)	7.85	7.75	7.77	7.36

Artificial Feed Formulation

Type of seaweed used is green strain of *K.alvarezii* (KH), brown strain of *K.alvarezii* (KC), *G.gigas* (GG), and *Sargasum*sp (SP).Seaweed is fermented using bacteria and yeast by comparison *Bacillus* sp. : Yeast (*Rhizopus* sp.): Baker's yeast (*Saccharomyces* sp.): seaweed flour, (1 ml: 1 g: 1 g: 100 g).

Growth

Growth was measured by weighing at beginning and at each observation period of 10 days until the end of the trial.Biomass growth is measured by comparing the weight of the fish at the start with the weight of fish at the end of the study.

Survival of fish

Calculated by comparing the number of fish treated with the amount of fish that have survived at the end of the observation, and multiplied by 100%.

Digestibility of feed

Determined by measuring digestibility using the indirect method, which uses chromium oxide (Cr2O3) as much as 0.6% were evenly mixed in the feed.

Chemical composition of the body

Chemical composition of the body is done by analyzing the content of protein, fat and glycogen content in the liver and muscle, at the beginning and the end of the study, using the proximate.

Data analysis

The data obtained in this study were analyzed using ANOVA and continued by the response test at the level of 5% with IBM SPSS Statistics 20.

Result

The addition of seaweed as a source of carbohydrates and also as a binder in fish feed showed a positive response to the growth performance of milkfish juvenile. The growth rate, survival rate and the rate of feed digestibility showed excellent results on all types of seaweed that were tested (Table 2).

Table 2. Effect of seaweed on growth, survival and nutrient digestibility in milkfish juvenile.

	Dietary group			
	KH	**KC**	**GG**	**SP**
Biomass (g)	128.86 ± 23.34[a]	127.08 ± 27.20 [a]	121.78 ± 0.68 [a]	150.45 ± 10.06 [a]
Survival (%)	66.67 ± 6.67 [a]	65.18 ± 2.57 [a]	60.0 ± 6.67 [a]	63.70 ± 3.39 [a]
Carbohydrate digestibility (%)	53.30 ± 0.92 [a]	55.15 ± 1.02 [a]	53.31 ± 1.00 [a]	57.19 ± 2.56 [a]
Protein digestibility (%)	65.71 ± 2.2	66.95 ± 2.12	59.64 ± 12.46	66.82 ± 1.76

The highest biomass growth seen in the use of SP is equal to 150.45 ± 10.06 a provisional highest survival rate seen in the use of KH 66.67 ± 6.67. The high growth of fish biomass coupled with the high percentage of survival were obtained in this study is very relevant to the level of feed digestibility obtained, where the level of digestibility of carbohydrates in the range of 50.22% - 57.19% and protein between 64.88% - 66.65%. The high value of the feed digestibility, allegedly for their treatment factors of fermentation. During the process of fermentation, degradation components of cellulose and hemicellulose by microbial activity[(6)]. After becoming simpler components, bacteria will convert the simple sugars produced into organic acids (acetate, lactate, propionate and butyrate) so that the resulting product will be more digestible than unfermented.

The chemical composition of the body of milkfish juvenile (Table 3) showed increase the amount of protein and fat. Values obtained on all kinds of seaweed show the difference but not so varied. Increasing the amount of glycogen in the liver and muscles also showed increased high enough. An increase of glycogen in the liver was seen in the use of KH as much as 6.29 ± 0.89, while the muscles seen in the treatment group of GG as much as 7.29 ± 2.05. The results are very relevant to results presented by Mustafa *et al.*[(5)]who has stated that the use of seaweed to the diet could increase the glycogen in the liver of Red Sea Bream**.**

Table 3. Chemical composition of the body of milkfish juvenile fed seaweed containing fermentation.

	Seaweed				
	Initial	**KPH**	**KPC**	**GRL**	**SRG**
Protein (%)	58.23	61.53 ± 1.71	62.34 ± 30.32	63.06 ± 16.39	63.14 ± 23.39
Lemak (%)	16.32	18.32 ± 1.19	18.33 ± 8.64	17.57 ± 4.54	17.93 ± 6.71
Liver Glycogen (mg/g)	5.3	6.95 ± 0.87	7.17 ± 3.2	7.29 ± 2.05	7.2 ± 2.58
Muscle Glycogen (mg/g)	4.57	6.29 ± 0.89	6.03 ± 2.65	6.28 ± 1.82	6.4 ± 2.31

Discussion

Fish growth is strongly influenced by the macro and micronutrient intake adequacy mainly derived from the feed. The use of seaweed in the formulation of artificial diet in this study were able to increase the growth and survival of milkfish juvenile. Caused by the role of seaweed in feed. Seaweed not only serve as a source of carbohydrates and a binder alone. Moreover, seaweed can also be used as an alternative protein source in fish feed. The fermentation process can increase the value of bioprotein and the amount of carbohydrates[(7)].

The results also showed a high glycogen in the liver and muscles of juvenile. It is anticipated by the intake of carbohydrates and high protein in the feed, so that the effect on the increase in the accumulation of glycogen in the liver. High content of protein or carbohydrate in the food resulting in high liver glycogen deposits[(5)].Glycogen in the liver acts as a source of energy and can increase the absorption of nutrients that will result in increased growth[(5]. These results are corroborated by data of feed digestibility, protein and carbohydrate deposits that have been obtained.Analysis of the amino acid content in seaweed are known to have highly variable protein content in the range of 8-50% dry weight and usually contain all essential amino acids[(8)]. The addition of seaweed in small amounts (2.5-10% of feed formulation) in the feed had a positive impact of growth, feed efficiency, physiology activity and the intestinal microflora[(5)].

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