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Effect of Unextracted and Hydrolysed Yeast *(Saccharomyces cerevisiae)* Products on African Catfish *(Clarias gariepinus)* Production

Badru, K.O., *Adeoye, A.A., Obasa, S.O. and Olaniyi, M.O.
Department of Aquaculture and Fisheries Management,
Federal University of Agriculture, P.M.B. 2240, Abeokuta – Nigeria

*Corresponding Author Email:
adeoyeaa@funaab.edu.ng

Abstract

A study was carried out to evaluate the effects of yeast products (unextracted and hydrolysed yeasts) on growth of African catfish (*Clarias gariepinus*). The catfish (11.770.05 g fish^{-1}, 100 857L tank^{-1}) were fed diets supplemented with either 0% yeast product, 3% unextracted yeast or 0.3% hydrolysed yeast. After 56 days of ad libitum feeding, there was no significant difference ($P > 0.05$) observed in the final weight, FCR, SGR, PER and survival of catfish fed the experimental diets. Similarly, the somatic indices and haematological parameters were not significantly different ($P > 0.05$) among catfish fed the experimental diets. It could be inferred that under optimum rearing condition, yeast products (at current level of inclusion) do not enhance the growth performance nor haematological parameters of *C. gariepinus*.

Keywords:
C. gariepinus, yeast, parameters, diets

Introduction

The growth of the aquaculture industry has been linked to population increases and consequently, the intensification of the aquaculture operations to meet the arising demand . However, the intensification of the operations is often accompanied by stress due to suboptimum environmental conditions resulting from overcrowding and overfeeding. To keep up with the demand, the suboptimal environmental conditions associated with intensive aquaculture operation will likely continue. Hence, the importance of including bio-active ingredients in formulated aquaculture diets. Bio-active ingredients are essential or non-essential compounds that confer growth, health and immune-enhancing benefits and can enhance the performance and health of aquaculture species in suboptimum environmental conditions .

Yeast (*S. cerevisiae*) as a single cell protein and bioactive ingredient can enhance the performance, health and immunity of aquaculture species under suboptimum environmental conditions. In addition to its high protein content, the cell wall of the yeast contains mannanoproteins, β (1,3)-glucans, β (1,6)-glucans, chitin and lycophospholipid surface proteins associated with plasma membrane . Thus, this study was designed to examine the effects of yeast (*S. cerevisiae*) products (unextracted and hydrolysed yeast) on African catfish (C. *gariepinus*).

Materials and Methods

Experimental design and diets preparation

The trial was carried out in a flow-through aquaculture system of the Department of Aquaculture and Fisheries Management of Federal University of Agriculture, Abeokuta – Nigeria. The flow-through

system contains nine circular tanks (857 L capacity each) and were supplied with freshwater from a deep well. Nine hundred African catfish (*C. gariepinus* - 11.770.05 g) obtained from a reputable hatchery were randomly distributed (100 catfish per tank) into the nine tanks after two weeks of acclimatisation. The photoperiod and water temperature was maintained at ambient condition.

Three iso-nitrogenous diets were formulated (Table 1) as Con (containing 0% yeast product), UnY (containing 3% unextracted yeast) and HyY (containing 0.3% hydrolysed yeast) diets. The inclusion levels (3% for unextracted yeast and 0.3% for hydrolysed yeast) of the yeast products were based on recommendation from the products' manufacturer. The feed ingredients were thoroughly mixed, moistened (200 mL kg^{-1}) and then cold press extruded to produce 2mm pellets using a flat die pelleting machine. The diets were sun dried and their proximate composition analysed (Table 1) using AOAC protocols . After drying, the diets were stored in airtight containers prior to use. *C. gariepinus* were fed the experimental diets to satiation for nine weeks in two equal rations. Daily feed was adjusted on a weekly basis by batch weighing following a 24 h deprivation period.

Table 1: Formulation and composition of the experimental diets

Ingredients (%)	**Con**	**UnY**	**HyY**
Fishmeal	22.0	22.0	22.0
Shrimp meal	1.00	1.00	1.00
Soybean meal	40.0	40.0	40.0
Groundnut cake	14.0	11.0	13.7
Maize	9.49	9.49	9.49
Whole wheat meal	7.50	7.50	7.50
Vegetable oil	4.00	4.00	4.00
Fish oil	1.00	1.00	1.00
Vitamin mineral premix	1.00	1.00	1.00
Unextracted yeast	0.00	3.00	0.00
Hydrolysed yeast	0.00	0.00	0.30
Anti-oxidant	0.01	0.01	0.01
Total	**100.0**	**100.0**	**100.0**
Composition (% dry weight)			
Moisture	11.7	11.5	12.6
Crude protein	36.1	38.8	36.5
Lipid	12.3	11.8	11.9
Ash	8.11	8.06	8.02
NFE	28.3	26.1	27.7
Crude fibre	3.48	3.69	3.35

Growth, feed utilisation and somatic indices

Growth performance, feed utilisation and somatic indices were assessed by final body weight (FBW), specific growth rate (SGR), feed conversion ratio (FCR), protein efficiency ratio (PER), hepatosomatic index (HSI), viscerosomatic index (VSI) and condition factor (K-factor). All fish were euthanized with clove oil at a concentration of 100 mg L^{-1} followed by destruction of the brain prior to sampling. At the

end of the trial, three fish per tank were sampled and used to record viscera weight and whole body weight to calculate the K-factor, HSI and VSI.

Haematology

At the end of the feeding trial, blood from three fish per tank (n = 9) was taken from the caudal arch using a 25-gauge needle and 1 mL syringe after the fish were anaesthetized with clove oil at 100 mg L^{-1}.

Statistical analysis

All data are presented as mean standard deviation. Data were analysed using one-way analysis of variance (ANOVA). Multiple comparisons were performed using Tukey post- hoc test. Differences were considered significant at a value of $P < 0.05$. The statistical analysis was carried out using SPSS for Windows (SPSS Inc., 23.0, Chicago, IL, USA).

Results

Table 2 shows the growth performance, feed utilisation and somatic indices of *C. gariepinus* fed the experimental diets. There was no significant difference ($P > 0.05$) observed in the final weight, feed conversion ratio, specific growth rate, protein efficiency ratio and survival of catfish fed the experimental diets. Similarly, the somatic indices (K-factor, hepatosomatic indices, and viscerosomatic indices) were not significantly different ($P > 0.05$) among catfish fed the experimental diets.

Table 3 shows the haematological profile of catfish fed the experimental diets. There was no significant difference observed in the haematological parameters of catfish fed the experimental diets.

Table 2: Growth, feed utilisation and somatic indices of C. gariepinus fed the experimental diets

	Con	UnY	HyY
IBW (g fish)	11.8±0.05	11.8±0.05	11.8±0.05
FBW (g $fish^{-1}$)	65.4±2.42	63.3±1.08	62.2±2.74
SGR (% day^{-1})	3.18±0.09	3.11±0.04	3.08±0.09
FCR	1.31±0.05	1.29±0.03	1.31±0.05
PER	1.67±0.07	1.69±0.04	1.66±0.08
K-factor	0.80±0.09	0.81±0.12	0.79±0.05
HIS	0.87±0.16	0.78±0.28	1.07±0.19
VSI	10.7±0.96	10.2±1.06	11.5±1.54
Survival (%)	88.3±0.94	93.7±1.25	90.0±1.41

Means in the same row with different superscripts were significantly different ($P < 0.05$). IBW, initial mean body weight; FBW, final mean body weight; SGR, specific growth rate; FCR, feed conversion ratio; PER, protein efficient ratio; HSI, hepatosomatic index and VSI, viscera-somatic index.

Table 3: Haematological parameters of catfish fed the experimental diets

	Con	UnY	HyY
Haematocrit (%PCV)	28.2±0.69	27.4±4.35	27.11±1.90
Haemoglobin (g dL^{-1})	9.47±0.36	9.24±1.49	9.17±0.62
WBC (10^9 L^{-1})	110±15.8	126±9.36	111±8.03
RBC (10^{12} L^{-1})	1.63±0.01	1.59±0.27	1.59±0.10
Neutrophil (%)	20.2±6.74	23.6±8.13	18.7±5.55
Lymphocytes (%)	76.1±5.93	70.4±9.74	79.2±4.67
Basophil (%)	0.56±0.20	0.56±0.39	0.11±0.20
Eosinophil (%)	1.67±1.20	2.56±1.39	0.89±0.70
Monocytes (%)	1.45±0.39	2.89±1.68	1.11±1.02
MCV (fL)	173±3.44	173±3.12	171±1.94
MCH (pg)	58.1±1.87	58.2±0.70	57.9±0.55
MCHC g dL^{-1})	33.5±0.41	33.7±0.30	33.8±0.32

WBC, leucocytes; RBC, red blood cells; %, mean percentage of total leucocytes; MCV, mean corpuscular volume (haematocrit (%PCV) × 10) / RBC (10^9 L^{-1}); MCH, mean corpuscular haemoglobin (haemoglobin (g dL^{-1}) × 10) / RBC (10^{12} L^{-1}); MCHC, mean corpuscular haemoglobin concentration (haemoglobin (g dL^{-1}) × 100) / haematocrit (%PCV)

Discussion

The insignificant effect of hydrolysed yeast product on the African catfish growth performance and nutrient utilisation could be as a result of low inclusion (0.3%) of the product in the current study unlike3% inclusion level . Hence, observed a significant improved growth performance after feeding Jian carp with diet supplemented with 3% hydrolysed yeast product.

The insignificant differences in the somatic indices and haematological parameters of African catfish fed the experimental diets is an indication that the dietary inclusion of yeast products do not have negative effect on African catfish (*C. gariepinus*) health and welfare. The increase in leucocytes count (though not significant) observed in catfish fed diet supplemented with unextracted yeast product could be because of immune-enhancing effect of the supplemented yeast product.

Conclusion

It could be inferred from the current study that under optimum rearing condition, yeast products (at current levels of inclusion) do not enhance the growth performance nor haematological parameters of the African catfish (C. *gariepinus*).

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