Arab Univ. J. Agric. Sci. (AUJAS), Ain Shams Univ., Cairo, Egypt
Special Issue, 26(2D), 2325-2334, 2019
Website: http://strategy-plan.asu.edu.eg/AUJASCI/

EFFECT OF SOME MAJOR ELEMENTS ON GROWTH PERFORMANCE AND BLOOD PARAMETERS IN FISH

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Received 10 July, 2018   Accepted 30 July, 2018

ABSTRACT

The present experiment was conducted to determine the optimal source and level of phosphorus supplementation in commercial feeds with the highest growth rate and the lowest releasing in environmental and protect water quality of Nile Juveniles tilapia (*Oreochromis niloticus*). Fish were divided into twelve groups (groups) each group was stocked into two aquaria each contains 10 fish.

Fish were fed diet contained different levels of phosphorus (0.005, 0.007, 0.009 and 0.011%Kg diet phosphorus) from three different sources of phosphorus (mono calcium phosphate, mono potassium phosphate and mono sodium phosphate) for a period of 12 weeks. Results showed that average daily gain, specific growth rate, protein efficiency ratio and feed conversation ratio were significantly improved at (p) 1.1% dietary phosphorus level with mono sodium phosphate as the source of phosphorus, mono calcium phosphate represented the highest significant (P<0.05) value of growth and blood parameters (Packed cell volume (PCV), Hemoglobein(Hb) ,red blood cell(RBC) and white blood cell(WBC) in *Oreochromis niloticus* .

Concerning levels of phosphorus the result clearly indicated that the 0.9% phosphorus level recorded the significant (P<0.05) highest growth and blood parameters in *Oreochromis niloticus*. Body composition analysis showed that the whole body protein and ash content were increased linearly but lipid was decreased (P<0.05) with increasing dietary of phosphorus.

Keywords: Phosphorus requirement, Growth Rate, Blood Parameters, Nile Tilapia (*Oreochromis niloticus*)

INTRODUCTION

Phosphorus is one of the most important minerals for fish, it is essential for normal growth and bone mineralization, and plays an important role in the metabolism of carbohydrate, lipid and amino acids, as well as various metabolic processes involving buffering in body fluids **(Watanabe et al 1988)**. The optimal amount of phosphorus supplementation in commercial feed is not only important economically, but also for environmental reasons to minimize its faecal and urinary discharge into natural waters **(Bureau and Cho 1999)**.

Phosphorus is an essential element for both plant growth and animal performance. In the soil, phosphorus exists in different forms, associated with soil particles; in mineral form mostly as Fe-Al oxides or Calcium carbonates; incorporated in organic matter; and to a much lesser extent in soluble form dissolved in the soil solution. Phosphorus absorption capacity is the process in which soluble phosphorus is substituted for less soluble forms by reacting with inorganic or organic compounds of the soil so that it becomes immobilized. Phosphorus can move into surface waters and cause water quality problems such as eutrophication. In surface waters, phosphorus is often found to be the growth limiting nutrient. If excessive amounts of phosphorus and nitrogen enter the water, algae and aquatic plants can grow in large quantities. Cycles of algal blooms and periods of low dissolved oxygen concentrations can lead to fish kills **(European Commission, DG Environment, 2005).**

Phosphorus is an important constituent of nucleic acids and cell membranes, and is directly involved in all energy- producing cellular reactions. The role of phosphorus in carbohydrate, lipid, and amino acid metabolism, as well as in various metabolic processes involving buffers in body fluids, is also well established.

The aim of this study is estimating the optimum source and level for enhancing the growth performance ,body composition and blood parameters of Tilapia Juvenile (*Orechromis niloticus*).

MATERIALS AND METHODS

The experiment was carried out at Regional Centre for Food and Feed, Minister of Agriculture, Egypt for a period of 3 months using Nile tilapia Juveniles (*Oreochromis niloticus,* 25 g average body weight).The experimental system was a separator system (open system), consisting of 24 fiber glass aquarium of 60 liter each (60 x 40 x 25 cm as length, width, depth). Each aquarium contained 10 Nile tilapia fish Juveniles (*Oreochromis niloticus*) of 25 g average body weight.

Twelve experimental diets belonging to three sources with four levels of phosphorus. Fish were divided into twelve groups each group was stocked into two aquaria(Triplicate) and each contains 10 fish, the diet contained 30% protein and 3848 kcal energy/digestible energy. Fish were fed at 3% of live body weight feeding level for 12 weeks at the end of the experimental period all fish in each aquarium were killed .Chemical analysis of the experimental diets were carried out according to **AOAC (2000)** . Fish were fed 0.005, 0.007, 0.009, 0.011%Kg phosphorusdiets from three different sources (Mono basic potassium phosphate (KH_2Po_4), mono sodium phosphate ($NaH_2Po_4.2H_2O$), mono calcium phosphate (ca $(H_2Po_4)_2$).Formulation and chemical composition of the experimental diets are shown in **Table (1)**.

Table 1. Formulation and chemical composition of the experimental diets (gm\1000gm diet)

Ingredients	Mono basic potassium phosphate (KH2Po4)				mono sodium phosphate NaH2Po4.2H2O				mono calcium phosphate (ca(H2Po4)2)			
Casein	250	250	250	250	250	250	250	250	250	250	250	250
Gelatin	60	60	60	60	60	60	60	60	60	60	60	60
Dextrin	353	343	331.8	316.3	352.5	341.1	329.6	318.12	354.3	344.1	334	323.8
CM cellulose	50	50	50	50	50	50	50	50	50	50	50	50
Sodium algainnate	200	200	200	200	200	200	200	200	200	200	200	200
Vit max	20	20	20	20	20	20	20	20	20	20	20	20
Choline chloride	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Oil	35	35	35	35	35	35	35	35	35	35	35	35
Sodium chloride	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
Fe citrate	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Ca lactate	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2
Trace element	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
Magnesium sulphate	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
The source of (p)	15	25	36.2	52.11	15.5	27.3	38.4	50	13.7	23.9	34	44.6
P(%)	**0.5**	**0.7**	**0.9**	**1.1**	**0.5**	**0.7**	**0.9**	**1.1**	**0.5**	**0.7**	**0.9**	**1.1**
Chemical composition (D.M)												
Dry matter (DM %)	89.90	90.00	89.80	89.91	89.95	90.20	89.99	89.90	89.80	89.88	89.90	90.0
Organic matter (OM %)	80.80	80.6	79.6	79.71	81.45	80.40	79.09	79.40	80.60	80.78	80.30	80.30
Crud protein (CP %)	30.00	30.10	30.00	29.90	29.80	30.00	29.90	29.90	30.00	29.80	29.80	30.00
Ether extract (EE %)	3.49	3.56	3.37	3.36	3.89	3.78	3.56	4.01	4.10	3.76	3.87	3.76
Crud fiber (CF%)	3.10	3.4	4.14	4.03	3.63	3.66	3.51	3.46	2.88	3.44	3.56	3.86
Ash %	9.10	9.40	10.30	10.20	8.50	9.80	10.90	10.50	9.30	9.10	9.60	9.70
[1]Nitrogen free extract (NFE) %1	44.21	43.54	42.09	42.42	44.13	42.96	42.12	42.03	43.62	43.78	43.07	42.68
[2]Digestible energy% Kcal/ 100gm diet%	269.83	269.62	264.31	264.58	272.27	269.94	265.78	269.65	273.94	270.4	269.97	269.2

1 NFE = 100- (Moisture + Crude protein + Ether extract + Ash + crude Fiber). , 2 Digestible energy, based on 5.0 Kcal/g protein, 9.0 Kcal/g lipid, and 2.0 Kcal/g carbohydrate **(Wee and Shu, 1989)**

At the end of the experimental period (3months) 5 fish were randomly taken from each experimental group for blood analysis. Blood samples from each fish of the different groups were collected by suction of the caudal peduncle. Whole blood samples were collected in small plastic vials containing heparin for determination of hemoglobin (Hb), packed cell volume (PCV), white blood cells (WBC) and red blood cell (RBC).The hemoglobin concentration was determined by using commercial kits (Elnasr Pharmaceutical Chemicals Co. Egypt) and the packed cell volume (PCV) was measured according to **Stoskop (1993)**, The total counts of (RBC) and (WBC) were determined manually with a Neubauer Counting Chamber after the blood was diluted with Daice diluting Fluid Solution.

Statistical analysis

Statistical analysis was applied according to **Steel and Torrie (1990)** on the collected data using a **SAS program (1998)**.Differences between means were tested for significance according to Duncan's Multiple Rang Test **(Duncan, 1955).**

RESULTS AND DISCUSSION

1- Growth performance

The results of **Table (2)** showed that mono sodium phosphate at 1.1% level represented the highest significant (P<0.05) value of feed intake (FI), weight gain (WG), average daily weight gain (ADWG), specific growth rate (SGR) and protein efficiency ratio (PER). With regard to sources of phosphorus the result **(Table 2)** exhibited that the highest significant (P<0.05) feed intake (FI), weight gain (WG), average daily gain (ADG), specific growth rate (SGR) and protein efficiency ratio (PER) was observed in mono calcium phosphate. Concerning levels of phosphorus the result clearly indicated that the 0.9% phosphorus level recorded the significant (P<0.05) highest feed intake (FI), weight gain (WG), average daily gain (ADG), specific growth rate (SGR) and protein efficiency ratio (PER). The significant (P<0.05) best value of feed conversion ratio (FCR) was noticed for mono sodium phosphate at 1.1% level (2.34) and the significant (P<0.05) worst feed conversion ratio (3.63) was recorded for mono potassium phosphate at 1.1% level. With regard to the effect of source regardless level of phosphorus results showed that the significant (P<0.05) best (FCR) value was noticed for mono calcium phosphate (2.54) and the worst value was observed for mono potassium phosphate (2.81). Concerning the effect of level regardless source of phosphorus the best significant (P<0.05) feed conversion ratio was observed with 0.9% level (2.39) whereas the significant (P<0.05) worst one (2.97) was noticed with 1.1% level.

The present results show that mono sodium phosphate at the level of 1.1%phosphorus significantly enhanced specific growth rate of *Oreochromis niloticus* fingerling compared with the other sources and levels of phosphorus. **Lall S.P. (1991)** reported that decrease dietary phosphorus under the minimum requirement level caused negative phosphorus balance and result of growth retardation and consequent economic losses, adjusted phosphorus balance will depend on dietary phosphorus supply, on its bioavailability in the different feedstuffs, and on the absorption rate. Effects of dietary phosphorus level on growth performance were reported in many fish species. Improved growth was observed in common carp **(Hepher et al 1989)** juvenile haddock **(Roy K. et al 2003),** juvenile silver perch **(Yang et al 2006)**, and juvenile black sea bream (**Hepher et al 1984)**. **Nwanna, L.C. et al (2008)** reported that the weight gain and specific growth rate (SGR) were increased steadily with increasing dietary phosphorus levels**. Nordrum et al (1997)** reported that the availability of phosphorus from added inorganic phosphorus-salts to fish is higher than from natural sources such as fishmeal and fish bone meal, depending on the solubility of the phosphorus-salt. The difference is probably due to fish species, form of phosphorus particularly relating to solubility, fish size, type of diet and culture system.

Table 2. Growth parameters of *oreochromius nilotica* fed diets with different sources and concentrations of phosphorus.

Item	Mono calcium Phosphate				Mono potassium phosphate				Mono sodium phosphate				Overall mean levels			
P levels	**0.5**	**0.7**	**0.9**	**1.1**	**0.5**	**0.7**	**0.9**	**1.1**	**0.5**	**0.7**	**0.9**	**1.1**	**0.5**	**0.7**	**0.9**	**1.1**
Feed intake (gm)	80.69^{ab} ±2.55	84.18^{ab} ±2.55	82.69^{abc} ±2.55	82.03^{abc} ±2.55	77.51^{bcdc} ±2.55	81.74^{abc} ±2.55	83.46^{ab} ±2.55	63.44^{d} ±2.55	75.61^{bcd} ±2.55	68.61^{cd} ±2.55	74.03^{bcd} ±2.55	89.95^{a} ±2.55	77.94^{B} ±1.47	78.18^{B} ±1.47	80.06^{A} ±1.47	78.47^{B} ±1.47
Overall mean sources	**82.65^{A}±1.27**				**76.53^{B} ±1.27**				**76.79^{B}±1.27**							
WG(g)	226.45^{ab} +6.66	217.87^{bc} +6.66	217.62^{bc} +6.66	181.77^{ed} +6.66	177.43^{e} +6.66	199.31^{ed} +6.66	217.33^{bc} +6.66	113.04^{f} +6.66	123.43^{f} +6.66	131.64^{f} +6.66	215.91^{bc} +6.66	240.^{a} +6.66	175.77^{B} ±3.84	182.94^{B} ±3.84	216.95^{A} ±3.84	178.26^{B} ±3.84
Overall mean sources	**210.93^{A}± 3.33**				**176.78^{B} ±3.33**				**177.75^{B}±3.33**							
ADWG (g/day)	3.02^{b} +0.09	2.90^{b} +0.09	2.89^{b} +0.09	2.42^{d} +0.09	2.37^{c} +0.09	2.73^{b} +0.09	2.93^{b} +0.09	1.50^{e} +0.09	1.64^{e} +0.09	1.83^{d} +0.09	2.92^{b} +0.09	3.30^{a} +0.09	2.35^{B} ±0.05	2.49^{B} ±0.05	2.92^{A} ±0.05	2.41^{B} ±0.05
Overall mean sources	**2.81^{A}±0.04**				**2.38^{B}±0.04**				**2.42^{B}±0.04**							
SGR (%/day)	1.08^{b} ±0.03	1.06^{b} ±0.03	1.06^{b} ±0.03	0.95^{c} ±0.03	0.94^{c} ±0.03	1.01^{b} ±0.03	1.06^{b} ±0.03	0.69^{d} ±0.03	0.73^{d} ±0.03	0.77^{d} ±0.03	1.05^{b} ±0.03	1.12^{a} ±0.03	0.92^{B} ±3.84	0.94^{B} ±3.84	1.06^{A} ±3.84	0.92^{B} ±3.84
Overall mean sources	**1.04^{A}±0.01**				**0.92^{B} ±0.01**				**0.92^{B}±0.01**							
PER (%)	0.13^{b} ±0.03	0.12^{b} ±0.03	0.12^{b} ±0.03	0.11^{b} ±0.03	0.11^{b} ±0.03	0.12^{b} ±0.03	0.12^{b} ±0.03	0.08^{b} ±0.03	0.08^{b} ±0.03	0.09^{b} ±0.03	0.14^{b} ±0.03	0.25^{a} ±0.03	0.11 ±0.02	0.11 ±0.02	0.13 ±0.02	0.14 ±0.02
Overall mean sources	**0.12^{A}±0.01**				**0.11^{B} ±0.01**				**0.14^{A}±0.01**							
FCR	2.35^{e} ±0.07	2.44^{e} ±0.07	2.42^{e} ±0.07	2.94^{d} ±0.07	2.76^{d} ±0.07	2.50^{e} ±0.07	2.36^{e} ±0.07	3.63^{a} ±0.07	3.08^{c} ±0.07	3.33^{b} ±0.07	2.38^{e} ±0.07	2.34^{e} ±0.07	2.73^{B} ±0.04	2.76^{B} ±0.04	2.39^{C} ±0.04	2.97^{A} ±0.04
Overall mean sources	**2.54^{B}± 0.03**				**2.81^{A}±0.03**				**2.78^{A}±0.03**							

Means with the different superscript letters are significant different ($p<0.05$).

2. Chemical composition of *Oreochromis niloticus*

The data of **Table (3)** showed that the significant (P<0.05) highest body protein content (58.43%) was recorded for mono calcium phosphate at 0.9% phosphorus level whereas the lowest one (44.53%) was detected for mono potassium phosphate at 0.5% phosphorus level. The highest significant (P<0.05) body lipid content (1.81%) was recorded for mono sodium phosphate at 0.5% phosphorus level whereas the lowest one (1.37%) was detected for monosodium phosphate at 0.9% phosphorus level .higher body ash content (27.0%) was recorded for mono sodium phosphate at1.1%phosphorus level .whereas lower one (19.9%) was detected for mono calcium phosphate at 0.5% phosphorus level.

Concerning the effect of phosphorus source the results showed that the significant (P<0.05) highest whole body protein content(52.88%**)** was recorded for mono calcium phosphate as sources of phosphorus while the lowest one (46.20%) was detected for mono potassium phosphate. and the significant (P<0.05) highest whole body lipid content (1.61%) was recorded for mono potassium phosphate as a source of phosphorus, and the significant (P<0.05) lowest one (1.57%) was detected for mono calcium phosphate, and the significant (P<0.05) highest whole body ash content (23.25%) was recorded for mono calcium phosphate as a source of phosphorus while the significant (P<0.05) lowest one (21.36%) was detected for mono potassium phosphate. With regard to the effect of phosphorus level the highest significant (P<0.05) body protein content (51.81%) was recorded for 0.9 % phosphorus level whereas the significant (P<0.05) lowest one (45.73%) was detected for 0.5 % phosphorus level and the highest significant (P<0.05) body lipid content (1.74%) was recorded for 1.1% phosphorus level whereas the lowest one (1.43%) was detected for 0.9 % phosphorus level. The results clearly showed that as the level of phosphorus was increased, the body ash content of fish increased.

The highest body ash content (24.93%) was recorded for the 1.1 % phosphorus level whereas the significant (P<0.05) lowest one (20.27%) was detected for 0.5% phosphorus level.

Ogino et al (1979) and Robinson et al (1987). Showed that, the increasing of phosphorus content in the diet significantly altered the chemical composition content of protein and ash in carp, rainbow trout, and Nile tilapia. Bone ash content is considered to be the most sensitive criterion for evaluating dietary phosphorus utilization. **Skonberg et al (1997)**; **Hardy et al** (**1991) and Skonberg et al (1997**) showed that the carcass ash and carcass phosphorus have been generally used as indicators of dietary phosphorus position in fish nutrition researches because the role of phosphorus in the bone structure. **Vielma et al (2002)** showed that excess lipid accumulation due to phosphorus deficiency has been linked to changes in intermediate metabolism rather than in feed intake .Also **Roy and Lall (2003)** reported that insufficient phosphate might have inhibited esterification of the free fatty acid with extra-mitochondrial CoA to yield fatty acyl-CoA resulting in a lower utilization of lipid as an energy source. In addition the fat increasing of fish suffer from low (0.5%) diet phosphorus(table3) may be attributed to the inhibition of B-oxidation of fatty acids resulting in a decrease utilization of lipids as energy source and used the protein as the source of energy. The present results of fish lipid carcass content are in good agreement with those of **Oliva-Teles and pimentet-rodrigues (2004)**, **Zhang, et al (2006**) who reported that the lipid content was decreased linearly with increasing dietary phosphorus.

3. Effect of treatments on some blood parameters

It is of interest to notice **(Table 4)** that mono sodium phosphate at 1.1% level recorded significant (P<0.05) highest value of packed cell volume PCV (32.05%), hemoglobin Hb (8.93mg/dl), red blood cell RBC (2.42 10^6/µL)and white blood cell WBC (68544 µL).

The same treatment (mono sodium phosphate) showed at 0.5% level significant lowest values of PCV (28.500%), Hb (7.3mg/dl), RBC (2.02 10^6/µL) and WBC (36586µL).

With regard to the effect of phosphorus source the results mono calcium phosphate recorded the significant (P<0.05) highest value of PCV (30.82%), Hb (8.44mg/dl), WBC (61980/µL) and nonsignificant (P>0.05) highest value RBC (2.25 10^6/µL). However, mono potassium phosphate showed the corresponding lowest values (29.56%, 8.25 mg/dl, 47403.25 /µL and 2.21$10^6$/µL).

The present results of blood parameters are in good agreement with those of **Chen et al (2003)** who shown that deficient phosphorus in diets cause reduction in haemoglobin content and red blood cell.

Table 3. Proximate composition of *oreochromius niloticus* (whole body) fed diets with different sources and concentrations of phosphorus

Item	Mono calcium Phosphate				Mono potassium phosphate				Mono sodium phosphate				Overall mean levels			
	0.5	0.7	0.9	1.1	0.5	0.7	0.9	1.1	0.5	0.7	0.9	1.1	0.5	0.7	0.9	1.1
Total protein	46.37^{d} ±0.23	58.06^{c} ±0.23	58.43^{c} ±0.23	48.66^{b} ±0.23	44.53^{e} ±0.23	46.70^{e} ±0.23	48.73^{d} ±0.23	44.7^{b} ±0.23	46.30^{d} ±0.23	46.77^{d} ±0.23	48.27^{c} ±0.23	49.60^{a} ±0.23	45.73^{D} ±0.01	50.55^{B} ±0.01	51.81^{A} ±0.01	47.65^{C} ±0.01
Overall mean source	**52.88^{A} ±0.12**				**46.20^{C} ±0.12**				**47.73^{B} ±0.12**							
Total lipid	1.38^{f} ±0.009	1.66^{c} ±0.009	1.47^{e} ±0.009	1.80^{a} ±0.009	1.67^{c} ± 0.009	1.53^{d} ±0.009	1.45^{e} ±0.009	1.78^{b} ± 0.009	1.81^{a} ±0.009	1.54^{d} ±0.009	1.37^{f} ±0.009	1.65^{c} ±0.009	1.62^{B} ±0.01	1.57^{C} ±0.01	1.43^{D} ±0.01	1.47^{A} ±0.01
Overall mean source	**1.57^{C} ±0.005**				**1.61^{A} ± 0.005**				**1.59^{B} ± 0.005**							
Total Ash	19.90^{g} ±0.42	23.40^{c} ±0.42	23.80^{c} ±0.42	25.90^{b} ±0.42	20.20^{fg} ±0.42	21.63^{e} ±0.42	21.70^{de} ±0.42	21.90^{d} ±0.42	21.30^{e} ±0.42	21.50^{de} ±0.42	23^{c} ±0.42	27.00^{ab} ±0.42	20.27^{C} ±0.24	22.17^{C} ±0.24	22.83^{B} ±0.24	24.93^{A} ±0.24
Overall mean source	**23.25^{A} ±0.21**				**21.36^{B} ±0.**				**23.2^{A} ±0.21**							

Means with the different superscript letters are significant different (P<0.05).

Table 4. Effect of difference source and concentrations on some blood parameters of *oreochromius niloticus*

Item	Mono calcium Phosphate				Mono potassium phosphate				Mono sodium phosphate				Overall mean levels			
	0.5	**0.7**	**0.9**	**1.1**	**0.5**	**0.7**	**0.9**	**1.1**	**0.5**	**0.7**	**0.9**	**1.1**	**0.5**	**0.7**	**0.9**	**1.1**
PCV%	32.00^{a} ±0.7	30.25^{b} ±0.7	32.01^{a} ±0.7	29.00^{c} ±0.7	29,5^{c} ±0.7	29.00^{c} ±0.7	31.00^{b} ±0.7	28.75^{d} ±0.7	28.50^{d} ±0.7	30.75^{b} ±0.7	29.50^{c} ±0.7	32. 05^{c} ±0.7	30.00^{B} ±0.40	30.00^{B} ±0.40	30.84^{A} ±0.40	29,93^{B} ±0.40
Overall mean source	**30.82^{A}±0.35**				**29.56^{B}±0.35**				**30.2^{B}±0.35**							
Hb(mg/dl)	7.63^{d} ± 0.08	8.66^{b} ± 0.08	8.86^{a} ± 0.08	8.60^{b} ±0.08	7.78^{d} ±0.08	8.15^{c} ±0.08	8.60^{b} ±0.08	8.48^{b} ±0.08	7.30^{d} ±0.08	8.25^{c} ±0.08	8.63^{b} ±0.08	8.93^{a} ±0.08	7.57^{C} ±0.04	8.35^{B} ±0.04	8.69^{A} ±0.04	8.67^{A} ±0.04
Overall mean source	**8.44^{A}±0.04**				**8.25^{B}± 0.04**				**8.28^{B}± 0.04**							
RBC(106/µL)	2.09^{d} ±0.05	2.36^{a} ±0.05	2.38^{a} ±0.05	2.18^{c} ±0.05	2.24^{c} ±0.05	2.29^{b} ±0.05	2.28^{b} ±0.05	2.04^{d} ±0.05	2.02^{d} ±0.05	2.25^{b} ±0.05	2.29^{b} ±0.05	2.42^{a} ±0.05	2.11^{C} ±0.02	2.30^{A} ±0.02	2.32^{A} ±0.02	2.21^{A} ±0.02
Overall mean source	**2.25 ±0.02**				**2.21 ±0.02**				**2.24±0.02**							
WBC(µL)	55657^{bc} ±4459.39	65552^{ab} ±4459.39	66846^{ab} ±4459.39	59865^{bc} ±4459.39	44605^{cd} ±4459.39	45570^{dc} ±4459.39	53968^{bc} ±4459.39	45470^{ef} ±4459.39	36586^{def} ±4459.39	39073^{f} ±4459.39	45668^{cde} ±4459.39	68544^{a} ±4459.39	45616^{D} ±2574.63	50065^{C} ±2574.63	55494^{A} ±2574.63	54626.33^{B} ±2574.63
Overall mean source	**61980^{A}±2229.69**				**47403.25^{C}±2229.69**				**47467.75^{B}±2229.69**							

Means with the different superscript letters are significant different ($P<0.05$).

Hemoglobin (Hb), packed cell volume (PCV), white blood cell (WBC) and red blood cell (RBC).

Hematological and serological parameters are useful in monitoring the physiological status of fish and as indicators of the health of the aquatic environment, although they are not routinely used in fish disease diagnosis **El-Sayed (1999)**.**Terry et al (2000)** reported that although tilapia is the second most frequently cultured fish in the world, there are a few reported of normal blood values. **Adamu and Audu (2008)** reported that decrease in (PCV) is attributed to gill damage or impaired osmoregulation causing anaemia and haemodilution.

Phosphorus and other minerals (Na,Ca,K) in blood were perferring to estimate with blood parameters

CONCLUSION

In conclusion, the present study showed the mono calcium phosphate represented the highest significant ($P<0.05$) value of growth and blood parameters in Tilapia fish *(Oreochromis niloticus*). Concerning levels of phosphorus the result clearly indicated that the 0.9% phosphorus level recorded the significant ($P<0.05$) highest growth and blood parameters in *Oreochromis niloticus*.

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مجلد(26)، عدد(2D)، عدد خاص ، 2325-2334، 2019
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تاثير بعض العناصر الكبرى على اداء النمو ومقاييس الدم فى الاسماك

[169]

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Received 10 July, 2018 Accepted 30 July, 2018

الموجـــــــز

اجريت هذه الدراسه لتقديرمصدر عنصر الفوسفور والمستوى الامثل فى الاغذيه مع تقدير اعلى معدلات نمو واقل تحرر لعنصر الفوسفور فى البيئه مع حمايه جوده المياه لاسماك البلطى النيلى .فتم تقسيم الاسماك الى اثنى عشر مجموعه (معاملات) وكل مجموعه وضعت فى حوضين وكل حوض به عشر سمكات لمده 3 اشهر حيث تم تغذية الاسماك على تركيزات مختلفه من عنصر الفوسفور (0.005%، 0.007 %، 0.009%، 0.011% كجم /عليقه) من ثلاث مصادر مختلفه (كالسيوم احادى الفوسفات، البوتاسيوم احادى الفوسفات والصوديوم احادى فوسفات). اظهرت النتائج ان كلا من العائد اليومى ومعدل النمو النوعى ومعامل الاستفاده من البروتين ومعاملات التحويل الغذائى قد تحسنت معنوياً بإستخدام الكالسيوم احادى الفوسفات كمصدر من مصادر الفوسفور وان المستوى الامثل فى التغذيه هو نسبه 0.9% فوسفور وان الصوديوم احادى فوسفات 1.1% هو افضل فى التغذيه عند هذا المستوى. وان التحليل الكيميائى للجسم اوضح ان محتوى الجسم من البروتين والرماد يتزايد بتزايد التغذيه على عنصر الفوسفور ولكن دهون الجسم قد انخفضت بزياده التغذيه اليوميه للفوسفور.

الكلمات الداله: احتياجات الفوسفور، معدل النمو، مقاييس الدم، البلطى النيلى

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