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Full Length Research Article

POTENTIAL OF YEAST (*SACCHAROMYCES CEREVISIAE*) AS FEED STABILIZER AND GROWTH PROMOTER ON *CLARIAS GARIEPINUS* (BURCHELL, 1822) FINGERLINGS

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ABSTRACT
This research was carried out to examine the potential of yeast as a fish feed stabilizer and growth promoter on *Clarias gariepienus* with varying levels of baker's yeast (*Saccharomyces cerevisae*). *Clarias gariepinus* fingerlings with mean weight of 2.40 grams fingerlings were obtained from Aliu Farms, Kaduna and transported to the Fishery unit located in the Zoological Garden of the school, Kaduna State University, Kaduna State Nigeria. The fish were acclimatized for two weeks in 60 Liters' plastic tanks. Fish were stocked at 10 fingerlings per tank containing de-chlorinated tap water in triplicate. Four experimental diets with different inclusion levels of *Saccharomyces cerevisiae* as follows; Diet I (5%), Diet II (7.5%) Diet III (10%) and Diet IV (12.5%) and the control diet without *Saccharomyces cerevisiae* were formulated at 40% crude protein. Feed subjected to stability test clearly showed that stability increases with increased level of yeast with Diet IV (12.5%) having the highest at 30 minutes (76%) and 60 minutes (68%). The pelleted feeds were fed to fish at the rate of 5% of the fish biomass throughout the experimental period. The growth response was assessed in terms of daily weight gain, relative weight gain, specific growth rate, feed conversion ratio. The results showed that diet III (10%) gave the best growth performance with an average weight gain of 2.7 followed by diet IV (12.5%) of average weight gain of 2.39 g when compared to the control diet. Similarly, diet III (10%) recorded the highest survival rate of 80%. Thus, adding baker's yeast cells into commercial fish feed at 10% improved growth and survival of Clarias *gariepinus*.

Keywords: Feed formulation, Stabilizer, Baker's yeast, *Clarias gariepinus*, Kaduna

INTRODUCTION
Aquaculture diets can either be extruded or pelleted and these according to Lim and Cuzon (1994), mentioned that for pellets to withstand handling, transportation and be of good water stability to minimize disintegration and loss of nutrients upon exposure to water they should have particles of increased durability. Quality binding agents is required for farm made fish feed that would go a long way in stabilizing feed in water and furthermore enhance prolonged floatation of feed when the floater is trapped or coated within the nutrients.

The manufacturing process includes grinding the feedstuff to reduce size of ingredient particle, mixing the selected feedstuff, subjecting the mixed feedstuff to moisture (water or steam) and applying heat and pressure to produce a particular product physical form (Tidwell and Allan, 2001).
A careful combination of ingredients to achieve pellets that has a relatively minimal bulk density and high buoyancy is possible (Obi *et al.*, 2011). Achievement of this characteristics in feeds is often aided by the inclusion of good quality binders such as cassava starch, wheat flour starch, maize flour starch, etc. (Solomon *et al.* 2011), with other ingredients capable of creating air traps within the pellets of the formulated feed, such as yeast, duckweed, honeycomb (Falayi and Sadiku 2013), and melon shell (Obi *et al.,* 2011).

MATERIALS AND METHODS
Study Area
The research was carried out in Zoological Garden, Department of Biological science of Kaduna State University (KASU) located within the main campus of Kaduna State University. Kaduna is located within the latitude of 10 ^{o}50'' and longitude of 7^{o}50'. The vegetation is of Sudan Savannah.
It covers an area of 46,053 km^2 with a population estimated at 6,113,505 million people (NPC, 2006)

Experimental design
One hundred and thirty *Clarias gariepinus* fingerlings weighing 2.4 ± 0.05 g with an average length of 7.5 ± 0.00 cm purchased from Aliu Farms, Kaduna, Kaduna State, Nigeria were transported in a plastic container of 15 L to the Zoological Lab located in Kaduna State University.

Fish was acclimatized for two weeks and covered with nets to prevent the fish from jumping out. During the acclimatization period, the fishes were fed at 5% of their body weight twice daily. Water was replaced every 48 h before feeding in order to maintain a healthy environment for the fish during both acclimatization and experimental period.

Feed water stability
The test for feed water stability was conducted using triplicate samples containing 15 single pellets (2 mm) diameter tied in nylon sieve materials of 0.1 mm mesh (Wood, 1993). The pellets were tied carefully with a twine to avoid breakage and slowly immersed in the aquarium. Five samples for each treatment were fixed in aquaria and allowed to remain for time intervals ranging from 30 minutes to 60 minutes with removal after every 30 minutes. At the end of every test time, one of the samples for each replicate was lifted slowly with the aid of the twine and allowed to drain water for 3 minutes after which the contents were put on flat boards, sun-

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dried for two days and weighed to obtain dry matter weight. The feed water stability was calculated as the percentage of the weight of retained (whole) pellets against the initial total sample dry weight. Water stability of the pellet was calculated using the equation:
M_{30}/M_1 x 100
M_{60}/M_1 x 100
Where M1= initial dry weight of pellet
M30= weight of pellet after 30 minute immersion and drying
M60= weight of pellet after 60 minute immersion and drying
(Fagbenro and Jauncey, 1995)

Fish growth performance
The growth rate was evaluated for a period of 90 days. In order to determine the growth response of the fish, weight and length gains were recorded on a weekly basis. The mean weight and length gain, feed conversion ratio (FCR), the specific growth rate (SGR), Protein efficiency ratio (PER) and survival rate were calculated.

Survival rate
Survival (%) = Ni /No x 100 (Stanley *et al*., 2017)
No = initial number of fish stocked at the beginning of the experiment Ni = Number of fish juvenile alive at the end of experiment

RESULTS
The water stability data for 30 minutes immersion in water of diets is shown in Figure 1. It shows that Diet 4 with 12.5% inclusion of yeast gave the highest stability performance at 76% while the control with no yeast inclusion gave the lowest stability performance. It can also be deduced from the result gotten that feed water stability increases with increase in yeast percentage given the percentage stability of all the diets recording a progressive stability rate simultaneously with the inclusion levels

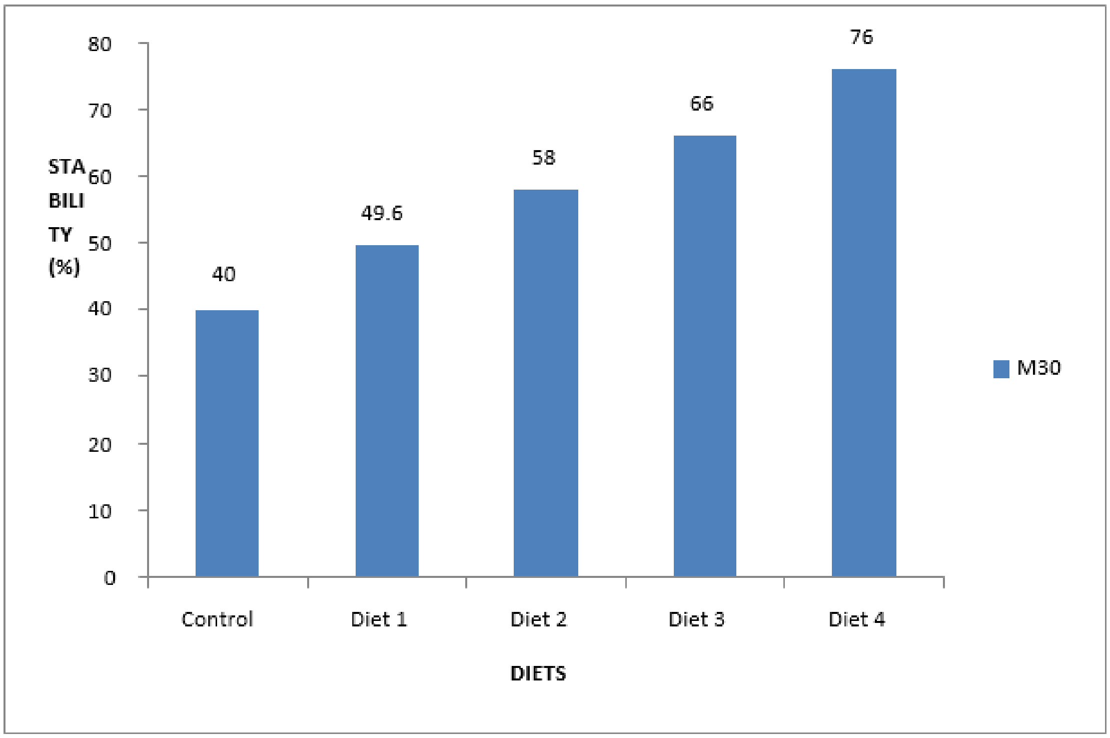

Figure 1: Feed Water Stability at different inclusion levels of yeast after thirty (30) minutes immersion in water

The water stability of feed immersed in water for a period of 60 minutes is shown in Figure 1. Diet 4 composed of 12.5% of yeast recorded the highest water stability of 68% while Control with zero yeast inclusion had the lowest and poorest stability of 27%.

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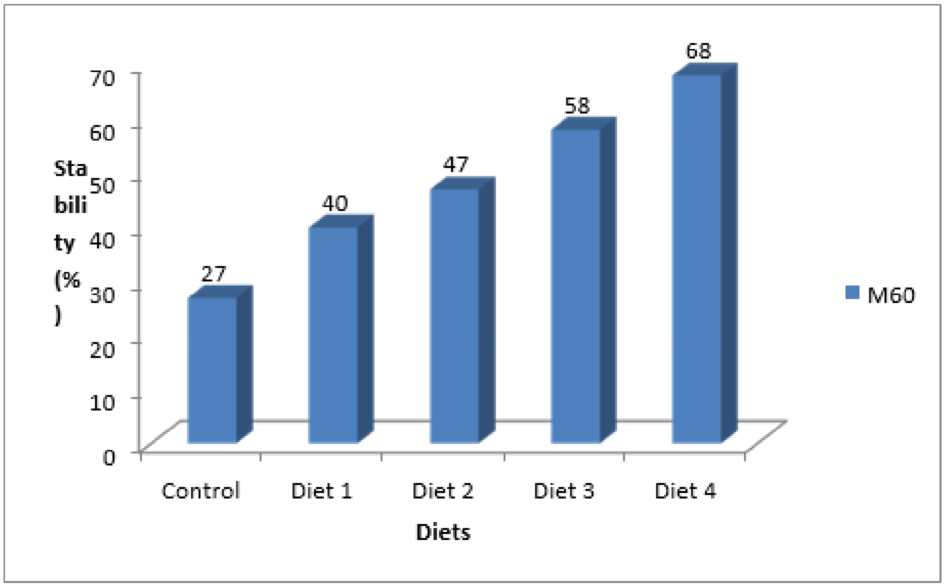

Figure 2: Feed Water Stability with different inclusion levels of yeast after sixty (60) minutes immersion in water.

After the experimental period, it was recorded that formulated feed with 10% inclusion level of yeast designated to be Diet 3 gave the best growth response with respect to weight gain (2.72 g), average daily weight gain (0.032 g), Length gain (2.98 cm), average daily length gain (0.035 cm), specific growth rate (3.16%) and Protein efficiency ratio (0.054) as shown in Table 1.

Table 1: Growth parameters, feed utilization parameters of Clarias *gariepinus* fed yeast supplemented diets

Parameters	Control	Diet 1 (5%)	Diet 2 (7.5%)	Diet 3 (10%)	Diet 4 (12.5)
Initial weight	1.86±00.03^{b}	1.88±0.0.03^{b}	1.75±0.028^{a}	1.96±0.02^{c}	1.93±0.02^{c}
Final weight	3.10±0.02^{a}	4.03±0.03^{b}	3.46±0.05^{b}	4.68±0.031^{c}	4.32±0.04^{c}
WG (g)	1.24±0.32^{a}	2.15±0.54^{b}	1.71±0.32^{a}	2.72±0.57^{c}	2.39±0.40^{c}
A/ DWG (g)	0.015±0.01^{a}	0.026±0.02^{b}	0.02±0.09^{b}	0.0320.03^{c}	0.028±0.03^{c}
LG (cm)	0.64±0.02^{a}	2.51±0.03^{b}	2.47±0.03^{b}	2.98±0.06^{c}	2.44±0.03^{b}
A/DLG (cm)	0.01±0.01^{a}	0.029±0.03^{b}	0.029±0.03^{b}	0.035±0.04^{c}	0.028±0.03^{b}
SGR (%)	1.44±0.13^{a}	2.50±0.20^{b}	2.00±0.16^{b}	3.16±0.3^{c}	2.78±0.22^{c}
PER	0.025±0.02^{a}	0.043±0.03^{a}	0.034±0.03^{a}	0.054±0.05^{c}	0.048±0.05^{a}
FCR	3.23±0.06^{c}	1.86±0.04^{b}	2.34±0.12^{b}	1.47±0.04^{a}	1.67±0.31^{a}

Survival rate data is presented in Figure 3 with diets 1, 2, 3, 4 representing different inclusion levels of yeast at 5, 7.5, 10 and 12.5% respectively. Diet 3 (with 12.5% inclusion of yeast) recorded the peak survival rate at 80% followed by Diet 4 (12.5%) at 66.67. Amongst the yeast supplemented diets, Diet 2 with 7.5% inclusion of yeast gave the lowest survival rate. The Control treatment without inclusion of yeast recorded the lowest survival rate at 40%.

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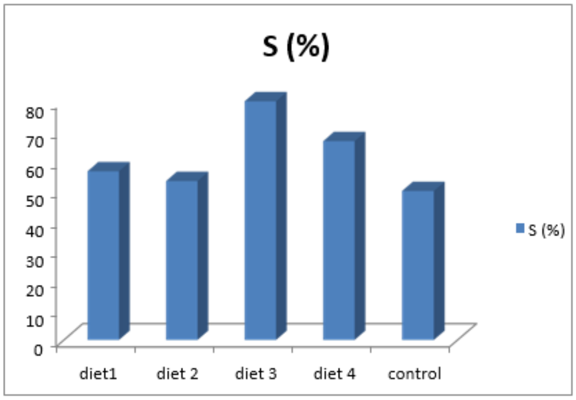

Figure 3: Survival rate of *Clarias gariepinus* fed with formulated diets of different inclusion level of yeast.

DISCUSSION

Water Stability of Yeast Supplemented Diets

This study shows that there was a significant difference in water stability between all the diets after 30 and 60 minutes. Although water stability reduced for all the diets after 30 minutes when the stability test continued for 60 minutes, the general trend was still maintained, and Diet 4 (12.5) still had significantly higher stability than the other diets. Among the yeast supplemented diets, Diet 1 (5%) gave the least water stability performance after 30-60 minutes immersion in water.
This shows a positive trend of higher percentage stability with higher percentage yeast inclusion.

Growth Performance of *Clarias gariepinus* Fed with Yeast Supplemented Diets

The increased gain in weight and specific growth rate in the experimental fish at 2.72 g and 3.16 g respectively that was recorded in catfish fed 10% yeast supplemented diet may be due to the effect of protein. This remark tally with the findings of Eyo (2005) who stated that however, Jarmolowicz *et al*., (2012) reported the effect of brewer's yeast extract on growth while Yuan *et al*. (2012) reported a significant negative relationship between growth response and the level of fish meal requirement.
The specific growth rate observed in this study was better than that which was reported for *Oreochromisniloticus* in the replacement of fish meal with yeast (Ebrahim and Abou-Seif, 2008; Bob-Manuel and Alfred-Ochiya, 2011).

The present study showed that there is a significant increase in the body weight and the specific growth rate of catfish treated with 10% local yeast. However, there is a significant decrease in the feed conversion ratio of the catfish that was treated with 10% yeast inclusion. The present study confirmed the previous findings of Kobeiusy Hussein, 1995 showing the positive effect of yeast on growth rate, feed conversion ratio and nutrient efficiency utilization of catfish.

Rumsey *et al*., 1992 explained that the enhanced growth performance and feed utilization may be due to the live yeast which act as a source of some enzymes namely, amylase, protease and lipase, which may improve food digestion and consequently food utilization. Lara-Flores *et al*. (2003) stated that the improvement of nutrient utilization and feed conversion ratio by using pro-biotic Baker's yeast in African catfish diets may be attributed to the act of the cell walls of yeast which provide very important non-nutritive compounds that may benefit fish health, including mannose. The Authors further added that the addition of live yeast improved the diet and protein digestibility, which may explain the better growth and feed efficiency with yeast supplements. Therefore, from this study, it can be concluded that supplementation of a diet with a supplementation of a percentage of 10% of commercial local yeast could be beneficial for growth and survival of African catfish, especially in fast growing conditions, where it may be essential to stimulate the digestive system.

Survival Rate of *Clarias gariepinus* Fed with Yeast Supplemented Diets

This study revealed that Diet 3 at 10% inclusion level of yeast gave the highest survival value of 80% among all the yeast supplemented diets. The next best diet that gave a high survival value is Diet 4 with 12.5% yeast inclusion at 66.7%. The third best survival rate is observed in Diet 1 at 56.6%. Diet 2 gave the poorest survival rate of 50% among the yeast supplemented diets and the Control diet (0%) had 40% survival value.

This study shows that the supplementation of live *Saccharomyces cerevisiae* improved growth and feed utilization. High values were recorded for treatment 3 with 10% inclusion when compared to the control diet. The improved performance as seen in the growth, feed utilization and survival due to better feed intake may have been due to increased fish appetite resulting in a higher feed intake and therefore improved growth.

Conclusion

Yeast supplementation significantly influenced the growth of fish ($p<0.01$). The growth and weight gain of fish after being fed the treatment pellets for ten weeks present a high significance level was observed in the growth performance and utilization of fish fed with yeast supplemented diet at 10%.

Among the diets tested, diet 4 with 12.5% inclusion of yeast records the highest potential to enhance stability of pellets for immersion periods of both 30 and 60 minutes. However, the stability of the diets reduced as immersion time increased. At 60 minutes immersion in water, there was a sharp decline in stability between Control diet and Diet 1 as it gave a stability result of 27% and 40% respectively and fish growth performance. From the economic point of view the use of baker's yeast for African catfish increases their growth and production under farming conditions.

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