Replacement of fish meal with MBM and PBM on growth performance of juvenile Black Tiger Shrimp (P. monodon) 1

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ABSTRACT

The objective of the present study was to measure the growth performance, feed utilization and mortality of juvenile black tiger shrimp when fed practical diet containing various levels of MBM and PBM in substitution of Fish meal (0, 20, 40, 80%). The control diet contained 28% fish meal, which was replaced on an equal protein basis by MBM and PBM for the experimental diets. Shrimp were raised in indoor aquarium for 70 days. Results showed that 1) FM substitution up to 80% by either MBM or PBM had no effect on weight gain, 2) performance was somewhat better for PBM vs. MBM diets, 3) mortality for all treatments was relatively high, and 4) FM substitution resulted in 15-20% savings in feed cost.

Introduction

Vietnam is the 4th largest shrimp producer in Asia (after China, Thailand and Indonesia) and has a real potential to surpass Indonesia and even Thailand in the near future. However, the country severely lacks the key raw material for shrimp feeds, namely fish meal (FM). Importing large quantity of FM from S. American may become a constraint considering the cost, availability and quality. The shrimp industry must explore FM substitutes and US MBM and PBM area of high quality animal proteins, and thus should be ideal candidates as FM replacements. The purpose of the present study is to demonstrate th4e feasibility and effectiveness of substituting FM in shrimp diets with US MBM and PBM on growth performance.

Material and Methods

1. Animals: PL30 shrimp (0.1gr/pcs)

2. No. of tanks: 28 concrete tanks (1x1x1 m3); 4 tanks/ treatment (4 replicates)

3. No. of shrimp/tank: 75

4. Duration of the trial: 8 weeks (from Jul. 1 to Aug. 31). The growth trial will be conducted at Vung Tau Shrimp Research Center – Research Institute for Aquaculture No. 2.

5. No. of dietary treatments: 7 iso-protein diets (40% crude protein) will be formulated to contain fish meal (63% crude protein), MBM (50% crude protein), PBM, (65% crude protein), extracted soybean meal, wheat flour, squid liver meal, squid liver oil, vitamin and mineral mix…Ingredients will be mixed and dry crumbles or pellets) will be made by a small pelleting machine. The dietary treatments are as follows:

1/ Diet 1: 28% fish meal serves as control.

2/ Diet 2, 3, 4: **MBM** substitution of fish meal on an equal **crude protein** basis at 20%, 40%, 80%, respectively.

3/ Diet 5,6,7: **PBM** substitution of fish meal on an equal **weight** basis at 20%, 40%, 80%, respectively.

Table 1. Diet formulation

Diet	Control	MBM			PBM		
	1	2	3	4	5	6	7
(%)							
Fish meal	28.00	22.40	16.80	5.60	22.40	16.80	5.60
MBM	-	7.06	14.11	28.22	-	-	-
PBM	-	-	-	-	5.60	11.20	22.40
Others							

6. Total No. of shrimp needed: 7 treatments x 4 replicates x 75 shrimp = 2,100
7. Experimental design

   75 shrimp will be randomly allotted to each concrete tank.

   Shrimp will be fed by hand 3 times/day. Feeding rate will decrease from 15% to 6% total weight of the shrimp and will be adjusted daily (visual observation).

8. Measurements required
   - Live weight and body length: at the beginning and during the trial shrimp will be weighed and measured 2 times/month.

- Feed consumption: daily feed consumption will be recorded.
- Health status and mortality.
- Water quality: Salinity, alkalinity, NH_3-N, $N0_2$-N, COD, DO will be monitored weekly; pH and temperature will be monitored daily at 7AM and 3PM.

Table 2. Growth Performance

% FM	MBM				PBM		
Replacement rate	0	20	40	60	20	40	60
Formulation							
FM[1]	28	22.4	16.8	5.6	22.4	16.8	5.6
MBM[2]	0	7.06	14.11	28.22	0	0	0
PFGPBM[3]	0	0	0	0	5.43	16.28	21.71
Performance (70D)							
Initial Wt (g)	.08	.07	.07	.07	.07	.08	.08
Final Wt (g)	2.72	3.8	2.7	1.97	3.06	2.76	3.25
SGR (%)	5.06	5.79	5.11	4.79	5.4	4.94	5.34
Survival (%)	60	55	43	41	46	52	42

[1] Fish Meal

[2] Meat and Bone Meal

[3] Pet food grade poultry byproduct meal

Results

Growth response is given in Table 2. Protein source had no significant (P>.05) effect on shrimp growth rate. At high substitution rates (>40%), PBM diet supported a slightly better a weight gain than MBM diet, both MBM and PBM can replace FM in shrimp diet up to 80%.

Discussion

Although in the present study feeds formulated with different protein sources supported a similar weight gain, the absolute growth rate was lower than the norm of P. mordent. This relatively slow growth could be related to the light initial weight (.07g) and perhaps the quality and uniformity of the shrimp. The relatively high mortality rate could also caused by the light beginning weight, but also suggests that FM substitution by MBM and PBM for light weight shrimp should be limited to less than 40%. Mortality has been low in similarly designed trials (with heavier initial

weight) do not affect the survival rate shrimp. We intend to conduct further trials with mound on in Viet man.

The slightly better growth response noted for PBM vs. MBM is probably due to the amino acids profile, and has been reported from other shrimp trials conducted by the Association is Thailand and China. Although amino acids (AA) profile of MBM diet could be fortified with crystalline AA, the efficiency of utilization has been frequently reported to be inferior to that found in natural in fact protein ingredients. This is particularly important for high rates of FM substitution by MBM and PBM.

Result from the present study are generally in agreement with findings reported from China 92002, 2003), Thailand (2003) and Australia 91996)

Conclusions

Use of US MBM and PBM as FM replacements in shrimp diets has been already demonstrated in several NRA's earlier studies conducted in China and Thailand. Results from the present study are consistent with NRA's findings that shrimp growth was not affected by FM substitution of MBM or PBM. Up to 60 to 80% replacement rate. Feed cost could be reduced by 10-20% with MBM and PBM substitution.