THE INFLUENCE OF DIETS AND BODY MANIPULATIONS ON THE GROWTH OF AFRICAN PRAWN - *MACROBRACHIUM VOLLENHOVENII* (HERKLOTS)

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ABSTRACT

Live African prawns -- Macrobrachium vollenhovenii were collected from Asejire reservoir by trapping. After acclimatization, the prawns were differently amputated: Some had their eye-stalks cut; some had their chelae cut; some had both eyestalks and chelae cut while some were intact which served as the control. Each set was placed under different levels of crude protein viz 15%; 20%; and 25%. Weekly weight changes were monitored. Results obtained were subjected to statistical analysis including analysis of variance (ANOVA). The results showed that prawns fed with 20% crude protein had the best growth rate. Specimens with the eyestalk and chelae removed also showed superior growth when compared with the others.

Specimens that had their eyestalks removed were able to feed for 18 hours in the day while those with intact body fed for 6 hours during the same period.

The amputation of the chelate appendages reduced considerably the cannibalistic urge in the prawns. This enabled a high number of prawns to be grown in the experimental tanks.

INTRODUCTION

The African river prawn is a decapod crustacean of the suborder NATANTIA; family PALAEMONIDAE and genus MACROBRACHIUM. It is commonly found in most inland freshwater areas including lakes, rivers, swamps irrigation ditches, canals, ponds, as well as in estuarine areas. Found in all mangroves, creeks and inland water of West Africa, except in clear backwaters (Powell, 1982) and in Nigeria, it may occur as far inland as Oyo, Lokoja and Ogoja Anetekhai, 1986. Many of the largest and most desirable shrimps occur in freshwater. Most species require brackish water in the initial stages of their life cycle so, they are found in water directly or indirectly connected with the sea although some complete their cycle in inland saline and fresh water lakes. Some species prefer clear-water rivers while others are found in extremely turbid conditions. In Nigeria, four species of macrobrachium occur with *M. vollenhovenii and* M. macrobrachium being the abundant species with *M.* attaining large sizes that are close to 2000mm. The African river prawn - *M. vollenhovenii* had been described to passes high commercial potential (Ajuzie & Fagade, 1992). It can live and complete its life cycle in freshwater Anetekhai, 1986. It tolerates a wide range of salinity ranging from 0% - 20%. There is a change in feeding habit from planktivorous in the larvae to carnivorous; mature prawns exhibit various feeding habits. These qualities make *M. vollenhovenii* a good species for freshwater prawn farming through out Nigeria where it is widespread (Rutherford, 1971; Powell, 1982; Anetekhai, 1986).

Materials and Methods

Feed Formulation

The materials used for the formulation included maize flour, cassava flour and fish meal. Traces of vitamin premix and common salt were added just as additives. The test diets employed were three 15%; 20% and 25% and were categorised according to crude protein levels. Pearson square method (Arthur 1975 or Jurgens, 1978) was used to determine the various protein levels for each test diet.

Pelleting of Feed

The determined constituents were made into paste which was extruded through an injection syringe of 25.0ml capacity; which served as improvised pelleting device. The pellets were oven-dried for preservation.

Apparatus

Three glass aquarial tanks of 120x45x45cm^3 dimension each, were partitioned into four different units with plywood and formica. Each tank was used to rear prawns on same crude protein level but, each unit held prawns of same body manipulation. There were stones and sand to serve as substratum in each unit. The water was continuously aerated with the aids of air-pumps that supplied air via air-tubes. Each tank was covered with chicken wire-mesh to curb escape of Prawns. The water level in the tank was maintained between 9 and 10cm to lower the water density and ensure more diffusion of atmospheric oxygen into the water.

Collection and Acclimation of the Prawns

Specimens of *M. vollenhovenii* were collected alive from both Asejire, reservoir and river Ogun; iced in ice-chest, transported to the laboratory, acclimated for 5 days, body manipulated and stocked accordingly; three sets according to test diet levels of prawns had their eyes cut, and each set placed on each diet; another 3 sets had their chelae amputed, third set had both eyes and chelae amputated while the fourth set was maintained for each level diet with their body complete and in tact as the control. After labeling tanks and units for identification, the initial weights were recorded and weight of each prawn was recorded thereafter on weekly basis.

Feed Trials

The prawns were fed twice daily on 5% of their body weight; 2% at 10.00am. and 3% at 5.00p.m daily. Amount of feed fed was adjusted weekly to 5% of the body weight. Excess or uneaten food was removed by muslin cloth and siphoned with rubber tube. No correction for weight of uneaten feed was made.

Methods of Analysing Results

The prawns were weighed weekly. Final mean weight of survivors for the different feeds calculated. Increased in weight was used as an index of growth and not increase in length which occurred only after moulting. Burkenroad (1951) showed that length did not reveal certain important changes in size in prawns and that increase in weight should be used as index of growth. Also, Zein Eldin and Corliss (1976) studied the effect of protein levels and their sources on growth of *Penaeus aztecus* using gain in body weight. The actual growth rates were calculated by finding the differences between initial and final weights. The relative growth rates were calculated as the percentage increase using this equation:

$$\frac{W_2-W_1}{W_2} \times \frac{100}{}$$

W_1 - initial weight at the beginning of the experiment

W_2 - final weight at the end of the experiment.

To obtain the rates of growth; change in weight was divided by length of time:

$$\frac{\text{Change in weight grammes}}{\text{length of time days}}$$

Conversion ratios were obtained by:

$$\frac{\text{Quantity of feed supplied grammes}}{\text{Increase in mean weight of prawns gm}}$$

Results

There was increase is size in all the prawns fed with the different diets by the end of the experimental period. The rate of growth fluctuated differently amongst the prawns according to protein levels and body manipulations. Table 1 shows growth response of *M. vollenhovenii* to different protein levels and body manipulations. It also shows actual growth rate, relative growth rate, daily and over all growth rate as well as conversion ratio while Table 2 shows statistical analysis (Anova).

Discussion

Growth Rate

The results showed that the 25% protein level diet was the least growth promoting diet. In contrast, the 20% protein level diet was the best growth promoter. Although the 25%, 20% and 15% protein diets were regularly consumed, the increasing conversion ratio and decreasing biomass change obtained with the diets suggested the possibility that too much protein in prawn feed might have a negative effect on growth of prawns. It also showed that prawns accepted and utilised artificial diet: indicating their suitability for commercial culture.

FOOD CONVERSION RATIO

The prawns were fed *ad libitum* though they could not eat every bit of food supplied, the weight of the uneaten feed was not subtracted from the total weight of feed supplied. So, not computed but the conversion ratio as given on Table 1 should be considered maximal.

DIFFERENCES AMONG PRAWNS USED

From Table 1, the initial weights showed that all the prawns were of different sizes though attempts were made to minimise this disparity this could as well mean differences in the rates of metabolic activities in the prawns some moulted while others did not which could in effect affect the rate of growth in prawns.

FEEDS AND GROWTH

The growth rate obtained with these prepared diets showed that they should still need to be improved; moreso, when compared with rate from fresh food containing the same protein source. A suitable food pellet would have to incorporate a superior binding agent, since prawn rather than ingesting pellets whole as do most fish, hold them and pick them apart. Resultant effect is wastage of much of the food. Productivity, growth and survival could be enhanced if supplementary feed could include dried animal material which could be softened in freshwater for a considerable length of time before use.

BODY MANIPULATIONS AND GROWTH

Ajuzie [1988] observed that under experimental conditions cannibalism among the prawns could be checked by amputation of the chelae. Bardach *et al* [1972] emphasised the significance of cutting chelae to be adaptability to crowding.

Anetekhai [1986] indicated that detection of food was by the use of eyes, antennular flagellae and the legs. In M. vollenhovenii, feeding activity was restricted to the night and they were euryphagons; feeding mainly on fish, organic detritus and aquatic plants in their natural habitat.

From the experiment it was observed that prawns with body manipulations grew faster than the intact prawns. With chelae amputation, more prawns could be reared in a unit; the prawns became less aggressive and or cannibalistic. *M. vollenhovenii* are nocturnal (Anetekhai, 1986) but the prawns with their eye stalks removed, would find it impossible to differentiate between day and night. Thus, they wandered around all the time grabbling and grasping any food, they came in contact with. These prawns fed all the time with little breaks. Those with chelae amputated, over time became less aggressive thus, charged less, attached less and defended less. Consequently, less energy was expended but more energy was available for body assimilation and biomass.

Conclusion

Macrobrachium vollenhovenii accepted and utilised artificial diet, so it can be cultured commercially, not necessarily with much protein as excess protein might even impair growth. When the prawns are rendered sedentary and less aggressive, much energy burning will be curbed and more growth enhanced. When prawns had their eyes removed, they still fed successfully using the flagellae as tactile detectors, utilising most of the food provided. So, reducing waste. With chelae confirmed to be for offence and defence removed, less injuries would be inflinched on other prawns. So, many prawns could be reared in a limited space. Specific preventive and curative measures like following of ponds with or without lime treatment can curb the transmission of diseases as another concomitant of high population density. Chemical treatment antibiotics can be incorporated into diets as prophylactic measures.

Table 1: Growth response of Macrobrachium vollenhovenii to different protein levels and body manipulation

{PRIVATE }Feed level	Set of prawns	Week 0	Week 1	Week 2	Week 3	Week 4	Week 5	Week 6	Difference W_2-W_1	Relative Growth Rate	Weight Mean Value	Conversion Ration
25%	Normal	22.45	23.33 <0.88> 0.16 7.91	23.51 <0.13> 0.02 8.19	23.79 <0.28> 0.05 8.26	23.93 <0.14> 0.03 8.33	24.11 <0.18> 0.03 8.40		1.61	0.28%	0.322	30.74
	Eye Cut	23.38	24.43 <1.05> 0.18 8.19	25.18 <0.75> 0.12 8.54	26.13 <0.95> 0.14 8.82	26.99 <0.86> 0.12 9.10	27.95 <0.97> 0.04 9.45		4.58	0.59%	0.916	11.77
	Chelae-cut	22.15	23.35 <1.20> 0.22 7.77	24,31 <0.96> 0.04 8.19	25.37 <1.06> 0.04 8.33	26.36 <0.99> 0.04 8.89	27.68 <1.32> 0.05 9.24					
	Eye & Chelae cut	23.07	23.97 <0.90> 0.04 8.05	24.42 <0.45> 0.08 8.40	25.04 <0.62> 0.10 8.54	25.58 <0.54> 0.08 8.74	26.18 <0.60> 0.02 8.96		3.11	0.54%	0.622	16.91

Table 1 (Contd.)

{PRIVATE }Feed level	Set of prawns	Week 0	Week 1	Week 2	Week 3	Week 4	Week 5	Week 6	Difference W_2-W_1	Relative Growth Rate	Weight Mean Value	Conversion Ration
20%	Normal	16.11	17.15 <1.04> 5.60 5.60	17.43 <0.33> 0.11 6.02	17.82 <0.34> 0.11 6.09	18.31 <0.49> 0.15 6.30	18.89 <0.58> 0.16 6.44		2.78	0.78%	0.556	13.35
	Eye Cut	12.93	14.43 <1.50> 0.72 4.55	15.18 <0.75> 0.33 5.04	16.00 <0.82> 0.32 5.32	17.05 <1.05> 0.36 5.60	18.30 <1.25> 0.10 5.95		5.37	1.60%	1.074	6.13
	Chelae-cut	12.68	13.68 <1.00> 0.53 4.41	14.25 <0.57> 0.28 4.76	14.87 <0.62> 0.28 5.04	15.62 <0.75> 0.31 5.2	16.67 <1.05> 0.38 5.46		3.99	1.44%	0.798	7.70
	Eye & Chelae cut	15.36	17.11 <1.75> 0.60 5.39	18.36 <1.25> 0.27 5.95	19.68 <1.32> 0.34 6.44	21.08 <1.40> 0.32 6.86	22.82 <1.75> 0.34 7.35		7.46	1.43%	1.49	5.36

Table 1 (Contd.)

{PRIVATE }Feed level	Set of prawns	Week 0	Week 1	Week 2	Week 3	Week 4	Week 5	Week 6	Difference W_2-W_1	Relative Growth Rate	Weight Mean Value	Conversion Ration
15%	Normal	15.81	16.71 0.90 0.05 5.53	17.41 0.70 0.40 5.81	17.81 0.40 0.13 6.09	18.20 0.39 0.12 6.23	18.36 0.16 0.05 6.37	18.51 0.15 0.04 6.51	2.70	0.79%	0.450	15.92
	Eye Cut	15.88	16.98 1.10 0.38 5.60	18.03 1.05 0.06 5.95	18.93 0.90 0.35 6.30	19.83 0.70 0.23 6.65	20.39 0.50 0.14 7.00	20.99 0.60 0.14 7.35	5.11	1.16%	0.850	9.00
	Chelae-cut	16.21	17.21 1.00 0.34 5.67	18.11 0.90 0.05 6.02	18.81 0.70 0.20 6.30	19.50 0.69 0.0 6.58	19.97 0.47 0.12 6.86	20.42 0.45 0.11 7.14	4.21	1.01%	0.700	10.82
	Eye & Chelae cut	16.61	17.86 1.25 0.40 5.81	19.16 1.30 0.07 6.30	20.19 1.03 0.05 6.72	21.20 1.01 0.05 7.07	21.82 0.62 0.03 7.421	22.52 0.70 0.03 7.9	5.91	1.17%	0.985	8/28

Figures in brackets < > are the weekly increases in Weight <g>
Figures underlined - are the weekly relative increase in weight <g>

Table 2: **Summary of ANOVA test results**

{PRIVATE }Sets of Prawns	Calculated Frequency F cal	Tabulated Frequency T tab
25% - level diet	2.89	5.91
20% - level diet	8.71	5.91
15% - level diet	3.05	5.91
Normal prawn	0.37	4.70
Eye ablation	0.43	4.70
Chelae amputation	2.10	4.70
Eye and Chelae cut	1.80	4.70

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