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LIST OF ABBREVIATIONS

Cr-Nic	Chromium nicotinate
Cu	Copper
dl	Decilitre
h	hour
IU	International unit
kj	Kilojole
No2	Nitrite
No3	Nitrate
O2	Oxygen
ppb	Part per billion
ppm	Part per million
Zn	Zinc
WG	Body weight gain
Ca	Calcium
CMC	Carboxy methyl cellulose
Cr	Chromium
Cr_2O_3	Chromium oxide
Cr-Pic	Chromium picolinate
CF	Crude fibre
CP	Crude protein
DE	Digestible energy
DM	Dry matter
ER	Energy retention
EOF	Erythrocyte osmotic fragility
EE	Ether extract
FCR	Feed conversion ratio
g	Gram(s)
HSI	Hepatosomatic index
IgM	Immunoglobulin M
Kcal	Kilocalorie(s)
Kg	Kilogram(s)

µg	Microgram
mg	Milligram
NFE	Nitrogen free extract
P	Phosphorous
PER	Protein efficiency ratio
PR	Protein retention
SGR	Specific growth rate

SUMMARY

This study was carried out in two experiments. The objectives of this study are ***first***, to study the effects of two different sources and three concentration levels of chromium on growth performance, body composition, some serum parameters and immune status of Nile tilapia. ***Second***, to determine the dietary vitamin E requirement of Nile tilapia based on growth performance, body composition, some serum parameters, erythrocyte osmotic fragility and the immune status.

The first experiment (chromium)

A total of 210 *Oreochromis niloticus* fingerlings were randomly divided into 7 groups, each group consisted of two aquaria (two replicates) and each aquarium contained 15 fish with an initial average weight of 1.54 ± 0.01 g. Aquaria were filled up to two thirds with de-chlorinated tap water and provided with continuous aeration via an air stone connected to an air compressor. A basal semipurified diet (DE, 3041 kcal/kg and CP, 32 %) containing corn starch as the only carbohydrate source and supplemented with an organic source of chromium, Cr-Pic at 800, 1000 or 1200 µg/kg diet or an inorganic source of chromium, Cr_2O_3 at 50, 100 or 150 mg/kg. Fish were fed a basal diet without supplemental chromium in the control group. The fish were fed the experimental diets at a rate of 3% of live body weight, for 16 weeks.

Fish were weighed every two weeks interval and growth performance and protein utilization indices were calculated. Blood samples were collected to determine glucose, cholesterol, triglyceride, total protein, albumin, globulin and immunoglobulin

M concentrations in serum. Samples of whole fish were analyzed for moisture, crude protein, ether extract and ash percentage.

Results can be summarized as follows:

Chromium picolinate supplementation did not significantly ($P > 0.05$) affect final body weight, total weight gain, FCR, PER, total feed intake or SGR of Nile tilapia fingerlings. Protein retention (PR) was significantly ($P<0.05$) higher in groups receiving 1000 and 1200 µg Cr-Pic/kg than group receiving 800 µg Cr-Pic/kg while, there weren't any significant differences between all Cr-Pic supplemented groups as compared to control. Energy retention (ER) was significantly lower in group receiving 1200 µg Cr-Pic/kg than the control group while, there were non-significant differences between groups receiving 800 or 1000 µg Cr-Pic /kg as compared to control. Moreover there were non-significant differences between all Cr-Pic-supplemented groups.

All fish appeared healthy. Condition factor (1.77, 1.66, 1.49 and 1.93), hepatosomatic index (2.19, 1.6, 1.98 and 1.94) and Survival percentage (ranged from 86.66 to 93.33) were not significantly ($P > 0.05$) affected by chromium supplementation.

Chromium oxide supplementation did not significantly ($P > 0.05$) affect any of the growth performance parameters measured (final body weight, total weight gain, SGR, total feed intake, feed conversion ratio, protein efficiency ratio, protein retention and energy retention) of Nile tilapia fingerlings.

Condition factor (1.77, 1.82, 1.97 and 1.78), hepatosomatic index (2.19, 1.3, 1.87 and 1.9) and survival percentage (ranged from 83.33 to 93.33%) were not significantly ($P>0.05$) affected due to chromium oxide supplementation.

Chromium supplementation did not significantly (P>0.05) affect moisture percentage of fish bodies regardless of the source or level. Ether extract percentage of fish has significantly (P<0.05) decreased as Cr-Pic supplementation level increased while, EE percentage has significantly (P<0.05) increased as Cr_2O_3 supplementation level increased but it remained lower than the control. A higher percentage of body crude protein was observed in fish receiving the diet supplemented with Cr-Pic at 1200 µg /kg as compared to 0, 800 or 1000 µg/kg while, CP percentage was significantly higher in chromium oxide supplemented groups as compared to the control. Ash percentage increased significantly in fish fed the diet supplemented with chromium oxide at 100 mg/kg as compared to those fed diets supplemented with 0, 50 or 150 mg/kg

Regardless of the source or dose of dietary chromium supplementation, no significant (P>0.05) differences were detected among treatments in whole-body chromium content of fish.

Serum glucose concentration increased significantly (P < 0.05) in fish groups receiving 1000 or 1200 µg/kg of Cr-Pic than group receiving 800 µg / kg and the control while, serum concentrations of cholesterol, triglyceride, albumin and globulin decreased in direct proportion to dietary chromium picolinate supplementation. Serum total protein concentration was not significantly (P>0.05) affected by chromium picolinate supplementation.

Serum concentration of glucose was significantly (P < 0.05) affected by chromium oxide supplementation where, fish received diet supplemented with 100 mg/kg diet has recorded a significant higher value (28.25 mg/dl) as compared to those fed the control diet

(25.75 mg/dl) or diet supplemented with chromium oxide at 150 mg/kg (25.4 mg/dl). Serum cholesterol concentration was not significantly ($P>0.05$) affected due to Cr_2O_3 supplementation. Moreover serum triglyceride was significantly ($P < 0.05$) decreased due to chromium oxide supplementation at 100 mg/kg (167.73 mg/dl) as compared to 0 or 50 mg/kg (231.6 and 235.23 mg/dl; respectively). Total protein concentration in the non-supplemented group was significantly higher than in the supplemented groups while, chromium oxide supplementation at 100 and 150 mg/kg has significantly decreased serum concentration of globulin as compared to 0 or 50 mg/kg (1.73, 1.75, 3.24 and 2.22 mg/dl; respectively).

Serum concentration of glucose was significantly ($P < 0.05$) affected where group receiving 100 mg/kg recorded the highest value while, the same group recorded the lowest value of serum triglyceride. Serum cholesterol was not significantly affected. Total protein concentration in the non-supplemented group was significantly higher than in the supplemented groups.

Immunoglobulin M level in the serum of fish was not significantly affected by chromium source or level.

It could be concluded that dietary supplementation of Nile tilapia (*Oreochromis niloticus*) diets with CrPic at 800, 1000 and 1200 µg/kg diet has significantly affected EE content of fish whole body, serum concentrations of glucose, cholesterol, triglyceride, total protein, albumin and globulin while, growth performance or immune status of Nile tilapia (*Oreochromis niloticus*) were not significantly affected. Dietary supplementation of Nile tilapia (*Oreochromis niloticus*) diets with chromium oxide at 50, 100 and 150 mg/kg diet has significantly affected EE content of fish whole body, serum

concentrations of glucose, cholesterol, triglyceride, total protein, albumin and globulin while, growth performance or immune status of Nile tilapia (*Oreochromis niloticus*) were not significantly affected

Experiment II (Vitamin E)

A total of 120 *Oreochromis niloticus* fingerlings were randomly divided into 4 groups: each group consisted of two aquaria (two replicates) and each aquarium contained 15 fish with an initial average weight of 1.54 ± 0.01 g. The same experimental procedures applied for experiment I was also applied for experiment II. The same basal diet of experiment I was used in experiment II except that vitamin E was omitted from the vitamin mixture. Fish were fed either the basal diet or the basal diet supplemented with dl-α-tocopheryl acetate at 100, 150 and 200 mg / kg. The fish were fed the experimental diets at rate of 3% of live body weight, for 16 weeks.

Results can be summarized as follows:

No gross vitamin E deficiency signs such as exudative diathesis, dermal depigmentation or muscular dystrophy in the fish given different diets were apparent. Survival ranged from 86.66 to 93.33% and mortality was not related to dietary treatment.

Vitamin E supplementation did not significantly ($P > 0.05$) affect final body weight, total weight gain, total feed intake, FCR and PER of Nile tilapia fingerlings. Specific growth rate was significantly ($P < 0.05$) lower in groups receiving 100 and 150 mg/kg as compared to control. Vitamin E supplementation at 100 mg/kg had significantly ($P<0.05$) decreased protein retention (1.59) as compared to the control while, energy retention was significantly ($P<0.05$) increased at 200 mg/kg diet (67.12) as compared to the control (62.46).

Condition factor (1.81, 1.69, 1.95 and 1.85), hepatosomatic index (1.74, 1.96, 1.6 and 1.97) were not significantly ($P > 0.05$) affected by vitamin E supplementation.

Ether extract content of fish has significantly ($P < 0.05$) increased in all vitamin E supplemented groups as compared to the non-supplemented groups but was not affected by the level of vitamin E in the diet. Crude protein percentage showed significant differences among treatments but without any trend. Moisture percentage was not significantly ($P > 0.05$) affected due to vitamin E supplementation. Fish fed diets supplemented with vitamin E has significantly lower values of ash percentage (12.44, 12.12 and 10.28 %; respectively) as compared to those fed the control diet (14.45 %).

Serum glucose, triglyceride, total protein, albumin and globulin concentrations were not significantly affected. Serum cholesterol in the non-supplemented group was significantly ($P < 0.05$) higher than in the supplemented groups.

Erythrocyte osmotic fragility was significantly ($P < 0.05$) increased in direct proportion to vitamin E supplementation level.

Immunoglobulin M level in the serum of fish was not significantly ($P > 0.05$) affected by vitamin E supplementation level in the diet.

CONCLUSION

On the basis of the results from this study, it would appear that under conditions of this study, inclusion of chromium in diets of Nile tilapia did not improve growth performance, feed utilization or immune status. Since starch is almost always the major source of carbohydrate in practical feeds, there are no evident benefits to supplementing Cr in practical diets. Moreover, Dietary chromium supplementation could enhance lipogenesis and influence serum biochemistry, thus most probably functions of the organs, under the present experimental conditions.

Dietary supplementation of Nile tilapia (*Oreochromis niloticus*) diets with vitamin E at 100, 150 and 200 mg/kg diet has significantly affected EE content of fish whole body and erythrocyte osmotic fragility while, growth performance, serum concentrations of glucose, cholesterol, triglyceride, total protein, albumin, globulin or immune status of Nile tilapia (*Oreochromis niloticus*) were not significantly affected.