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EFFECTS OF USING DIFFERENT LEVELS OF DIETARY SUPPLEMENTATION OF SOME PROBIOTICS AS GROWTH PROMOTERS IN DIETS ON GROWTH PERFORMANCE, FEED UTILIZATION, BODY BIOCHEMICAL COMPOSITIONAND IMMUNE OF MONOSEX ALL MALE NILE TILAPIA (*OREOCHROMISNILOTICUS*) FINGERLINGS

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ABSTRACT

The present experiments were conducted at the experimental fish culture fiberglass tanks with closed a water recirculation system, belonging to the fish production section, Animal production department, faculty of agriculture, Al-Azhar University, Cairo, Egypt. The experiments lasted for 90 days , using three commercial probiotics (Biogen , Premalac and Lacto Cel- con) as growth promoters in diets to study their effects on Growth Performance, Feed Utilization , Body Biochemical Composition and immune of monosex Nile Tilapia (*Oreochromis niloticus*) Fingerlings . Each one of these probiotics was applied in tilapia basal diets at three levels being 1, 2, and 3 g/kg diet as recommended by the producers. The experiments were conducted in 4 x 3 factorial design and included ten treatments each in three replicates (tank). A total number of 750 sex-reversed all male Nile tilapia (*Oreocheromisniloticus*) fingerlings (25 fingerlings / tank , 3 tanks for control and 27 tanks for three experiments) ,each block included control one were fed to fish basal diet as triplicates and assigned for one of the three tested commercial probiotics , with the same initial average weights and with same average total length.

All results indicated that either Biogen or Lacto- Cel - con* at 3 g/kg produced a positive effect on growth and feed utilization of tilapia fingerlings. In addition, the immune responses were substantial in both treatment groups following the challenge with bacterial disease. However, the probiotic Biogen or Lacto- Cel - con* when added to fish diet at 3 g/kg, produced a steady improvement of tilapia growth compared to Premalac. Meanwhile, both were superior than using Premalac as commercial probiotics. Lacto- Cel - con*and Biogen*were clearly beneficial for cultured *O. niloticus* when administered as a food additive. It is argued that such probiotic has a role in disease control strategies, growth promotion and immunostimulation. Further studies are needed in this field as this strategy strengthens and help understanding the role of probiotics looking for the alternative health management strategy for developing aquaculture productivity.

Key words: Probiotics Preparations, Growth performanc, Feed utilization, Body composition and Immune response*, Oreochromis niloticus* fingerlings.

INTRODUCTION

Egypt is one of the major contributors to the world aquaculture projects. Production from both wild fishing and aquaculture are of premium importance on fresh and marine continents **Aqu, Gafrd (2006).**

A culture development has accelerated throughout the country, since 1982, it has accounted for more than 70% of the country's aquatic production, making Egypt the largest producer of aquatic products in Africa and in high rank production in the world **FAO (2011).** As fast growing sector, the desire for more and efficient production with minimal hindrances forced the producers to seek for health strategies that medley both fish and consumers.

Feed in aquaculture plays an important role in the production cycle and exert threshold on both practical and economic aspects. Feed additive sectors are expanding day after day to achieve better growth and health for fish and shrimp and to meet the potential requirements of the culturists.

In last decade, the search of new options, several studies have been carried out to test new compounds, from which the aquaculture industry has developed the concept of "functional additives".

Among these additives, the additions of microorganisms to diets, named probiotics, has shown to improve the energy expenditure derived from other sources such as carbohydrates and increase the incorporations of protein for growth; increase the immunity and disease resistance of host organism. **(Lara-Flores 2012).**

The term "probiotic" comes from Greek pro and bios meaning "prolife (**Schrezenmeir and De Vrese, 2001)** having different meanings over the years.

In 1905, Dr. Elie Metchnikoff was the first to describe the positive role played by some bacteria among farmers who consumed pathogen-containing milk and that "reliance on gut microbes for food makes it possible to take steps to change the flora of our bodies and to replace harmful microbes by beneficial microbes (**Metchnikoff 1907).**

Microbial feed supplement which beneficially affects the host animal by improving its intestinal balance".

This definition is still widely referred to, despite continual contention with regard to the correct definition of the term. Current probiotic applications and scientific data on mechanisms of action indicate that non-viable microbial components act in a beneficial manner and this benefit is not limited just to the intestinal region (**Salminen *et al.,* 1999).**

Most studies concerned with the effects of probiotics on cultured aquatic animals have emphasized a reduction in mortality or, conversely, increased survival **(Change and Liu, 2002**), improved resistance against disease **(Villamil *et al*., 2003);** enhance the ability to adhere and colonize the gut **(Abo-State 2009);** improved the ability to antagonize other organisms **(Li *et al*., 2004; Panigrahi *et al*., 2005 and Shelby *et al*., 2006)** also, the ability to reduce the number of bacterial cells in kidneys **(Park *et al*., 2001),** the production of polyamines and digestive enzyme activity **(Hidalgo *et al*., 2006)** and the development of the non-specific immune system by means of Cellular systems like increased phagocytic and lysozyme activities **(Irianto and Austin, 2002).**

Another proposed definition of probiotics used in aquaculture is "live microbial cultures added to feed or environment (water) to increase viability (survival) of the host" **(Ringo *et al.,* 2010)**.

They are also refer to as bio-proteins containing living microbial cells that optimize the colonization and composition of the growth and gut microflora in animals and stimulate digestive processes and immunity.

The use of probiotics in aquaculture is now widely accepted with an increasing demand for environment friendly aquaculture **(Vine *et al.*, 2006; Wang, 2007 and Qi *et al.*, 2009).**

Nowadays, a number of preparations of probiotics are commercially available and have been introduced to fish, shellfish and molluscan farming as feed additives, or are incorporated in pond water. According to **Gatesoupe (1999),** the first application of probiotics in aquaculture was in the mid-1980s **(Kozasa, 1986)** and since then interest in such environment-friendly treatments has increased rapidly. Probiotics have been widely used as dietary supplementations in aquaculture to control of disease and also to the increase of feed efficiency and husbandry parameters **(Jovanović *et al.*, 2011).**

As has been pointed out by numerous researchers **(Merrifield *et al.*, 2010a).**

More possible benefits for fish linked to the administration of probiotics have been suggested: B. subtilis and B. licheniformis fed fish displayed a significant improvement of feed conversion ratio (FCR), specific growth rate (SGR) and protein efficiency ratio **(Merrifield *et al*, 2010).** Other protective mechanisms of probiotics against pathogens are production of inhibitory compounds with antibacterial activities and effects on the immune responses, such as modulation of the white blood cell counts.

The study of the effects of probiotics supplemented in the diet of tilapia has not advanced as far as it has in other species, such as salmonids **(Merrifield *et al.*, 2010).**

By comparison, the available research with tilapia is severely lacking, underscoring that more research is required. However, research on the supplementation of probiotics in the diets of tilapia is advancing rapidly with the majority of studies taking place since the mid-2000s, and further advances are likely to occur in the coming years. **Eid and mohamed (2008**) concluded that the positive influence of additions (Biogen® and Pronifer®) on growth performance of monosex fingerlings Nile tilapia diets showed positive effects. From feed utilization data and the economical point of view the diet supplemented with 0.1% Biogen® was the best treatment. **Ali. *et al.*,, (2010)** found that all results indicated that either Biogen or Premalac at 2g/Kg produced a positive effect on growth and feed utilization of tilapia fingerlings.

In addition, the immune responses were substantial in both treatment groups following the challenge with bacterial infection. However, the probiotics Biogen when added to fish diet at 2g/Kg, produce a steady improvement of tilapia growth compared to **Premalac. Mehrim (2011)** concluded that, it could be recommended the useful dietary supplementation of commercial probiotic Biogen® at a level of 0.3% with stoking density of 30 fish/$m^3$of mono-sex Nile tilapia fingerlings.This treatment realized the best growth performance, carcass composition, blood hematological and biochemical parameters, histometric characteristics of fish dorsal muscles and economic efficiency without any adverse effects on water quality criteria.

Yet, it could be required a lot of scientific efforts to maximize the commercial benefits from the environmentally-friendly commercial or natural probiotics with the local fish species.

Furthermore, the non-specific immune system can be stimulated by probiotics. Rengpipat *et al.* (2000) indicated that the use of Bacillus sp. in tiger shrimp provided disease protection by activating

both cellular and humoral immune defenses.

In a recent study, investigated the effect of AquaStar ® Growout (Biomin GmbH, Austria) in white shrimp (Litopenaeusva-nnamei) production performance parameters. In the economically important panaeid shrimp, Vibrio species have become a major constraint on production and trade during the past two decades.

They are responsible for several diseases and mortalities of up to 100 percent, causing global losses of around US$ three billion **(Lara-Flores, 2012**). Thus, there is clearly a need in increasing our knowledge of aquacultural animals and of effective preparation, technological applications and safety evaluation of probiotics.

The aim of this study is to find out the effect of different levels of three commercial probiotics (Biogen, Premalac and Lactocelcon) preparations supplemented to diets as growth promoters on growth performance, feed utilization efficiency, and immune response of monosex male Nile tilapia, Oreochromis niloticus fingerlings.

MATERIALS AND METHODS

The present experiments were conducted at the experimental fish culture fiberglass tanks with closed a water recirculation system, belonging to the fish production section, Animal production department, faculty of agriculture, Al-Azhar University, Cairo, Egypt. The experiment lasted for 90 days (from 15th May, 2012 to 18th Aug. 2012).

Experimental Aquaculture Units:

The experimental rearing system consisted of a series of 30 rectangular fiberglass tanks (in triplicate) each of total volume of one m3 (1m x 2m x 0.5m) in a closed recycling water system. The water supply of these tanks is the drinking tap water which derived the mechanical filter reservoir via a pump to another two fiberglass tanks of 5 m3 capacity.

A series of fiberglass tanks connected together with a tap water supply as well as a drainage system and connected with a mechanical filter. All experimental tanks were supplied with air through an aeration system which connected with an oil free air compressor (30hv).

Tap water have been stored for two days in two fiberglass tanks of 5 m3 capacity for dechlorination and for filling the experimental tanks and replacing the changed water at (100 % of tank water twice/week).

Experimental Fish and maintenance:

In this research we have choose Tilapia which is the second largest in the world, after carp, for the importance of aquaculture activities. Among these three species recognized the potential of aquaculture,the Nile tilapia, O. niloticus,is by far the one most used in aquaculture worldwide **(FAO, 2002).**

The fish used in this study were sex-reversed all male Nile tilapia (Oreocheromis niloticus) fingerlings, were purchased from a private tilapia hatchery in. Kafr El-Sheikh Governorate, Egypt. The experimental fish were transported at early morning using a special fish transport car with aeration facilities.

They seemed healthy and were acclimated to the experimental system condition 7 days before starting the experiment.

A total number of 750 sex-reversed all male Nile tilapia (Oreocheromisniloticus) fingerlings (25 fingerlings / tank, 3 tanks for control and 27 tanks for three experiments) were distributed at random into four blocks (control and probiotics) experimental dietary , each block included control one were fed to fish basal diet in three tanks as triplicates and three treatments (three probiotic levels , and each level in three tanks as triplicates) and assigned for one of the three tested commercial probiotics, with initial average weights of 12.14±.033, 12.11±.033,

12.24±.088, 12.21± 0.057, 12.14±.003, 12.21±.088, 12.24±.088, 12.17±.033, 12.21±.057, And 12.24±.033 g/ fish, and with average total length of 8.50±.057, 8.43±.033, 8.48±.11, 8.50±,12, 8.50±0.057, 8,47± 0.057, 8.43±0,17, 8,46±.14, 8.44±0,00, and 8,47±.057cm for D1, D2, D3, D4, D5, D6,D7,D8, D9, and D10,, respectively, table (3) to study the effect of three commercial probiotics (Biogen, Premalac and Lacto Cel-con) preparations supplemented to fish diets as growth promoters on the survival rate , growth performance, feed utilization efficiency, and immune response of monosex male Nile tilapia, Oreochromis niloticus fingerlings.

At the beginning and end of the experiment (10 fish) of the study fish from each tank were homogenized and analyzed for muscle composition according to **A.O.A.C. (2000).**

Streptococcus faecium, Aspergillusoryzae extract, *Bifedobacteriumbifedum*and *Torula yeast* (Premalac), *Saccharomyces cerevisiae, Lactobacillus acidophilus and Enterococcus faecium* (Lacto Cel – con) to test their effect on the productive performance of Nile tilapia fingerlings. The composition of these four probiotic preparations, as claimed by the manufacturers, is as follow:

1. Biogen:

Biogen is a dried natural product composed of Allicin, High unit hydrolytic enzymes (proteolytic, lipolytic, amylolytic and cell separating enzymes), *Bacillus subtilis* and Ginseng extract.

It is stable for 24 months under room temperature conditions. It is worthy to note that, before introducing any of the above three commercial probiotics in the experimental diets, it was necessary to insure that these commercial products have really viable microorganisms.

2. Premalac:

It is a dried fermentation product of *Lactobacillusacidophilus*, *Lactobacillus casei*, *Aspergillusoryzae* extract, *Bifedobacteriumbifedum*, *Streptococcus faecium*, *Torula yeast*, skim milk, rice meal products, vegetable oil and calcium carbonate. It is stable for 24 months if kept in room temperature.

3. *Lacto Cel – con:*

Lacto Cel – con isa dried natural product each 1 Kg contains of a good mixture of *saccharomyces cervesia* (2 $x10^{12}$ CFU) in purified mature live cells with the most beneficial intestinal micro flora – Lactobacillus acidophilus (100 x 10^9 CUF) and Enterococcus faecium(70 x 10^9 CUF), Carrier with mixture of ground yellow corn and gluten meal– in ratio 3:1.

Ingredients:

Yeast Culture (Active Saccharomyces cerevisiae Yeast grown and dogmatized on ground yellow corn gluten meal, condensed fermented corn extractives, cane molasses and malted barley), dried Lactobacillus acidophilus fermentation product, dried Enterococcus faecium fermentation product, dried Aspergillusoryzae fermentation extract, dried Aspergillusniger fermentation extract**,** dried Bacillus subtilis fermentation extract and Lactose .Experimental Design and Diets Formulation**:**

Three experimental studies were carried out to investigate the effect of three commercial probiotics as growth promoters on the performance and immune response of sex-reversed all male Nile tilapia (*Oreocheromisniloticus*) fingerlings.

A conventional yellow corn , soybeen meal (SBM)-fish meal and wheat bran basal diet was formulated to meet the minimum all nutrients required by Tilapia as recommended by the **NRC (1993**), and used with supplementation representing the control unsupplemented group (Table 1).

The basal diet was supplemented with three commercial probiotic preparations being Biogen, Premalacand Lacto Cel– con. Each one of these probiotics was applied in tilapia diets at three levels being 1, 2, and 3 g/kg diet as recommended by the producers (Table 2).

Which is considered as an indication for the viability of the microorganisms present viable in these commercial probiotics and so represents their growth promoting effect. Then, the feeding experiment started and durated for 90 days.

The dietary experimental ingredients were finely ground, weighed according to their percentage and then mixed together. Some warm water was added to each diet to be easily pelleted by pressing through 2mm die by a meat mincer machine.

The pellets were dried in a drying oven at 60°C for 24 hours and crushed to adjust the diameter of pellets according to fish size and then stored at -4°C to avoid oxidation and rancidity.

Accordingly, this experimental diet (isonitrogenous, 30% CP and isocaloric ,4400 Kcal GE/kg.) contained 10th treatments groups including the control group which received the basal diet free of probiotic

supplementation as follow:

D1=control = group received the basal diet free of probiotic supplementation.

First experiment:

D2=group received the basal diet + 1% g/kg Biogen of probiotic supplementation.

** Gross energy value was calculated from their chemical composition, Estimated according to **NRC(1993)** as 5.64, 9.44 and 4.11 Kcal/g for protein, lipid and NFE, respectively.

**** Calculated by differences [Nitrogen free extract (NFE) = 100-(CP+EE+CF+Ash)].**

***** Estimated according to NRC (1993).) as 5.64, 9.44 and 4.11 Kcal/g for protein, lipid and NFE, respectively.**

D3= group received the basal diet + 2% g/kg Biogen of probiotic supplementation**.**

** Gross energy value was calculated from their chemical composition, Estimated according to **NRC (1993)** as 5.64, 9.44 and 4.11 Kcal/g for protein, lipid and NFE, respectively.

**** Calculated by differences [Nitrogen free extract (NFE) = 100-(CP+EE+CF+Ash)].**

***** Estimated according to NRC (1993).) as 5.64, 9.44**

D4= group received the basal diet + 3% g/kg Biogen of probiotic supplementation.

Second experiment:

D5=group received the basal diet+1% g/kg Primalac of probiotic supplementation.

D6=group received the basal diet+2% g/kg Primalac of probiotic supplementation.

D7= group received the basal diet+3% g/kg Primalac of probiotic supplementation**.**

Third experiment:

D8=group received the basal diet+1% g/kg Lacto Cel-con of probiotic supplementation.

D9= group received the basal diet+2% g/kg Lacto Cel-con of probiotic supplementation**.**

D10=group received the basal diet+3% g/kg LactoCel-con of probiotic supplementation.

and 4.11 Kcal/g for protein, lipid and NFE, respectively.

Feeding technique:

Diets were fed to each group of fish during the experimental period .In the form of dried pellets suitable to fish size Feeding level was 4% of the total biomass of the fish /day.

Fish were fed 6 day/week and the amount of feed was divided into two equal portions at 9 am and 2 pm Every seven days, the fish in each tank were weighed and the amount of feed was corrected according to the new fish biomass throughout the experimental period **(Annet, 1985).**

The actual experimental feeding trials durated for a period of 3 months (90 days) Growth and feed utilization parameters:

Table (1): Proximate Chemical analyses of the feed ingredients used in the experimental diets.

Item Ingredients	DM %	CP %	EE %	CF %	Ash %	*NFE %	**GE (Kcal/kg DM)
Fish meal	92	65	9.6	0.7	19.4	5.3	4806
Soybean meal	90	44	1.1	7.3	6.3	41.3	4283
Yellow corn	88	8.5	3.6	2.3	1.3	84.3	4284
Wheat bran	89	16.4	4.0	9.9	5.3	64.4	3949

*** Calculated by differences [Nitrogen free extract (NFE) =100-(CP+EE+CF+Ash)].**

As mentioned before, fish were weighed at weekly intervals (to minimize the effect of handling) as reported by **Windell *et al.* (1978) and El-Banna (1991).**

Fish were netted in a deep bodied net to be lifted from the water, allowed to drain for a full 5 seconds interval and put into a prepared container containing a known sufficient amount of water to eliminate any stress.

Total weight was determined to the nearest gram and the fish immediately returned to their tank conditions and the feed amounts were adjusted and corrected according to their weight **(Annet, 1985).**

The growth performance and feed utilization parameters included final weight gain (WG), average daily gain (ADG), specific growth rate (SGR),Survival rate (SR %) , Condition factor (K) feed conversion ratio (FCR), protein efficiency ratio (PER), protein productive value (PPV), fat productive value (FPV), and energy utilization (EU) were calculated according to the following equations:

Final weight gain (g) = final wt. (g)-initial wt. (g)Average daily gain **(Castell and Tiews, 1980).**

$ADG = (W_1 - W_0)/T$

Where:

W_0 = Initial body weight (g).

W_1 = Final body weight (g).

T = Experimental period (days).

Specific growth rate (Pouomogne and **Mbongblang, 1993).**

$SGR\ (\%/day) = (\ln W1 - \ln W_0) / T \times 100$

Where:

W1 = final wt.

W_0 = initial wt

Ln = Natural logarithm

T = period (days) Survival rate (SR %) =Number of fish at final/Number of fish at startX100Condition factor (K): Estimated according to as:

$$K = \frac{W(Kg)}{L^3(cm)} \times 100$$

Where: W = fish weight

L = fish length 2.7.6.

Feed conversion ratio **(Tacon, 1987):**

FCR = Feed intake (g) / weight gain (g) Protein efficiency ratio.

PER (%) = weight gain (g) / protein intake (g) × 100Protein productive value.

Table (2): Ingredients, proximate composition and calculated analysis of the formulated and basal diet used in the experimental diets (on DM basis)

Item Ingredients	D1	D2	D3	D4	D5	D6	D7	D8	D9	D10
Fish meal	15	15	15	15	15	15	15	15	15	15
Soybean m56eal	37	37	37	37	37	37	37	37	37	37
Yellow Corn	28	27.9	27.8	27.7	27.9	27.8	27.7	27.9	27.8	27.7
Wheat bran	10	10	10	10	10	10	10	10	10	10
Vit. Mix *	2	2	2	2	2	2	2	2	2	2
Biogen g/kg	----	0.1	0.2	0.3	----	-----	-----	-----	------	-----
Primalac g/kg	----	-----	-----	----	0.1	0.2	0.3	----	-----	-----
Lacto cel-con g/kg	----	-----	-----	----	----	-----	-----	0.1	0.2	0.3
Linsed Oil	4	4	4	4	4	4	4	4	4	4
Min.Mix	1	1	1	1	1	1	1	1	1	1
(CMC) carboxy methyl celluleoe	3	3	3	3	3	3	3	3	3	3
Total	100	100	100	100	100	100	100	100	100	100
Chemical analysis and Nutritive value of the experimental diets (on DM basis)										
Dry matter (DM) %	91.9	90.0	88.0	92.4	92.4	88.0	92.4	92.4	93.2	92.2
Crude protein (CP) %	30.0	30.02	29.98	30.01	29.95	30.02	29.98	30.01	30.00	29.99
Ether extract (EE) %	7.25	7.24	7.20	7.23	7.22	7.19	7.18	7.13	7.16	7.22
Crude fiber (CF) %	4.44	4.42	4.43	4.41	4.44	4.39	4.43	4.38	4.41	4.40
Ash %	7.00	7.00	8.00	8.00	7.00	8.00	8.00	7.00	7.00	8.00
****NFE %**	51.31	51.32	50.39	50.35	51.39	50.40	50.41	51.48	51.43	50.39
*****GE(Kcal/kg)**	4485	4485	4441	4443	4483	4443	4439	4481	4481	4443
C/P %ratio	١١.89	66.93	67.50	67.54	66.80	67.56	67.53	66.97	66.94	67.49

*** Vitamin & mineral mixture/kg premix: Vitamin D, 0.8 million IU; E, 4g; k, 0.8g; B1, 0.4g; Riboflavin 1.6g; B6 0.6g 3B12, 4mg; Pantothenic acid, 4g; Nicotinic acid, 8g; Folic acid, 0.4g Biotin, 20mg, Mn, 22g; Zn, 22g; Fe, 12g; Cu, 4g; 1, 0.4g, Selenium, 0.4g and Co, 4.8mg.**

PPV (%) = Retained protein (g) / protein intake (g) × 100 Fat productive value:

FPV (%) = Retained fat (g) / fat intake (g) × 100 Energy retention (%): (ER %) = E-E_O / E_F X 100Where:

E = the energy in fish carcass (kcal) at the end of experiment.

E_O= the energy in fish carcass (kcal) at the start of experiment.

E_F = the energy (kcal) in feed intake.

Chemical analysis of feed:

Periodical feed samples were taken for chemical analysis to insure that the composition of diets was stable during the experimental period.

The proximate analysis of each feed sample including moisture, crude protein (CP), ether extract (EE), crude fiber (CF) and total ash content were determined according to **(A.O.A.C. 2000)** methods, while nitrogen free extract (NFE) was calculated by difference. Gross energy in feed samples were calculated from their chemical composition, estimated according to **NRC (1993),** as 5.64, 9.44 and 4.11 Kcal/g for protein, lipid and NFE, respectively.

Chemical analysis of fish:

At the beginning of feeding trial, a total number of twenty five fingerlings were netted, weighed and immediately kept in a deep freezer (-18°C) for chemical analysis (as zero group).

Similar procedure was applied at the end of such experimental period (five fingerlings as final samples of each treatment). Zero group and the final samples of each treatment were separately dried at 65°C for 24 hrs. Then ground in a mixer.

Represtative samples were chemically analyzed according to **(A.O.A.C. 2000)** methods, while their energy contents were calculated according to **(NRC 1993).**

The immune response of fish as affected by treatments:

Biochemical parameters:

At the end of the experiment, 10 fish were taken from each tank and prepared for blood analysis.

The blood was obtained from the heart of the fish and the blood samples were collected in sterilized tubes, then kept in stating position at room temperature for 30 minutes, then in a refrigerator overnight, the separation of blood serum was completed by centrifugation for 20 minutes at 3000 r.p.m., blood Haemolysis was avoided.

Serum aspartate aminotransfears, AST (u/ml) and serum alanine amino transfears ALT (u/ml) were determined using commercial kits purchased from DIAMNOD DIAGNOSTIC Co. (Egypt). Colorimetric determinations of ALT and AST activity were determined based on the method developed by according to.

Statistical analysis:

The data of the present study were analyzed using the SAS **Programme (2001)** SAS/STAT User's guide Release 6.03 Edition SAS Inst. INC. Cary, NC, USA, considering the control group for comparison. Source and level of probiotics in experiment were the main comparison effects either for the feeding or the immunity experiments. Duncan's New Multiple Range Test was conducted to determine the significant differences between means **(Duncan, 1955).**

Accordingly:

In experiment, considering the control group without probiotic supplementation, the used model for analysis was:

$$X_{ij} = \mu + T_i + E_{ij}$$

Where: μ is the overall mean.

T_i is the effect of all treatments including the control. Ei is the experimental random error.

RESULTS AND DISCUSSION

Generally, no water quality problems were observed during the trial period. These means indicating that water quality parameters were within the acceptable range for mono-sex male Nile tilapia (O.niloticus)

fingerlings growth **(El-sayd,2006),** and the experimental diets has a detrimental effects on the surrounding water quality criteria were the experimental fish had been stocked.

Therefore all experimental fish were in normal activity.This experiments were extended for 90 days using sex-reversed all male Nile tilapia (*Oreocheromisniloticus*) fingerlings.

It appears that all dietary treatments have commenced with a nearly similar initial body weight which ranged between 12.11± 0.003 and 12.24 ±.088 g / fish, and initial body length which ranged between 8.43±.033 and 8.50±.057 cm / fish.

Results revealed that averages of initial weights and lengths of the experiment start had insignificant differences among the experimental groups indicating that the complete randomization of individual fish among the experimental trials at the start of the experiment and were homogenous.

Growth Performance, specific growth rate (SGR), Condition factor(K) and survival rate:

The results of the average values of growth Performance, specific growth rate (SGR), Condition factor(K) and survival rate, of sex-reversed all male Nile tilapia (*Oreocheromisniloticus*) fingerlings, fed the Probiotics containing experimental diets are presented in Table (3).

At the end of the experimental period (90 days), the group of fish fed the supplemented diets grew as well or better than the group of fish fed the control diet. Whereas, the final body weight of the fish groups fed on diets 2 ,3,4,6,8,9 and 10 had significantly ($P<0.05$) higher final body weight than the rest of the experimental groups.

However, the lowest final body weight was achieved by the groups of fish fed the control diet (D1).Growth performance in all treatment groups was better than control and Premlac group ($P<0.05$). At the end of experimental period three groups received by 3% Biogen and Lacto cel- Con showed increase in the body weight gain (BW), body length gain, specific growth rate (SGR), condition factor (K) and survival rate % ($P<0.05$).

These results indicated that average values of growth Performance, specific growth rate (SGR), condition factor (K) and survival rate, of sex-reversed all male Nile tilapia (Oreocheromis niloticus) fingerlings which received diets supplemented with Biogen and Lacto cel-Con at 3g/kg diet also exhibited the highest final live body weight, fish length, weight gain, daily weight gain, specific growth rate (SGR), condition factor (K) and survival rate values.

These values were significantly higher than those obtained by fish having Premalac at 1 or 3 g/kg, however were a significantly different compared to the control group. The survival rate of fish fed with supplemented Biogen, Premalac and Lacto cel-Con showed no significant difference (100 %).

These results are in agreement with the results of **Mehrim (2001)** and **Diab, *et al* (2002)** for warm water fishes like Nile Tilapia (*Oreocheromis niloticu*). **Khattab, *et al* (2004)** and **Mohamed *et al*., (2007)** reported that Nile tilapia fingerlings fed on diets supplemented with probiotics exhibited greater growth performance and feed efficiency than those fed with control diet (0% probiotic); these results are comparable with our results for Nile tilapia (*Oreocheromis niloticu*) fingerlings.

Similar results were reported by using bacteria as probitics which promote growth and feed efficiency. Moreover they also reported that Biogen® is an appropriate growth-stimulating additive in tilapia cultivation.

Yet, **Mohamed *et al.* (2007)** and **Eid** and **Mohamed (2010)** reported that *O. niloticus* fingerlings fed on diets supplemented with

probiotics exhibited greater growth than those fed the control diet. Also, they added that the diet containing 30% protein and supplemented with Biogen® at level of 0.1% produced the best growth performance. Results of table (4) indicated that differences in D1 (control) among the experimental diets were significant (P<0.05).

On the other hand, the experimental fish fed on D3 (2 g/Kg Biogen), D4(3 g/Kg Biogen), D6 (2g/kg,Premalac),D8(1g/kg Lacto Cel-con),D9(2g/kg Lacto Cel-con),D10(3g/kg Lacto Cel-con) had a significantly (P<0.05) higher Feed intake, Daily Feed intake, feed conversion ratio, Feed efficiency and nutrients utilization of sex-reversed all male Nile tilapia (*Oreocheromis niloticus*) fingerlings than the rest of experimental diets.

Whereas the lowest feed intake, Daily Feed intake, feed conversion ratio, Feed efficiency and nutrients utilization by experimental fish fed on control diet (Table 4). Also, showed a significant decrease in feed conversion ratio (FCR) in comparison with control group (p<0.05).

All experimental diets contained treated commercial probiotic (Biogen* and Lacto Cel-con*) preparations supplemented to fish diets as growth promoters improved the feed utilization efficiency and increased the feed utilization efficiency significantly (P<0.05) of monosex male Nile tilapia, *Oreochromisniloticus* fingerlings (Table 4).

Results of protein efficiency ratio (PER) productive protein value (PPV %), energy utilization (EU) and energy retention (ER) of Nile tilapia fed experimental diets containing treated Biogen* and Lacto Cel-con* are presented in table (4).

In Table (4), results revealed that Biogen* and Lacto Cel-con* experimental fish diets increased PER, PPV, EU and ER% values significant (P<0.05).

The best FCR values observed with probiotics Biogen® and Lacto Cel-con supplemented diets suggested that addition of probiotics improved feed utilization. These result sfor probiotics use in diets for tilapia fingerling are in agreements with the findings of **Bomba *et al.* (2002), Khattab *et al.* (2004)** and **Mohamed *et al* (2007).**

In practical terms, this means that the use of probiotics can decrease the amount of feed necessary for animal growth which could result in reductions of production cost.

Results indicate that supplementing diets with probiotics significantly (P<0.05) improved protein utilization in commercial diets of tilapia.

In the present study (Table 4), protein efficiency ratio (PER), specific growth rate (SGR) and feed conversion ratio (FCR) improved by using, however, addition Biogen* and Lacto Cel-con to diet enhanced

The survival rate (SR) but different was not significant.

The improved fish growth and feed utilization may possible be due to improved nutrient digestibility. In this regard, **Tovar *et al.* (2002), Lara-Florse *et al.* (2003),** and **Wachee *et al* (2006),** found that the addition of live yeast improved diet and protein digestibility, which may explain the better growth and efficiency seen with yeast supplements. Also, **Abdel-Tawwab *et al.* (2006),** founded that the addition of *S.cerevisea*in diet improvedprotein efficiency ratio of *Oreochromisniloticus.*

Effect of commercial probiotic on Carcass chemical composition and energy content of monosex male Nile tilapia, *Oreochromis niloticus* fingerlings.

Averages of Carcass chemical composition and energy content (on DM) basis of monosex male Nile tilapia, *O.*

Table (3): Average values of growth Performance , specific growth rate (SGR) , condition factor(K) and survival rate ,of sex-reversed Nile tilapia (*Oreocheromis niloticus*) fingerlings, fed the Biogen, Premalac and Lacto cel-con) containingexperimental diets (means ±SD).

Treatment Parameters	Experimental diets									
	(D1-Control)	(D2) (1g/Kg) Biogen	(D3) (2g/Kg) Biogen	(D4) (3g/Kg) Biogen	(D5) 1g/Kg Premlac	(D6) 2g/Kg Premlac	(D7) 3g/Kg Premlac	(D8) 1g/Kg Lacto Cel-con	(D9) 2g/Kg Lacto Cel-con	(D10) 3g/Kg Lacto Cel-con
Init. fish weight (g)	12.14 ±.033	12.11 ±.003	12.24 ±.088	12.21 ±.057	12.14 ±.033	12.21 ±.057	12.24 ±.088	12.17 ±.033	12.21 ±.057	12.24 ±.033
Final fish weight (g)	53.64 ±.43cd	55.74 ±0.35 c	62.81 ±0.55 b	67.03 ±.063 a	51.91 ±,69 c	55.10 ±1.73 a	50.12 ±.057 c	59.61 ±.46 c	65.81 ±1.21 b	70.71 ±.057 a
Init. fish length (cm)	8.50 ±.057	8.43 ±.033	8.48 ±.11	8.50 ±.12	8.50 ±0.057	8.47 ±0.057	8.43 ±0,17	8,46 ±.14	8.44 ±0,00	8,47 ±.057
Final fishlength (cm)	13.50 ±0.17 c	13.93 ±.17 b	14.00 ±.37 a	14.25 ±.057 a	13.11 ±0.14 b	13.20 ±0.17 a	13.12 ±0.19 b	13.95 ±.17 c	14.25 ±.26 b	14.50 ±.094 a
Total weight gain (g)	41.50 ±.64 cd	43.63 ±.066c	50.57 ±1.44 b	54.82 ±0.44 a	39.8 ±0.72 bc	42.8 ±1.67 a	37.9 ±.14 c	47.44 ±.46 c	53.60 ±1,27 b	58.47 ±.066 a
Av. daily gain (g)	0.46 ±.005 c	0.48 ±.0.00a c	0.56 ±.117 b	0.61 ±.017 a	0.44 ±.005 bc	0.47 ±.151 ab	0.42 ±.003 bc	0.53 ±.005 c	0.60 ±.011 b	0.65 ±0.01 a
SGR (%/ day)	1.65 ±.014 d	1.69 ±.003 c	1.81 ±.034b	1.89 ±.034a	1.61 ±.017 c	1.67 ±0.031 a	1.56 ±.008d	1.76 ±.012 c	1.87 ±.028 b	1.95 ±.003 a
Condition factor (K)	2.18 ±.066 c	2.06 ±.017 d	2,28 ±.11a b	2,32 ±0.11 a	2.30 ±.057b	2.39 ±.014 a	2,22 ±.080 c	2.19 ±.057 c	2.27 ±.061 b	2.32 ±.032 a
No. of fish at Start.	25	25	25	25	25	25	25	25	25	25
No. of fish at end.	24a	25a	25a	25a	25	25	25	25	25	25
Survival ratio (SR%)	96a	100a	100a	100a	100	100	100	100	100	100

a, b….. Means within column with different superscripts are significantly different (P<0.05)

niloticus fingerlings at the beginning and the end of the feeding experiments including dry matter (DM), crude protein (CP), ether extract (EE), ash, and gross energy (GE kcal/kg) are presented together in Table (5).

Averages DM contents of Carcass chemical composition and energy content of the experimental fish at the experimental diets start was 23.40±0.17 and increased significantly (P<0.05) in all experimental diets groups at the end of the experiment.

There were no significant ($P \geq 0.05$) differences in dry matter, crude protein and ash of *O. niloticus* between D_4, D10and T_1. While, there were significant ($P \leq 0.05$) decreased in both of ether extract and energy content in $D_4$and D10 compared with the control group (D_1). These positive effects in carcass composition of experimental fish may be due to the dietary supplementation with Biogen® and Lacto Cel-con* which caused the good growth performance compared with the control group (Table 5).

Table (4): Feed intake, Daily Feed intake, feed conversion ratio, Feed efficiency and nutrients utilization of sex-reversed all male Nile tilapia (*Oreocheromisniloticus*) fingerlings. fed the Probiotics containing experimental diets (means ± SD),

Treatment parameter	D_1 Control	D2 (1g/Kg) Biogen	D3 (2 g/Kg) Biogen	D4 (3 g/Kg) Biogen	(D5) 1g/Kg Premlac	(D6) 2 g/Kg Premlac	(D7) 3 g/Kg Premlac	(D8) 1g/Kg Lacto Cel-con	(D9) 2 g/Kg Lacto Cel-con	(D10) 3 g/Kg Lacto Cel-con
Feed intake (g/fish) (FI)	87.88±077 c	89.39±0.36 b	92.80±0.45 a	94.45±2.55 a	78.45±2.55c	83.39±.36 b	75.41±.45 d	90.50±.003c	94.4±1.48b	97.32±35 a
Daily Feed intake (DFI)	1.22±0.011bc	1.24±.003 bc	1.28±0.005 b	1.31±0.034 a	1.08±.003 c	1.16±.034 ab	1.05±.005c	1.26±.003 c	1.31±.023b	1.35±.055 a
Feed conversion ratio(FCR)	2.11±0.023 a	2.05±0.12 b	1.83±0.044 c	1.72±0.057 d	1,97±.012 b	1.94±.057 c	1.98±.044 b	1.91±.015b	1.76±.043c	1.66±/005d
Feed efficiency (FE)	0.47±.06c d	0.48±0.003 c	0.54±0.012 b	0.58±0,017 a	0.51±.003 a	0.51±.017 a	0.50±.012 b	0.52±.003bc	0.56±.013b	0.60±.003a
protein efficiency ratio (PER)	1.57±0.017cd	1.63±.005 c	1.82±0.039 b	1.93±0.057 a	1.69±.005ab	1.71±.057 a	1.67±.039 c	1.75±.018 c	1.89±.049ab	2,00±.005a
Productive protein value(PPV %)	29,74±0.60 c	32.47±1.15 b	36.64±0.88 b	40.52±0.61 a	33.19±1.15 b	34.57±.61 a	33,11±.88bc	35,14±1.78 c	39,79±1.3 b	42,99±1.08a
Energy utilization (EU)	47±0.12 d	50±0.05 c	53±0.006 b	55±0.17 a	58±0.03 c	58±0.011 ab	61±0.09a b	51±0.07 c	53±0.008 b	55±0.19 a

a,b…Means within rows with different superscripts are significantly different (P<0.05)

Table (5): Proximate analysis of fish whole-body and energy content of sex-reversed all male Nile tilapia (Oreocheromis niloticus) fingerlings as affected by incorporation of Biogen in the experimental diets (% On Dry matter basis, Mean ± S.D).

Treatment	At the end									
Parameter	At the start	(D1) Control	(D2) (1g/Kg) Biogen	(D3) (2 g/Kg) Biogen	(D4) (3 g/Kg) Biogen	(D5) (1g/Kg) Premlac	(D6) (2 g/Kg) Premlac	(D7) (3 g/Kg) Premlac	(D8) (1g/Kg) Lacto cel-con	(D9) (2 g/Kg) Lacto cel-con	(D10) (3 g/Kg) Lacto cel-con
Dry matter (DM %)	23.40±0.17d	28.18±0.05 c	28.92±0.11b	28.85±0.14b	29.33±0.32a	28.92±0.11b	29.33±0.32a	28.85±0.14ab	29.11±0.15b	29.55±0.19ab	29.71±0.51a
Crude protein (CP%)	59.90±1.45d	62.10±.57 c	64.53±.33b	65.76±0.21ab	67.12±1.45a	63.33±.33b	64.12±1.45a	63.76±0.21b	65.32±.23b	66.77±0.29b	67.92±1.59a
Ether extract (EE%)	19.8±1.51d	25.20±0.33a	24.57±0.27 b	22.60±1.41 bc	21.08±0.67 c	25.37±0.27 b	25.18±0.67 b	25.10±1.41 b	23.38±0.25b	21.45±1.22c	20..11±0.71 cd
Ash %	20.3±0.52a	12.70±0.00 b	10.90±.33 d	11.64±0.33c	11.80±0.57c	11.30±.33 b	10.70±0.57 d	11.14±.33 bc	11.30±.52bc	11.78±.37bc	11.97±0.63b
Growth energy (Kcal GE/g)	5247.48±47.6d	5881,28±6.17b	5958,9±21.9a	5842,2±47.6 b	5775,5±21.9c	5966,7±39.5b	5993,4±21.9a	5965,5±60.8b	5891±54.5a	5790,6±44.07b	5729±91.6c

a,b…Means within rows with different superscripts are significantly different (P<0.05)

Results of the same table revealed that crude protein (CP) in whole fish body at the experimental start was significantly (P<0.05) higher in the experimental diet (D4) than that of all experimental diets at the end indicating an increase in CP parallel are decrease in whole fish body ether extract (EE).

These results indicated in general that CP% content in whole fish bodies is related to EE Contents where the increase in one is decrease on the costs of the other. Averages of whole fish bodies ash % results revealed that ash% in whole tilapia bodies was significantly (P<0.05) highest at the initial of the experiment (20.3±0.52) compared to those of all experimental diets at the end of the experiment (Table 5).

At the end of the experiment, the diet (D6) showed the lowest (P<0.05) ash % (10.70±0.57). The higher ash % (12.70±0.00) in the control diet (D1) used in the current study (Table 5).

As presented in the same table, energy contents as GE kcal/kg dry matter at the initial of the experiment was found to be 5247.48±47.6 kcal/kg dry matter and it was increased significantly (P<0.05) to 5993.5±21.9 kcal/kg dry matter in the experimental diets D5, at end of the experimental period.

These results are in close agreement with the results of **Diab *et al.* (2002), Lara-Flores *et al.* (2003**), **Mohamed *et al.* (2007)** and **Mehrim (2009).**

Since, Biogen® can enhance the metabolism and energy of fish body cells and raise the efficiency of feeds (**Mehrim, 2001**). On the other side, results in the present study are in close agreement with those of **Khattab *et al.* (2004), Srour (2004), EL-Haroun *et al.* (2006)** for tilapia **and EL-Haroun, (2007)** for catfish.

Moreover, **Eid and Mohamed (2008**) found that no statistical differences were observed in whole body moisture, crude protein, ether extract and ash of mono-sex O. niloticus fingerlings fed diets containing different levels of commercial feed additives (Biogen® and Pronifer®), compared with the control treatment. Effect of commercial probiotic on the immune response (liver functions and survival rate of monosex male Nile tilapia, Oreochromisniloticus fingerlings.

Determining the immune response of experimental fish to the tested probiotics had been done in two measures being the mortality percentage and the Liver Enzymes testes of monosex male Nile tilapia, *O. niloticus* fingerlings.

The results of the differential count of the mortality percentage and the Liver Enzymes testes of monosex male Nile tilapia, *O. niloticus* fingerlings having the tested probiotics as an index for the immune response are listed in Table (6).

Results of Table (6) indicate that, supplementation of the basal diet with feed additives (probiotics) significantly (P<0.01) decreased serum levels of transferase enzymes (ALT and AST).

Fish fed the control diet showed the highest levels of (ALT and AST) while fish fed the diet supplemenmted with probiotics showed the lowest ones. These results indicate that probiotics removed the toxic factors of the diets and therefore improved liver function. **Shalaby et al., (2003)** found that activity of liver enzymes (ALT and AST) was markedly decreased in tilapia fed diets containing licorice roots than those fed the control diet.

El-Dakar *et al.*, (2004) showed significant lower (P<0.05) ALT and AST activities with fish fed fennel seed meal in diets. The results could be attributed to the immune – modulatory effect of Probiotics on the liver cell which activate the anabolic capacity of the hepatocytes to produce blood protein particularly globulin **(Jessus *et al.*, 2002),** and this was also supported by the results of hepatic enzymes activity which decreased in O. nilticus kept on probiotic in comparison to the control group. These results were supported by the findings of regarding the viability; the all experimental fish were in

Table (6): Effect of Biogen*, Premalac and Lacto Cel-conpreparations supplemented to fish diets on the liver functions and survival rate of monosex male Nile tilapia, *Oreochromis niloticus* fingerlings. (Mean ±S.D).

Treatment / Parameter	D_1 Control	D2 (1g/Kg) Biogen	D3 (2 g/Kg) Biogen	D4 (3 g/Kg) Biogen	D5 (1g/Kg) Premalac	D6 (2 g/Kg) Premalac	D7 (3 g/Kg) Premalac	D2 (1g/Kg) Lacto- Cel – con	D3 (2 g/Kg) Lacto- Cel - con	D4 (3 g/Kg) Lacto- Cel - con
SGOT (AST)	49.62±0.67 a	48.44±0.17 b	45.23±0.42 c	43.41±0.87 d	47.00±.57 b	46.33±.57 c	48.20±.57 b	45.11±.52 ab	42.15±.37 a	38.42±.57 ab
SGPT (ALT)	47.35±0.55 a	45.20±.57 b	43.11±0.51 c	42.71±0.37 d	45.00±.57 d	44.00±.57 a	45.10±.57 c	43.41±.67c	40.35±.51 a	36.71±.44 b
Survival rate (SR%)	96	100	100	100	100	100	100	100	100	100

normal conditions and activity.

Under the prevailing conditions of water surrounded fish, the probiotics fed through diets, no mortality had been recorded at the end of the experimental groups.

However, there have been very few studies in aquaculture that focus on bacteria that prevent the growth of pathogenic microorganisms **(Austin *et al.,* 1995, Bergh, 1995, and Riquelme *et al.,* 1997).**

El-Dakar and Goher (2004) used B. subtilis in micro-binding diets for Penaeusjaponicus post-larvae. They found that the level of survival in response to bacterial challenge was high in shrimp fed the diet containing B. subtilis, while survival rate declined in the control shrimp fed the basal diet. Several mechanisms have been suggested as modes of action for probiotic bacteria.

The competitive exclusion mechanism, based on the substitution of pathogen by the beneficial population, has been considered to be important by many authors **(Moriarty, 1998; Gatesoupe, 1999**.and **Li** and **Galtin, 2004).**

In the present study, supplementation of the basal diet by Probiotics resulted in higher survival rate than fish fed the control diet. **Mehrim (2001)** reported that addition of 0.3% Biogen® to the diet increased the survival rate of tilapia compared with the control diet (without Biogen®).

El-Barbary (2002) showed that survival rate of Nile tilapia was increased as Biogen® level increased from 0 to 0.4 %. The positive effect of Biogen® and Lacto cel-Con may be due to its probiotic effects which serve as antitoxic, antibacterial and antifungal agents, which may lead to improve the survival rate. **Ghosh *et al* , (2007)** indicated that incorporation of pobiotics (B. subtilis) in fish diets significantly increased survival and decreased fry mortality.

Biogen® can enhance the metabolism of fish body cells, raise the efficiency of feed utilization and balance the secretion of various secretary glands.

Moreover, it increases the vitality of cells by supplying oxygen to whole body and improves the immune responses **(Diab *et al.,* 2002),** helps to excrete heavy metals, inhibits aflatoxin and stimulates the normal endocrine system.

CONCLUSION

In conclusion, all results obtained indicated that either Biogen or Lacto- Cel - con* at 3 g/kg produced a positive effect on growth and feed utilization of tilapia fingerlings.

In addition, the immune responses were substantial in both treatment groups following the challenge with bacterial disease. However, the probiotic Biogen or Lacto- Cel - con* when added to fish diet at 3 g/kg, produced a steady improvement of tilapia growth compared to Premalac.

Meanwhile, both were superior than using Premalac as commercial probiotics. Further studies are needed in this field as this strategy strengthens and help understanding the role of probiotics looking for the alternative health management strategy for developing aquaculture productivity.

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الملخص العربى

تأثيرات استخدام مستويات مختلفة من بعض الاضافات الحيوية كمنشطات للنمو فى العلائق على أداء النمو والاستفادة الغذائية والتركيب الكيماوى للجسم والمناعة فى إصبعيات البلطى النيلى وحيد الجنس

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أجريت هذه التجارب فى الأحواض الفيبرجلاس فى المزرعة السمكية التجريبية بنظام اعادة استخدام المياه المغلقة الملحقة بشعبة انتاج الاسماك- قسم الانتاج الحيواني – كلية الزراعة- جامعة الأزهر بالقاهرة- مصر.

استمرت التجربة لمدة ٩٠ يوم استخدم فيها ثلاثة انواع من الاضافات الحيوية التجارية (البيوجين- البريمالاك – اللاكتوسيل كون) كمنشطات نمو فى العلائق لدراسة تأثيرها على اداء النمو والاستفادة الغذائية والتركيب الكيماوي لجسم الأسماك والمناعة فى اصبعيات اسماك البلطى النيلى وحيدة الجنس (ذكور).

وكل اضافة حيوية تم تطبيقه فى العلائق الاساسية للبلطى على ثلاث مستويات ١، ٢ ، ٣ جرام / كجم عليقة وذلك حسب توصية منتجيها والتجارب تم تحليلها احصائياً.

وتتضمن التجارب عشرة معاملات لكل واحدة منها ثلاث مكررات وتم استخدام عدد ٧٥٠ من اصبعيات ذكور البلطى النيلى المحولة جنسياً بواقع ٢٥ اصبعية لكل تنك وثلاث تنكات للكنترول وسبعة وعشرون تنك للثلاث تجارب الأخرى وتم توزيعها عشوائيا داخل اربعة مجاميع (الكنترول والثلاث انواع الاخرى من البروبيوتك) فى التجارب الغذائية و المجموعة الاولى تتضمن (الكنترول) وغذيت الاسماك به على العليقة الاساسية بثلاث مكررات والثلاث مجموعات الاخرى تتضمن ثلاثة مستويات لكل نوع من البروبيوتك وكل مستوى فى ثلاث تنكات (كمكررات) وجميعها لها نفس متوسط الوزن والطول الابتدائى.

وكل النتائج المتحصل عليها توضح أن كل من البيوجين أو اللاكتوسيل كون عند مستوى ٣كجم/ كجم عليقة كان لها تأثير موجب على النمو والاستفادة الغذائية فى اصبعيات البلطى بالإضافة الى الاستجابة المناعية ومقاومتها للأمراض البكتيرية وادت الى تحسين النمو فى البلطى مقارنة فى البريمالاك مما ينصح استخدامها كمنشطات نمو تجارية واتضح ان اللاكتوسيل كون ينصح بإضافته الى البلطى النيلى المستزرع عند استخدامه كإضافات غذائية ونحتاج الى دراسات عديدة فى هذا المجال للمساعدة فى فهم البروبيوتك كإضافات غذائية صحية لتطوير كفاءة الاستزراع المائي.

الكلمات الإسترشادية : البروبيوتك، منشطات النمو، الاستفادة الغذائية ،التركيب الكيماوي للجسم إصبعيات البلطي النيلى وحيد الجنس (ذكور).

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