EARTHWORM AND MAGGOT MEALS AS A POTENTIAL FISH MEAL REPLACEMENT

BY

HAWA BINT YAQUB

Marine Fisheries Research Division,

P. O. Box BT 62,

Tema

ABSTRACT

Three meals were formulated from the earthworm (Endrilus eugineae) and maggot (Musca domestica) and fish (Engraulis encrosicolus). These meals were evaluated as a potential replacement for fishmeal. This is because fishmeal could be very expensive at times. The three meals were used in feeding the catfish (Heterobranchus isopterus) fry for 30 days.

The study was conducted in 1991 at the Institute of Renewable Natural Resources Farm, University of Science and Technology. Two replicates were done using four hapas in each replicate. Each hapa was stocked with 50 fry and fed. Those in the fourth hapa were not fed to ascertain the effect of supplementary feeding on the growth of the fish. Weight increment was found to be less in the fourth hapa than the other three hapas, though the difference was not significant at the 5% level.

On the basis of weight increment, the best growth performance was produced by maggot meal. It was followed by earthworm and fish meals respectively. Based on food conversion ratio maggot meal was again the best, followed by earthworm and fish meals respectively. The importance of supplementary feeding was evidenced in the higher weight increment in fish that were fed than those that were not fed. Maggot and earthworm meals could therefore be a whole or partial replacement for fishmeal. The difficulty in the harvesting or rearing maggots and earthworms may however reduce this potential.

INTRODUCTION

Protein is taken by man to meet his physiological needs. It is for maintenance and repairs of tissues of organisms for optimum growth and development. But there is insufficient intake of protein especially in developing countries due to poverty. Protein deficiency could lead to malnutrition in pregnant women, nursing mothers and young growing babies and children. Malnutrition could cause retardation in the development of the central nervous system, reduce mental alertness and physical efficiency. It makes these groups of people vulnerable to infectious diseases and had caused and continues to cause high mortality among infants and young children in developing countries (Aylward and Mogen, 1975).

Fish containing about 60% protein is a very good source of protein. Meat it also rich in protein but very expensive and many families in developing countries could not afford. Plants protein also lack at least one of the essential amino acids needed by the body. Fish is may therefore be the cheapest and best form of protein source (Spinelli, 1978).

However fish, which is normally obtained from the wild, has dwindled due to overexploitation, resulting from the ever-increasing human population. Aquaculture has been found necessary as one approach to increase fish production to make enough fish/protein available to the populace. However one major constrain facing aquaculture is feeding. There is high competition for the same foodstuffs between man and his domestic animals. This has increased the price of fish meal, which is the sole protein source in fish feeds. It is therefore very crucial that an alternative is found (Jauncey and Ross, 1982) to reduce feeding cost, and to make aquaculture a viable and attractive venture. Earthworm has been found to be a good source of protein (Guererro, 1981; Tacon et al.1982; Hilton, 1983), it uses as fish bait is well known in fishing. Maggot meal has high protein content and the high crude lipid could act as protein sparer, which can be used to maximise protein utilization for growth (Jauncey and Ross, 1982; Oti Boateng, 1988; Sackey, 1989). However little is known about their potential as a fish meal replacement in the diet of the Catfish

In view of this, three meals (Maggot, Earthworm and Fish) were formulated as feeds to determine a potential fish meal replacement. This was based on growth rate, weight increment and food conversion ratio.

MATERIALS AND METHODS

Three meals were formulated from fish, earthworm and maggot. The fish was bought from the local market whiles the earthworm and maggot were produced by culturing. Maggots were produced from poultry droppings and animal carcass. Earthworms were from pito waste. Three pits were filled with these wastes (poultry droppings and pito waste). Loamy soil was added to the droppings to provide the natural environment for the production of earthworms. The pits were covered with plastic sheets to prevent the substrate from being saturated by rain, however they were watered to keep the substrates moist for the best results.

Maggots and earthworms were ready for harvesting in 5-8 days. Sieves and trays were used to get them from the substrates. Thus the substrates containing the animals were put on the sieve (mesh size of 5mm) and placed over the tray and placed in the sun. Being phototaxic, the animals move away through the sieve into the tray. They were washed with water and dried separately for 5 days in the sun and in the oven at 50˚C for 24hrs. Using cyclotic milling machine, they were separately milled together with the other component to pass through 0.5mm sieve mesh. The feeds were then formulated. Table 1 presents the composition of the formulated feeds and table 2, the composition of earthworm and maggot.

Four hapas were built in a pond and catfish fry were then obtained from a fry pond. The hapas were labelled according to the experimental feeds(fish meal -A, Earthworm meal-B and Maggot meal-C). Each hapa was stocked with fifty fry. The fry were weighed before putting them in the hapas to know the initial weight. Fish in the first three hapas were fed three times (4hrs interval starting from 8.30am,) a day whiles those in the fourth hapa were not fed. Fish fry were then weighed every ten days with Oheus Sensitive Balance to determine growth rate. Fry were blotted to remove excess water before being introduced into a known weight/volume of water. The fry were weighed in tens due to their small size and the fact that they were very

delicate. Also weighing them individually did not give any appreciable difference in the weight.

Other environmental factors like temperature and oxygen that could affect growth were also taken care of. Surface and Bottom temperatures of the water were measured with thermometer, Oxygen with Oxygen meter, pH with pH meter, water conductivity with conductivity meter. The environmental factors were measured in ten days interval and are presented in table 4.

The results obtained from the experiment were then subjected to analysis of variance, which gave a Standard Error of 2.2 and co-efficient of variation of 13.9%. Table 5 presents this.

RESULTS

Table 1: Composition of formulated feeds.

	Fish meal (**A**)	Earthworm (**B**)	Maggot(**C**)	Percentage (%)
Fish meal	400g			28.6
Earthworm		400		28.6
Maggot			400	28.6
Corn	280	280	280	20.0
Rice bran	200	200	200	14.3
Spent brew	200	200	200	14.3
Brewer's yeast	200	200	200	14.3
Groundnut cake	120	120	200	8.6

Table 2: Proximate Composition of Maggot and Earthworm

	% Dry Matter	
	Maggot	Earthworm
Moisture	8	60
Crude Protein	45	12

Crude Lipid	15	-
Ash	8	10
Chitin	25	-

The fish soon became used to the feeds in all the treatments. They were observed to be feeding actively throughout the study period. All the fish were found to increase their weight constantly except on the 20th day where they all showed negative growth during the second replicate. Fish in all the hapas were found to be decreasing in numbers as the days passed by. This observation was more rapid in hapas B and C, which was for maggot and earthworm meals respectively. The averaged weight increment and Food Convention Ratio (FCR) are shown in Table 3 below. The FCR, which is the ratio between change in average weight increment and weight of food fed (Final weight - Initial weight / Food fed), is based on the average weight of ten fry for ten days.

Table 3:

	Fishmeal (A)	Earthworm meal (B)	Maggot meal (C)	No Feeding
1st replicate				
Initial weight (g)	1.157	1.008	0.970	0.372
Final weight	24.858	32.591	33.867	10.000
2nd replicate				
Initial weight (g)	8.715	11.639	9.331	
Final weight	18.750	18.750	21.429	
Mean Weight (g)				
Increment	16.868	19.347	22.000	9.628.7
Food Fed	10.121	13.543	17.600	
FCR	0.60	0.70	0.80	-

Table 4: Environmental parameters monitored

Days	Temperature	pH	Oxygen	Conductivity (*10^{-})

10	32.3	6.4	5.1	1.9
20	33.0	6.8	5.4	1.6
30	32.1	6.9	3.7	1.5

Table 5: Analysis of Variance

S.V	D.F	S.S	M.S	F.Cal	F.Tab 5%	F.Tab 1%
Treatment	2	15.090	7.545	1.029	9.550	30.800
Error	3	21.999	7.333			
Total	5	37.089				

DISCUSSIONS

The replicates were not done at the same time since there were not enough space and fish. This could have affected the result. Though experimental conditions were the same for both replicates. The negative growth showed by all the fish on the 20th day during the second replicate could be that the fish were not fed or did not have access to feed. In the mornings they were normally fed by the senior technician in the laboratory. The decreasing in number of fish could be attributed to mortality or they were finding a way of getting back into the pond. Examinations of the hapas did not show that they were torn and so the mortality could be attributed to cannibalism. No reason could really be found why the decrease was more rapid in hapas B and C, which were for maggot and earthworm respectively. This is because examination of the hapas did not show any holes in the hapas nor were there any predators.

The few remaining fish had enough space to enhance growth. This could have contributed to these two feeds being the best. Maggots were also found to contain high protein than earthworms this could have also contribute to the high growth of fish fed on the maggot meal and also the high crude lipid that could act as protein sparer to maximise growth. The fry were of the same age but not of the same size and weight. Those for the maggot meal had the lowest weight and yet still it gave the best growth performance. This could be due to high preference for this meal, which may be that the meal is more palatable and digestible. Oti Boateng (1988), Sackey(1989)

and Spinneli(1978) also made this observation. Also small fish have been found to eat more to increase weight when fed on different feeds, and this could have contributed to the highest growth performance by maggot meal. Sackey 1989 found this. Bigger fish eat more to gain more weight when fed on same feed and this was found by Yaqub, (1991) when working on mono sex culture of Tilapia involving feeding and growth rate analysis.

The difference in weight between the fish that were fed and those that were not fed is an indication that supplementary feeding is important in fish culturing, though statistically the weight difference was not significant. Standard error of 2.2 and co-efficient of variation of 13.9% shows that the experiment was reliable.

The production of maggot and earthworm, which involved culturing and harvesting, was very laborious. It was also time consuming and a lot of water is needed to wash them. This made production very difficult and expensive in terms of time and energy, unlike fishmeal, which could easily be obtained from the local market.

CONCLUSIONS AND RECOMENDATIONS

After the experiment fish were found to perform better on maggot meal and earthworm. Maggot meal and earthworm could therefore be good whole or partial replacement for fishmeal respectively. However laborious nature of harvesting could be a major constraint to the potential of maggot as a source of protein for fish and fishmeal replacement.

Farmers may find it difficult to use maggot meal to formulate feed to feed their fish due to the work involve and where the maggot may be coming from or the source of it production. It is suggested that the feed be prepared and sold to farmers. Also the most effective way of maggot and earthworm production be researched into.

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