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Effect of different sources and levels of some dietary biological additives on: III- body composition and muscular histometric characteristics of Nile tilapia fish

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ABSTRACT

This study aimed to investigate the effect of dietary graded levels of Aqua Superzyme, Garlen Allicin, and Diamond V (Original XPC)on the chemical composition and histometric parameters of all-males mono-sex Nile tilapia *Oreochromis niloticus*. The carcass composition concerning their DM, CP, and EE contents are increased by age advance, but the ash percentages decreased. At the end of the experiment (16 weeks), DM did not significantly ($P \geq 0.05$) influence by all dietary treatments; yet, 0.01% of the diet of either the 1st two substances was responsible for the highest CP and ash percentages and the lowest EE and energy contents. Moreover, 0.5% of the diet of the 3rd substance gave the highest ($P \leq 0.05$) level among its tested levels concerning CP and the lowest ($P \leq 0.05$) EE and energy contents, but ash was not affected ($P \geq 0.05$). The best treatment (highest carcass crude protein and lowest ether extract percentages) was feeding fish the diet containing Diamond V-Original XPC at 0.5% of the diet. The same probiotic at the same level led also to improve most of the histometric characteristics of the dorsal muscles. So, it could recommend the dietary inclusion of the probiotic Diamond V-Original XPC at 0.5% of the tilapia diet.

Key words: Prebiotic – probiotic – composition – histometric – Nile tilapia.

INTRODUCTION

The first probiotics tested in fish were commercial preparations devised for land animals. Though some effects were observed with such preparations, the survival of these bacteria was uncertain in aquatic environment. Most attempts to propose probiotics have been undertaken by isolating and selecting strains from aquatic environment. These microbes were *Vibrionaceae*, pseudomonads, lactic acid bacteria, *Bacillus* spp. and yeasts. The most promising prospects are sketched out, but considerable efforts of research will be necessary to develop the applications to aquaculture (Gatesoupe, 1999). Aquaculture is one of the fastest developing growth sectors in the world. However, disease outbreaks are constraint to aquaculture production, thereby affects both economic development of the country and socio-economic status of the local people in many countries. Disease control in aquaculture industry has been achieved by following different methods using traditional ways, synthetic chemicals and antibiotics. However, the use of such expensive chemotherapeutants for controlling diseases has been widely criticized for their negative impacts like accumulation of residues, development of drug resistance, immunosuppressants and reduced consumer preference for aqua products treated with antibiotics and traditional methods are ineffective against controlling new diseases in large aquaculture systems. Therefore, alternative methods need to be developed to maintain a healthy microbial environment in the aquaculture systems there by to maintain the health of the cultured organisms. Use of probiotics is one of such method that is gaining importance in controlling potential pathogens (Sahu *et al.,* 2008). Therefore, the present research aimed to study the effect of dietary graded levels of three pre- and probiotics on Nile tilapia *O. niloticus* quality (chemical composition and muscular histometric parameters).

MATERIALS AND METHODS

The experimental period was 16 weeks after 2 weeks adaptation period. All the experimental conditions, diets, and facilities were as mentioned before in Abdelhamid *et al.* (2013a). The 1st and 2nd additives used were the prebiotic Aqua Superzyme (A) and the probiotic Garlen Allicin (G), each at 0.01, 0.02, and 0.03% of the diet. The 3rd additive used was the probiotic Diamond V-Original (XPC) at 0.4, 0.5, and 0.6% of the diet, besides the control without additives.

Chemical analysis of fish:

At the end of experimental period, three fish/treatment were taken for body composition analysis. The whole-fish body from the beginning and the end of the experiment were analyzed in triplicates. Fish samples were weighed and killed. To obtain a homogenous material for chemical analysis, fish carcass of each group was homogenized by a mixer and stored at -20^{o}C until analysis. Samples of the homogenized fish carcass materials were taken for determination of dry matter. Chemical analysis of fish carcass was carried out according to the methods described by A.O.A.C. (2000) for dry matter, crude protein, ether extract, and ash. Nitrogen free extract (carbohydrate) content was calculated by subtraction the total percentages of CP, EE, CF and ash from 100. The gross energy contents of the fish samples were calculated by using factors of 5.65, 9.45 and 4.2 Kcal / g of protein, lipid and carbohydrate, respectively (NRC, 1993).

Histometric examination:

At the end of the experiment, fish were sacrificed and dorsal muscles were sampled. Samples were fixed in 10% neutralized formalin solution followed by washing with tab water, then dehydrated by different grades of alcohol (70, 85, 96 and 99%). Samples were cleared by xylene and embedded in paraffin wax. The wax blocks were sectioned to six micron. The sections were stained by hematoxyline (H) and eosin (E) (Roberts, 2001), and then subjected to a histometric examination for dorsal muscles according to Radu-Rusu *et al.* (2009).

Statistical analysis:

Data obtained were analyzed using one-way analysis of variance which was performed according to SAS (2006). Differences were subjected to Duncan's (1955) multiple range test.

RESULTS AND DISCUSSION

Body composition:

Data of chemical composition (% DM basis) of fish body at the start and at the end of the experimental period are shown in Tables 1-3 for those fed the Aqua Superzyme, the Garlen Allicin probiotic, and the Diamond V (Original XPC) probiotic containing experimental diets, respectively, concerning their dry matter (DM), crude protein (CP), ether extract (EE), and ash besides the gross energy content (GE).

The body composition concerning their DM, CP, and EE contents are increased by age advance, but the ash percentages decrease. At the end of the experiment, DM did not significantly ($P \geq 0.05$) influenced by all dietary treatments; yet, A_1 and G_1 were responsible for the highest CP and ash percentages and the lowest EE and energy contents. Moreover, XPC_2 gave the highest ($P \leq 0.05$) level among its tested levels concerning CP and the lowest ($P \leq 0.05$) EE and energy contents, but ash was not affected ($P \geq 0.05$) as shown from Tables 1, 2 and 3, respectively. Table 4 shows that the best treatment (highest carcass crude protein and lowest ether extract percentages) was (3*2, XPC_2) by feeding fish the diet containing XPC at 0.5% of the diet.

El-Hadidy *et al.* (1993) studied the effect of experimental diets namely, brewers tefla, activated sludge, yeast and algae as major constituents of Nile tilapia diets. Statistical analysis indicated that no significant differences were found in crude protein, lipids, ash, drymatter of the body as affected by experimental diets, except fish fed the sludge diet.

Noh *et al.* (1994) fed Israeli carp of 300 g body weight on basal diet composed of fish meal 9% soybean meal 47% wheat flour 36.05 maize gluten 3.6% and sardine oil 2% plus vitamins minerals supplements or that diet plus oxytetracyline 0.05% Nosiheptide, 0.1% *Lactobacillus* concentrate (*Strepococcus faccium* cencell 68), yeast culture (yeast culture on grain media) 0.5% or enzyme complex (alpha- amylase, beta glucanae, fluranase, pectinase endoprotease, exoprotease and cellulase) 0.05%. Increases in the body content of crude fat, crude fiber and nitrogen freeextract were detected in case of treated groups.

Table 1: Carcass chemical composition (% DM basis) and gross energy content (kcal./100g) of Nile tilapia (*O. niloticus*) fed the Aqua Superzyme experimental diets.

Treat.	**DM**	**CP**	**EE**	**Ash**	**GE**
At the start:					
	33	49.37	31.03	18.79	572.00
At the end:					
Control	33.59^a	50.23^d	32.52^a	17.25^b	590.30^a
A_1	33.47^a	56.91^a	22.18^d	20.90^a	530.36^c
A_2	34.14^a	54.50^b	28.92^b	16.57^b	580.46^a
A_3	33.67^a	53.20^c	26.56^c	20.22^a	550.86^b
P > F	0.93	0.0001	0.0001	0.0010	0.0001
±SE	0.77	0.30	0.51	0.54	4.80

a-d: Means in the same column having different letters are significantly ($P \leq 0.05$) different.

Table 2: Carcass chemical composition (% DM basis) and energy content (kcal/100g) of Nile tilapia (*O. niloticus*) fed the Garlen Allicin experimental diets.

Treat.	**DM**	**CP**	**EE**	**Ash**	**GE**
At the start:					
	33	49.37	31.03	18.79	572.00
At the end:					
Control	33.59^a	50.23^d	32.52^a	17.25^a	590.30^a
G_1	34.02^a	57.38^a	21.91^c	20.70^a	530.53^b
G_2	32.61^a	55.15^b	26.29^b	18.55^a	559.30^{ab}
G_3	33.85^a	53.80^c	27.34^b	18.86^a	561.53^{ab}
P > F	0.644	0.0001	0.001	0.192	0.018
±SE	0.825	0.305	1.11	1.0	9.83

a-d: Means in the same column having different letters are significantly ($P \leq 0.05$) different.

Table 3: Carcass chemical composition (% DM basis)and energy content (kcal/100g) of Nile tilapia (*O. niloticus*) fed the Diamond V (Original XPC) experimental diets.

Treat.	DM	CP	EE	Ash	GE
At the start:					
	33	49.37	31.03	18.79	572.00
At the end:					
Control	33.59^{a}	50.23^{c}	32.52^{a}	17.25^{a}	590.30^{a}
XPC$_1$	32.83^{a}	57.44^{b}	23.34^{b}	19.32^{a}	543.33^{b}
XPC$_2$	32.85^{a}	59.47^{a}	22.22^{b}	18.30^{a}	545.20^{b}
XPC$_3$	32.78^{a}	56.68^{b}	24.42^{b}	18.89^{a}	550.20^{b}
P > F	0.85	0.0001	0.0002	0.459	0.013
±SE	0.76	0.402	0.90	0.919	8.43

a-c: Means in the same column having different letters are significantly (P≤0.05) different.

Kobeisy and Hussein (1995) used *Oreochromis niloticus* to determine the effect of three concentrations of live yeast (5, 10 or 20% of dietary DM) on body composition**.** The protein content of the fish body was significantly higher in fish fed diets containing yeast than in those fed control diets. Also, Adamek *et al.* (1996) found that the addition of the probiotic Ascogen at 0.62 and 2.5 g / kg pelleted diet lo rainbow trout resulted in 11.2 and 12.1% in protein content of fish flesh, but reduced fat content of fish flesh by 42.9 and 45.8%, respectively compared with the basal diet given alone. Aseogen at 5 g / kg diet had no positive effect on those values. Moreover**,** Khattab *et al.* (2004) and El-Haroun (2007) reported that dietary inclusion of Biogen® significantly increased crude protein content and decreased total lipids in whole fish body of Nile tilapia and African catfish, respectively.

In an evaluation for the effects of graded levels of a new commercial probiotic Hydroyeast Aquaculture® (0, 5, 10 and 15 g / Kg diet) on both sexes of adult Nile tilapia *O. niloticus*, on their carcass composition for 8 weeks, the obtained results showed that tested probiotic at level of 15 g / kg diet and 10 g / kg diet for adult males and females *O. niloticus*, respectively, realized slight improving of fish carcass composition. Hence, it could be concluded that Hydroyeast Aquaculture® probiotic is useful at levels of 15 g / kg diet and 10 g / kg diet for enhancing production performance of adult males and females Nile tilapia (*O. niloticus*) respectively, so may be using of this probiotic led to economic efficiency especially, for fish farming and hatcheries (Khalil *et al*., 2012).

Table 4: Comparison between carcass chemical composition and energy content of Nile tilapia (*O. niloticus*) fed the Aqua Superzyme, Garlen Allicin, and Diamond V (Original XPC) experimental diets, at the end of the experiment.

Treat.	Dry matter %	CP %	EE %	Ash %	GE kcal/100g
Control	33.59^{a}	50.23^{f}	32.52^{a}	17.25^{bc}	590.30^{a}
1*1	33.47^{a}	56.91^{b}	22.18^{d}	20.90^{a}	530.36^{d}
1*2	34.14^{a}	54.50^{cd}	28.92^{b}	16.57^{c}	580.46^{ab}
1*3	33.67^{a}	53.20^{e}	26.56^{bc}	20.22^{ab}	550.86^{cd}
2*1	34.02^{a}	57.38^{b}	21.91^{d}	20.70^{a}	530.53^{d}
2*2	32.61^{a}	55.15^{c}	26.29^{bc}	18.55^{abc}	559.30^{bc}
2*3	33.85^{a}	53.80^{ed}	27.34^{bc}	18.86^{abc}	561.53^{bc}
3*1	32.83^{a}	57.44^{b}	23.24^{d}	19.32^{abc}	543.33^{cd}
3*2	32.85^{a}	59.47^{a}	22.22^{d}	18.30^{abc}	545.20^{cd}
3*3	32.78^{a}	56.68^{b}	24.42^{cd}	18.89^{abc}	550.20^{cd}
P > F	0.902	0.0001	0.0001	0.0541	0.0011
±SE	0.861	0.360	0.941	0.918	8.600

a-f: Means in the same column having different letters are significantly (P ≤ 0.05) different.

A negative relationship was noticed between CP and EE contents of fish body but a position relationship between CP and ash contents was recorded too (Abdelhamid *et al*., 2005 and 2007; El-Ebiary and Zaki, 2003). Yet, El-Saidy *et al*. (1999) and El-Saidy and Gaber (2002) found that there was a positive correlation between crude protein and fat contents of the fish.

Histometric characteristics of dorsal muscles:

The following Tables 5-8 and Figures 1-3 present data of the histometric characteristics carried out on the dorsal muscles of experimental fish fed diets containing the pre-and probiotics Aqua Superzyme (A) prebiotic, Garlen Allicin (G), and Diamond V (Original XPC), respectively. All histomestic parameters were improved by the dietary inclusion of either pre-or probiotics. Yet, the best treatment realized improvement of these histometric characteristics of fish dorsal muscles compared with the control or other treatments was 3*2, i.e. the diet containing XPC at 0.5% of the diet (Table 8).

The results revealed that fish fed the high level of A prebiotic (A_3) followed by A_1 led to significantly ($P \leq 0.05$) increased the largest diameter (µm), smallest diameter (µm), mean diameter (µm), smallest/largest ratio and the percentage of muscular bundles area/mm^2 of dorsal muscles compared with the A_2 and control treatments, meanwhile, the intensity of muscular bundles/mm^2 significantly ($P \leq 0.05$) decreased in fish fed the A prebiotic compared with the control group. On the other hand, there was unclear trend in the percentageof interstitial connective tissue/mm^2 among all treatments (Table 5).

Table 5: Histometric characteristics of dorsal muscles of mono-sex of Nile tilapia (*O.niloticus*) fed the Aqua Superzyme prebiotics of the experimental diets.

Treat.	Largest diameter (µm)	Smallest diameter (µm)	Mean diameter (µm)	Smallest /Largest ratio	Intensity of muscular bundles/mm^2	% of muscular bundles area*/ mm^2	% of connective tissue**/ mm^2
Control	8.95^d	5.54^d	7.24^d	0.616^b	6.0^a	59.69^b	40.31^a
A_1	17.58^b	13.35^b	15.47^b	0.760^a	3.22^c	78.22^a	21.77^b
A_2	14.01^c	7.95^c	10.98^c	0.567^b	4.0^b	60.66^b	39.33^a
A_3	19.70^a	15.0^a	17.35^a	0.764^a	2.67^d	67.46^{ab}	32.53^{ab}
P > F	0.0001	0.0001	0.0001	0.0005	0.0001	0.0258	0.0258
±SE	0.441	0.411	0.336	0.028	0.060	4.06	4.059

a-d: Means in the same column having different letters are significantly ($P \leq 0.05$) different. * % of muscular bundles area / mm^2 = ([3.14 X (mean diameter / 2)^2] X Intensity of muscular bundles / mm^2) X 100, whereas: the muscular bundles were considered in approximately circular shape.** % of connective tissue / mm^2 = (1-muscular bundles area, mm^2) X 100.

Also, Nile tilapia fed G probiotic significantly ($P \leq 0.05$) increased the largest diameter (µm), smallest diameter (µm), mean diameter (µm), smallest/largest ratio and the percentage of muscular bundles area/mm^2 of dorsal muscles compared with the control; however, the intensity of muscular bundles/mm^2 significantly ($P \leq 0.05$) decreased in fish fed the G compared with the control group. On the other hand, there was unclear trend in the percentageof interstitial connective tissue/mm^2 among all treatments (Table 6).

Table 6: Histometric characteristics of dorsal muscles of mono-sex of Nile tilapia (*O.niloticus*) fed the Garlen Allicin probiotics of the experimental diets.

Treat.	Largest diameter (µm)	Smallest diameter (µm)	Mean diameter (µm)	Smallest /Largest ratio	Intensity of muscular bundles/mm^2	% of muscular bundles area*/ mm^2	% of connective tissue**/ mm^2
Control	8.95^{b}	5.54^{b}	7.24^{b}	0.616^{b}	6.0^{a}	59.69^{b}	40.31^{a}
G_1	14.60^{a}	12.77^{a}	12.77^{a}	0.878^{a}	3.92^{b}	78.93^{a}	21.07^{b}
G_2	13.36^{a}	11.23^{a}	11.23^{a}	0.836^{a}	4.25^{b}	66.66^{ab}	33.33^{ab}
G_3	12.58^{a}	10.02^{a}	10.02^{ab}	0.789^{a}	4.65^{b}	64.20^{ab}	35.79^{ab}
P > F	0.0105	0.0015	0.0128	0.0003	0.0017	0.1243	0. 1243
±SE	1.003	0.996	0.993	0.030	0.295	5.372	5.373

a-d: Means in the same column having different letters are significantly (P ≤ 0.05) different. * % of muscular bundles area / mm^2 = ([3.14 X (mean diameter / 2)^2] X Intensity of muscular bundles / mm^2) X 100, whereas: the muscular bundles were considered in approximately circular shape.** % of connective tissue / mm^2 = (1- muscular bundles area, mm^2) X 100.

In addition, fish fed XPC probiotic revealed significantly (P ≤ 0.05) increases in the largest diameter (µm), smallest diameter (µm), mean diameter (µm), and the percentage of muscular bundles area / mm^2 of dorsal muscles compared with the control treatment, meanwhile, the intensity of muscular bundles / mm^2 significantly (P ≤ 0.05) decreased in fish fed the XPC probiotic compared with the control group. On the other hand, there was unclear trend in smallest/largest ratio and the percentageof interstitial connective tissue/mm^2 among all treatments (Table 7).

Table 7: Histomitrac characteristics of dorsal muscles of mono-sex Nile tilapia (*O. niloticus*) fed the Diamond V (Original XPC) probiotics of the experimental diets.

Treat.	Largest diameter (µm)	Smallest diameter (µm)	Mean diameter (µm)	Smallest /Largest ratio	Intensity of muscular bundles/mm^2	% of muscular bundles area*/ mm^2	% of connective tissue**/ mm^2
Control	8.95^{d}	5.54^{d}	7.24^{d}	0.616^{b}	6.0^{a}	59.69^{b}	40.31^{a}
XPC_1	12.50^{c}	8.70^{c}	10.60^{c}	0.696^{a}	4.0^{b}	57.05^{b}	42.94^{a}
XPC_2	21.65^{a}	14.0^{a}	17.82^{a}	0.646^{ab}	4.95^{d}	86.40^{a}	13.59^{b}
XPC_3	16.85^{b}	11.55^{b}	14.20^{b}	0.685^{ab}	3.37^{c}	71.94^{ab}	28.06^{ab}
P > F	0.0001	0.0001	0.0001	0.1221	0.0001	0.0034	0. 0034
±SE	0.502	0.507	0.462	0.023	0.076	5.372	4.748

a-d: Means in the same column having different letters are significantly (P ≤ 0.05) different. * % of muscular bundles area / mm^2 = ([3.14 X (mean diameter / 2)^2] X Intensity of muscular bundles / mm^2) X 100, whereas: the muscular bundles were considered in approximately circular shape.** % of connective tissue / mm^2 = (1- muscular bundles area, mm^2) X 100.

Generally, it can be noted that dietary supplementation of experimental commercial pre- (A) and (G and XPC) probiotics led to improvement of the histometric characteristics of the dorsal muscles of fish compared with the control group, which fed the basal diet free from pre- or probiotics. These improvements in the histometric parameters are positively correlated with the obtained results of different parameters concerning the growth performance, feed and nutrients utilization, digestibility, immunity, carcass composition, haematology, and economic evaluation. Also, these improvements are due to the contents of the tested pre-and probiotics, including: minerals, enzymes, amino acids, and beneficial microorganisms (Abdelhamid *et al.*, 2013 a, b, and c).

Table 8: Comparison Histomitrac characteristics of dorsal muscles of mono-sex Nile tilapia (*O. niloticus*) fed the Aqua Superzyme, Garlen Allicin, and Diamond V (Original XPC) of the experimental diets.

T*L	Largest diameter (µm)	Smallest diameter (µm)	Mean diameter (µm)	Smallest /Largest ratio	Intensity of muscular bundles/mm^2	% of muscular bundles area*/ mm^2	% of connective tissue**/ mm^2
Control	8.95^{e}	5.54^{e}	7.24^{g}	0.616^{de}	6.0^{a}	59.69^{c}	40.31^{a}
1*1	17.58^{bc}	13.35^{ab}	15.47^{bc}	0.760^{bc}	3.22^{ef}	78.22^{ab}	21.77^{bc}
1*2	14.01^{d}	7.95^{d}	10.98^{ef}	0.567^{e}	4.0^{c}	60.66^{c}	39.33^{a}
1*3	19.70^{ab}	15.0^{a}	17.35^{ab}	0.764^{bc}	2.67^{f}	67.46^{bc}	32.53^{ab}
2*1	14.60^{d}	12.77^{ab}	12.77^{de}	0.878^{a}	3.92^{cd}	78.93^{ab}	21.07^{bc}
2*2	13.36^{d}	11.23^{bc}	11.23^{ef}	0.836^{ab}	4.25^{bc}	66.66^{bc}	33.33^{ab}
2*3	12.58^{d}	10.02^{cd}	10.02^{f}	0.789^{b}	4.65^{b}	64.20^{bc}	35.79^{ab}
3*1	12.50^{d}	8.70^{d}	10.60^{ef}	0.696^{cd}	4.0^{c}	57.05^{c}	42.94^{a}
3*2	21.65^{a}	14.0^{a}	17.82^{a}	0.646^{de}	2.95^{ef}	86.40^{a}	13.59^{c}
3*3	16.85^{c}	11.55^{cd}	14.20^{cd}	0.685^{cd}	3.37^{de}	71.94^{bc}	28.06^{ab}
P > F	0.0001	0.0001	0.0001	0.0001	0.0001	0.0010	0. 0010
±SE	0.749	0.735	0.709	0.028	0.196	4.557	4.557

a-d: Means in the same column having different letters are significantly ($P \leq 0.05$) different. * % of muscular bundles area / mm^2 = ([3.14 X (mean diameter / 2)^2] X Intensity of muscular bundles / mm^2) X 100, whereas: the muscular bundles were considered in approximately circular shape.** % of connective tissue / mm^2 = (1-muscular bundles area, mm^2) X 100. T*L: treatment * level.

In this topic, the present findings are closed agree with those reported by Abdelhamid *et al.* (2004), they found that the *O. niloticus* group fed diet containing 1 kg Betafin® / ton and 600 ml Biopolym® / ton was the best treatment among all treatments concerning the muscular bundles and total surface area occupied by the muscular bundles/mm^2 mm^2 (least thickness of connective tissues between muscular bundles and thickness of skin and subcutaneous layer), and net return. Also, they added that the superiority of the histological structure of dorsal muscles in this treatment among all treatments was related with the high growth performance, feed and nutrients utilization and characteristics of fish production.

Moreover, Khalil *et al.* (2009) revealed that mono-sex *O. niloticus* fed diet containing 25% replacement of fish meal by supplemented jojoba meal *Simmondsia chinensis* with methionine and Biogen® at level of 0.6 and 2.0 g/kg diet respectively (T_2), led to significantly ($P \leq 0.05$) improved the histometric characteristics of the dorsal muscles of mono-sex *O. niloticus* compared with the control treatment (T_1). Also, Mehrim (2009) reported that mono-sex *O. niloticus* fed basal diet supplemented with 3g Biogen® Kg^{-1} diet for 14 weeks significantly ($P \leq 0.05$) improved histometric parameters of fish dorsal muscles among other treatments. In addition, Abdelhamid *et al.* (2009) found that African catfish fed diet containing 1 g T-Protphyt 2000 (a new patent local probiotic) / kg diet led to improvement of most histometric characteristics of the fish dorsal muscles compared with the control and other treatments.

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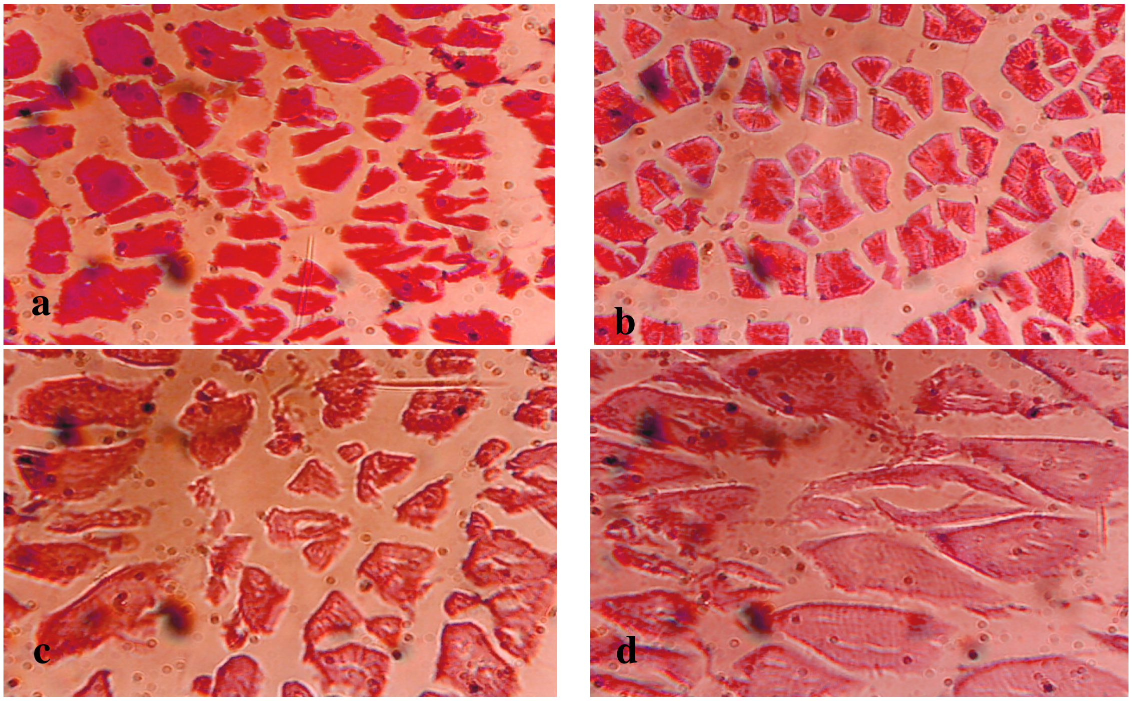

Fig. 1: Showing cross–section of muscular bundles and interstitial connective tissue of the dorsal muscles of mono-sex of Nile tilapia (*O. niloticus*) fed Aqua Superzyme prebiotics, (a): control; (b): 0.01%; (c): 0.02%; (d): 0.03% of the experimental diets (X 400, H & E stains).

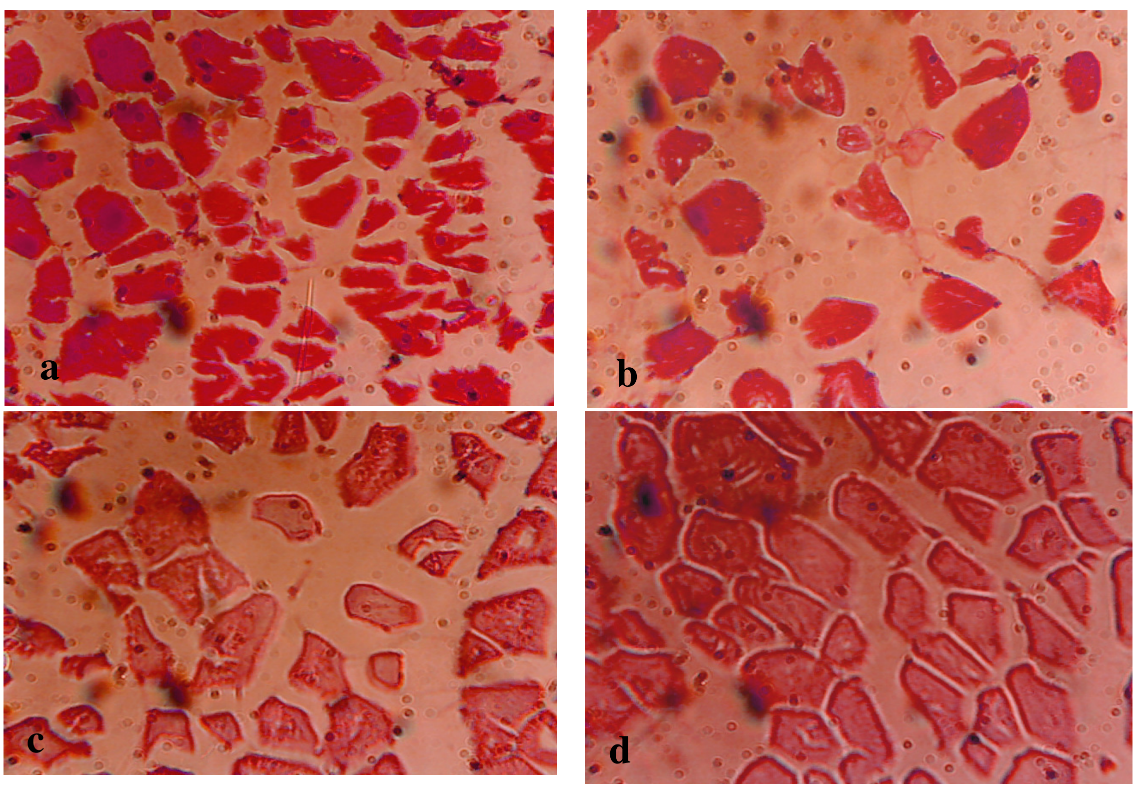

Fig. 2: Showing cross–section of muscular bundles and interstitial connective tissue of the dorsal muscles of mono-sex of Nile tilapia (*O. niloticus*) fed Garlen Allicin probiotic, (a): control; (b): 0.01%; (c): 0.02%; (d): 0.03% of the experimental diets (X 400, H & E stains).

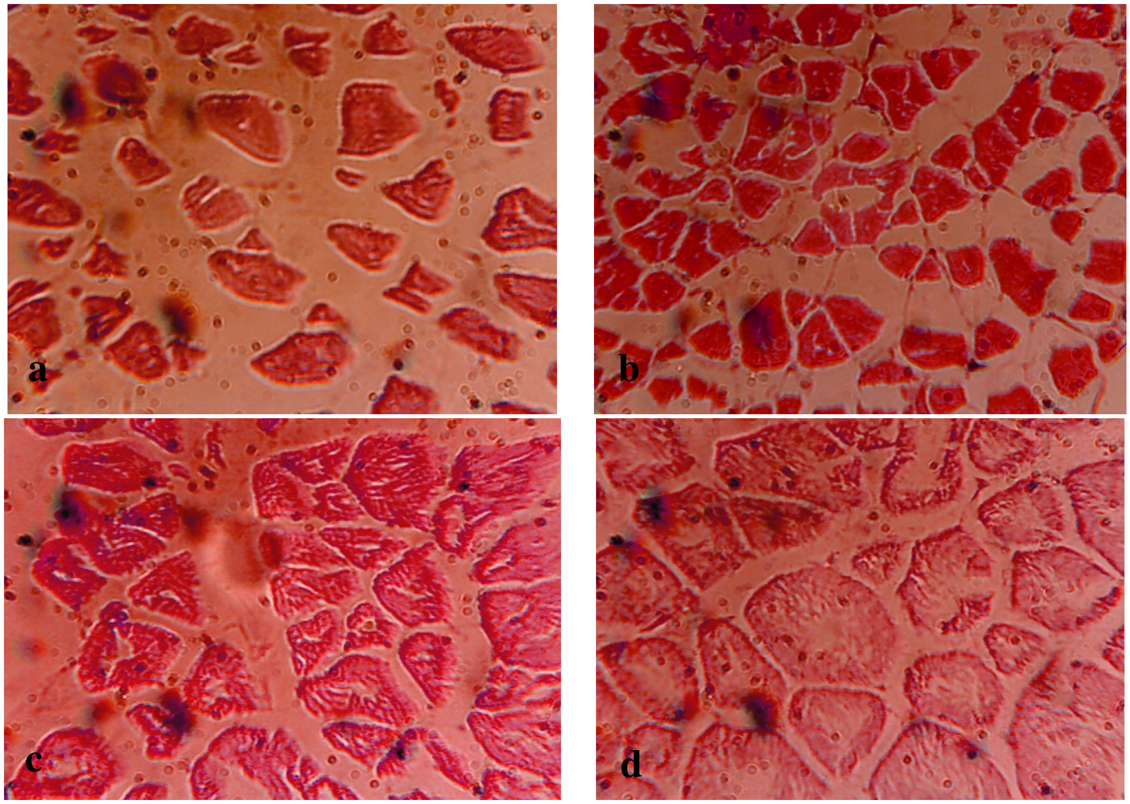

Fig. 3: Showing cross–section of muscular bundles and interstitial connective tissue of the dorsal muscles of mono-sex of Nile tilapia (*O. niloticus*) fed Diamond V (Original XPC) probiotic, (a) control; (b) 0.4%; (c) 0.5%; (d) 0.6% of the experimental diets (X 400, H & E stains).

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ARABIC SUMMARY

تأثير اختلاف مصدر ومستوى بعض الإضافات الحيوية العلفية على : 3- تركيب الجسم والخصائص النسيجية العضلية لأسماك البلطي النيلى

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1. قسم إنتاج الحيوان ، كلية الزراعة ، جامعة المنصورة ، المنصورة ، مصر.
2. المعمل المركزي لبحوث الثروة السمكية ، مركز البحوث الزراعية ، العباسة ، أبو حماد ، مصر.

استهدف هذا البحث دراسة تأثير مستويات غذائية متدرجة من كل من المواد البيولوجية Aqua Superzyme, Garlen Allicin, and Diamond V (Original XPC) على التركيب الكيماوي للجسم والقياسات النسيجية لعضلات جسم أسماك البلطي النيلى وحيد الجنس كله ذكور بعد 16 أسبوع تغذية تجريبية. أظهرت النتائج تحسن التركيب الكيماوي بزيادة العمر، وفى نهاية التجربة لم تختلف معنويا المادة الجافة بين المعاملات، لكن التركيز 0.01% في العليقة من كل من المادتين Garlen Allicin&Aqua Superzyme وتركيز 0.5% من Diamond V (Original XPC) في العليقة كانت مسئولة عن زيادة بروتين الجسم وانخفاض دهنه وطاقته معنويا، وكان تركيز 0.5% من Diamond V (Original XPC) في العليقة هو الأفضل على الإطلاق معنويا من حيث تركيب الجسم. وذات المركب الأخير بمستواه هذا حقق أفضل النتائج لمعظم القياسات النسيجية للعضلة الظهرية للأسماك. وعليه ينصح بإضافة البروبيوتيك Diamond V (Original XPC) لعلائق أسماك البلطي النيلى بتركيز 0.5% من العليقة لتحسين كل من تركيب الجسم والبناء النسيجي لعضلاته.