BioCore Exploring Scientific Community

International Journal of Biotechnology and Bioengineering

ISSN 2475-3432

Research Article Open Access

Growth Performance of African Catfish Clarias Gariepinus (Burchell, 1822) Treated with Live Bakers Yeast (Saccharomyces Cerevisiae) in Egypt

Mohamed M M El-feky[1], M A Essa1, A G M Osman[2], S M SHALABY[3] and A M Moustafa[2]

[1]National Institute of Oceanography and Fisheries, Egypt
[2]Zoology Department, Faculty of Science, Al-Azhar University, (Assiut),Egypt
[3]Fish Resources and Aquaculture Department. Suez Canal University, El-Arish, Egypt

Corresponding Author: Mohamed M M El-feky, National Institute of Oceanography and Fisheries, Egypt.
E-mail: dive_mmae2010@yahoo.com

Citation: Mohamed M M El-feky et al. (2017), Growth Performance of African Catfish Clarias Gariepinus (Burchell, 1822) Treated with Live Bakers Yeast (Saccharomyces Cerevisiae) in Egypt. Int J Biotech & Bioeng. 3:6, 176-187.
DOI: 10.25141/2475-3432-2017-6.0171

Received: April 28, 2017; **Accepted:** May 10, 2017; **Published:** July 05, 2017

Abstract:

This study aims to evaluate the effect of different graded levels of local yeast (Saccharomyces cerevisiae) on the growth performance of Africancatfish, Clarias gariepinus. At the start of the experiment, a total number of 140 healthy fish were chosen. The fish were weighed and then divided into seven experimental groups of 10 fish per 70 –L aquarium. The water was replaced every day, but the fecal matters were siphoned out daily. Each aquarium was supplied with dechlorinated water and aerated continuously by an air compressor, so that oxygen levels were kept close to saturation. Dissolved oxygen, pH and total NH3-N were monitored in each aquarium during the experimental period. Dissolved oxygen levels were monitored close to air saturation (5.6mg/L) and pH was always on the alkaline side (7.9), while NH3-N not more than 0.097mg/L and temperature 25.5co as well as photoperiod12:12 Light: Dark). One control and six experimental diets duplicate (B2%, B1%, B0.5%, B0.2%, B0.1%&B0.05%) were arranged. Baker yeast (Saccharomyces Cerevisiae) was not included to the control group; however a (B2% at B0.05%) group was supplemented with baker yeast at 20.0, 10.0, 5.0, 2.0, 1.0and 0.5 g per kg diet respectively.

The experimental diets were formulated to contain approximately 33.64 % crude protein. The feed was provided two times a day (10:00 am and 2:00 pm). All the experimental groups were fed the experimental diets at a rate of 3% of the live body weight of the fish. The experimental aquaria were inspected daily to remove food wastes and dead fish. The conclusion from the economic point of view the use of cheap local baker's yeast for African catfish increases their growth and production under farming conditions. The present study indicates that live baker's yeast positively enhance some hematological and physiological parameters as a results of the feed utilization, growth and production performance of African catfish.

Introduction

World Aquaculture is growing with an annual rate of 8.9–9.1% since the 1970s.This high growth rate necessary to solve the problem of food shortages protein, which is particularly situated in the developing countries (Gutierrez-Wing and Malone, 2006). There is also reference to these early practices in the Christian Bible. Now, Egyptian aquaculture has become an increasingly important activity, as an immediate source of animal protein required for the country's growing population. Total aquaculture production in 2013 in Egypt reached 705 490 tones with a total market value of USD 1 354.646 million (1 USD = 5.55 Egyptian pounds) (GAFRD, 2014).

Clarias gariepinus (Burchell, 1822) or African catfish is a species of catfish of the family Clariidae. It is one of the most highly valued species in Africa (Egypt, Ethiopia, Ghana, Mali and Nigeria) and Asia (China, Indonesia, Malaysia, Philippines and Thailand). It is considered one of the best suitable alternatives to tilapia for subsistence fish farming in Africa. The African catfish species is an excellent for aquaculture as it is omnivorous, grows

fast, and tolerates relatively poor water quality (Rad et al., 2003).

The dietary requirements of cultured fish are probably the most important factor influencing the success of any fish farming. Research on nutrition of fish has been expanded over the past three decades including the use of potential of new
functional ingredients, feed additives and probiotics to improve the growth, feed utilization and fish health. In recent years, the role of probiotics in nutrition and health of certain aquaculture species have been investigated (Ringo et al., 2010). In the treatment of (G2) that fed on commercial pellets diet with 2% local Baker Yeast showed the lowest values for dray matter, ether extract and ash content, while it show highest value for crude protein compared to the control group. From the economic point of view similar to the imported yeast, the use of cheap local baker's yeast for African catfish also increases their growth and production under farming conditions (Mona et al., 2016).

The major objective of this work was to study the effect of nutritive values and the economic feasibility of dietary supplementation of probiotic (Backer yeast Saccharomyces cerevisiae) at different levels (2, 1, 0.5, 0.2, 0.1 and 0.05%) on
growth performance; production; feed utilization & histological condition of intestine; body composition and some blood parameters of African catfish Clarias gariepinus.

Materials and methods

Experimental fish:

Fry of the African catfish Clarias gariepinus (Mean body weight 1.55g± 0.027) were collected from private farm located in Kafr El Sheikh and transported to the fish rearing unit in El-Max Research Station, National Institute of Oceanography and Fishers (NIOF), Alexandria, Egypt. Prior to the start of the experiment, fry were placed in a fiberglass tank and randomly distributed into glass aquaria to be adapted to the experimental condition until starting the experiment.

Management of experimental fish:

At the start of the experiment, a total number of 140 healthy fish were chosen. The fish were weighed and then divided into seven experimental groups of 10 fish per 70 –L aquarium. The water was replaced every day, but the fecal matters were siphoned out daily. Each aquarium was supplied with dechlorinated water and aerated continuously by an air compressor, so that oxygen levels were kept close to saturation. Dissolved oxygen, pH and total NH3-N were monitored in each aquarium during the experimental period. Dissolved oxygen levels were monitored close to air saturation (5.6mg/L) and pH was always on the alkaline side (7.9), while NH3-N not more than 0.097mg/L and temperature 25.5co as well as photoperiod
12:12 Light: Dark).

Diet preparation:

One control and six experimental diets duplicate (B2%, B1%, B0.5%, B0.2%, B0.1%&B0.05%) were arranged. Baker yeast (Saccharomyces Cerevisiae) was not included to the control group; however a (B2% at B0.05%) group was
supplemented with baker yeast at 20.0, 10.0, 5.0, 2.0, 1.0and 0.5 g per kg diet respectively.

The experimental diets were formulated to contain approximately 33.64 % crude protein. Soybean meal, Guar meal, Gluten (plant protein) and fish meal (animal protein) were used as protein sources (Tables 1&2). The experimental diets
were also contained wheat bran (15%), yellow corn (13%) and sun flower oil (3%) as energy sources. Vitamin and mineral premixes (2%) were added to each experimental diet. The feed was provided two times a day (10:00 am and 2:00 pm). All the experimental groups were fed the experimental diets at a rate of 3% of the live body weight of the fish. The experimental aquaria were inspected daily to remove food wastes and dead fish.

Diet groups / Ingredients	Diet (%)						
	Control	B2%	B1%	B0.5%	B0.2%	B0.1%	B0.05%
Fish Meal	10	8	9	9.5	9.8	9.9	9.95
Guar meal	10	10	10	10	10	10	10
Soy Bean	27	27	27	27	27	27	27
Yellow Corn	13	13	13	13	13	13	13
Wheat bran	15	15	15	15	15	15	15
Gluten	10	10	10	10	10	10	10
Vitamin & Mineral	2	2	2	2	2	2	2
Oil	3	3	3	3	3	3	3

Table (1): Ingredients composition (%) of diets used in experiment

Diet groups / Items	Diet (%)						
	Control	B2%	B1%	B0.5%	B0.2%	B0.1%	B0.05%
Dry matter % (DM)	88.6	90.1	89.1	88.6	89.1	89.6	89.1
Crude protein % (CP)	25.93	27.9	25.95	25.96	25.94	25.97	25.97
Ether Extract %(EE)	6.52	6.57	6.58	6.59	6.6	6.6	6.6
crude fiber (C F) %	4.37	4.32	4.31	4.3	4.26	4.25	4.25
Ash %	6.37	7.32	6.3	6.27	6.23	6.22	6.22
NFE %	56.81	53.89	56.86	56.88	56.97	56.96	56.96
Gross energy Kcal/100g	470.38	446	447.61	447.90	448.16	448.39	448.39
P\ E ratio	55.26	62.56	57.97	57.95	57.88	57.92	57.92

Table (2): Chemical analysis of the experimental diets.

Measurement of growth performance and feed utilization:

Body weight of fish in each aquarium was measured at start and every two weeks during experimental period. After the feeding trial, the growth parameters such as survival rate (SR), weight gain (WG), specific growth rate (SGR), feed conversion rate (FCR), feed conversion efficiency (FCE) and protein efficiency rate (PER) were individually determined by Following equations:

1- Weight gain WG (g) = final fish weight (g) – initial fish weight (g).

DG = Gain (g) / time (DAY).

Average daily gain (ADG %) = {ADG / Initial weight of fish (g)} X 100.

Specific growth rate (SGR %) = log FW – log IW/ t x100.

Where.... FW is the final weight of fish (G).

Where.... IW is the initial weight of fish (G).

t = Total number of experimental days

Survival rate(S %) was determinate as follows:

SR = 100 [Number of fish at the end of experiment ÷ Total number of fish at the start of the experiment].

2- Feed conversion rate (FCR) =Feed intake (g) / Weight gain (g).

3- Protein efficiency ratio (PER) = Weight gain (g) / Protein in intake (g).

4- Protein protective value (PPV %) = {(Retained protein (g)) / (protein in intake (g))} X 100.

5- NFE = Nitrogen free extract = □ 100 — (Crude protein +ether extract + crude fiber +ash)□ .

6 - Gross energy retention (GER %) = {(Energy gain (Kcal)) / GE in intake (kcal))} X100.

Chemical analyses.

The test diets and whole-fish body from each treatment were analyzed according to the standard methods of AOAC (1980) for moisture, crude protein, crude fat and ash. Moisture content was estimated by drying the samples to constant weight at 70 C° in a drying oven. Nitrogen content was measured using a microk-jeldahl apparatus and crude protein was estimated by multiplying nitrogen content. Lipid content was determined by ether extraction in multi-unit extraction Soxhlet apparatus and ash was determined by combusting dry samples in a muffle furnace at 550 C°.

Histological examination of fish intestine:

Five specimens of African catfish fry from each experimental group were used at the end of the experiment. Anterior, middle and posterior intestine sections were collected and fixed in formalin 10 %, dehydrated in graded ethanol solution, embedded in paraffin wax, sectioned at 6–7 µm thick using a microtome and stained with hematoxiline and eosin (H&E) (Gurr, 1962). Intestine sections were submitted to

measurement of: a) thickness of muscularis, mucosal folds and number of goblet cells. The slides were examined microscopically (Olympus) and photographed by digital camera (C-4000 zoom).

Hematological and biochemical analyses:

At the end of the experiment, blood samples were taken from the caudal vein into (EDTA) tubes.

Hematological parameters:

a) At the end of the experiment, blood samples were collected from the fish caudal peduncle of the different groups. Adequate amounts of whole blood in small plastic vials containing (EDTA) were used for the total erythrocytes count (RBC's) and total leukocytes count (WBCs) were measured on an Ao Bright -Line Haemocytometer model (Neubauer improved, Precicolor

HBG, and Germany).

b) Hemoglobin concentration (Hb gm/dl) was estimated according to the method of Zinkl (1986).

c) Differential leukocyte count: the stained blood film was prepared. The relative and absolute count was estimated according to Vankamlen (1961).

d) 3-8-2 Biochemical parameters:

e) Plasma total protein was measured calorimetrically according to Henry (1964).

f) a- Total proteins (TP) concentration; were measured according to the method of Henry, (1964).

b- ALT (U/L) and AST (U/L): Both alanine aminotransferase

(ALT) and aspartate aminotransferase (AST) activities were assayed according to the method of Reitman and Frankel (1957).

c- Serum cholesterol (mg/dl) was estimated by enzymatic colorimetric methods.

d- Triglycerides (mg/dl) were estimated according to the method of Fridewald et al. (1972).

Statistical analysis

The obtained results were statistically analyzed using SPSS (version 16, 2011) for one-way analysis of variance. Differences between individual treatments were tested with Duncan Multiple range test at probability level of 5% when Ttest was significant.

Nutrition

The present work studied the effects of baker's yeast levels on growth performance, feed utilization and body composition parameters of African catfish, Clarias gariepinus fry under controlled conditions of water quality criteria (PH,

temperature and ammonia).

Water Quality criteria

The present study was applied under environmental controlled conditions. Therefore water temperature, pH and ammonia were monitored and the results are presented in table (3). Water resource supplied was dechlorinated and aerated continuously by air pumps, so that oxygen levels were kept close to saturation level. Water temperature ranged between 24 C° and 27 C° with the average of 25.5±2.12. Water pH fluctuated between an 8.0 to 7.8 with average of 7.9±0.14. The ammonia (NH3) concentration ranged between 0.099 ‰ and 0.0.095 ‰ and its average was 0.097±0.028. The water was replaced every third day, but the fecal matters were siphoned out daily.

Items	NH3 mg/L	pH	T °C
Ranged	0.099 : 0.095	8.0 : 7.8	27 : 24
Average	0.097± 0.0028	7.9± 0.14	25.5°C±2.12

Table (3): Means of water quality parameters during the present experiment.

Growth Performance parameters

Data presented in table (4) showed the increase of final fish weight with the increasing of dietary yeast level in the selected treatments. From such table, the highest values of weights were recorded in the fishes that exposed to treatments B2%, B0.5%, and B0.05% (3.36. 3.19 and 3.10 g, respectively). The latter treatments showed significant difference ($p \leq 0.05$) compared to the control group. The insignificant differences ($p \geq 0.05$) were recorded in fishes exposed to treatments B1%, B0.2 % and B0.1% compared to the control groups. In general, all treatments showed higher values than control groups. The survival rate was 100 % for the control group and for all the tested catfish exposed to different yeast levels (i.e. no mortalities in all the treatments were recorded).

Parameters Group	IWg	FWg	Gg	ADGg/fish/day	G%	SGR%/day	SR%
Control	1.52 a ±.09	2.87a±.03	1.35a±.04	22.53a±.6	89.08ab±3	1.06ab±.03	100
B 2%	1.57ab ±.02	3.36b±.01	1.79b±.04	29.88b±.07	114.43b±1.6	1.27b±.01	100
B 1%	1.56ab±.04	2.91a±.01	1.35a±.02	22.43a±0.4	86.05a±3.6	1.03a±.04	100
B 0.5%	1.55ab±.03	3.19ab±.3	1.64ab±.3	27.35ab±5.6	106.13ab±23.5	1.20ab±.2	100
B 0.2%	1.54ab±.09	2.97a±.06	1.43ab±.07	23.76ab±1.2	92.61ab±5.3	1.09ab±.04	100
B 0.1%	1.59b±.01	2.90a±0.1	1.31a±.2	21.84a±2.6	82.50a±10.6	1.a±.09	100
B0.05%	1.54ab±.01	3.09ab±0.1	1. 55ab ±.1	25.89ab±2	101.08ab±8.8	1.16ab±.08	100

Table (4): Growth performance of Clarias gariepinus fed on experimental diets containing different yeast levels.

≤0.05).

- IW = initial weight.
- FW = final weight.
- G = Gain= final fish weight (g) – initial fish weight (g).
- ADG = Gain (g) / time (day).
- SGR% = 100 x (ln FBW – ln IBW) / t, Where FBW is final body weight (g), IBW is initial body weight (g) and t is time in days.
- SR = No. of survive fish / total no. of fish at the beginning X 100.

Carcass composition of African catfish

The results of carcass composition analysis of the African catfish fed on experimental diets are presented in table (5). The highest values for dry matter were recorded for fish treated with B 0.1 % & B 0.2 % counting 28.35±0.88 & 28.35±0.67 respectively, while the lowest value was recorded for fish exposed to B 2 % (27.00±1.09). Concerning protein content, our results illustrated that all the treatments exhibited higher values and significance than control groups. The highest value was recorded for the fishes treated with B 2% (56.91±1.03). The ether extracts (fat contents) were higher Significant than control group in all the treatments except for B 2 % (21.72±0.79), it was less than control group (21.89±1.2). The ash contents were less than the control group for all the treatments. The lowest value was recorded in fishes treated with B 2% compared to the control group. In general, compared to the control group, treatment of B 2% showed the lowest values for dray matter, ether extract and ash content, while it showed highest value for crude protein.

Parameters Group	DM%	CP%	EE%	Ash%
Control	27.11a±1.2	54.23b±0.58	21.89a ±1.2	22.88b ±2.3
B2%	27.00a±1.09	56.91a±1.03	21.72b ±.79	20.87 ab ±1.2
B1%	27.49a±0.89	56.56b±.89	22.50ab±.98	20.94ab±1.3
B0.5%	27.65a±1.3	56.52a±.64	22.43b±.77	21.05bc±.74
B0.2%	28.35a±0.67	56.64b±.66	22.35b±.49	21.01c±.67
B0.1%	28.35a±0.88	56.64b±.59	22.35b±.98	21.01c±.78
B0.05%	27.58a±0.85	56.28a±.59	22.59ab±1.0	21.13cd±.48

Table (5): Average body composition of Clarias gariepinus fed on experimental yeast diets.Values in the same Column having different litter (a, b, c, ab, bc, cd) significantly

different ($p \leq 0.05$).
- Dry Matter (DM %).
- Crude Protein (CP %).
- Ether Extract (EE %).
- Ash.

Feed and nutrients Utilization

Feed utilization parameters are presented in table (6). From this table, the feed intakes were higher than the control group for all the treatments that contained different yeast levels. The fishes exposed to B2 % B 0.2 %, B
0.1 % and B 0.05 % showed significant ($p \leq 0.05$) difference compared to the control group, while those exposed to the treatment (B 1 %) showed insignificant difference. Regarding, other parameters (Dry matter, protein intake and energy intake)
they have the same trend as feed intake is being higher in all the treatments compared to the control group. These parameters showed the same trend of significance ($p \leq 0.05$) as in feedintake compared to the control.

Table (7) showed feed conversion ratio (FCR), protein efficiency ratio (PER), protein productive value (PPV) and energy retention (ER). From this table, values of FCR for fish exposed to B2%, and B0.5 % were significantly ($p \leq 0.05$) lower than the control group, while the fish exposed to B 0.2 %, and B 0.05 % exhibited insignificant ($p > 0.05$) decrease compared to the control group. Significant ($p \leq 0.05$) increase in FCR value was recorded only in fishes exposed to B 0.1 % compared to the control. No significant differences were recorded in PPV and PER values for all the treatments compared to the control group. ER values exhibited significant ($p \leq 0.05$) difference for fishes exposed to B2% & B0.5 %B 0.2 % and insignificant ($p > 0.05$) difference for fishes exposed to B 1%, B0.1 % and B0.05 % compared to the control group.

Parameters / Group	FI	FI-DM	PI	EI
Control	2.84 a±0.08	2.57 a ±0.07	1.31 a ±0.0	12.43 a ±0.32
B2%	3.32 b±0.16	3.01 b±0.15	1.74 b±0.13	14.73 b ±0.61
B1%	2.87 a±0.03	2.60 a±0.03	1.45 a±0.01	12.76 a±0.11
B0.5%	3.01 ab±0.27	2.73 ab±0.24	1.53 ab±0.06	13.42ab±1.08
B0.2%	2.91 ab±0.02	2.64 ab±0.01	1.48 a±0.01	12.98 ab±0.09
B0.1%	2.95 ab±0.04	2.67 ab±0.04	1.5 ab±0.01	13.14 ab ±0.18
B0.05%	3.14 ab±0.28	2.84 ab±0.25	1.59 ab±0.07	13.99 ab±1.13

Table (6): Feed and nutrients utilization of Clarias gariepinus fed on different yeast levels.

Group / Parameters	Control	B2%	B1%	B0.5%	B0.2%	B0.1%	B0.05%
FCR	1.90ab±0.11	1.68a±0.08	1.93ab±0.01	1.68a±0.20	1.85ab±0.11	2.05b±0.21	1.83ab±0.01
PPV	20.26a±2.81	19.77a±1.90	19.75a±0.99	21.86a±1.44	21.24a±1.45	19.21a±1.99	19.6a±1.38
PER	0.97a±0.03	0.97a±0.07	1.08a±0.02	0.94a±0.05	1.04a±0.03	1.15a±0.06	1.02a±0.01
ER	19.50a±0.44	21.51ab±0.87	20.61a±1.09	22.64b±1.07	21.81ab±0.98	19.67a±0.73	17.64a±0.91

Table (7): Feed, protein and energy intake of Clarias gariepinus fed on yeast level and control diet without yeast.

Values in the same row having different litter (a, b, ab) significantly different ($p \leq 0.05$).

FCR: feed conversion ratio.

PPV: protein productive value.

PER: protein efficiency retention.

ER: Energy retention.

Histology:

Histological characteristics of intestine of the African catfish Clarias gariepinus:

The intestine is made up of four distinct layers: outer Serosa, muscularis, submucosa and mucosal epithelium. Inner circular and outer longitudinal muscle layers were evident and mucosa was tall and interspersed with absorptive epithelial cells and numerous mucus-secreting goblet cells (Fig. 1).

At the end of experiment, the thickness of muscularis layer, the hight of mucosa and the number of its goblet cells were detected in the anterior, middle and posterior part of intestine for each of the control and treated groups. The results are shown in table (8) and Fig. (1).The present results showed remarkable variations between all the treatments and the control group. The heights of mucosa (M) in all the treatments were higher than that in the control group for the whole intestine. The highest value for the anterior mucosa and middle mucosa was recorded in the intestine of fish treated with B2% (341 ±1, 320±0.5 respectively). The highest value of mucosa for the posterior intestine was recorded in fishes exposed to the treatment B0.2% (410±2.2). Statistical analysis exhibited significant ($p \leq 0.05$) increases in the height of mucosa along the whole intestine for all the treatments compared to the control group.

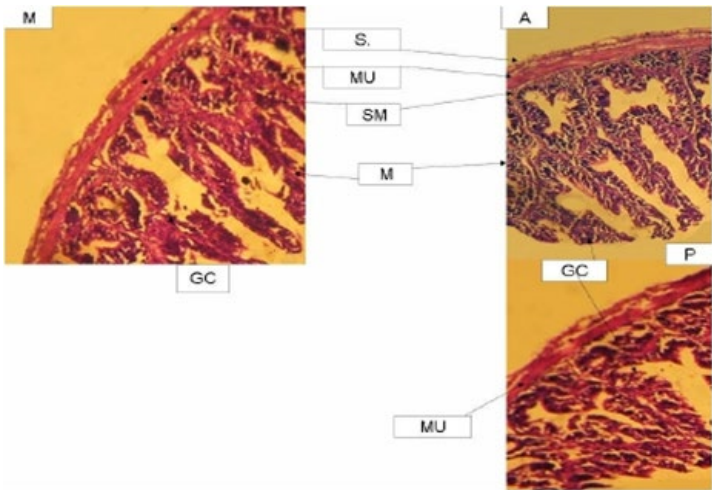
The thickness of muscularis (MU) of the whole intestine of African catfish fry C. garepienus fed on different diets contained different yeast level were higher than that for the control group. The highest values of the anterior and posterior (31.2±3.1& 32.2±2.8 respectively) compared to the control intestine were recorded in fish exposed to treatment B2% groups. The highest value of the middle intestine was detected in fish exposed to B 0.05 % (32.2± 2.8). Significant statistical differences ($p \leq 0.05$) were recorded in the thickness of muscularis of the anterior and middle intestine for all the treatments compared to the control one.

In contrast the thickness of muscularis of the posterior intestine exhibited insignificant ($p > 0.05$) differences nearly between all the treatments and the control group. In the same way the number of goblet cells (GC) in the whole intestine of the African catfish fry C. garepienus were higher in fish exposed to all the treatments (excluded B0.1% for the anterior intestine and B0.05 % for the middle intestine) compared to the control group. The highest number of goblet cells were observed in fish exposed to B 1% (7± 2.1) for anterior intestine and B 2% (6.6± 1.5and 7.2± 1.3) for middle and posterior intestine, respectively. These increases in the number of the goblet cells were significant ($p \leq 0.05$) between all the treatments and the control group in case of the anterior and middle intestine (excluded B0.05 % for the middle intestine). In contrast the number of the goblet cells exhibited nonsignificant ($p > 0.05$) differences in all the treatments and the control one. In general, histological analysis showed satisfactory values in all the treatments compared to the control. B 2% treatment was the most important treatment since it illustrated highest values of the height of mucosa, thickness of muscularis layer, and number of goblet cells through out the whole intestine compared to the control group.

Layer	M (µ)			MU(µ)			GC		
Group	anterior	middle	posterior	anterior	middle	posterior	anterior	middle	posterior
Control	230a ±0.5	238 ab±1.3	144a ±.7	13.6a ±2	13.6a ±4.2	14.4a ±3.1	3.8a ±.7	3.6 a±2.1	3 a±.3
B2%	341bc ±1	320c ±1	366c ±1.4	31.2bc ±3.1	30.2de ±1.6	32.2a ±.9	6.8b ±2.8	6.6c ±1.5	7.2a ±1.3
B1%	302bc±1.3	236 ab±3.1	310bc ±1.9	30 c±2.8	21.6bc±3.5	31.2 a±2	7 b±2.1	4.6ab ±.8	6.2a ±2.1
B0.50%	264bc± 1.6	286bc ±1.5	354bc ±2	26.8bc ±1.5	25cd ±2	25 a±2.2	5.6b ±.4	5.2b ±2.9	6.8a ±.6
B0.20%	300c ±2.1	202a ±3	410 ab±2.2	28.4bc ±2.4	19b ±2.1	26.8 a±3	4.2 b±.6	4 ab±1	6.2a ±1.2
B0.10%	292b ±1.7	266 ab±.9	302bc ±2.4	18.6bc±1.6	23 ±1.4	24.6 a±.8	3.8 ab±1.2	4 ab±1.5	4.8a ±1
B0.05%	258bc±2.2	280 bc±1.8	360 bc±3	23.8bc±2.5	32.2e ±2.8	24a ±.5	4ab ±1.8	3.6a ±.7	5.2a ±.7

Table 8. Average of height of mucosa (M), Thickness of muscularis (MU) and number of goblet cells (GC) in the anterior, posterior and middle intestine of the African catfish, Clarias gariepinus.

Values in the same Column having different litter (a, b, c, e, ab, bc, cd) significantly differant ($p \leq 0.05$).



Hematology:

Red-blood-cells (RBC's) count, haemoglobin (Hb) content, haematocrit (HCT) value, white blood cells (WBCs) and differential WBCs percentages of Clarias gariepinus fed on diets that contained various yeast levels are shown in Table (9). The highest values of RBCs count were reported in the blood of fish exposed to B0.5% (1.85 X106 / µL) compared to the control group. The highest WBCs number was recorded in the blood of Clarias gariepinus exposed to B 0.05% (27 X103 /
µL). The haemoglobin (Hb) content in the blood of Clarias gariepinus exhibited its highest values in the groups exposed to B0.2 and B0.05% (11.5 g/dl) compared to the control group. The PCV percentage in the blood of Clarias gariepinus was recorded to be higher in the group exposed to B0.05% (11.5 %) compared to the control group. Differential of leucocytes (lymphocyte, Monocyte, Basophile, Eosinophil and
Neutrophil) exhibited nonsignificant ($P \geq 0.05$) differences between all the treatments and the control group (Table 10). The highest lymphocyte percentages were recorded in the blood of fish exposed to B0.2% (45 %). The highest monocyte
percentage was recorded in the blood of fish exposed to B0.2% and B0.5% (1%). The eosinophile percentage exhibited their highest values in the blood of fish exposed to B0.1% (11.5 %) compared to the control group. The highest percentage of
neutrophile was recorded in the blood of Clarias gariepinus exposed to B2%.

Table (10) presents some biochemical parameters (ALT, AST, cholesterol, Triglyceride, total protein, albumin and globulin) in blood sample taken from Clarias gariepinus fed on experimental diets that contained different yeast level. The cholesterol concentration recorded significant differences between all the treatments and the control (excluded B1% treatment). The latter treatment exhibited nonsignificant differences compared to the control group.

The concentration of Triglyceride in the blood of African catfish showed significant difference ($P<0.01$) between the groups treated with B 0.1% and B 0.05% and the control one., while there were nonsignificant differences in serum Trigelisrol
in the blood of fish exposed the other treatments. The alanine aminotransferase (ALT) concentration exhibited significant differences ($P<0.01$) in the blood of fish
exposed to B 0.1%, B 0.05%, B 2% and B1% groups. On the other hand, the fishes exposed to B 0.5% and B0.2% showed insignificant differences compared to the control. The aspartate aminotransferase (AST) concentration in the blood serum of
African catfish reported significant difference between the fishes exposed to B 0.5%, B 0.2%, B 2%, B0.1% & B0.05% and those in the control group. In contrast the catfish exposed B1% exhibited nonsignificant differences compared to the control.

Total protein concentration increased significantly in the blood of fish exposed to all the treatments (excluded B 0.2%) compared to the control. Total protein of the blood of fish exposed to B0.5% showed nonsignificant difference compared
to the control group. The concentration of albumin exhibited significant differences ($P<0.05$) in the blood of fish exposed to B2%, B0.2% and B0.1% compared to the control. Insignificant differences were observed for groups treated with B0.5%, B0.05% and B1%. The globulin concentration showed significant difference ($P<0.05$) in the blood of fish exposed to B 1% and B0.1% and insignificant difference in the groups exposed to B 2%, B0.5%, B0.2% and B0.05% .

Parameters / Group	WBCs (10 /L)	RBC's(10 /L)	Hb (g / dl)	PCV (%)	Lympho-cytes %	Monocytes %	Baso-philes%	Eosino-phils%	Neutro-phils%
Control	25.00±1.41	1.65 ±0.07	9.50±0.71	29.50±2.12	43.50±0.71	9.00±1.41	0.50±0.71	9.00±2.83	38.00±4.24
B2%	22.50±0.71	1.60±0.00	11.00±0.00	32.50±0.71	42.00±1.41	9.50±0.71	0.50±0.71	8.00±1.41	40.00±1.41
B1%	22.50±2.12	1.60±0.14	9.50±2.12	29.50±6.36	44.50±0.71	8.50±0.71	0.50±0.71	9.00±1.41	37.50±3.54
B0.5%	24.50±2.12	1.85±0.07	9.50±0.71	29.50±0.71	44.50±2.12	10.00±0.00	0.50±0.00	10.50±0.71	34.00±2.83
B0.2%	25.50±0.71	1.65±0.07	11.50±0.71	34.00±2.83	45.00±1.41	10.00±1.41	0.50±0.71	10.00±2.83	34.50±0.71
B0.1%	25.00±1.41	1.75±0.07	10.50±0.71	32.00±1.41	44.00±1.41	9.00±1.41	0.50±0.71	11.50±0.71	35.00±1.41
B 0.05%	27.00±0.00	1.75±0.21	11.50±0.71	35.00±1.41	42.50±0.71	9.50±2.12	0.50±0.71	11.00±2.83	36.50±2.12

Table 9: Haematological parameters of catfish (Clarias gariepnus) at different of yeast levels.

Parameters / Group	Chol. (mg\dl).	Tri-G.(g\dl).	ALT (U /L)	AST (U/L)	T. proteins (gm\dl).	Albumin g / dl)	Globulin g / dl)
Control	181.0±1.41	217.0±2.83	22.0±0.00	61.2±2.6	4.8±0.14	2.9±0.00	1.9±0.14
B2%	186.0±1.41*	211.0±1.41	18.0±2.83*	57.5±0.71*	5.2±0.00**	3.2±0.00*	2.0±0.00
B1%	182.0±0.00	216.0±1.41	19.0±0.00*	61.0±0.00	5.4±0.14**	3.1±0.00	2.3±0.14*
B0.5%	182.0±2.83**	201.0±1.41	19.5±0.00	60.0±1.4**	4.9±0.00	2.7±0.14	2.2b±0.14
B0.2%	181.0±0.00**	196.0±1.41	20.0±0.00	63.0±1.4**	5.1±0.14*	3.3±0.00*	1.8±0.14
B0.1%	188.0±1.41**	199.0±0.00**	17.0±1.41**	64.0±0.0*	5.6±0.00**	3.2±0.28*	2.4±0.28*
B 0.05%	187.0±0.00**	204.0±2.83**	17.0±0.00**	62.0±2.83*	5.35±0.07**	3.1±0.00	2.25±0.07

Table 10: Physiological parameters of catfish (Clarias gariepnus) at different of yeast levels.

* The significant difference at (P<0.05).
** The significant difference at level of (P<0.01).

Discussion and conclusion

Fish nutrition considered as one of the most important requirements for fish farmers, so this topic attracts many attention. The effects of different dietary supplementation of yeast on several fish species have been demonstrated previously for Pangasius pangasius (Debnath et al., 2005) Nile tilapia (Lin et al., 2007) rainbow trout, Oncorhynchus mykiss (Irianto and Austin, 2003) and common carp, Cyprinus carpio (FAO, 1996).

In the present study, the supplementation of commercial live yeast, S. cerevisiae, improved growth and feed utilization. Significant highest values were recorded for treatment of B2% compared to the control group. These

results agree with that obtained with catla carp (Mohanty et al., 1996) hybrid striped bass (Li, and Gatlin, 2005).

The improved fish growth and feed utilization may possibly be due to improved nutrient digestibility. In this regard, Lara-Flores et al. (2003) found that the addition of live yeast improved diet and protein digestibility, which may explain the better growth and feed efficiency seen with yeast supplements. Also, De Schrijver and Ollevier (2000) reported a positive effect on apparent protein digestion when supplementing turbot feeds with the bacteria Vibrio proteolyticus. According the present results the yeast supplementation significantly affected the whole-fish body composition (Feed intake-dry matter, protein intake and energy intake). All treatments exhibited higher values compared to the control group. These results suggest that yeast supplementation plays a role in enhancing feed intake with a subsequent enhancement of fish body composition.

The better feed intake in yeast supplemented diets (B2%) may have been due to increased fish appetite resulting in a higher feed intake and therefore improved growth. Moreover, due to the high feed intake, nutrient utilization, and the high nutrient digestibility, the deposited nutrients increased. On the other hand, changes in protein and lipid content in fish body could be linked with changes in their synthesis, deposition rate in muscle and/or different growth rate (Soivio et al., 1989 and Abdel-Tawwab et al., 2006).

The positive effect of live yeast in African catfish diets under the present study conditions may be due the release of growth factors

at the selected yeast concentration. Tovar et al. (2004) found that growth rate of Sea bass larvae fed 1.1% yeast was twice than that fed on 5.7% level. Feed conversion ratio FCR for different treatment showed variety with the control group. The lowest value was recorded in the fish exposed to B 2%. The values of PPV and PER were close to the value of the control group. There were no significant difference between all the treatments and control group for both parameters. Similar results were recorded by Abdel-Tawwab et al. (2006) with Nile Tilapia. These results agreed with that of Ebrahim and Abou-Seif (2008).

The yeast supplement affected fish body composition except moisture and ash. In this study treatment of B 2% showed the lowest values for dray matter, ether extract and ash content, while it showed highest value for crude protein compared to the control group. In contrast Ebrahim and Abou-Seif (2008) recorded that, dry matter, crude protein, body fat and body ash content of Nile tilapia fingerlings were slightly fluctuated among all the experimental diets without significantly differences and exhibited no differences in carcass composition.

The intestine of many bony fishes are composed of four layers, however there are great differences in the histology of intestinal tract among different fish species (Kumar and Tembhre, 1996). The results exhibited that the height of mucosal folds in all the treatments was higher than that in the control group for the whole intestine. The highest value for the anterior mucosa and middle mucosa was recorded in the intestine of fish treated with B2%. Numerous mucussecreting goblet cells and an increase of the muscularis thickness were observed in fish fed on B2%, B1% and B0.5% diets. These results may lead to the increase of mucus secretion and absorptive area. In contrast a reduction in the height and number of mucosal folds in winter flounders Pseudopleoronectes americanus, smaller and fewer mucous cells in rainbow trout Oncorhynchus mykiss, and a loose, fragile submucosa in the bluegill sunfish Lepomis macrochinus (Hall and Bellwood, 1995) were recorded.

Histological analysis detected that all the treatments showed satisfactory values compared to the control group with emphasize that B 2% was the most important treatment where it illustrated highest values of the height of mucosal folds, thickness of muscularis layer, and number of goblet cells through out anterior, middle and posterior parts of intestine compared to the control group. De Silva and Anderson (1995) reported that the number of goblet cells could vary with the food habit or starvation. The raise of yeast levels resulted in the increase of goblet cells number in the whole intestine, mainly in the animal fed B 2%. The number of goblet cells at the anterior intestinal section accents its protective function against the content coming

from the stomach. At the middle portion the responsiveness was observed just for the highest levels of yeast. According to Evangeline et al. 2004, the anterior intestine appeared to be the most active in the absorption of macronutrients suggesting that the observed effects may be play an important role in the adaptation of the reduced food intake.

In the present study, fish fed diets containing 2.0–0.0 5% yeast/kg exhibited higher RBCs, Hb, and Ht values, whereas glucose, lipid, protein, albumin, and globulin values were increased up to 2.0 % yeast/kg diet after which those

parameters decreased. These results suggest an improvement of fish health when fed a yeast supplement. Moreover, the measurement of albumin, globulin, and total protein in serum or plasma is of considerable diagnostic value in fish, as it relates to general nutritional status as well as the integrity of the vascular system and liver function. This result agrees with Taoka et al. (2006) who investigated the effect of probiotic cells on the non-specific immune system of Nile tilapia.

The cholesterol concentration had significant difference in all the treatments compared to control group. These results are in agreement with the findings of Hussein et al. (2001) who showed that dietary yeast improved significantly the triglycerides and cholesterol of O. niloticus. The alanine aminotransferase (ALT) concentration illustrated significant difference in B 0.1%, B 0.05%, B 2%,

and B1% groups compared to the control group. Significant differences were recorded in the aspartate aminotransferase (AST) concentration in nearly all the treated groups

compared to the control one. These improvements of AST and ALT may be due to their requirement for the synthesis of all L-amino acids (Tryfiates, 1986).

The present findings are confirmed by the result of Siwicki et al. (1994) who reported that the total protein and immunoglobulin levels were significantly elevated by feeding rainbow trout on some species of yeast and algae strains. Also, Choudhury et al. (2005) obtained the same results with the dietary yeast supplementation. In addition, Lunger et al. (2006) recorded that the cobia fed on yeast diet had the highest plasma protein concentration. The present study indicates that live bakers' yeast positively enhanced growth performance and feed utilization of African catfish as well as its resistance and the optimum level of dietary live bakers' yeast is about 2.0 g per kg diet.

Conclusion:

From the economic point of view the use of cheap local baker's yeast for African catfish increases their growth and production under farming conditions. The present study indicates that live baker's yeast positively enhance some hematological and physiological parameters as a results of the feed utilization, growth and production performance of African catfish.

References

1. Abdel-Tawwab, M., Khattab, Y. A. E., Ahmad, M. H. and Shalaby,A. M. E. (2006): Compensatory Growth, Feed Utilization, Whole-Body Composition and Hematological Changes in Starved Juvenile Nile Tilapia, Oreochromis niloticus (L.). J. Appl. Aquac. 18, 17–36.

2. AOAC (1980): Official Methods of Analysis, 13th ed. Association of

Analytical Chemists, Washington, DC. 1018 p.

3. Choudhury, D., Pala, A. K., Sahua, N. P., Kumara, S., Dasb, S. S. and Mukherjeeb, S. C. (2005): Dietary yeast RNA supplementa-

tion reduces mortality by Aeromonas hydrophila in juveniles. Fish & Shellfish Immunology 19: 281-291.

4. De Groot, S. J. (1987): Culture of Clarias species. Elsevier Science

Publishers, Amsterdam, 366 pp.

5. De Silva, S. S., and Anderson, T. A. (1995): Fish nutrition in Aquaculture, Chapman & Hall, London. Duncan db, 1955: Multiple range and multipleF-tests: Biometrics ...aiep. Vol, 2000: 1-2.

6. Debnath, J., Baehrecke, E. H. and Kroemer, G. (2005): Does autophagy contribute to cell death Autophagy? 1:66–74.

7. Ebrahim, M. S. M. and Abou-Seif, R. A. (2008): fish meal replacement by yeast protein (Saccharomyces Cerevisiae) supplemented with biogenic l-carintine as a source of methionine plus lysine mixture in feed for nile tilapia (Oreochromis Niloticus) fingerlinges, Central Laboratory for Aquaculture Research, Agriculture Research Center, Cairo, Egypt.

8. Evangeline E., Jaravata1, A., Herrera1 and Jose, S. A. (2004):

Impact of The Quality of First Food on Digestive Enzymes and

Development of The Anterior Intestine and Hepato pancreas of Genetically Male Nile Tilapia (Gmt) Oreochromis Niloticus, Freshwater Aquaculture Center, College of Fisheries, Central Luzon State University, Science City of Muñoz, Nueva Ecija 3120, Philippines, 316: 336.

9. FAO (1996): Food and Agriculture Organization of the United Nations, Aquaculture Production Statistics 1986–1995. FAO Fish. Circ. No. 815, Rev. 9, Rome, Italy. 179 pp. Fiogbe E. D., Micha J. C. and Van Hove C. 2004.

10. Reitman, S. and Frankel, S. (1957): A colourmetric method for the determination of serum glutamic oxaloacetic and glutamic pyruvic transaminases. Am. J. Clin. Pathol. 28, 56.

11. Friedewald, W. T., Levy, R. A. and Fredrickson, D. S. (1972): Estimation of the concentration of low-density lipoprotein cholesterol in plasma, without use of the preparative ultracentrifuge. Clin Chem; 18:499-502.

12. GAFRD (2010): The 2003 Statistics Yearbook, Ministry of Agriculture Publications.

13.Gurr, E. (1962): Staning Animal Tissue: Pratical and Theoretical Leonard Hill Book. London.

14. Gutierrez-Wing, M. T. and Malone, R. F. (2006): Biological filters in aquaculture: trends and research directions for freshwater and marine applications. Aquac, Eng. 34 (3), 163–171.

15. Hall, K. C. and Bellwood, D.R. (1995): Histological Affects of Cyanide, Stress and Starvation on the Intestinal mucosa of Pomacentrus Coelestis, a marine aquarium fish species. J. Fish Biol., 47:438-454.

16.Henry, R. J. (1964): Colorimetric determination of total protein. In: Clinical Chemistry. Harper and Row Publ., New York, USA.

17. Hussein, S. Y., Soliman, I. A. and AbdEl-Latif, A. H. (2001). Growth performance, blood constituents and thyroid hormone in Nile tilapia (Oreochromis niloticus) fed diets cotained canola meal and supplemented with yeast strains. Assiut Vet. Med. J. 45: 75-93.

18. Irianto, A. and Austin, B. (2003): Use of probiotics to control furunculosis in rainbow trout, Oncorhynchus mykiss (Walbaum). Journal of Fish Diseases, 25: 333–342.

19. Kobeiusy, M. A. and Hussein, S. Y. (1995): Influence of Dietary Live Yeast on Growth Performance and Some Blood Constituents in Oreochromis Niloticus. Proceedings of 5th science conference Animal Nutrition, Dec. 12-13, Ismailia, Egypt, Pp: 417-425.

20. Kumar, S. and Tembhre, M. (1996): Anatomy and physiology of fishes. 1st Edn., Nehru Nagar, Ghaziabad, Vikas Publishing House PVT Ltd., PP: 65-70.

21. Lara-Flores, M., Olvera-Novoa, M. A., Guzman-Mendez, B. E. and Lopez- Madrid, W. (2003): Use of the Bacteria Streptococcus faecium and Lactobacillus acidophilus, and the Yeast Saccharomyces cerevisiae as Growth Promoters in Nile Tilapia (Oreochromis niloticus). Aquac, 216 193–201.

22. Li, P. and Gatlin, D. M. (2005): Evaluation of brewers yeast (Saccharomyces Cerevisiae) as a feed supplement for hybrid striped bass (Morone chrysops_M. saxatilis) Aquac, 219; 681 – 692.

23. Lin, B., Stackhouse, J. r., P., Minnis, P., Wielicki, B., Hu, Y., Sun, W., Fan, T. F. and Hinkelman, L. (2007): Assessment of global annual atmospheric energy balance from satellite observations, J. Geo- phys. Res., 113, D161.

24. Lunger, A. N., Craig, S. R. and Mclean, E. (2006): Replacement of Fish Meal in Cobia (Rachycentron Canadum) Diets Using an Organically Certified Protein. Aquac, 257: 393–399.

25. Mohanty, S. N., Swain, S. K. and Tripathi, S. D. (1996): Rearing of

fishmeal by brewers yeast (Saccaromyces Cerevisae) in diets for sea bass (Dicentrarchus labrax) juveniles. Aquac, 202, 269– 278.

26. Mona, M. H., Alm-Eldeen, A. A., Elgayar, E. E., Heneish, A. M. and El-feky, M. M. M. (2015): Evaluation the Effect of Local and Imported Yeasts as Supplementary Food on the African Catfish (Clarias gariepinus) in Egypt. J Aquac Mar Biol 2(3): 00024. DOI: 10.15406/jamb.2015.02.00024

27. Rad, F., Kurt, G. I. and Bozaoůlu, A. S. (2003): Effects of sp tially localized and dispersed patterns of feed distribution on the growth, size dispersionand feed conversion ratio of the African Catfish (Clarias gariepinus). Turk J Vet Anim Sci28, 851-856.

28. Ringo, E., olsen, R. E., Gifstad, T. O., Damo, R. A., Amlund, H., Hemre G. I. and Bakke, A. M. (2010): prebiotics in aquaculture: Areview. Aquacult. Nutr., 16: 117-136.

29.Siwicki A. K., Erson D. P. and Rumsey, G. L. (994). Dietary intake of immunostimulants by rainbow trout affects non-specific immunity and protection against furunculosis. Veterinary lmm nology and lmmunopathology, 41: 125-139.

30. Smith, M. A. K. (1981): Estimation of Growth Potential By Measurement of Tissue Protein Synthetic Rates In Feeding And Fasting Rainbow Trout, Salmo Gairdneri Richardson. J. Fish Biol. 19, 213–220.

31. Soivio, A., Niemisto, M. And Backstrom, M. (1989): Fatty Acid Composition of Coregonus Muksun Pallas: Changes During

Incubation, Hatching, Feeding And Starvation. Aquac, 79, 163–168.

32.Taoka, Y., Maeda, H., Jo, J. Y., Jeon, M. J., Bai, S. C., Lee, W. J., Yuge, K. and Koshio, S. (2006a): Growth, stress tolerance and non specific immune response of Japanese flounder Paralichthys olivaceus to probiotics in a closed recirculating system. Fish. Sci. 72,310–321.

33. Tovar, R. D., Zambonino, I. J., Cahub C., Gatesoupeb F. J. And Vazquez, J. R. (2004): Influence of Dietary Live Yeast on Europ an Sea Bass (Dicentrarchus Labrax) Larval Development. Aquac, 234: 415–427.

34. Tryfiates, G. P. (1986): Pyridocal Phosphate and metabolism. In: D. Dolphin, R. Poulson and 0. Avramovil (Eds.), Vitamin B6, Pyridoxal Phosphate. Part B, pp. 422-447. John Willy & Sons, Inc. USA.

35. Zinkl, J. G. (1986): Avian hematology. In: Jain NC (Edd. Schalm's Veterinary Hematology, Philadelphia, Pai hea and Febiger. pp. 256- 260.