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Effects of Copra (*Cocos nucifera*) Meal on The Growth Performance of *Cyprinus carpio*

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Abstract. This research aimed to evaluate the optimum concentration of copra meal as a fish meal replacement on the growth performance of *Cyprinus carpio*. Various concentrations of copra (*Cocos nucifera*) meal, *viz* 3, 6, 9, and 12 % were used to determine the final weight, body weight gain (BWG), average weekly gain (AWG), daily weight gain (DWG), specific growth rate (SGR), protein efficiency ratio (PER), feed conversion ratio (FCR) of the *C. carpio* (Initial body weight 25-25.2 g/fish) and compare with control group (Basal diet) without copra meal replacement and commercial diet (CD). Six groups of *C. carpio* with three replicates were used and fed with different concentration of copra meal at satiation level five times per day for 12 weeks. At the end of feeding trial, the *C. carpio* fed 9% copra meal in the diet had higher final weight, BWG, AWG, DWG, SGR than any other groups, except commercial diet (CD). Meanwhile, the highest PER was found on the fish fed CD, followed by fish fed 3 % of copra meal in the diet. However, FCR was not affected by any types of diets. These finding suggested that the 9% replacement of wheat in the diet with copra meal is beneficial to improve growth performance.

INTRODUCTION

The cost imported feed ingredients using commercial aquafeeds recently are developed in many countries in Asia [1]. At present, fed of aquaculture containing the compounds is being most expensive to input on farming of aquatic species. The Aquaculture should be an increasing emphasis to reduce feed cost by finding cheaper of available source likes carbohydrate and protein [2].

Copra Meal (CM) by product available as a protein source (swine and poultry) [3] and carbohydrate [4]. This plant contains 43-45% carbohydrates, 19- 20% protein, 10-11 % oil and 12% crude fiber [5]. Copra meal by-product of oil extraction from fruits/nuts of coconut, *Cocos nucifera* contains lower levels of anti-nutritional factors than legumes [2] and refined not a good dietary fiber in wheat [6].

The common carp (*Cyprinus carpio*) is the number one fish of aquaculture and widespread freshwater fish of eutrophic waters in lakes and large rivers in Europe and Asia [7]. In recent study, *C. carpio* has experimented with three oilseeds (mustard, linseed, and sesame) [8]. However, *C. carpio* has a limited report for experimental of the copra meal diets.

Hence, this study was carried out to evaluate the effects of replaced wheat by adding copra meal in the diets to determine growth performance and proximate performance. The effects of dietary treatments body weight gain (BWG), average weekly gain (AWG), daily weight gain (DWG), specific growth rate (SGR), protein efficiency ratio (PER), feed conversion ratio (FCR) and proximate values were evaluated.

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MATERIALS AND METHODS

Formulated Diets

The copra meal (CM) used in this study was purchased from a local supplier (Sumatera, Indonesia). Five isonitrogenous diets were prepared with CM progressively replaced wheat at 3, 6, 9, and 12% and compare with control groups basal diet and commercial diet (CD). Feed samples were analyzed for their proximate composition before the start of the feeding trial.

Ponds Feeding Trial

Hatchery-reared *C. carpio* were acclimatized in the outdoor different pond and were fed the regular commercial common carp diet for 3 days before the start of the feeding trial. Thereafter, *C. carpio* with the average weight of 25 ± 25.2 g were stocked in pond cages at outdoor. Eighteen experimental pond cages were randomly assigned to each dietary treatment with 3 replicates per diet. The daily feed ration was divided into 5 parts for the 8:00, 10:00, 11:30am, 2:00 and 4:00pm. Dissolved oxygen (DO), pH, temperature, ammonia, and nitrite values were measured at twice a day for the 8:00am and 4:00pm (data did not show). The feeding experiment lasted for 85 days. *C. carpio* sample was collected before the start of the feeding experiment for the determination of its proximate composition.

Chemical Analysis

Samples of feed and *C. carpio* were submitted to the analytical laboratory for proximate analysis to determine of moisture, ash, crude protein, crude fat and crude fiber. Analyses for the proximate composition of the samples were performed according to the methods of AOAC (1990).

Statistical Analysis

Data of results were analyzed by non-parametric tests using SPSS 22 software. Differences between treatments were evaluated by Duncan test. Values were considered statistically significant at $P<0.05$.

RESULTS AND DISCUSSIONS

Experimental Diets

The composition of experimental diets is presented in **TABLE 1**. Crude protein, Ash, Nitrogen free extract, phosphor and crude oil showed highest in diet 9% from all group diets.

TABLE. 1 Proximate composition of the experimental diet

Parameters	Diet				
	BD	3%	6%	9%	12%
Dry matter (%)	89.2	89.9	89.8	90.3	90
Crude protein (%)	34.9	33.7	33.7	35.3	34.5
Ash (%)	8.74	8.88	9.05	9.20	9.19
Nitrogen free extract (%)	40.9	42.1	41.7	40.4	41.1
Phosphor (%)	1.5	1.6	1.6	1.6	1.7
Crude oil (%)	4.7	5.2	5.3	5.4	5.2

Growth and Feeds Performance

The effects of copra meal (CM) on *C. carpio* growth (Weight Gain) performance showed on **FIGURE 1**.

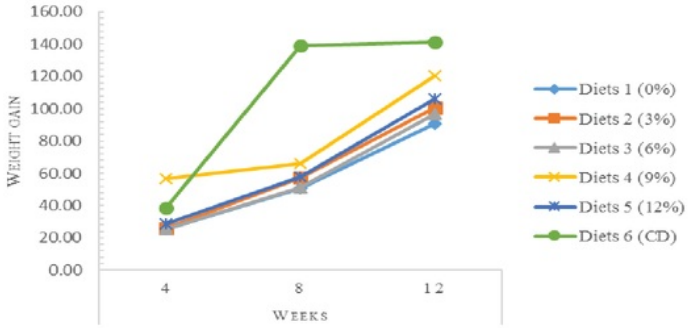

FIGURE. 1 Growth of *C. carpio* in pond and fed the experimental diets for 12 weeks

The levels concentrations indicated difference in all parameters measured. The standard error of weight gain showed on **FIGURE 2**.

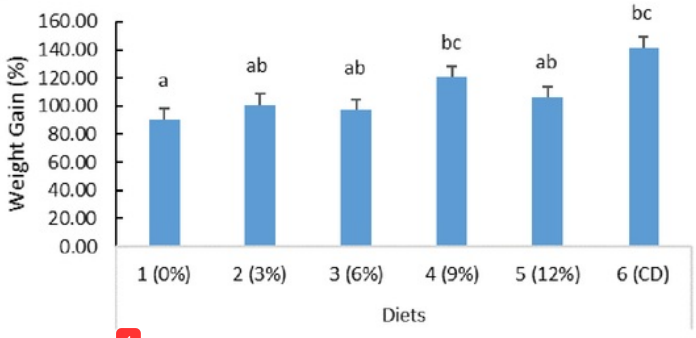

FIGURE 2. Weight gain of *C. carpio* fed the experimental diets for 12 weeks.

All of the growth performance had been presented in **TABLE 2**. Growth performance and protein efficiency were significant in 9% diet compare to CD combination.

TABLE 2. Growth performance of feed and protein efficiency ratio of *C. carpio* fry fed on experimental diet 84 days

Parameter	Groups					
	BD	3%	6%	9%	12%	CD
Initial Weight (g/fish)	25.06 ± 0.06^{a}	25.06 ± 0.06^{a}	25.06 ± 0.06^{a}	25.13 ± 0.06^{a}	25.13 ± 0.06^{a}	25.13 ± 0.06^{a}
Final Weight (g/fish)	115.56 ± 6.74^{a}	125.98 ± 9.02^{ab}	122.11 ± 6.47^{ab}	145.76 ± 10.66^{bc}	131.20 ± 1.14^{ab}	166.66 ± 7.75^{bc}
AWG (g/fish/week)	7.54 ± 0.55^{a}	8.41 ± 0.74^{ab}	8.09 ± 0.53^{ab}	10.05 ± 0.89^{bc}	8.84 ± 0.09^{ab}	11.76 ± 0.64^{bc}
DWG (g/fish/day)	1.08 ± 0.08^{a}	1.20 ± 0.10^{ab}	1.16 ± 0.07^{ab}	1.44 ± 0.12^{bc}	1.26 ± 0.01^{ab}	1.68 ± 0.09^{bc}
SGR (%)	1.82 ± 0.06^{a}	1.92 ± 0.08^{ab}	1.88 ± 0.06^{ab}	2.09 ± 0.09^{bc}	1.97 ± 0.008^{ab}	2.24 ± 0.05^{bc}
PER	1.66 ± 0.06^{a}	1.84 ± 0.06^{bc}	1.79 ± 0.01^{abc}	1.76 ± 0.01^{ab}	1.66 ± 0.04^{a}	1.93 ± 0.05^{c}
FCR	1.73 ± 0.06^{a}	1.62 ± 0.06^{a}	1.66 ± 0.01^{a}	1.61 ± 0.01^{a}	1.75 ± 0.04^{a}	1.63 ± 0.04^{a}

Means in the same row having different superscript letters (a, b, c) indicated significant differences ($P<0.05$). BD = Basal diet; CD = Commercial diet; BWG = Body weight Gain; AWG = Average weekly gain; DWG = Daily Weight Gain; SGR = Specific Growth Rate, PER = Protein Efficiency Rate; FCR = Feed Conversion Ratio

Whole body nutrients of the proximate performance of both times (started and the end) showed on **TABLE 3.**

TABLE 3. Proximate composition (% dry matter basis) of *C. carpio* for 12 weeks

Parameters	Initial	Diet					
		BD	3%	6%	9%	12%	CD
Moisture	9.37	7.94 ± 0.42	8.37 ± 0.51	7.12 ± 1.13	8.12 ± 1.29	8.06 ± 1.17	8.99 ± 1.14
Protein	52.31	49.64 ± 0.22	47.99 ± 0.27	49.51 ± 0.97	47.89 ± 0.35	50.26 ± 0.95	48.09 ± 0.76
Ash	23.76	9.86 ± 0.57	10.86 ± 0.16	10.78± 0.39	11.10 ± 1.00	10.90 ± 0.35	10.57 ± 0.31
Fat	12.93	32.39 ± 0.20	32.59 ± 0.51	31.25 ± 0.95	29.02 ± 2.03	29.37 ± 2.48	31.31 ± 1.64

This present study demonstrated that copra meal (CM) is a good replacement plant protein source. The results showed that the optimum inclusion level of CM in terms of growth was diet 9% (**FIGURE 1)**. Increasing the level of dietary copra meal on the growth of *C. carpio* was shown in **FIGURE 2** that apparently not significantly difference ($P>0.05$). Effect of optimum level of 9% CM was indicated from the composition of proximate diet that higher than other diets (**TABLE 2**). The weight gain performance of *C. carpio* was also highest in this level compare to CD group. However, weight gain performance obtain CM was lower than CD fish group (**FIGURE 2**). Previous research [9] stated that copra meal typically content high crude fiber, generally associated with plant-derived proteins to depress apparent protein digestibility coefficients which directly affects growth performance. Copra meal also contains tannins [10] as an anti-nutritional factor [11] and limits utilization by toxicity to the fish [8]. Copra has a presence of a wide variety of antinutrisional substances. Important among these are protease inhibitors, phytates, glucosinolates, saponins tannins, lectins, oligosaccharides and non-starch polysaccharides, phytoestrogens, alkaloids, antigenic compounds, gossypols, cyanogens, mimosine, cyclopropenoid fatty acids, canavanine, antivitamins, phorbol and esters [11].

Growth performance and protein efficiency were significant in 9% diet compare to CD combination control. Meanwhile, PER and FCR did not show significantly different except 3% in PER. The lower of PER values was at both of diets, 3% and 12%. Previous research that used *Oreochromis mossambicus*, showed the level of growth performance of tilapia fingerlings increased at the higher dietary protein levels [12]. However, feed efficiency was reduced in terms of protein efficiency ratio (PER) and specific growth rate (SGR) at lower protein diet. Further, the results clearly showed that fish growth was best at the basal protein diet.

The feed conversion ratio (FCR) which measures at all group diets did not show significantly different. This indicated that the quality of the diets CM is a good diet of digestibility. The FCR inclusion level in the diet was lowest at 3% and highest at 12 %. This trial indicated, the feed type, smaller ration size and proper utilization of diet are important factor. In addition, daily feeding frequency is an effects tool particularly when the balance between maximum growth and optimal food conversion.

The results of proximate composition of *C. carpio* fed the experimental diets for 12 weeks are presented in **TABLE 3.** There was no significant difference ($P>0.05$) in the proximate composition analysis among the groups of fish fed different level CM in the diet. The composition of CD and all diets did not change proximate composition in whole body nutrition by increasing level of copra level. Meanwhile, the non-significant difference in body composition of fish might be due to the high level of inclusion of plant protein sources.

CONCLUSSIONS

Copra meal can be inferred ingredient that could be beneficial to replace wheat meal in the diet of *C. carpio* fry at optimum level 9%. However, increasing up to a level of 12% copra meal may unnecessary to enhance growth performance of *C. Carpio*.

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