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The Use of Chicken Manure Fermentation for Protein Source on Juvenile Catfish (*Clarias* sp.) Diets

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ABSTRACT: Protein in the catfish diets are replaceable. The effect of replacement total protein juvenile catfish diets with fermented chicken manure was investigated. Five treatment diets containing 30% crude protein in the total protein diets was replaced by fermented chicken manure (*Rhizopus* sp.) 0% (A), 2.5% (B), 5% (C), 7.5% (D) and 10% (E) levels formulated and fed to catfish juvenile (weight 2,05±0,02 g) for 30 day on controlled aquaria. Results from studies found that the best diet formulation can provide catfish juvenile growth and feed efficiency response was diet C. Juvenile catfish responded to the diets C with survival rate (SR) 72.22±4.81; specific growth rate (SGR) 2.33±0.08; feed conversion ratio (FCR) 1.69±0.07; protein efficiency ratio (PER) 2.00±0.08; protein retention 22.7±1.38 and energy retention 9.3±0.99.

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INTRODUCTION

Based on the Fisheries and Marine Ministry of Indonesia data, freshwater production was increase significantly during past 4 years for hybrid catfish (*Clarias* sp.) commodity. The increase of freshwater production was proposed to reach nation goal which Indonesia government policy. Production goal for catfish production in 2012 and 2013 was 270.000 and 700.000 tones. East Java province was the highest catfish producer on Indonesia with 311.500 tons in 2013 and reached 44.5% of national goal [1]

National goal could be reached by increased catfish culture. High feed cost was problem that emerged during catfish culture [2. Substitution for total protein feed in the catfish diet with other protein source could be solved the problem. Chicken manure with high protein source which abundance and cheap could replace protein source on the catfish diet [3]. Another problem by used chicken manure as protein substitution on catfish feed was low digestibility so it needed to be fixed.

Fermentation could be increase digestibility of chicken manure. The increase of chicken manure digestibility give opportunity to be used as protein substitution on catfish feed. Mold used on fermentation process to degrade complexes compound to be simple compound [4]. Simple compound have higher digestibility than complexes compound [5]. Rizophus sp. was mold which used on tempeh production as tempeh fermentation starter in Indonesia [6]. The used of Rizophus sp. as tempeh fermentation starter in Indonesia can increased digestibility of soybean [7]. A research on the use of Rizophus sp. as fermentation starter on feed husbandry can increase digestibility feed husbandry [8].

The aim of this study was to investigate the effect of fermented chicken manure by Rhizopus sp.for substitute protein source of catfish feed on the catfish juvenile growth.

MATERIALS AND METHODS

Chicken manure fermentation

Chicken manure from chicken husbandry on Karangploso region were fermented by mold (*Rhizopus* sp.) from tempeh producer Sanan region in Malang, East Java (10^8 *Rhizopus* sp. spore/g chicken manure).Chicken manure were sterilize at 1210C for 15 minutes. Sterilized chicken manure fermented by Rhizopus sp. at 300C and pH 5 for 3 days.

Juvenile catfish diets preparation

Fermented chicken manure used as substitute protein source on the catfish juvenile diet for 0%, 2.5%, 5%, 7.5% and 10%. Proximate analyze were carried out to gained catfish juvenile diet nutrition index [9].

Catfish juvenile

Catfish juvenile with length 5-7cm and weight 2.05±0.02 g from Sumbersekar region were lived transported to the laboratory on container box (1x1x1 m) within 2 hours. Catfish juvenile were grows on the aquarium

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(30x30x30 cm) for 30 days with 12 catfish juvenile on each aquarium. Catfish juvenile was feed 2 times a day on 5% biomass. Water replacement (20%) was carried out every 3 days.

Water quality analysis

PH, Demand Oxygen (DO) and temperature measurement were carried out 2 times a days at 6.00 AM and 2.00 PM for 30 days. Ammonia measurement was carried out on day 0, 10, 20, 30,.

Catfish growth performance analysis

Proximate analyses were carried out at day 30 with 3 replication was carried out for each treatment. Proximate analysis result used to measured Survival Rate (SR), Specific Growth Rate (SGR), Protein Efficiency Ratio (PER), Food Conversion Ratio (FCR), Protein Retention and Energy Retention [3 and 10].

Data analysis

One-Way ANNOVA was carried out using SPSS 16 for windows.

RESULT AND DISCUSSION

Fermented chicken manure as replacement protein source on juvenile catfish diet

Protein is important nutrient on growth of catfish juvenile [11]. Crude protein contents on juvenile catfish diets should be above 28% [12]. Proximate composition of fermented chicken manure as protein replacement on the catfish juvenile diets showed on Table 1. Crude protein on the catfish juvenile diet ranged 29.51-29.96%. Replacement of protein source on the catfish juvenile diet was to recommendation. Proximate analysis showed that dry weight of feed treatment ranged 85.49-86.75% after drying in the sun. Ash content of manure in line with the addition of meal and crude fiber in line with the addition of CMC.

Table 1. Composition of Experimental Diets (g/100 g diet) and proximate composition (%)

Ingredients	Diets				
	A (0%)	B (2.5%)	C (5%)	D (7.5%)	E (10%)
Manure meal	0	6.21	12.43	18.64	24.86
Fish meal	59.02	57.54	56.07	54.59	53.12
Tapioka meal	18.57	17.75	16.93	16.11	15.29
Vit Mineral Mix	4	4	4	4	4
CMC	18.41	14.49	10.57	6.66	2.74
Analysed composition					
Dry Metter (%)[a]	86.75	86.43	86.12	85.80	85.49
Crude protein (%)[a]	29.96	29.73	29.62	29.44	29.51
Crude fibre (%)[a]	15.63	13.70	11.77	9.84	7.06
Fat (%)[a]	7.57	7.46	7.38	7.25	7.06
Ash (%)[a]	19.14	21.91	24.68	27.45	30.22
Nitrogen free extract (%)[b]	27.70	27.20	26.55	26.02	26.15
Gross Energy (kkal/kg)[a]	3.43	3.42	3.4	3.34	3.33
Digest Energy (kkal/kg)[c]	2.99	2.95	2.91	2.87	2.86

a :The results AOAC [9] method
b: Nitrogen free extract = 100 – (crude protein + fat + ash + crude fibre)
c : Digest = (4 x % crude protein) + (9 x % fat) + (4x % nitrogen free extract) [13]Wilson (1994)

Juvenile growth performance

Water quality during experiments were showed on Table 2. pH, DO and ammonia levels during experiments were suitable for catfish culture. Temperature during experiments showed unsuitable during experiments. Temperature reached 200C at night which unsuitable for catfish juvenile growth. According to Boyd [14], lower temperature decreased catfish metabolism. Lower metabolism caused lower growth performance.

Table 2. Water quality during the study

Parameter	Result	Normal
PH	6,81 – 7,98	6,65 – 8,55 [15] (Boyd, 1982)
Temperature (⁰C)	20 – 27,8	24 – 28 [14] (Boyd, 1990)
DO (ppm)	4,11 – 5,48	>4,0 [16] (Zonneveld, 1991)
Ammonia (ppm)	0,2 – 0,33	< 0,6 [17] (Amalia*et al.*, 2013)

Measurement on the catfish juvenile carcass after 30 days culture showed on table 3. Ash contents increased during culture of catfish juvenile. Increase on the ash contents indicated that mineral contents on catfish juvenile

was high and have high retention metabolism. According to Halver [11], protein, fiber, fat content and energy gross decreased while fish bone grow larger.

Table 3. Carcass composition of *Clarias* sp. fed chicken manure fermented based diets

	Initial Fish	After 30 days treatment				
		A (0%)	B (2.5%)	C (5%)	D (7.5%)	E (10%)
Dry Metter (%)[a]	15.38	16.03±0.34	16.59±0.58	16.04±0.31	17.03±1.00	16.65±0.35
Crude protein (%)[a]	65.88	64.55±0.32	64.28±0.88	67.13±0.29	64.21±1.11	64±1.43
Crude fiber (%)[a]	0.9	0.2±0.005	0.28±0.03	0.35±0.02	0.30±0.01	0.35±0.12
Fat (%)[a]	16.81`	8.08±0.47	7.85±0.25	6.87±0.18	6.73±0.12	6.4±0.19
Ash (%)[a]	13.98	20.46±0.29	20.78±0.79	20.86±0.01	21.73±0.17	23.62±0.99
Gross Energy (kkal/kg)[a]	4.96	4.07±0.01	4.06±0.04	4.04±0.02	3.93±0.06	3.88±0.11

a : The results AOAC [9] method

Survival rate showed that the used of fermented chicken manure on the catfish juvenile diet were not significant different among treatment (p≤0.05). Catfish juvenile growth performance showed on table 4. Average survival rate for all treatment was 75% and lower compared to Obasa et al. [3] founding. Temperature during experiment was not suitable for catfish juvenile culture and impacted on survival rate [14].

Tabel 4. Growth of *Clarias* sp. fed chiken manure fermented based diets

Parameters	Diets				
	A (0%)	B (2.5%)	C (5%)	D (7.5%)	E (10%)
[a]SR (%)	75±14.43[a]	77.8±9.62[a]	72.22±3.91[a]	75±22.05[a]	77.8±12.73[a]
[b]SGR (%/day)	1.73±0.04[a]	2.03±0.14[b]	2.33±0.08[c]	1.99 ±0.05[b]	1.65 ±0.06[a]
[c]FCR	2.34 ±0.04[c]	1.97 ±0.15[b]	1.69 ±0.07[a]	2.03 ±0.05[b]	2.38 ±0.12[c]
[d]PER	1.43 ±0.02[a]	1.71 ±0.13[b]	2.00 ±0.08[c]	1.68 ±0.04[b]	1.43 ±0.07[a]
[e]PR (%)	15.2 ±0.81[a]	19.3 ±1.88[bc]	22.7 ±1.38[c]	19.9 ±1.52[bc]	16.4 ±1.42[ab]
[f]ER (%)	6.13 ±0.59[a]	8.45 ±1.46[ab]	9.3 ±0.99[b]	8.17 ±1.07[ab]	5.86 ±0.95[a]

Values without common superscripts in horizontal rows are significantly different (P<0.05)
[a] Survival rate = fish survival/initial fish
[b] Specific growth rate = loge W2 – loge W1 /T2 - T1 X 100. Where: W2 = weight of fish at time T1; W2 = weight of fish at time T2
[c] Feed conversion ratio =weight of feed/ fish wet weight gain.
[d] Protein efficiency ratio =Mean weight gain / protein consumed
[e] Protein Retention=Nb – Na / Ni X 100. Where: Nb = body nitrogen at the end of the test; Na = body nitrogen at the beginning of the test; NI = amount of nitrogen ingested.
[f] Energy Retention =Eb –Ea/ Ei X 100. Where: Eb= body gross energy at the end of the test; Ea = body gross energy at the beginning of the test; EI = amount of gross energy ingested.

Specific growth rate (SGR) showed that the used of fermented chicken manure on the diet of juvenile catfish were significantly different among treatment (p≥0.05). Specific growth rate (SGR) in this study showed the best results at the 5% diet (C). Provision of chicken manure that difermentasiakan improve feed quality. The exact composition of protein sources will improve fish growth [11]. Variations in the precise amino acid derived from protein chicken manure and fish meal protein in the diet of 5% (C) can improve fish growth better than other treatments.

Food Conversion Ratio (FCR) showed that the used of fermented chicken manure on the diet of juvenile catfish were significantly different among treatment (p≥0.05). Low food Conversion ratio (FCR) indicates that the feed can be put to good use by fish. With the use of feed protein sources catfish produce food as much as 5% Conversion ratio (FCR) of catfish best compared to other treatments. The decline was caused by the balance of nutrients that can be absorbed sources. According Karmini et al. [18], the fermentation Occurs enzymes amylolytic activity, lipolytic and proteolytic produced by Rhizopus sp. The enzyme produced by *Rhizopus* sp. the fermentation process is able to help the absorption of nutrients fish.

Protein efficiency ratio (PER) Showed that the used of fermented chicken manure on the diet of juvenile catfish were significantly different among treatment (p≥0.05). Protein efficiency ratio (PER) best at 5% dietary treatment (C) of 2.00 ± 0:08. The amount of protein efficiency ratio (PER) indicate that the number of proteins that can be utilized fish feed. This protein utilization is influenced by amino acid requirement for growth catfish. Addition chicken right diversity of amino acids that can be utilized catfish. According Cock et al. [19] chicken manure containing amino acids vary in large enough quantities.

Protein retention (PR) showed that the used of fermented chicken manure on the diet of juvenile catfish were significantly different among treatment (p≥0.05). Protein retention (PR) is the best in the treatment of 5% (C) of 22.7% ± 1:38, this is in line with the results of the specific growth rate and protein efficiency ratio. Availability protein feed determine the amount of protein that is utilized. Chicken manure additions will add variety of feed amino acids. Chicken manure is able to provide the necessary tryptophan catfish [20] in order to increase protein retention.

Energy retention (ER) Showed that the used of fermented chicken manure on the diet of juvenile catfish were significantly different among treatment (p≥0.05). Energy retention (ER) showed the best treatment results in diets C (5%) and in line with the results of protein retention (PR) The balance of the building blocks of protein consumed lead can be used for growth and not used as a source of energy [21]. Energy showed are relative low retention experiments between 5.86-9.3% this is because the catfish are carnivorous fish species of which are very efficient in the use of carbohydrates from chicken manure [22].

CONCLUSION

In view of the above, it is evident that fermented chicken manure can replace 5% of total protein feed in the juvenile *Clarias* sp*.* diet.

Future search can take advantage of chicken manure fermentation with *Rhizopus* sp. to improve the performance of other farmed fish growth

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