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# Growth performance and hematological indices of *Clarias gariepinus* (Burchel, 1822) fingerlings fed varying levels of *Telfairia occidentalis* leaf meal additives

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**Abstract**
As aquaculture production become more intensive, the sustainability of the industry depends upon the availability of suitable and economical feeds, which are organically derived. Essential information is needed especially on organically derived feed additives that can enhance diet digestibility and immune responses. This study evaluates the performance of *Clarias gariepinus* fingerlings fed varying levels of *Telfairia occidentalis* leaf meal additives. The plant leaves were shade dried to constant weight and milled to powder form. Five diets; $T_1$, $T_2$, $T_3$, $T_4$ and $T_5$ containing 0g (control), 0.5%, 1.0%, 1.5% and 2.0% *Telfairia occidentalis* leaf meal additives respectively were formulated. The diets were fed to *C. gariepinus* fingerlings for eight weeks. The mean weight gain were significantly different ($p$< 0.05) with diet $T_3$ having the highest value, 25.93±2.11g and $T_5$ the least value, 17.93±1.81g. Diet $T_1$, $T_3$, $T_4$, and $T_5$ had 85% survival and diet $T_2$ had the least survival, 75% however, with no significant difference (p>0.05). The haematology profiles of the experimental fish indicated significant differences (p>0.05) in all the parameters examined. The erythrocytes and leukocytes were highest for diet $T_3$ with 3.17±0.27 and 285.10±2.10 respectively. The proximate analysis of the carcass of *C. gariepinus* indicated diet $T_1$ having higher crude protein content (63.59%) than other treatments however with no significant difference (p>0.05). *Telfairia occidentalis* leaf meal can be used as plant additives in the diet of *Clarias gariepinus*.

**Keywords:** Aquaculture, growth performance, haematological profiles, *Clarias gariepinus*, fluted pumpkin, *Telfairia occidentalis*

## Introduction

Aquaculture is the fastest growing food producing sector, compared to other food commodities [1]. FAO [2] projected the total annual demand for fish and fishery products to expand by over 50 million metric tons from year 2015; and explained that 73% of supply is expected to come from aquaculture. Likewise, the demand for animal protein in Nigeria is increasing with increase in human population and aquaculture is an important option to meet this demand [3]. As aquaculture production become more intensive in Nigeria, fish feed has been identified to be a significant factor in increasing its productivity and profitability [4, 5]. Information on type, quality, quantity, seasonality and cost of fish feeds is important in determining the appropriate production strategy in aquaculture [6]. However, essential information is needed especially on organically derived feed additives that can enhance diet digestibility and immune responses of culture fish. There are a rich abundance of plants reputed in traditional medicine to possess medicinal values, protective and therapeutic properties [7, 8]. Traditional medicinal plants are a therapeutic resource used by the population of the continent specifically for health care, which may also serve as starting materials for drugs [9].

Public health issues are considered as those of direct importance to both producers and consumers of fish and include broader issues of food production, processing and delivery systems [10]. As aquaculture assumes an expanding role in meeting the increasing consumers' demands and the intensified use of antibiotics and other synthetic drugs to treat and control disease outbreaks. The safety of aquaculture products for consumption has continued to generate anxiety among consumers, posing public health concern globally [11]. Thus, actions are needed to explore better alternatives in other to replace or reduce the use of antibiotics (synthetic drugs) in aquaculture production to enhance quality and safety of products. Herbal biomedicine has been indicated as promising alternatives [12, 13]. This present study aimed at examining the performance of African mud catfish (*Clarias gariepinus*) fingerlings fed varying levels of fluted pumpkin (*Telfairia occidentalis*) leaf meal additives.

## Materials and Methods

### Preparation of experimental diets

The experiment was carried out at the Department of Fisheries, Modibbo Adama University of Technology, Yola (9.35 00 $^0$N 12.50 11 $^0$E). The feed ingredients and *Telfairia occidentalis* leaves were obtained from Jimeta-Yola. The feedstuffs were given appropriate processing, milled separately using a domestic hammer milling machine, package and stored for use. The fresh leaves of *T. occidentalis* were air dried under shade and milled to a fine powder using mortar and pestle to form *Telfairia occidentalis* leaf meal (TOLM).

The feed ingredients were measured and mixed to obtain a homogeneous mass. TOLM was added at 0% (control), 0.5%, 1.0%, 1.5% and 2.0% and mixed thoroughly with cassava starch as a binder. The resultant dough was pelleted, air-dried under shade to constant weight and stored in the laboratory for further use. The percentage composition of ingredients in experimental basal feed is shown in Table 1. The proximate composition of the experimental basal feed was carried out according to the methods of Association of Official Analytical Chemist Methods [14].

### Feeding trials

One hundred and fifty (150) fingerlings of *Clarias gariepinus* procured from a reputable fish farm in Yola were acclimatized for 7 days and randomly distributed into plastic tanks of 25 litres volume. The fish were distributed at 10 fish/tank representing five treatments in triplicates; 0g (control), 0.5%, 1.0%, 1.5% and 2.0% of TOLM and designated as $T_1$, $T_2$, $T_3$, $T_4$ and $T_5$ respectively. Each tank was three quarter ($^3/_4$) filled with water in a mini-flow through system set up. Fish were fed at 5% of their body weight in two equal meals, 08:00 – 9:00 hours and 17:00 – 18:00hours). The water quality of the system were monitored and kept at acceptable limit during the period of the feeding experiment. Fish were weighted weekly and feeding rates adjusted accordingly. The experiment lasted for eight weeks. Weekly weight of fish and feed fed were used to assess growth response of fish to diets [15].

### Haematological examination

Five fish were selected randomly rom each tank and blood samples were collected for haematological analysis as described in Idowu *et al.* [17].

### Carcass analysis

Five fish were randomly chosen from each treatment and the whole fish body proximate analysis was carried out according to AOAC [14].

### Statistical analysis

Data generated in the study were subjected to analysis of variance (ANOVA) and Duncans LSD at $p< 0.05$.

**Table 1:** Composition of the 40% crude protein experimental basal diet

| Ingredients | Composition (% dry matter) |
|---|---|
| Fish meal | 32.00 |
| Soybean | 33.00 |
| Maize | 30.00 |
| Vitamin premixes | 1.0 |
| Bone meal | 0.5 |
| Lysine | 0.5 |
| Methionine | 0.5 |
| Palm oil | 1.0 |
| Cassava starch | 1.0 |
| Common salt | 0.5 |
| Total | 100.0 |
| Calculate crude protein | 39.94 |

## Results

The proximate compositions of experimental diets; $T_1$, $T_2$, $T_3$, $T_4$ and $T_5$ are represented in Table 2. Water quality parameters during the feeding experiment, are indicated Table 3. Table 4 presents growth performance of *Clarias gariepinus* fed experimental diets. The haematological indices of *Clarias gariepinus* fed the experimental diets is presented in Table 5. The proximate analysis of the carcass of *C. gariepinus* fed experimental diets are indicated in Table 6.

**Table 2:** Proximate composition of experimental diets (p>0.05)

| Diet | Crude protein (%) | Crude lipid (%) | Crude fibre (%) | Ash (%) | Moisture (%) | NFE (%) |
|---|---|---|---|---|---|---|
| $T_1$ | 40.03±0.05 | 2.01±0.10 | 9.43±0.11 | 6.28±0.13 | 5.33±0.27 | 36.77±0.29 |
| $T_2$ | 40.05±0.00 | 2.03±0.15 | 9.53±0.00 | 6.12±1.00 | 5.35±0.45 | 36.82±0.00 |
| $T_3$ | 40.60±0.00 | 2.01±0.01 | 9.52±0.12 | 6.18±0.04 | 5.20±0.10 | 36.70±0.00 |
| $T_4$ | 40.03±0.03 | 2.00±1.00 | 9.61±0.11 | 6.10±0.00 | 5.23±0.23 | 37.03±0.33 |
| $T_5$ | 38.79±0.00 | 2.10±1.00 | 9.77±0.54 | 6.36±2.84 | 5.23±0.00 | 37.37±0.17 |

NFE – Nitrogen Free Extract

**Table 3:** Water quality parameters during the experimental period

| Parameters | Minimum | Maximum |
|---|---|---|
| Temperature ($^0$C) | 27.60 | 29.55 |
| Dissolved oxygen (mg/l) | 4.25 | 5.00 |
| pH | 6.60 | 6.90 |

**Table 4:** Growth performance of *Clarias gariepinus* fed experimental diets

| Parameters | $T_1$ | $T_2$ | $T_3$ | $T_4$ | $T_5$ |
|---|---|---|---|---|---|
| Mean initial weight of fish (g) | $3.59\pm0.62^{a}$ | $3.63\pm0.36^{a}$ | $3.96\pm0.47^{a}$ | $3.87\pm0.55^{a}$ | $3.71\pm0.60^{a}$ |
| Mean final weight of fish (g) | $27.52\pm3.14^{ab}$ | $26.38\pm2.90^{b}$ | $29.89\pm2.66^{a}$ | $25.01\pm2.71^{b}$ | $21.64\pm2.45^{c}$ |
| Mean weight gain (g) | $23.93\pm2.12^{b}$ | $22.75\pm1.86^{b}$ | $25.93\pm2.11^{a}$ | $21.14\pm1.96^{c}$ | $17.93\pm1.81^{d}$ |
| Relative weight gain | $566.57\pm20.19^{a}$ | $478.73\pm17.09^{b}$ | $554.79\pm18.45^{a}$ | $446.25\pm20.27^{b}$ | $283.28\pm30.23^{d}$ |
| Specific growth rate (%/Day) | $1.57\pm0.24^{a}$ | $1.49\pm0.16^{b}$ | $1.56\pm0.18^{a}$ | $1.45\pm0.14^{b}$ | $1.36\pm0.14^{c}$ |
| Initial number of fish stocked | 20 | 20 | 20 | 20 | 20 |
| Final number of fish stocked | 17 | 15 | 17 | 17 | 17 |
| Survival (%) | 85 | 75 | 85 | 85 | 85 |

Values in the same row with different superscripts are significantly different ($p < 0.05$)

**Table 5:** Haematology of *Clarias gariepinus* fed experimental diets ($p>0.05$)

| Parameters | $T_1$ | $T_2$ | $T_3$ | $T_4$ | $T_5$ |
|---|---|---|---|---|---|
| Erythrocytes | $3.03\pm0.65^{b}$ | $2.93\pm0.25^{c}$ | $3.15\pm0.27^{a}$ | $3.08\pm0.23^{b}$ | $2.95\pm0.31^{c}$ |
| Leukocytes | $283.65\pm2.45^{ab}$ | $280.00\pm0.40^{b}$ | $285.10\pm2.10^{a}$ | $279.90\pm0.30^{b}$ | $279.30\pm1.90^{b}$ |
| PCV (%) | $41.40\pm1.10^{a}$ | $38.60\pm1.90^{b}$ | $41.40\pm1.70^{a}$ | $39.70\pm0.50^{b}$ | $36.35\pm3.75^{\backslash c}$ |
| MCV (fl) | $136.40\pm0.70^{a}$ | $131.45\pm5.35^{b}$ | $131.90\pm5.90^{ab}$ | $129.75\pm8.25^{b}$ | $123.25\pm0.25^{c}$ |
| MCHC (g/dL) | $28.95\pm0.45^{b}$ | $31.10\pm1.70^{a}$ | $28.25\pm2.35^{b}$ | $29.35\pm0.75^{b}$ | $32.50\pm0.90^{a}$ |
| Hb (g/l) | $12.00\pm0.50^{a}$ | $12.05\pm1.25^{a}$ | $11.75\pm1.45^{b}$ | $11.65\pm0.45^{c}$ | $11.78\pm1.48^{b}$ |
| MCH (pg) | $39.50\pm0.80^{a}$ | $41.00\pm3.90^{a}$ | $37.20\pm1.40^{b}$ | $38.00\pm1.40^{b}$ | $40.05\pm1.05^{a}$ |
| Platelets | $97.50\pm18.50^{a}$ | $84.50\pm4.50^{b}$ | $63.50\pm12.50^{c}$ | $62.00\pm4.00^{c}$ | $66.50\pm6.50^{c}$ |

Values in the same row with different superscripts are significantly different ($p < 0.05$)
PCV – Pack cell volume; MCV – Mean cell volume; MCHC – Mean cell hemoglobin concentration; Hb – Haemoglobin; MCH – Mean cell hemoglobin

**Table 6:** Proximate analyses of the carcass of *C. gariepinus* fed the experimented diets ($p>0.05$)

| Parameters | $T_1$ | $T_2$ | $T_3$ | T4 | T5 |
|---|---|---|---|---|---|
| Crude protein (%) | 63.59 | 63.10 | 63.19 | 62.11 | 61.83 |
| Crude lipid (%) | 13.63 | 13.10 | 13.11 | 13.10 | 13.05 |
| Crude Fibre (%) | 1.97 | 1.80 | 1.84 | 2.00 | 2.08 |
| Ash (%) | 2.94 | 2.63 | 2.65 | 3.10 | 2.83 |
| Moisture (%) | 1.92 | 1.93 | 2.01 | 1.93 | 1.97 |
| Ether extract (%) | 17.25 | 17.45 | 17.20 | 17.66 | 18.04 |

## Discussion

The physicochemical parameters of the culture condition for the experimental fish were within the tolerable limits for African catfish [18]. In the present study there was a general increase in weight gain in all treatments, thus indicating that the fish were able to convert feed protein to extra muscle. In fish nutrition, weight gain is usually considered as the most important measurement of productivity of diets [4, 17]. The increase in weight gain reported in all the treatments indicated that the fish responded positively to all the diets and the protein content of the experimental diets enhanced weight gain, growth and dietary energy supply of the fish. However, the observed decrease in the growth of the experimental fish fed diet of TOLM additives may be attributed to the anti-nutritional factors present in leaves of *Telfairia occidentalis*. Fasuyi and Nonyerem [19] reported the presence of phytates and Alkanoids in *Telfairia occidentalis*. The decrease in growth rate with increase inclusion level might be attributed to the presence of these anti-nutritional factors in *Telfairia occidentalis*. These anti nutrients may have affected the digestibility and palatability - taste and even smell of the feed [15].

Blood is a major index of physiological, immunopathological, and nutritional status of an organism. And as reported in Haruna and Adikwu [20], Adeyemo [21] and Sogbesan *et al*. [6], diet compositions among other factors affect the blood biochemical compositions of fish and result to changes in their haematology profiles. In the present study, there were significant differences in all the parameters examined for haematology profiles of the experimental fish fed TOLM meal diets. The reduction in the values of haematological indices such as packed cell volume, haemoglobin concentration, and erythrocytes could be as a result of nutritionally deficient diet or presence of toxic substance in the diet of fish [22, 23]. The above explanation could be responsible for the haematological values observed in the present study. The change in the blood constituent components could be used to adjudge the health status of an organism [24, 25]. Leukocytes are important blood constituents for defense against unwanted foreign bodies in an organism. Their amount has implication in immune responses and the ability of the animal to defend itself against infections [26, 27]. In this study, the highest Leukocytes recorded for diet $T_3$ with a corresponding highest value for erythrocytes could be an indication that this inclusion level (1.0%) of fluted pumpkin (*Telfairia occidentalis*) leaf meal in catfish (*Clarias gariepinus*) diet have better stimulatory effects on the fish leucocyte populations as compare to the other inclusions levels (diets).

The proximate values of the carcass of *C. gariepinus* fed fluted pumpkin (*Telfairia occidentalis*) leaf meal indicated the potency of *Telfairia occidentalis* leaf meal as additives from plant origin in the diet of *Clarias gariepinus* for better food fish. However, the carcass of the experimental fish crude protein values reduced with increase in inclusion levels of TOLM, although with no significant difference ($p>0.05$). The presence of high fiber levels in fish diets can cause intestinal irritation, lower digestibility and overall decreased nutrient utilization [28, 19].

## Conclusion

The results obtained from this study indicated that *Telfairia occidentalis* leaf meal can be used as plant additives in the diet of *Clarias gariepinus*. *Telfairia occidentalis* leaf meal at 1% inclusion could be the preferable level in the diet of *Clarias gariepinus*.

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