INFLUENCE OF ANTOX® PROBIOTIC, AS WATER ADDITIVE ON GROWTH PERFORMANCE AND NUTRIENT UTILIZATIION OF THE AFRICAN CATFISH, *(Clarias gariepinus*) FINGERLINGS

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ABSTRACT
The study was carried out for three (3) months to determine the influence of a commercial probiotic Antox® which is a mono- strain probiotic consisting of live *Saccharomyces cerevisiae* at 4.125×10^6 cfu per 100mL, on growth and nutrient utilization of *Clarias gariepinus* fingerlings. Fish fingerlings (7.6 – 7.9g) were randomly distributed into five triplicate treatment groups in fifteen plastic tanks (80 lt) at a stocking density of ten (10) fish per tank. The probiotic was administered in the culture water of the treatment groups; 0mls (control, C), 0,5ml (T_1), 1.0 ml (T_2), 1.5 ml (T_3), 2.0 ml (T_4) probiotic/80L. Water quality parameters were regularly monitored. The growth performance and nutrients utilization of *C. gariepinus* fingerlings between probiotic treated groups were significantly increased ($P < 0.05$) with increasing dosage of the probiotic. The best final mean weight (121.3g), mean meight gain (113.5g), percentage mean weight gain (1456.5g), feed conversion ratio (0.92g) and protein efficiency ratio (2.6g), was recorded in probiotic treatment group T4 (2.0ml). Probiotic (Antox®) is recommended for administration in *C. gariepinus* fingerlings culture water at 2.0mls/ 80L.
Key words: Probiotic, *Clarias gariepinus*, growth performance, nutrient utilization

INTRODUTION
The African catfish *Clarias gariepinus* is of great economic importance to aquaculture in Nigeria because of their high market price, fast growth rate, its ability to withstand adverse conditions especially low dissolved oxygen content, ability to practice aquatic and aerial respiration and resistance to parasites and diseases (Umaru *et al*.,2018). Catfish production accounts for 85% total aquaculture production in Nigeria (Bolorunduro, 2016). One of the major challenges to increase fish production in the developing world, including Nigeria, is the improvement of production efficiency, which is hampered by high cost of imported feeds (Bolorunduro, 2016). Local feeds has low digestibility, poor feed conversion efficiency with majority of them sinking to the bottom and are equally expensive. (AU-IBAR, 2013). To address the challenge of low feed conversion efficiency and growth through better food digestibility and nutrient uptake, probiotics could be employed.

A probiotic is "any microbial cell provided via the diet or rearing water that benefits the host fish, fish farmer or fish consumer, which is achieved, in part at least, by improving the microbial balance of the fish" (Llewellyn *et al*., 2014). Similarly, Verschuere *et al*. (2000) defined aquatic probiotics as "Live microorganisms that have a beneficial effect on the host by modifying the microbial community, associated with the host, by ensuring improved use of the feed or enhancing its nutritional value, by enhancing the host response towards disease, or by improving the quality of its ambient environment". Probiotics effectively participate in the digestive process by producing extracellular enzymes such as proteases, carbohydrolases and lipases, and by providing growth factors (Umaru *et al*. 2018)). The water probiotics contain multiple strains of bacteria like *Bacillus acidophilus*, *B. subtilis*, *B. licheniformis*, *Nitrobacter* sp., *Aerobacter* sp. and *Saccharomyces cerevisiae* (Ramasamy and Venkatasamy. 2015).

Overall, yeast has been added directly to the water, administered as an additive in micro-particulated diets, and has been used alive to feed live food (rotifers or *Artemia*) as a possible vector to deliver yeast into the gut of fish larvae (Tovar-Ramirez *et al*., 2010). There is paucity of information on the use of live yeast (*Saccharomyces cerevisiae*) as water additive in tank rearing of the African catfish fingerlings. This study was therefore designed to evaluate the efficacy of adding different concentration of Antox® probiotic consisting of live *Saccharomyces cerevisiae*, to culture tanks on growth and nutrients utilization of *Clarias gariepinus* fingerlings.

MATERIALS AND METHOD

Formulation of experimental diets

The ingredients and proximate composition of the experimental diet are presented in Table 1. The basal feed comprising standard amounts of fish meal, yellow maize, soybean meal, vegetable oil, salt, vitamin premix and starch, was formulated according to Pearson square method with pre-determined values of 42% protein content. The pellets were dried at ambient temperature (27 -30°C).and stored in airtight jars at room temperature. Proximate composition of experimental diets was determined according to AOAC method (1990).

Complete Randomized Design (CRD) was used in setting up the experiment comprising of fifteen plastic tanks (80 litres capacity). The experiment was conducted for three (3) months, on *Clarias gariepinus* fingerlings (*n* = 150). One hundred and fifty fingerlings of *Clarias gariepinus* were randomly distributed into five triplicate groups of 10 fish each: Control, C, and treatment groups comprising T_1, T_2, T_3 and T_4 administered with 0.5 mL, 1.0 mL, 1.5 mL and 2.0ml yeast probiotic per tank, respectively. The physico-chemical parameters (water pH, temperature, electrical conductivity and dissolved oxygen) were determined using LaMotte fresh water aquaculture test kit (Model: AQ-2, Code 363303)..

Determination of Growth performance and nutrient utilization

Growth parameters were calculated according to Panasea *et al*., (2018): as shown below;

Mean body weight Gain: Weight gain was determined between the final weight and initial weight of experimental fish.

Weight gain = Final weight -Initial weight

Specific Growth Rate:

It is the percentage rate of change in the logarithmic body weight and was computed.

$$SGR = \frac{LN_{c\ final\ weight} - LN_{c\ initial\ weight}}{\text{Initial weight}} \times 100$$

Mean Percentage Weight Gain:

The percentage (%) weight gain was determined as follows;

$$MPWG = \frac{\text{Mean weight gain}}{\text{Mean initial weight}} \times 100$$

Feed Conversion Ratio:

This was calculated using the formula

$$FCR = \frac{\text{Feed fed}}{\text{Fish weight gain}}$$

Protein Efficiency Ratio:

It is calculated from the relationship between the increments in the weight of fish (I.e. weight gain of fish) and protein consumed.

$$\textbf{PER} = \frac{\text{Mean weight gain (g)}}{\text{Protein intake}}$$

$$\text{Where protein intake} = \frac{\text{Total feed consumed}}{\text{Crude protein in feed}} \times 100$$

Mean Protein Intake:

$$\text{Where protein intake (g)} = \frac{\text{Protein (\%) in feed} \times \text{total weight (g) of diet consumed}}{100}$$

Data Analysis

All data collected were subjected to One way analysis of variance (ANOVA) to test for significant differences among treatments using IBM SPSS version 23, followed by Turkey's' Post-Hoc test which was used to separate significantly different means. The level of significance set for treatments was $P \leq 0.05$.

Table 1 Ingredients/proximate composition of formulated diets (% Dry weight)

Ingredients	Control	T_1(0.5ml)	T_2(1.0ml)	T_3(1.5ml)	T_4(2.0ml)
Fish meal (75%)	35	35	35	35	35
Soybean meal (44%)	17	17	17	17	17
Yellow Maize	43	43	43	43	43
Cassava	2	2	2	2	2
Vitamin premix (a)	1.5	1.5	1.5	1.5	1.5
Mineral premix (b)	1.5	1.5	1.5	1.5	1.5
Total	100	100	100	100	100
Proximate composition of experimental diet					
Parameters					
Dry Matter	94	94	94	94	94
Crude protein	40.53	40.53	40.53	40.53	40.53
Crude fiber	1.19	1.19	1.19	1.19	1.19
Oil	4.69	4.69	4.69	4.69	4.69
Ash	8.04	8.04	8.04	8.04	8.04
Nitrogen free extract	45.10	45.10	45.10	45.10	45.10

Premix:

a. Provided the following vitamins: Vitamin A 8,500,000.00IU; Vitamin D3 1,500,000.00 IU; Vitamin E 10,000.00IU; Vitamin K3 1500.00mg, Vitamin B1 1600.00mg; Vitamin B2 4000.00mg; Niacin 20,000.00mg; Pantothenic acid 5,000.00mg, Vitamin B6 1,500.00mg; Vitamin B12 10.00mg; Folic acid 500.00mg; BiotinH2 750.00mg; Choline Chloride 175,000.00mg; Cobalt 200.00mg; Copper 3,000.00mg; Iodine 1000.00mg; Iron 20,000.00mg; Manganese 40,000.00mg; Selenium 200.00mg; Zinc 30,000.00mg; Antioxidant 1,250.00mg

b. Provided the following minerals (mg kg-1 diet): zinc (as ZnSO4·7H2O), 150; iron (as FeSO4·7H2O), 40; manganese (as MnSO4·H2O), 25; copper (as CuCl2), 3; iodine (as KI), 5; cobalt (as CoCl2·6H2O), 0.05; selenium (as Na2SeO3), 0.0

RESULTS

Within the probiotic treatment groups as presented in Table 2, growth performance and nutrients utilization significantly increased with increase concentration of the probiotic administration. The highest final mean weight (121.3g), mean weight gain (113.5g) and percentage mean weight gain (1456.5%) were recorded in T4 (2.0ml/80 l). Similarly, the best mean protein intake (640.9g), feed conversion ratio (0.92) and protein efficiency ratio (2.6g), was recorded in T4.

Table 2 Influence of Antox® probiotic administration in culture water, on growth performance and nutrients utilization

Parameters	(T0) Control	T1(0.5ml)	T2(1.0ml)	T3(1.5ml)	T4(2.0ml)
IMW(g)	7.6 ± 0.09^{a}	7.9 ± 0.26^{a}	7.6 ± 0.07^{a}	7.5 ± 0.20^{a}	7.8 ± 0.17^{a}
FMW	90.5 ± 2.62^{c}	100.0 ± 1.42^{b}	103.8 ± 0.47^{b}	115.5 ± 2.54^{a}	121.3 ± 1.62^{a}
MWG	83.3 ± 2.45^{c}	92.1 ± 1.38^{b}	96.2 ± 0.53^{b}	107.9 ± 2.39^{a}	113.5 ± 1.6^{a}
PMWG	1102 ± 45.5^{d}	1172 ± 42.4^{cd}	1272.1 ± 18.0^{bc}	1433.5 ± 26.0^{ab}	1456.5 ± 37.0^{a}
SGR	1.51 ± 0.01^{c}	$1.50\pm0.01d^{bc}$	1.53 ± 0.01^{b}	1.57 ± 0.01^{a}	$1.57\pm0.01b^{a}$
MPI(g)	507.5 ± 2.89^{d}	527.6 ± 11.50^{cd}	585.4 ± 5.78^{bc}	608.3 ± 4.62^{bc}	640.9±11.55
FCR	1.63 ± 0.02^{a}	$1.52\pm0.04a^{bc}$	1.57 ± 0.01^{ab}	1.46 ± 0.00^{c}	1.34 ± 0.01^{c}
PER	2.2 ± 0.0^{c}	2.4 ± 0.09^{bc}	$2.3\pm0.02d^{bc}$	2.5 ± 0.01^{ab}	2.6 ± 0.04^{a}
NPU	17.6 ± 6.42^{c}	$20.3\pm0.63ed^{bc}$	$21.4\pm0.17b^{ab}$	22.8 ± 0.45^{ab}	24.6 ± 0.75^{a}
%SURV.	88.9 ± 2.20^{c}	91.1 ± 2.20^{c}	93.3 ± 0.00^{ab}	95.5 ± 2.23^{ab}	100 ± 0.00^{a}

Values within each row not sharing a common superscript letter are significantly different. Data are means ± SEM of triplicate tanks (15 fish per tank).

Key: IMW: Initial Mean Weight **SGR:** Specific Growth Rate **FMW**: Final Mean Weight **MWG**: Mean Weight Gain **PMWG**: Percentage Mean Weight Gain **MPI:** Mean Protein Intake **PER:** Protein Efficiency Ratio **FCR:** Feed Conversion Ratio

%SUR.; Percentage Survival

DISCUSSION

Growth performance and nutrients utilization

In the present study, administration of *Saccharomyces cerevisiae* (Antox® probiotic) in the culture water enhanced growth, nutrient utilization and survival of *Clarias gariepinus* fingerlings. This agrees with EL-Dahhar *et al.* (2014), who reported a better growth, feed utilization, and survival rate of sea bream larvae administered liquid probiotics in the culture water, in comparison to the control. A probiotic acts by reducing the feed conversion ratio, resulting in an increase in daily live weight gain, through improvement of digestion by balancing the resident gut microflora as reported by Enyidi and Onuoha (2016); Umaru *et al*. (2018),. This may explain relatively lower fed conversion ratio recorded in the probiotic treated groups. Yeast probiotic reinforce mucosal barrier function through maintaining epithelial integrity which improve growth and nutrient utilization (Aluwong *et al*., 2013). Yeast is also a very good source of vitamin B6 as reported by Mc Dowell (1989), which act as a stimulator of growth hormone (Hassan, 2007).

CONCLUSION

Administration of *Saccharomyces cerevisiae* (Antox® probiotic) in the culture water improved growth and nutrient utilization of *Clarias gariepinus* fingerlings than the control group without probiotic administration. Similarly,

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