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# Use of fresh or dried manure worm (*Eisenia foetida*) on the growth performance of juvenile of *Clarias gariepinus* high out in basin

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**Abstract**
For 45 days we tested the effect of three treatments (T8, T9 and T11) on the growth of fingerlings with an initial mean weight of 5.91 ± 0.51g in a breeding basin. The treatments T8 and T9 are based on conventional and unconventional local by-products. The main ingredients used are fish meal, soybean meal, yellow corn and manure worms (*Eisenia foetida*) in the same proportions. The treatment T11 is the control (Coppens). The experiment was carried out in triplicates for each treatment. The physico-chemical parameters of the water and the recorded growth performance parameters were subjected to the Analysis of Variance with a criterion (Anova1). The differences were significant at level of 5%. Statistical processing was carried out using software Statview 5.1. The main results recorded in this study indicate that the growth performance of fish was not influenced ($p$>0.05) by the physico-chemical parameters of the water in the different treatments. The growth rate (TCS) and conversion rate (TC) ranges obtained show no significant difference ($p$>0.05) for fish subjected to the treatments T9 and T11. On the other hand, there is a significant difference ($P$<0.05) between these two treatments (T9 and T11) and the treatment T8 for these same parameters (TCS and TC). The local treatment T9 is therefore as effective as Coppens.

**Keywords:** Manure's worm, compared effect, growth, *Clarias gariepinus*, fresh

## 1. Introduction
In Benin, fish farming is a sector of activity which is arousing more and more interest in the face of the overexploitation of fishery resources in continental waters. Indeed, the political will of the government, the initiatives of private promoters and the support of various projects have aroused the enthusiasm of the population for this activity, especially with the availability of markets for the sale of the fish produced [1]. *Clarias gariepinus* is one of the most consumed fish species in Benin, however its farming is confronted with the high cost of its food which represents more than 50% of the production cost [2]. This carnivorous species with an omnivorous tendency has been the subject of several studies aimed at promoting local by-products in its diet, such as manure worm flour in combination with soybean meal, yellow corn meal and fish meal [3]. Given that the condition, quality of the food and the way the fish are fed are key factors influencing on the growth of fish and the viability of fish farms [4], it is therefore normal that studies are carried out for a better use of manure worm in the diet of this species of fish. This is what justifies the present study, the objective of which is to assess the comparative effect of two diets enriched with fresh or dried manure worm incorporated on the growth performance of fingerlings of *C. gariepinus* hight out in basins.

## 2. Materials and Methods
### 2.1 Experimental procedure
The experiment took place in 9 square tanks of 1m side arranged in three triplicates operating in closed circuit at the experimental station of fish farming located in the fishery sub-program of the National Institute of Agricultural Research in Benin. Two food treatments T8 and T9, iso-protein and iso-energy and with high nutritional values, intended for the feeding of catfish *Clarias gariepinus* in the pre-magnification phase, were developed from conventional and unconventional raw materials.

In treatment T8, the manure worm was incorporated in the form of flour while in treatment T9 it was served fresh, as a dietary supplement to the fingerlings of *C. gariepinus*, in the mornings at a quantity corresponding to one third of the daily ration. The T11 treatment (Coppens 3 mm) served as a control food. The biochemical composition of the main ingredients is shown in Table 1. These foods were tested on juveniles of catfish *C. gariepinus*, with an initial average weight of 5.91 ± 0.51 g (Average weight ± ES). A total 270 fishes were weighed individually and distributed randomly in 3 triplets of ponds with 400 liters of useful volume, i.e. 30 fishes per pond, thus forming three triplicate treatments each corresponding to one treatment. The fish were stored in the tanks 3 days before the start of the experiment to acclimatize them to the new conditions. They were fed manually 3 times a day at 8 a.m., 1 p.m. and 5 p.m for 6 weeks. During the first four weeks the fish were fed with a ratio of 10% and then the last two weeks with a 5% of the biomass. They were considered full when they were no longer paying attention to the pellets.

### 2.2 Manufacturing of treatments

The crushed raw ingredients were screened using a 400 micron sieve. For each food the ingredients were weighed and mixed until a homogeneous powder was obtained. Hot water was then added to obtain a malleable dough which, passed through the die of a meat grinder (TC 22SL), gives filaments of 2 mm in diameter. These filaments were then dried in the sun, fragmented to the desired size, bagged and stored until distribution. The composition by fresh weight of the foods tested is shown in the table.

### 2.3 Biochemical composition of the ingredients

The biochemical analysis of the various ingredients used for the manufacture of the T8 and T9 treatments was carried out in the laboratory of Valorization and Management of the quality of the Bio-ingredient feeds LABIO of department of Nutrition and Food Science of the Agronomic Faculty of Science of the University of Abomey-Calavi according to the official method of analysis AOAC. 2000 and the values obtained for this purpose are shown in the table below.

**Table 1:** Biochemical composition of the ingredients

| Ingredients | Fish meal | Flour of soya | Flour of yellow corn | Flour of worm (*Eisenia foetida*) | Flour of moringa sheet |
|---|---|---|---|---|---|
| **Composition (% MS)** | | | | | |
| Matière sèche[1] | 91.47 | 88.96 | 86.12 | nc | 25.00 |
| Protein | 47.21 | 43.50 | 7.84 | 59.00 | 6.70 |
| Lipids | 1.62 | 1.38 | 1.43 | 9.00 | 1.70 |
| Fibres | 0.95 | 6.60 | 6.59 | <5.00 | 0.90 |
| Ashes | 28.14 | 5.80 | 1.32 | 17.00 | nc |
| ENA[2] | 13.55 | 31.68 | 68.94 | 15.00 | nc |
| Calcium (g/Kg) | 6.31 | 0.29 | 0.03 | nc | 440 mg |
| Phosphore (g/Kg) | 3.89 | 0.71 | 0.25 | nc | 70 mg |
| ***AAE (g/100 g MS)[3]*** | | | | | |
| Lysin | 5.05 | 2.79 | 0.17 | 6.80 | +4.30 |
| Valin | 3.91 | 1.41 | 0.30 | 4.70 | 7.10 |
| Leucin | 4.62 | 3.53 | 0.80 | 7.20 | 9.30 |
| Histidine | 1.48 | 0.98 | 0.17 | 2.60 | +2.10 |
| Arginine | 3.15 | 3.48 | 0.30 | 6.00 | 6.0 g/16g |
| Threonine | 3.32 | 1.68 | 0.20 | 5.2 | 4.9 |
| Isoleucine | 2.11 | 1.61 | 0.25 | 4.30 | 6.30 |
| Methionine + Cysteine | 2.31 | 1.08 | 0.28 | nc | 2.00 |
| Tryptophan | 0.91 | 0.69 | 0.06 | nc | +1.90 |
| Phenylalanine | 2.73 | 1.83 | 0.58 | 3.80 | +6.40 |

### 2.4 Presentation, composition by fresh weight and bromatological analysis of the treatments

Both treatments contain the same raw materials in the same proportion. However, the difference between these treatments lies in the nature of the manure worm which is found fresh in the T9 treatment and in the form of flour incorporated in the T8 treatment.

**Table 2:** Composition by fresh weight of the food tested

| Ingredients | T8 (treatment contain flour of manure's worm) | T9 (treatment contain fresh manure's worm fumier) |
|---|---|---|
| Fish meal | 25 | 25 |
| Flour of yellow corn | 15 | 15 |
| Worm of manure | 15 | 15 |
| Flour of soya | 40 | 40 |
| Flour of moringa sheet | 5 | 5 |
| Methionine | 0,5 | 0,5 |
| Lysin | 0,5 | 0,5 |
| Palm oil | 1 | 1 |
| Total | 102 | 102 |
| Analytic composition of treatments (g/100g) | | |
| Dry matter | 90,05 | 90,05 |
| Protein | 36,77 | 36,77 |
| Lipids | 18,15 | 18,15 |
| Starch | 30,09 | 30,09 |
| Fibre | 2,91 | 2,91 |

| | | |
|---|---|---|
| Ashes | 12,09 | 12,09 |
| Energy (Kcal/100g) | 492,06 | 492,06 |

### 2.5 Data collection
The data collected relate to the physicochemical quality of the farming environment on the one hand and the morphometric measurements of fish on the other. Physico-chemical parameters such as water temperature, hydrogen potential, dissolved oxygen, conductivity, TDS and salinity were measured three times a day (7:30 a.m., 12:30 p.m. and 5:30 p.m.) for three days a week. These parameters were taken using a "Model SX736 pH / mV / Conductivity / DO Meter" multimeter equipped with probes. At each weekly growth control fishery, the total length and the standard length and then the total weight were determined on each individual fish with complete water renewal and basin rotation. The ration not consumed was weighed and recorded by basin as well as any mortalities. The various weight were carried out with a brand balance "Sartorius basic" capacity 110g and precision 0.001g.

### 2.6 Statistical analysis of the data
Statistical processing of the data collected has been carried out. The comparisons were made using the Analysis of Variance to a classification criterion (Anova 1). The Hartley test allowed to test the homogeneity of variances and the Least Significant Difference (LSD) test [5] made it possible to determine any differences between the calculated means. A probability threshold of 5% has been adopted [6]. With regard to biometric data, before each repetition is considered as an observation before any calculation of averages for initial comparisons.

## 3. Results
### 3.1 Average values of the physico-chemical parameters of water.
The average values of the physico-chemical parameters recorded during the experiment are presented in Table 3

**Table 3:** Average values of the physico-chemical parameters of the breeding environment

| Treatments | | Parameters | | | | | |
|---|---|---|---|---|---|---|---|
| | | T °C eau | $O_2$ (mg/L) | pH | Cond (µS/cm) | TDS (mg/L) | Sal (g/L) |
| T8 | Moyenne | 26.11 | 7.13[a] | 7.02[a] | 573.10[a] | 391.74[a] | 0.08[a] |
| | Ecart-type | 0.91 | 2.32 | 0.50 | 39.31 | 32.90 | 0.04 |
| T9 | Moyenne | 25.78[a] | 7.27[a] | 7.00[a] | 569.81[a] | 388.84[a] | 0.08[a] |
| | Ecart-type | 0.82 | 2.52 | 0.49 | 32.91 | 31.81 | 0.01 |
| T11 | Moyenne | 25.19[a] | 7.23[a] | 7.06[a] | 547.80[a] | 385.26[a] | 0.07[a] |
| | Ecart-type | 0.87 | 2.40 | 0.10 | 31.81 | 34.41 | 0.01 |

T: temperature; O2: dissolved oxygen; potential pH of hydrogen; Cond: conductivity; TDS: total dissolved solids and Sal: salinity, T8: food contain manure's worm flour, T9: food contain fresh manure's worm, T11: control food (Coppens 3mm).

For the same parameter, the means bearing the same letters indicate that there is no significant difference between these values ($p$>0.05). The highest average temperature (26.11 ± 0.91 ° C) was obtained in the T8 treatment. However, it does not present a significant difference ($p$>0.05) compared to the average temperature values obtained with the T9 and T11 treatments. For the mean dissolved oxygen, pH, conductivity, TDS and salinity values, no significant difference was observed between the treatments.

### 3.2 Zootechnical performances
Table 4 shows the growth performance of *C. gariepinus* fingerlings fed the experimental foods (T8, T9 and T11). The growth parameters: final average weight, initial average weight, specific growth rate (TCS), weight gain, survival rate and the coefficient of variation showed that there is a significant difference ($P$<0.05) between treatments. The coefficient of variation which shows the heterogeneity of the final average weight of the *C. gariepinus* fingerlings subjected to the different treatments also varied significantly ($P$<0.05). The lowest values were recorded in fingerlings fed the T8 diet containing manure worm meal indicating relatively low growth.

**Table 4:** Growth performance of *C. gariepinus* fed with the different treatments

| Parameters | Treatments | | |
|---|---|---|---|
| | T8 | T9 | T11 |
| Average initial weight | 5.91 ± 0.51 | 5,91 ± 0.51 | 5.91 ± 0.51 |
| Average final weight | 52.18 ± 0.22 | 68,37 ± 0.41 | 69.02 ± 0.53 |
| Gain of weight (g) | 46.27 ± 0.17 | 62,46 ± 0.45 | 63.11± 0.47 |
| Specific growth rate (%/j) | 5.18 ± 0.25a | 5,82 ± 0.78b | 5.85 ± 03b |
| Conversion rate | 1.09 ± 0.01 | 0,91 ± 0.02 | 0.92 ± 0.2 |
| Factor of condition | 0.77 ± 0.01a | 0,82 ± 0.01b | 0.82 ± 0.01b |
| Survival (%) | 100 ± 0.00 | 100 ± 0.00 | 100 ± 0.00 |
| Coefficient of Variation CV (%) | 1.20 ± 0.01 | 1,82 ± 0.03 | 1.78 ± 0.03 |
| Prime of one kg of food | 632.25 | 632.25 | 1000 |
| CUA | 689.15 | 575.34 | 920.00 |

T8: food contain manure's worm meal, T9: food based on fresh manure worm, T11: control food (Coppens 3mm).
For the same parameter, the means bearing the same letters indicate that there is no significant difference between these values ($p$>0.05).

### 3.3 Evolution of the fingerlings weight
From the beginning to the end of the experiment, an increase in weight is observed in the fish subjected to the different treatments. This increase in weight is higher for the fingerlings subjected to the T9 treatments based on fresh manure worm and T11 (control). However, no significant

difference ($p$>0.05) is to be reported compared to the growth of fish induced by these two treatments. However, there is a significant difference between the final average weights of the fish in these two treatments (T9, T11) and those in the T8 treatment. Treatment 9 based on fresh manure worm as a dietary supplement, like Coppens, was well valued by the *Clarias gariepinus* fingerlings.

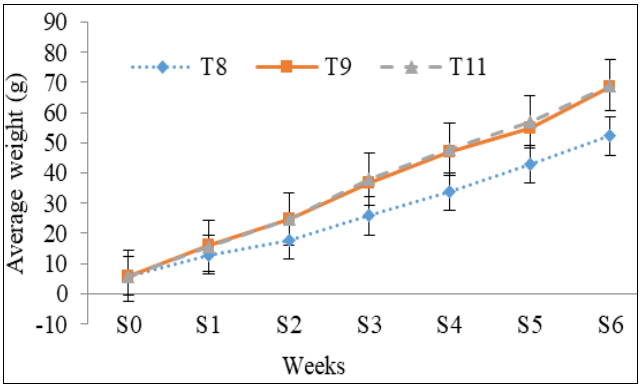


**Fig1:** Evolution in weight of *Clarias gariepinus* fingerlings subjected to different treatments

T8 and T9: treatments based on manure worm and fresh manure worm respectively as a dietary supplement, T11: control treatment (Coppens: 3 mm)

## 4. Discussion

### 4.1 Physico chemistry

The average values of the physico-chemical parameters of the fish farming water are within the standards recommended by several authors for the breeding of *Clarias gariepinus*. Indeed, the temperatures observed by *Tossavi et al.* [7] in the breeding basins of *Parachana obtura* and *Schilbe intermédius* are in line with those obtained for this study. Houndonougbo *et al.* [2] reported similar values for pH and dissolved oxygen for a study carried out on the comparative effect of two diets enriched with fresh or dried manure worm incorporated on the growth performance of tilapia juveniles (*Oreochromis niloticus*) raised in the basin. Azaza *et al.* [8] reported values very close to those recorded in this study.

The values of the water mineralization parameters such as the TDS and the Conductivity were in line with the observations made by Madjiki *et al*. [9]. It therefore follows that the fish were raised in good conditions. In this study, the physico-chemical parameters of the rearing environment did not therefore influence the growth of *C. gariepinus* fingerlings subjected to the various food treatments.

### 4.2 Fish growth parameters

Manure worm *E. foetida* has been used in chicken feed with varying degrees of success. It serves as bait for fishing for fish in inland waters. Recently, the manure worm was tested in the feeding of juveniles of Heteroclarias (hybrid resulting from the cross *Heterobranchus longifilis* X *Clarias gariepinus*) by Monebi *et al.* [10] who showed that 50-75% of this protein source could replace fishmeal without affecting the growth and food use performance of this fish. The survival rate obtained (100%) is much higher than that recorded by Tossavi *et al.* [7], Vodounou *et al.* [11] and Djissou [12] for tests carried out respectively on *Schilbe intermedius*, *Parachanna obtura* and *Clarias gariepinus* and shows that treatments based on manure worm do not present any toxicity for fish. The observed growth rates (TCS) perfectly corroborate those reported by Kpoguè *et al.* [13], Oké *et al.* [14] and Elègbè [15] for the rearing of the same species in pre-growout ponds. T8 and T9 foods have the same biochemical composition, the difference observed between T8 and T9 treatments is therefore related to the state of the manure worm. This study shows that the *Clarias gariepinus* fingerlings make better use of the manure worm in the fresh state.

## 5. Conclusion

The high survival rates (100%) of the fingerlings obtained during the experiment show that it is a hardy species which endures the harsh stress conditions linked to the various manipulations carried out during breeding in a controlled environment. The foods tested in this study induced generally acceptable growth performance. The species *Clarias gariepinus* is a fish that values the manure worm better in a fresh state as a food supplement compared to the flour incorporated into food by-products.

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