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ORIGINAL RESEARCH

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EFFECT OF *BASELLA ALBA* ON GROWTH PERFORMANCE OF NILE TILAPIA (*Oreochromis niloticus)* FINGERLINGS.

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Abstract:
Introduction: Tilapias (Family Cichlidae) are among the freshwater fish species suitable for aquaculture and widely cultivated globally because of their fast growth rate, efficient use of natural aquatic foods, propensity to consume a variety of supplementary feeds, omnivorous feeding habits, resistance to disease and handling, ease of reproduction in captivity, and tolerance to wide ranges of environmental conditions
Aims: Experiment was conducted to evaluate the growth performance ^ *nutrient utilization* of *Oreochromis niloticus* fed varying levels of *Basella alba* leave based diets.
Materials and Methods: *O. niloticus* fingerlings (1.95±0.01g) were randomly selected and distributed into 15 glass tanks at the rate of 15 fish per tank representing five treatments and three replicates. Five diets were formulated to containing (0, 1.0, 1.5, 2.0 and 2.5 g/100kg diets) of *B. alba* were prepared and fed to the fish for 70 days.
Results: The results revealed that weight gain, specific growth rate, feed intake and feed conversion ratio improved progressively up to the inclusion level of 2.0 g/100g of B. alba leave meal and then declined indicating 2.0g/100g B. alba leave meal as the optimum level that can promote the growth performance of the fish. However, 4th degree polynomial regression analysis indicated the optimum level as about 2.1 g/100g diet. It was observed that there was no significant difference in the survival ($p > 0.05$) of the fish fed diets with different *B. alba* leave meal.
Conclusion: Based on the results obtained from this present study, it could be concluded that 2.0-2.1 g/100kg of *B. alba* leave can be included in the diets of *O. niloticus* fingerlings for optimum growth performance. **To**
Keywords: Nile tilapia, *B. alba*, growth performance, *plant additives*, *in vitro*.

All co-authors agreed to have their names listed as authors.

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1. INTRODUCTION

Tilapias (Family Cichlidae) are among the freshwater fish species suitable for aquaculture and widely cultivated globally because of their fast growth rate, efficient use of natural aquatic foods, propensity to consume a variety of supplementary feeds, omnivorous feeding habits, resistance to disease and handling, ease of reproduction in captivity, and tolerance to wide ranges of environmental conditions [1],[2],[3]. In recent year, herbal supplements as feed additives have been tested in aquaculture as an alternative to chemicals to enhance fish growth [4]. Using of plant-based additives in aquaculture is one of the methods used to improve weight gain and feed efficiency in cultured fish [4]. Beneficial effects of bioactive plant substances in animal nutrition may include the stimulation of appetite and feed intake, the improvement of endogenous digestive enzyme secretion, activation of immune responses and antibacterial, antiviral and antioxidant actions [5]. Ceylon spina (*Basella alba*), a fast growing vegetable, probably originating from India or Indonesia [6], has been reported to possess active components that increase testosterone production in adult male rat testes during in vitro studies [7]. The leaves contain a high level of calcium and are rich in vitamins like A, C, thaimine, riboflavin, niacin, and betacyanin, oxalic acid, flavonoid like acacetin, 4,7- dihydroxy kempferol and 4'-methoxyisovitexin and also phenolic acids like vanilla, syringic and ferulic acid [8]. It also contains essential amino acids such as arginine, isoleucine, leucine, lysine, threonine, and tryptophan. *B. alba* has also been described to possess nutritional values including androgenecity in traditional medicines of several countries [9]. This present study was to investigate the potential effect of *B. alba* leave on the growth performance and nutrient utilization of *O. niloticus.*

2. MATERIAL AND METHODS

2.1 Plant Material

The fresh leaves of (*B. alba*) used in the study was harvested fresh from Ogunlade compound, Ibule-Soro, Ondo State. Nigeria. It was identified and authenticated at the Department of Crop, Soil and Pest Management, Federal University of Technology, Akure using plant identification guide provided by [10]. The leaves were washed thoroughly with running tab water, chopped into small pieces and dried at room temperature for 15 days to prevent the loss of volatile compounds. The dried leaves were ground into fine powder using pestle and mortar and stored at 4°C in sealed airtight bottle until used.

2.2 Experimental Fish

Five hundred (500) *Oreochromis niloticus* fingerlings were collected from the Fish Hatchery of The Federal University of Technology Akure. The experimental fish were acclimatized to laboratory conditions for one week. Fish were fed during the acclimatization period with commercial feed (35% cp) to satiation twice daily. They were then starved for 24 hours prior to the beginning of the feeding trials. Fish were then weighed after subjecting to commercial diets and starving in order to determine the mean weight.

2.3 Experimental Design

The experimental design was a complete randomized design. Two hundred and twenty-five (225) *O. niloticus* fingerlings with mean weight of 1.95±0.01g were randomly selected and distributed into 15 glass tanks (70litre) each measuring (70cm x 45cm x 45cm) at the rate of 15 fish per tank representing five treatments and three replicates.

2.4 Experimental Diets

Five iso-nitrogenous diets (35%CP) were formulated to containing *B. alba* at (0.0, 1.0, 1.5, 2.0 and 2.5 g/kg) and labelled as BA1-BA5 (Table 1). Other feed ingredients include fishmeal, soya bean meal, groundnut cake, yellow maize, methionine, lysine, fish oil, vitamin premix, and starch as a binder. One portion of the feed was kept without *B. alba* incorporation which served as control. The *B. alba* leave meal was mixed thoroughly with other feed ingredients to ensure an equal distribution throughout the feed. The ingredients were weighed with an electronic weighing balance (Model PB3002). The dough was pelleted using a Horbart A-200T mixing and pelleting machine using 2mm die diameter. After making one diet, the machine was cleaned before making the next diet. Diets were fan dried under room temperature for 72 hours packed in polyethylene bags, sealed, and marked according to treatments and stored at 4oC before use.

2.5 Weighing of Experimental Fish

The individual weight of each fish from each glass tank was determined immediately after acclimatization using an electronic weighing balance (model PB 3002). The mean weights of fish per tank were recorded. The weighing continued biweekly until the experiment was terminated.

TABLE 1: Gross composition of the experimental diets (g/100g) for *O. niloticus*

Ingredients	BA1	BA2	BA3	BA4	BA5
Fish meal (65%cp)	16.8	16.8	16.8	16.8	16.8
Soybean meal(45% CP)	30.0	30.0	30.0	30.0	30.0
Ground nut cake (48% CP)	22.1	22.1	22.1	22.1	22.1
Yellow maize	18.6	18.6	18.6	18.6	18.6
Methionine	1.0	1.0	1.0	1.0	1.0
Lysine	1.0	1.0	1.0	1.0	1.0
Fish oil	5.0	5.0	5.0	5.0	5.0
Vitamin premix**	3.5	3.5	3.5	3.5	3.5
Starch	2.0	2.0	2.0	2.0	2.0
B. alba leave	0.0	1.0	1.5	2.0	2.5

2.6 Feeding of Experimental Fish

The diets were fed to the fish to apparent satiation, twice daily between 08:00 and 09:00 and 16:00 and 17:00 hours for 70 days. After each feeding all uneaten feeds was removed from the tanks by siphoning at 08:00 and 4:00 hours daily before feeding with culture water partially drained and replenished with fresh water. Culture water in experimental units were completely drained and changed twice a week.

2.7 Monitoring of Water Quality

Tank water was changed regularly to maintain good water quality. Temperature was measured using mercury glass thermometer. pH was measured with a pH meter (Jenway model 9060). Dissolved oxygen (DO) was measured using dissolved oxygen test kit (Hanna model: HI-9142). Calculation of the growth performance data was according to [11] and [12]. The proximate analysis of the *B. alba* leaves and experimental feed was done following the method of [13] while gross energy was calculated as 5.65, 9.45, 4.1 kcal/g for protein, fat and carbohydrate respectively [14].

2.8 Statistical Analysis

Data collected were subjected to one-way analysis of variance (ANOVA) as describe by [15] followed by Duncan new multiple range test [16] to separate differences among the means. The statistical analysis was performed with the aid of the computer software SPSS (Statistical Package for Social Science Version 22). The optimum concentration of *B. alba* required by the fish for best performance was determined by polynomial regression analysis using (Microsoft Office Excel Programme 2010).

3. RESULTS AND DISCUSSION

The nutrient composition of *B. alba* leave meal is presented in Table 2. The result showed that *B. alba* has a low moisture content, this could be attributed to the period of sampling which was about onset of dry season/ the harmattan period, a season characterized by intensive sunlight and dryness. Moisture content of the fresh samples was 68.3% which is similar to results reported by [17] for some leafy vegetables. The result of this study compared favourably with that reported by [18] who reported that leafy vegetables have a moisture content ranging from 72 to 93%. On dry matter basis, moisture content of *B. alba* in this study was 9.82%. The high moisture content of vegetables indicates freshness and perishability, as well as indicating that they may play a key role in aiding the digestion of food [19]. It also has high ash content value which showed that the leave contained appreciable amount of mineral elements. It has higher crude protein (17.05%). This justifies its use as a protein feed ingredient in animal production including fish. The lipid content is high enough to supply fats and oil to the diets. It also high in non-protein value that can be advantageous in energy supply.

TABLE 2: Proximate analysis of *B. alba* leave

Parameters (%)	shade dried	Fresh, raw leaves
Moisture	9.82	68.3
Ash	23.10	25.1
Protein	17.05	15.7
Fibre	20.23	25.6
Lipid	5.09	8.10
NFE	24.71	42.8

KEY: NFE= Nitrogen free extract

The water quality parameters measured during the feeding trial for 70 days varied as follows; temperature ranged from 26.4 to 27.9oC, Dissolved oxygen ranged from 6.51 to 7.10mg/l and hydrogen ion concentration (pH) ranged from 6.51 to 7.58 respectively. The values of physic-chemical parameters observed in the glass tank were within the acceptable range recommended for rearing and culture of most fresh water fishes, including *O. niloticus* [20].

Results from proximate composition of the experimental diets are documented in Table 3. The values are very

closely related confirming good feed formulation. The values are also standard for production of tilapias [21].

TABLE 3: Proximate composition (g/100g) of experimental diets

Parameters	BA1	BA2	BA3	BA4	BA5
Moisture	10.5	9.18	10.20	9.21	9.15
Ash	5.73	6.10	6.23	6.32	6.33
Protein	35.28	35.17	35.05	35.03	34.63
Fibre	4.54	5.22	5.39	5.62	5.75
Lipid	7.82	9.13	9.22	9.26	9.31
NFE	36.65	35.20	33.91	34.56	34.83
GE	423.86	429.66	424.56	427.47	423.67

Key; NFE = Nitrogen free extract, GE =Gross Energy

Data on growth performance and survival of *O. niloticus* is presented in Table 5. There was no significant difference ($p>0.05$) in the initial weight of the fish at the beginning of the experiment. At the end of the feeding trial, there was variation in the growth indices and nutrient utilization parameters. The present results evidenced that the incorporation of *B. alba* with artificial diet did not affect growth performance and feed utilization of the experimental fish. The inclusion of the *B. alba* gave a positive result showing that the fish readily accepted the diets. All groups of *B. alba* treated fish exhibited growth acceleration compared with the control. The high percentage survival recorded in the study is an indication that the leave meal was palatable and well digested and absorbed by the fish. Highest growth performance was obtained from the group fed with BA4 which indicate that (2.0 g/100kg) inclusion level of *B. alba* can be considered as the most optimal level of inclusion in the diet of the fish, 4th degree polynomial regression analysis (Figure 1) revealed the optimum level as (2.1 g/100kg). Improvement in growth of fish has been reported by feeding herbs supplemented diet [4]. The use of *B. alba* at high inclusion levels (2.5 g/100kg) in this study led to a reduction in growth of the fish. Similarly, [22] reported that there was reduced growth of *O. niloticus* and *T. zillii* with increasing levels of freshwater algae *Hydrodictyon reticulatum* at 5% inclusion level. The result of this present study is in agreement with that reported by [23] who reported that incorporation of garlic in growing *O. niloticus* diets improved significantly final weights, weight gain and specific growth rate. Furthermore, this report is in conformity with the work of [24] where no significant difference was observed in survival of *O. niloticus* during immersion treatment with *Basella alba* leaf aqueous extract.

Table 4: Growth performance of *O. niloticus*

Parameters	BA1	BA2	BA3	BA4	BA5
IW	1.95±0.01^{a}	1.95±0.01^{a}	1.95±0.02^{a}	1.95±0.01^{a}	1.95±0.01^{a}
FW	5.58±0.30^{a}	5.69±0.22^{ab}	5.71±0.18^{c}	5.74±0.24^{b}	5.66±0.21^{ab}
WG	3.63±0.29^{a}	3.74±0.07^{ab}	3.76±0.19^{c}	3.79±0.38^{b}	3.71±0.21^{ab}
SGR (%/day)	1.50±0.07^{a}	1.53±0.02^{ab}	1.53±0.05^{b}	1.54±0.06^{ab}	1.52±0.05^{ab}
FI	6.08±0.02^{a}	6.20±0.05^{b}	6.22±0.18^{c}	6.23±0.07^{b}	6.16±0.06^{ab}
FCR	1.67±0.15^{a}	1.66±0.03^{a}	1.65±0.04^{a}	1.64±0.10^{a}	1.66±0.10^{a}
FER	0.60±0.31^{a}	0.60±0.07^{b}	0.60±0.19^{b}	0.61±0.31^{b}	0.60±0.24^{b}
Survival	97.8±2.23^{b}	88.9±2.20^{a}	100.0±0.00^{b}	100.0±0.00^{b}	100.0±0.00^{b}

Mean in the same row with different letter are significantly different at $P<.05$

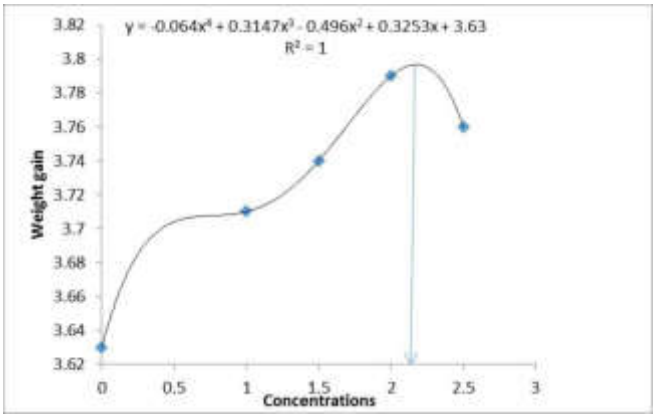

Fig. 1. Fourth degree polynomial regression analysis of WG to dietary *B. alba*

4. CONCLUSION

This study has shown that *B. alba* leaves can be tolerated by *O. niloticus*. The results revealed that weight gain, specific growth rate, feed intake and feed conversion ratio improved progressively up to the inclusion level of 2.0 g/100g of *B. alba* leave meal and then declined indicating 2.0g/100g *B. alba* leave meal as the optimum level that can promote the growth performance of the fish. It could be concluded that 2.0 - 2.1 g/100kg of *B. alba* leave can be included in the diets of *O. niloticus* fingerlings for optimum growth performance.

AUTHORS' CONTRIBUTIONS

Oladipupo Mathew designed the study, performed the statistical analysis, wrote the protocol, and wrote the first draft of the manuscript. Osungbemiro Nelson, Bankole Gafar and Sanni Rafiu managed the analyses of the study, managed the literature searches and typesetting. All authors read and approved the final manuscript.

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