DIETARY ADMINISTRATION OF MALABAR SPINACH (*Basella alba*) LEAVES EXTRACTS ON GROWTH PERFORMANCE, SURVIVAL AND CONDITION FACTOR OF JUVENILES *Clarias gariepinus*

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ABSTRACT
A 56 day experiment was aimed to determine the dietary supplementation of Malabar spinach leaves (*Basella alba*) (BA) extracts and Chloramphenicol (CHRL) on growth, survival and condition factor of juveniles *Clarias gariepinus*. Fish with average weight of 4.11±0.01g were distributed into five treatments, replicated twice with 20 fish per replicate. Experimental diets consist of control (0%), BA_2 (1%), BA_3 (2%), $CHRL_4$ (30mg/kg), and $(BA+CHRL)_5$ (2%) were fed twice daily to the experimental fish at 3% body weight of 45% crude protein. Biological indices (Mean weight gain, Specific growth rate, Survival rate, Nitrogen metabolism, Protein efficiency ratio and Protein intake) were determined. Data were analyzed using descriptive statistics and ANOVA at P=0.05. The result indicated that, fish fed the diets supplemented with BA and CHRL enhanced weight gain, specific growth rate, survival rate, Nitrogen metabolism, protein efficiency ratio and protein intake when compared to the control diets ($P<0.05$). The result suggested that BA extracts, and combination of the plant with chloramphenicol would positively enhance growth, survival and health status of *C. gariepinus* juveniles

Keywords: *Clarias gariepinus*, Spinach leaves, Chloramphenicol, Growth, Survival.

INTRODUCTION
Fish is a vital source of high-quality protein, providing approximately 16% of the animal protein consumed by the world's population (Food and Agricultural Organisation, FAO, 1997). It is a particularly important and cheap protein source in regions where livestock is relatively scarce and expensive. It is estimated by the FAO that about one billion people worldwide rely on fish as their primary source of animal protein (FAO, 2000). The global aquaculture production has quadrupled over the past twenty years and that aquaculture production is likely to double in the next fifteen years, as a result of wild fisheries approaching their biological limits and the world demand for cultured fish continuing to increase (Ayinla 2012). The aquaculture sub-sector is considered a very viable alternative to meet in the nation's need for self-sufficiency in fish production.

Malabar spinach (*B. alba*) leaves as plant immunostimulants can be used as a growth promoter and for health management in African catfish (*Clarias gariepinus*) in which it could increase body weight gain, feed intake and feed efficiency. However, scientists have worked on different natural products such as onion bulb (Bello *et al* 2012), garlic (Nya and Austin, 2009) microalgae (Cerezuela *et al*, 2012), and mistletoe (Park and Choi, 2012), but there is a dearth of information and research on the utilization of Malabar spinach leaves by *C. gariepinus.* The aim of this study was therefore to evaluate the growth performance, survival and health status in *C. gariepinus* juveniles.

MATERIALS AND METHODS
Malabar spinach leaves were plucked and air dried at an ambient temperature (25°C) for three weeks. After which it was grinded to fine powder and soaked in 2500ml of 95% ethanol for 48 hours. The plant was stirred every three hours for proper extraction and filtered using sterile muslin cloth, after which the extract was obtained, air dried and stored until required. The experiment was carried out in ten aquaria for 8 weeks in the Fisheries and Aquaculture Laboratory, Ondo State University of Science and Technology, Okitipupa. The water level in each aquarium was maintained at volume of 35 litres throughout the experimental period. Water in each bowl was replaced every three (3) days throughout the period of the

experiment to maintain relatively uniform physiochemical parameters and also to prevent fouling that may result from food residues.

Each treatment have two replicates, 20 fish per replicate with mean initial body weight of 4.11±0.01g and uniform- sized fish was selected from 450 juveniles, weighed and distributed in the experimental bowls. The fish was acclimatized for fourteen days before the experiment. The experiment lasted for 8 weeks during which the fish was fed at 3% body weight daily. The diet per day was divided into two; 1.5% was given in the morning by 9.00-10.00 am and 1.5% in the evening by 5.00 pm. Measurement of the weight changes was performed weekly and the feeding rate adjusted every week according to the new body weight. After preparation, feed ingredients were mixed together to formulate 45% crude protein diet. The pelleted diets were sun dried, packed in labeled polythene bags and stored in a cool dry place to prevent mycotoxin formation (Table 1).

Table 1: Gross and proximate composition of experimental diets (g/100g)

Ingredients/Parameters	Control (0%)	BA2 (1%)	BA3 (2%)	CHRL (30mg/kg)	CHRL + BA (2%)
Fish meal	21.25	21.25	21.25	21.25	21.25
Soy bean	42.49	42.49	42.49	42.49	42.49
Yellow maize	28.26	27.26	26.26	26.26	26.26
Starch	1.00	1.00	1.00	1.00	1.00
Vegetable oil	2.00	2.00	2.00	2.00	2.00
DCP	2.00	2.00	2.00	2.00	2.00
Vitamin premix*	2.00	2.00	2.00	2.00	2.00
Salt	1.00	1.00	1.00	1.00	1.00
Basella alba	-	1.00	2.00	-	1.00
Chloramphenicol	-	-	-	2.00	1.00
Total	100.01	100.01	100.01	100.01	100.01
Moisture (%)	6.61±0.01^{c}	6.75±0.01^{d}	6.57±0.01^{c}	6.35±0.01^{a}	6.54±0.01^{b}
Crude protein (%)	43.63±0.02^{a}	45.84±0.01^{a}	45.49±0.01^{b}	45.40±0.29^{a}	45.31±0.01^{a}
Ether extract (%)	6.38±0.01^{b}	6.73±0.01^{c}	6.00±0.04^{a}	6.32±0.02^{b}	6.03±0.02^{a}
Ash (%)	8.55±0.01^{c}	6.09±0.02^{a}	7.56±0.01^{b}	10.35±0.01^{e}	9.34±0.01^{d}
NFE (%)	37.07±0.40^{b}	36.90±0.02^{c}	36.57±0.05^{a}	33.93±0.23^{d}	36.22±0.02^{b}

BA = *Basella alba*, DCP = Dicalcium phosphate, CHRL = Chloramphenicol, the mean values in each rows with similar superscript are not significantly different (P> 0.05)

Fish were evaluated as follows: weight gain = final body weight - initial body weight; weight gain (%) = 100 (final body weight - initial body weight)/initial body weight; specific growth rate (SGR) = 100 (loge final body weight - loge initial body weight)/time (days); feed conversion ratio (FCR) = dry weight of feed fed (g)/fish weight gain (g); protein efficiency ratio (PER) = wet body weight gain (g)/crude protein fed; protein productive value (PPV) = 100(final fish body protein - initial body protein)/crude protein intake; survival (%) = 100 (initial number of fish stocked - mortality)/initial number of fish stocked, protein intake = (feed intake × percent protein in diet)/100, and condition factor (K) = $100W/L^3$ where: W =Weight of fish (g), L = Standard length (cm)

Experimental diets and fish carcasses were analyzed for proximate composition before and after the experiment according to the methods of Association of Official Analytical Chemists [A.O.A.C] (2005). Growth performance and nutrient utilization indices resulting from the experiment were subjected to one-way analysis of variance (ANOVA) and Duncan multiple range test was used to compare differences among individual means at P = 0.05

RESULTS

Proximate composition of experimental diets

The proximate composition of experimental diets showed significant differences (p< 0.05) among the dietary groups in the moisture, crude protein, ether extract, ash and Nitrogen Free Extract (NFE) (Table 1).

Proximate composition of experimental fish before and after the experiment

The proximate composition of experimental fish after the experiment were better in the treated groups (P< 0.05) compared to the control and value obtained before experiments in terms of moisture, crude protein, ash and Nitrogen Free Extract (NFE) (see Table 2).

Table 2: Proximate composition of fish before and after experiment (DM %)

	BEFORE	CONTROL	BA2	BA3	CHRL4	(CHRL+BA)5
Moisture	4.59±0.02^{a}	5.90±0.01^{b}	6.25±0.02^{c}	9.17±0.02^{f}	6.82±0.02^{e}	6.62±0.04^{d}
Crude protein	47.00±0.02^{a}	65.24±0.02^{c}	69.33±0.01^{b}	68.35±0.03^{d}	67.50±0.02^{cd}	67.76±0.01^{cd}
Ether extract	4.07±0.02^{b}	4.39±0.01^{d}	4.14±0.01^{a}	4.04±0.07^{b}	4.22±0.01^{c}	4.56±0.01^{e}
Ash	4.02±0.02^{a}	4.12±0.01^{b}	6.83±0.01^{e}	5.64±0.02^{c}	6.68±0.01^{d}	7.25±0.01^{f}
NFE	42.35±0.02^{f}	26.26±0.01^{d}	19.72±0.01^{e}	21.98±0.10^{c}	21.61±0.01^{b}	20.28±0.02^{a}

Key: Mean followed by the same letter in the row was not significantly different (p > 0.05). NFE = Nitrogen Free Extract, BA= *Basella alba*, CHRL= Chloramphenicol

Growth performance of *Clarias gariepinus* juveniles fed with spinach leaves enriched diet for 56 days

The result of the experiment revealed general increase in the values of treated groups when compared with the control in terms of weight gain, SGR, NM, PPV, PER and SR and there were significant differences (P > 0.05) within the treatments (see Table 3).

Table 3: Growth response, nutrient utilization and survival parameters of *Clarias gariepinus* fed with experimental diet

Parameters	Control (0%)	BA2 (1%)	BA3 (2%)	CHRL (30mg/kg)	CHRL + BA (2%)
Initial Body Weight	4.11±0.00^{a}	4.11±0.00^{a}	4.12±0.50^{a}	4.11±0.00^{a}	4.12±0.50^{a}
Final body weight	8.44±0.65^{a}	10.26±1.56^{a}	15.93±0.37^{b}	11.11±1.15^{a}	12.22±1.60^{b}
Mean Weight gain	4.33±0.65^{a}	6.15±1.56^{a}	11.82±0.38^{b}	7.00±1.15^{a}	8.10±1.60^{ab}
Body weight gain (%)	105.35±5.82^{a}	149.64±7.96^{b}	286.65±9.95^{d}	170.20±7.86^{bc}	196.89±9.12^{c}
Specific growth rate	0.64±0.07^{a}	0.81±0.04^{b}	1.20±0.02^{b}	0.89±0.03^{c}	0.97±0.05^{b}
Nitrogen metabolism	168.81±8.75^{a}	193.29±5.99^{b}	269.62±4.91^{d}	299.28±9.23^{e}	219.65±1.39^{c}
Survival Rate (%)	75.0±0.00^{a}	77.5±2.50^{a}	82.5±7.50^{a}	85.0±5.00^{a}	85.0±5.00^{a}
Feed Conversion Ratio	3.76±0.57^{a}	4.24±1.08^{a}	2.39±0.08^{a}	4.07±0.67^{a}	3.17±0.63^{a}
Protein Efficiency ratio	0.10±0.02^{a}	0.14±0.04^{a}	0.26±0.01^{b}	0.16±0.03^{a}	0.18±0.04^{ab}
Protein Production valu	39.97±0.05^{a}	48.70±0.00^{e}	46.93±0.07^{d}	45.15±0.32^{b}	45.82±0.03^{c}
Protein Intake	7.25±0.01^{a}	11.18±0.01^{b}	12.80±0.01^{d}	12.60±0.08^{c}	11.16±0.00^{b}
Condition factor (K)	1.53±0.19^{a}	0.97±0.23^{a}	1.05±0.03^{a}	1.09±0.37^{a}	1.18±0.21^{a}

Key: Mean followed by the same letter in the row was not significantly different (p > 0.05). BA= *Basella alba*, CHRL= Chloramphenicol

DISCUSSION

The results of proximate composition of experimental diets obtained in this study corroborates with the findings of Bello *et al*., (2012) who reported 45% crude protein for *C. gariepinus* juveniles fed graded levels of onion bulb and walnut leaves supplemented diet. The result of proximate composition of the experimental fish after the experiment showed a general increase in crude protein, ether extract, moisture, and ash contents when compared to the values obtained in the control and before the experiment. The result of this study agree with those obtained by Dienye and Olumuji (2014) and Obe (2014) who reported higher values of crude protein, ether extract and moisture content of *C. gariepinus* juveniles fed graded levels of *Moringa oleifera* and sorghum supplemented diet respectively.

The result of experimental fish obtained in this study showed an increased in weight gain, percentage weight gain, specific growth rate, nitrogen metabolism, protein efficiency ratio, protein productive value, protein intake and survival rate in the treated groups when compared to the control and they were significant difference (P< 0.05) within the treatments. Fish fed with BA_3 (2%) had the best performance. This suggest the potential of Malabar spinach leaves as feed additive and agree with the report of Sotolu, (2010) who observed better performance in *Leucaena leucocephala* when compared to the control. Also, the results of the condition factor of this study support the report of Bello *et al*., (2012) who recorded better condition factor in treated groups when compared to the control.

Conclusion

It can be inferred from this study that diets with *B. alba* leaves extracts had nutritional beneficial use in fish farming and an inclusion of 2% *B. alba* leaves extracts in fish feed will positively enhanced the growth performance, survival and health status of *C. gariepinus* juveniles

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