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# GROWTH PERFORMANCE OF THE AIR BREATHING CAT FISH, *CLARIAS BATRACHUS* (LINN.) FED WITH VERM MEAL AS FISH FOOD

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**KEYWORDS**

*P. sansibaricus*
Verm meal
Growth rate
*Clarias batrachus*

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## ABSTRACT

Investigation was carried out to assess the growth performance of the freshwater cat fish, *Clarias batrachus* (Linn.) maintained on three different fish meals i.e. earthworm (*Perionyx sansibaricus*) , pila (*Pila bengalensis*) goat liver for 45 days under ideal and identical laboratory conditions. The growth rate of fishes (mg $g^{-1}$ wet weight $day^{-1}$) was calculated to test the suitability of fed meals. Significant higher rate of growth was recorded for *Clarias batrachus* fed with earthworms as compared to molluscan meal and goat liver meal. The average weight gain for different diet at different time interval was in order: earthworm > goat liver > pila. It was 1.932 ± 0.3409 > 1.156 ± 0.275 > 0.676 ± 0.2139 respectively at 15 day. At 30 day it was 2.786 ± 0.6016 > 1.588 ± 0.2777 > 1.63 ± 0.8998 and 3.086 ± 0.561 > 2.062 ± 0.4303 > 1.21 ± 0.561 at 45 day respectively. The growth rate was higher for earthworms fed group showing their suitability. Two way ANOVA revealed significant variation in meal on 15th, 30th and 45th day ($F = 25.58$; df 2; $p < 0.001$,$F = 7.3708$; df 2; $p < 0.01$ and $F = 29.004$; df 2; $p < 0.001$) over the population fed on other meals. The difference in growth rate of fishes when fed on earthworms showed a significant ($p < 0.01$) variation over the population fed on other meals.

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## INTRODUCTION

Fishes are said to be gold of water. They playing an important role in Nation's economy. They are major source of protein for human population on the planet. Production of more fish is one ray of hope to feed the growing population of the globe. Fishes are intimately associated with their environment and food. Therefore physical and chemical changes in the environment as well as quality of food readialy reflected the measurable physiological changes.

Growth and development can also be affected by quantity and quality of food which bring about changes in body composition. Growth of an organism means a change either in length or weight or in both. With an increase in age and an increase in size is due to the conversion of the food material into the body building molecules by means of nutrition, digestion and metabolism (Saxsena and Saksena, 2009). In extream old age, growth of fish becomes extreamly slow. The growth is dependent on population density also. Growth in fish has its specific characteristics in different age groups of fishes. The study of growth rate of fresh water air breathing cat fish *Clarias batrachus* is known for its practical utility in fish management and conservation. The growth and production of fish depend on several factors including environmental factors and management practice, food quality etc (Sahoo *et at.,* 2002).

The freshwater air breathing cat fish *Clarias batrachus* found primarily, Southeast Asia, so name for its ability to "walk" across dry land to find food and suitable environments. In the wild, the natural diet of this creature is omnivorous. It feeds on smaller fish, molluscs and earthworm as well as detritus and aquatic weeds. It is a voracious eater which consumes food rapidly and this habit makes it a particularly harmful invasive species. Increasing cost of fish food ingredients (grains, fish meal, oil cakes etc.) has made scientists all over the world to look for cheaper and abundant substitutes. Fish meal though highly nutritive and palatable is a relatively expensive feed ingredient as compared to other low cost protein rich ingredients such as earthworm, molluscs, meat meal, soyabean meal etc. being used as protein source for fish (Lim and Dominy, 1990; Davis *et al.,*1995; Nandeesha *et al*., 2000, Davis *et al.,* 2005). Most wastes and by-products from agriculture, animal husbandary and industries have good food value having low cost which can be easily processed and recycled in the form of fish food (Langer *et al.,* 2011).

Sabine (1978) and Yoshida and Hoshii (1978) have suggested that the possible substitution of earthworms as protein substitute in feed of pigs and poultry. Arunachalam and Palanichamy (1984) have reported the improved growth rate of cat fish *Mystus vittatus* when fed on earthworms. Langer *et al*. (2011) have observed maximum growth rate in the prawns when fed on earthworm meals. Das and Patra, (1977) and Das and Senapati (1984) have reported high protein content in earthworm. In terms of nutritional quality and quantity, earthworm protein has been meal valued equally important and useful as fish meal and meat meal (Veeresh, 1984; Lee, 1985).

Keeping the all above facts in mind, the present work was taken up to investigate the suitability of an earthworm *Perionyx sansibaricus* as fish food for *Clarias batrachus* taking growth rate (mg $g^{-1}$ wet weight $day^{-1}$) as parameter.

## MATERIALS AND METHODS

### Experimental fish and management

*Clarias batrachus* weighting 500g-600g and body length measuring 20-25cm were purchased from local fish market Lalpur, Ranchi, Jharkhand and were acclimated to laboratory condition for 15 days. Fishes were divided into three groups and each group consisted of five sets (five individuals in each set). Each set of individuals was introduced into rectangular glass aquaria (60 × 30 cm capacity) containing 15 litre of water. The frist group was fed on an *ad labitum* diet of chopped muscle of earthworm *(P.sansibaricus*) twice a day. Prior to feeding, the gut of earthworms were evacuated by keeping them for 24 h in water (Das and patra, 1977) and then washed carefully in tab water to remove sand particles present (if any). Similarly second and third group were fed on *ad libitum* diet of chopped foot muscle of *pila bengalensis* and liver of goat respectively. Food remains were collected with least disturbance to the fish, using pipette. Thus rearing experiment was carried out 45 days clubbed at 15 day interval. Aquarium water was aerated continuously and changed daily. Live weight of fishes was taken by electronic balance.

### Water quality

During the period of investigation water was exchanged every day. Water was well aerated with the help of air pumps to maintain the dissolved oxygen (DO). Various physio-chemical parameters such as water temperature, dissolved oxygen, total alkalinity, pH, hardness and turbidity were analyzed by using standard methods (APHA, 1998) were recorded.

## RESULTS AND DISCUSSION

The data on growth of experimental fish as mg $g^{-1}$ wet weight $day^{-1}$ fed on three different types of food during experiment have been presented in Table 1. The growth rates have been clubbed for 15 days interval depending upon range of variation and have been represented in Fig. 1. After analysis of the table, it clearly specified that the growth rate of the experimental fish is maximum for earthworm *(P.sansibaricus*) fed group followed by goat liver meal and molluscan meal. The results indicate the suitability of verm meal over rest two type. The final average weight gain for three different types of food at three different intervals were in the order: earthworm meal > goat liver meal > pila (*P.bengalensis*). It was 1.932 > 1.156 > 0.676 respectively at 15 day. At 30 day it was 2.786 > 1.588 > 1.63 and 3.086 > 2.062 > 1.21 mg $g^{-1}$ wet weight $day^{-1}$ at 45 day respectively.

Starvation affects the physiology and other constituents of fish (Rajyasree and Naidu, 1989; Mukhopadhyaya *et al.,* 1991; Lee and Huse, 1992; Chin and Shin, 1992; Deng *et al.,* 1993; Mommsen *et al.,* 1980; Sullivan and Somero, 1983; Lowery *et al*., 1987). Lowery and Somero, (1990) observed that the amounts of different glycolytic enzymes are well conserved during periods of starvation, despite very large decrease in the total activities of the enzymes. Fasting also affects metabolic enzymes, RNA/DNA ratio and proteins in fish which has great impact on fish growth (Tripathi and Verma, 2003). So, for proper growth and physiological activities of the fish, foods are required. Because food has been a basic part of existence. Food is that which nourishes the body. They may also be defined as anything eaten or drank, which can be absorbed by the body to be used as an energy source, building, regulating or protective material (Sanyal, 2011). In short, food is the raw material from which bodies are made. Food is a prerequisite of nutrition.

**Table 1: Growth rate (mg $g^{-1}$ wet weight $day^{-1}$) at 15 day interval and average ± SD**

| S.No. Day | Earthworm meal (*P.sansibaricus*) | *Pila bengalensis* | Goat liver |
|---|---|---|---|
| | 15 day | | |
| 1 | 1.83 | 0.5 | 0.9 |
| 2 | 2.23 | 0.47 | 0.99 |
| 3 | 1.86 | 0.85 | 1.35 |
| 4 | 2.29 | 0.61 | 1.54 |
| 5 | 1.45 | 0.95 | 1 |
| Average | 1.932 ± 0.3409 | 0.676 ± 0.2139 | 1.156 ± 0.275 |
| | 30 day | | |
| 1 | 2.51 | 0.96 | 1.34 |
| 2 | 2.78 | 1.3 | 1.32 |
| 3 | 1.95 | 1.43 | 1.64 |
| 4 | 3.5 | 1.25 | 2 |
| 5 | 3.19 | 3.21 | 1.64 |
| Average | 2.786 ± 0.6016 | 1.63 ± 0.8998 | 1.588 ± 0.2777 |
| | 45 day | | |
| 1 | 2.95 | 1.15 | 1.91 |
| 2 | 3.22 | 1.22 | 2.7 |
| 3 | 2.85 | 1.3 | 2.25 |
| 4 | 3.96 | 1.16 | 1.88 |
| 5 | 2.45 | 1.22 | 1.57 |
| Average | 3.086 ± 0.561 | 1.21 ± 0.561 | 2.062 ± 0.4303 |

The statistical analysis of growth rates of earthworm fed group and molluscan meal fed group showed significant difference at 15-day ($p < 0.01$), 30-day ($p < 0.02$), 45-day ($p < 0.001$) intervals. Similarly, growth rates of earthworm (*P.sansibaricus*) and goat liver fed group at all the three different intervals showed significant ($p < 0.01$) difference (Table 2). A two way ANOVA test (Table 3) of the generated data on growth rates at

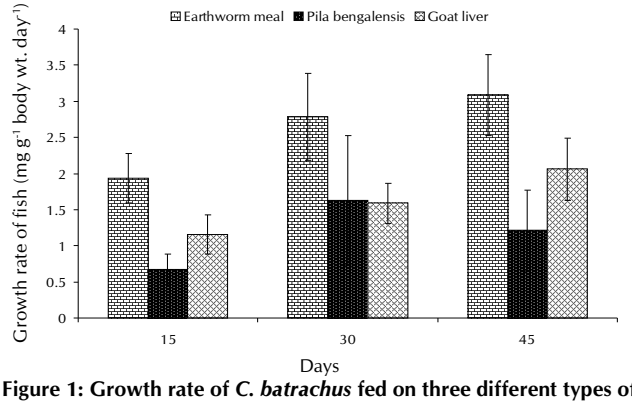


**Figure 1: Growth rate of *C. batrachus* fed on three different types of food during 45 days averaged for 15 days.**

**Table 2: t- test between growth rates of Clarias batrachus fed on vermi meal and goat liver meal as well as vermi meal and molluscan tissue meal with significance at different intervals**

| | Type | df | Calculate "t" | Significance |
|---|---|---|---|---|
| 15 day | E-P | 4 | 5.4268 | $p < 0.01$ |
| | E-GL | 4 | 5.3759 | $p < 0.01$ |
| 30 day | E-P | 4 | 2.8701 | $p < 0.02$ |
| | E-GL | 4 | 2.8701 | $p < 0.01$ |
| 45 day | E-P | 4 | 7.0943 | $p < 0.001$ |
| | E-GL | 4 | 3.6549 | $p < 0.01$ |

all three different intervals reveals no significant difference among the replicates of the samples while a highly significant and more significant difference has been produced ($df = 2,8, F = 25.58723$; 29.00489; $p < 0.001$ and 7.370829; $p < 0.01$) in growth rates of experimental fish due to variation in meal.

The observation shows the superiority and suitability of verm meal over the other meals for growth and development. Further, the consumption of verm meal was higher than other meals, which was determind by left out food materials after feeding.

Capacity of stomach, rate of digestion and gastric evacuation have been reported to influence the rate of food consumption (Pandian, 1967; Brett and Higgs, 1970), which in turn is dependent upon the nature of food materials (Arunachalam and Palanichamy, 1984). Reimmers (1957) has reported a comparatively shorter period for gastric evacuation for meals of oligochaetes. Arunachalam (1978), while studying *Tubifex tubifex* and aquatic oligochaete and fish muscle of *Gambusia affinis* as food items *M.vittatus,* has confirmed the findings of Reimmers (1957). The higher consumption of verm meal by the experimental fish, *Clarias batrachus* in present work might be due to the reasons mentioned above. Several types of stimuli are usually linked with fish feeding (Langer *et al.,* 1977). The present observation and statistical analysis indicate significant influence on growth rates by the types of food used during experiment on *C. batrachus*. Growth rate was higher when fed on earthworm (*P.sansibaricus*). This may be attributed to higher food consumption as higher food consumption leads to maximisation of growth rate in one hand while other hand the nutritional value of the food consumed. Maximisation of food intake in fishes by increasing the feeding frequency resulted in increased growth (Sampath and Pandian, 1984; Andrews and Page, 1975).

The nutritional value of the food is another important aspect to be evaluated to analyse the influence of food on growth *i.e.* the composition of food from carbohydrate, protein content viewpoint. Garling and Wilson (1976, 1977) and Murray *et al*. (1977) have suggested an optimum level of protein, fat and carbohydrate component to promote growth in *Lctalurus punctatus*- a cat fish.

Fishes are main source of nutrients and easily digestible, besides being the source of a number of byproducts beneficial to human being (Singh and Keshari, 2011). Extrinsic factors such as space, competition for food by other species, fish enemies and change in the physico-chemical characteristics of water and intrinsic factors such as genetic makeup, reproductive state and endocrine balance etc. also influence the growth rate of fish (Saksena and Kulkarni, 1983). Availability, consumption and assimilation of food directly influence the growth of fish (Brown, 1957). It has been very difficult to predict which factor is responsible or predominant for better or worse growth of fish when both the physico-chemical and biological factor are influencing the growth rate. Kartha and Rao (1990) have reported an isometric growth in *Catla catla* in commercial landings of Gandhi Sagar.

So far the economics of verm meal is concerned, it is easily available and affordable in Jharkhand. Sinha and Srivastava (2001) have reported a biomass of 328.38 g dry wt $m^{-2}$ from a garbage site of ranchi. The total population of the species has been found to be as high as 10,050 individuals $m^{-2}$ (Sinha and Srivastava, 2001). This shows the abundance and easy availability of *Perionyx sansibaricus* can be taken up as ideal fish food in commercial population.

## CONCLUSION

After experiment *Clarias batrachus* were found to perform better growth fed on earthworm (*Perionyx sansibaricus)* compare to *Pila bengalensis* and goat liver. Earthworm contain high protein than other meals. It contribute to the high growth of fish than molluscan and meat meal. Earthworm fed group 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. Protein is taken for maintenance and repairs of tissues of organisms for optimum growth and development. Fish containing about 60% protein is a very good source of protein. Farmers may find it difficult to use earthworm meal to formulate feed to feed their fish due to the

**Table 3: Two ways ANOVA of growth rate of *C.batrachus* obtained after feeding on earthworm, pila goat liver at different intervals**

| Source of variation | Sum of square | Degree of freedom | Mean square | Variance ratio F | Significance |
|---|---|---|---|---|---|
| 15th Day | | | | | |
| Replicates of same meal | 0.322573 | 4 | 0.080643 | 1.027391 | NS |
| Variation in meal | 4.016853 | 2 | 2.008427 | 25.58723 | $p < 0.001$ |
| Residual | 0.627947 | 8 | 0.078493 | | |
| 30th Day | | | | | |
| Replicates of same meal | 2.48684 | 4 | 0.62171 | 1.982841 | NS |
| Variation in meal | 4.622173 | 2 | 2.311087 | 7.370829 | $p < 0.01$ |
| Residual | 2.50836 | 8 | 0.313545 | | |
| 45th Day | | | | | |
| Replicates of same meal | 0.798827 | 4 | 0.199707 | 1.313025 | NS |
| Variation in meal | 8.823093 | 2 | 4.411547 | 29.00489 | $p < 0.001$ |
| Residual | | 8 | 0.152097 | | |

work involve and where the earthworm 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 earthworm production is researched into.

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