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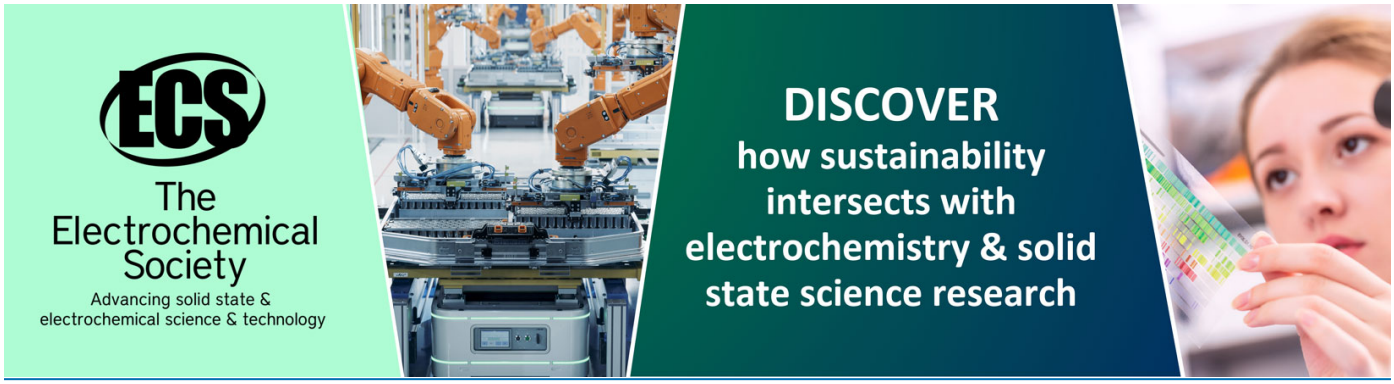

Proximate carcas composition with different $CaHPO_4$ and body conformation of Red Tilapia

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Abstract. Carcass composition of traits such as protein, ash, moisture, amino acids and minerals in red tilapia was investigated. All diets were formulated at 29% of crude protein 0.5% of calcium-phosphate and energy: protein ration 150:5 for diet C1, 30% of crude protein, 1.0% of calcium-phosphate and energy: protein ration 151:7 for diet C2, and 31% of crude protein, 1.5% of calcium-phosphate and energy: protein ration 151:5 for diet C3. The body weight of tilapia species is 169.38g (±4.32). 60 of fish and three replicates were used for this study to the analysis of carcass composition. The other carcass parts of body fish as muscle, bone, scale, and gill was found to be significant ($p<0.01$). The mean of carcass composition of three levels of calcium-phosphate as muscle, bone, scale, and gill were found to be higher in level diet C2 compared to diet C1 and C3 was found no significant differences.

1. Introduction

Studies of carcass composition of fish are quite important in relation to the choice of fish, especially red tilapia in the future as consumers are becoming more conscious of cost and quality. Since not many kinds of literature are available on this subject in red tilapia. Present attempt is also considered as a meagre effort [1].

The relative proportion of moisture, protein, fat, and ash generally governs carcass quality and as for this reason it is a routine practice to test the carcass composition [2] and 30% crude protein and 0.5% and 1.0% of calcium-phosphate in diet, the composition of carcass minerals was found to be different and was higher in level of 1.0% calcium-phosphate diet [3]. There are numerous studies to show that dietary protein, carbohydrate, fibres, and lipid levels do influence the final carcass composition. Therefore, the quality of the feed may influence the final carcass composition and hence flesh quality of the final product.

Factors affecting the proximate composition of cultured fish were reviewed [4]. Some studies on tilapia have shown significant changes in whole body composition due to age, diet feeding frequency, ration, season, sex, starvation and temperature [2]. During starvation, there is an increase in water content [5]. This increase in water content on reading a critical point cause relative muscle ash to decline. Such correlation between different chemical constituents has been previously reported. In

tilapia, fat increase at the expense of moisture has been widely reported to increase [2][3][6-8]. Protein on the other hand been reported to increase together with moisture [8][9], and protein decrease when fat increase. The objective of this study was to evaluate the level of calcium-phosphate in the fish feed and evaluated proximate of carcass composition in the body of fish and carcass minerals of part of the body of fish.

2. Materials and methods

These ingredients are easily available from local sources, for examples, Soya bean meal, and fish oil, except casein, dextrin, vitamin, mineral, and calcium phosphate. Similar composition with prepared ingredients is shown in the section digestibility, where the proximate feed composition of the experimental diet (Table 1), proximate ingredient diet was found in terms of 29% crude protein, 14% ash, 2% fat, 10% moisture, 0.5% $CaHPO_4$ and 150:5% ME kcal/% protein (calorie: protein) with diet level 1 (C1), 30% crude protein, 11% ash, 3% fat, 9% moisture, 1.0% $CaHPO_4$ and 151:7% ME kcal/% protein with diet level 2 (C2) and 31% crude protein, 13% ash, 6% fat, 9% moisture, 1.5% $CaHPO_4$ and 151:5% ME kcal/% protein with diet level 3 (C3).

Samples were taken randomly after 24 weeks or after the weight of fish is $\pm$ 65.70g, 60 fish in each of 3 replicates were used for analysis of carcass composition as such protein, fat, ash, moisture, amino and acids, and the other parts of carcass composition of minerals were used of 60 of fishes were used for analysis by method [10], of bone, muscle, gill and scale as magnesium (Mg), natrium (Na), calcium (Ca), phosphorus (P) and potassium (Pot).

Table 1: Proximate and ingredient composition of the experimental fish diet

Test ingredients	**Diet1 (C 1) (Kg)**	**Diet2 (C2) (Kg)**	**Diet3 (C3) (Kg)**
$CaHPO_4$	0.5	1.0	1.5
Dextrin	13.11	13.61	13.61
Casein	30.59	30.59	30.59
Fish oil	1.64	1.64	1.64
Vitamin mix*	1.14	1.14	1.14
Minerals mix*	0.82	0.82	0.82
Soybean meal	22.20	21.20	20.70
Fish meal	30.00	30.00	30.0
Total diet (Kg)	**100**	**100**	**100**

*The content of $CaHPO_4$ with 20% P and 25% Ca, Windemill Dicalphos, The Windemill Feed phosphate, Tessenderjo chemic, Rotterdam, the Netherlands

2.1 Statistics analysis

Mean and coefficients of carcass minerals of the body of fish were also calculated. Statistical analysis involved the use of SPSS (Statistical Package for the Social science) [11]. The statistics of these data were calculated by level calcium-phosphate diet, replicate and control. For minerals in test and basal diets were expressed as a fractional net absorption of nutrient from diets. The statistical model was $Y_{ijk} = \mu + R_i + L_j + \epsilon_{ijk}$, μ = common mean, $R_i = i^{th}$ replication effect, $L_j = j^{th}$ calcium level effect, R_iP_j = effect between replication and protein level and ϵ_{ijk} = Error ($N–0.6^2$). Differences between treatments were considered statistically significant at the $P<0.05$ levels.

3. Results and discussion

3.1 Result

For carcass weight, diet x sex effect was not studied in this experiment, for the fish effect and treatment (including control) (T), replicate (R), and treatment (T) x replicate (R) effect was significant ($p<0.01$). The carcass of ash, moisture, fat and protein content was found to be significant compared in the replicate diet was found not significant.

Table 2: Mean and standard error of weight, moisture, ash, protein and fat in *Tilapia sp.*

Level diet	Carcass weight	Moisture	Protein	Ash	Fat
C1	66.33[a]	69.67[a]	13.39[b]	2.05[a]	1.33[a]
	± 4.12	± 2.06	± 0.28	± 0.16	± 0.29
	79.94[b]	70.50[b]	16.58[c]	4.97[b]	2.50[b]
C2	± 4.58	± 2.09	± 0.40	± 0.27	± 0.24
	69.33[a]	70.45[b]	13.87[b]	2.23[a]	1.37[a]
C3	± 4.26	± 2.20	± 0.42	± 0.30	± 0.21

[a,b and c] Mean with the same superscript in the same column within levels diets

Mean carcass weight and carcass part of body weight was presented in Table 2 to 5 of muscle, bone, scale, and gill. These results were calculated separately from the body of fish as muscle, bone, gill and scale when fish fed of the level of calcium- phosphate diet. Carcass weight, moisture, protein, ash and fat was higher in diet C2 compared to diet C1 and C3.

Table 3: Mean and standard error of ash, Mg (magnesium), Na (natrium), Ca (calcium), P (phosphate) and Pot (potassium) in Muscle

Level diet	Ash	Mg	Na	Ca	P	Pot
C1	7.85[b]	0.20[b]	0.24[b]	2.65[b]	1.46[a]	0.35[b]
	± 0.19	± 0.01	± 0.01	± 0.14	± 0.13	± 0.01
	10.15[c]	0.35[c]	0.40[c]	4.21[c]	2.19[b]	0.56[c]
C2	± 0.19	±0.01	±0.01	± 0.18	± 0.01	±0.01
	7.79[b]	0.18[a]	0.22[a]	1.85[a]	1.08[a]	0.24[a]
C3	± 0.18	± 0.01	± 0.01	± 0.13	± 0.03	± 0.01

[a,b and c] Mean with the same superscript in the same column within levels diets

Table 3 was presented of carcass in muscle was higher in diet C2 compared to diet C1 and C3. However, carcass mineral of ash in Bone was found between 10.15% in diet C2 to 7.85% in C1. The calcium was found of 4.21% in diet C2 and lower 1.85% in diet C1, phosphorus was found to be higher 2.19% in diet C2, lower of 1.08% in diet C. Magnesium, manganese, zinc, Ion, and Cupper was higher in diet C2 than another diet (Table 3).

Table 4: Mean and standard error of ash, Mg (magnesium), Na (natrium), Ca (calcium), P (phosphate) and pot (potassium) in Scale

Level diet	Ash	Mg	Na	Ca	P	Pot
C1	8.20[b]	0.12[b]	0.01[a]	11.71[b]	0.45[a]	0.28[b]
	± 0.19	± 0.01	± 0.01	± 0.14	± 0.03	± 0.01
	9.43[c]	0.15[c]	0.01[a]	13.09[c]	0.63[b]	0.37[c]
C2	± 0.19	±0.01	±0.01	± 0.18	± 0.01	±0.01
	7.75[b]	0.13[b]	0.01[a]	10.28[a]	0.39[a]	0.25[b]
C3	± 0.18	± 0.01	± 0.01	± 0.13	± 0.13	± 0.01

[a,b and c] Mean with the same superscript in the same column within levels diets

Table 4 was presented of carcass minerals in scale almost was higher in diet C2 compared to diet C1 and C3. However, carcass mineral of ash, Mg, Ca, P and potassium in scale was found of 9.43%, 0.15%, 13.09%, 0.63% and 0.37% (Table 4).

Table 5: Mean and standard error of ash, Mg (magnesium), Na (natrium), Ca (calcium), P (phosphate) and Pot (potassium) in Bone

Level diet	Ash	Mg	Na	Ca	P	Pot
C1	8.20^{b} ± 0.16	0.24^{b} ± 0.01	0.01^{a} ± 0.01	10.54^{b} ± 0.14	0.21^{a} ± 0.03	0.11^{a} ± 0.01
C2	10.12^{c} ± 0.38	0.26^{c} ±0.01	0.03^{b} ±0.01	12.84^{c} ± 0.18	0.42^{b} ± 0.01	0.16^{b} ±0.01
C3	7.75^{b} ± 0.15	0.24^{b} ± 0.01	0.01^{a} ± 0.01	9.37^{a} ± 0.13	0.15^{a} ± 0.13	0.12^{a} ± 0.01

[a,b and c] Mean with the same superscript in the same column within levels diets

Table 5 was presented of the carcass in bone was higher in diet C2 compared to diet C1 and C3. However, carcass mineral of Ash, Mg, Na, Ca, P and Pot (potassium) in bone was found to be higher of 10.12%, 0.26%, 0.03% in diet C2 compared to diet C3 was lower in Ash, Mg, Na, Ca, P, and Pot as well as of 7.75% for ash, 9.37% of calcium, 0.15% of phosphorus in diet C3.

Table 6: Mean and standard error of ash, Mg (magnesium), Na (natrium), Ca (calcium), P (phosphate) and Pot (potassium) in Gill

Level diet	Ash	Mg	Na	Ca	P	Pot
C1	8.19^{b} ± 0.19	0.21^{b} ± 0.01	0.01^{a} ± 0.01	6.37^{b} ± 0.14	2.41^{a} ± 0.03	0.11^{b} ± 0.01
C2	8.20^{b} ± 0.19	0.24^{c} ±0.01	0.01^{a} ±0.01	9.82^{c} ± 0.18	4.12^{b} ± 0.01	0.14^{c} ±0.01
C3	7.75^{a} ± 0.18	0.22^{b} ± 0.01	0.01^{a} ± 0.01	5.93^{a} ± 0.13	2.17^{a} ± 0.13	0.11^{b} ± 0.01

[a,b and c] Mean with the same superscript in the same column within levels diets

Table 6 was presented in carcass minerals in the gill of fish, muscle, bone, scale, and gill. Carcass mineral was higher in diet C2 compared to diet C1 and C3. However, carcass mineral of ash in gill was found to be 10.12%% in diet C2 and diet C was lower of 7.99%, calcium was found to be 5.93-9.82% in diet C3 and C2 (Table 6).

3.2 Discussion

Study on carcass scale and bone show that calcium is an important mineral of other physiological processes, but phosphorus is the major mineral required by fish in the bone and scales [12]. These studies found highest calcium and phosphorus content in bone and scale in diet C2 compared to other diets with values of 13.09% for calcium and 0.63% of phosphorus for scales, 12.84% calcium and 0.42% phosphorus in bone. Generally, phosphorus and calcium were more efficiently conserved in the whole body and both calcium and phosphorus have to be given in the fish diet. Although information for all elements of minerals was very limited, yet this study suggested for better future experiment when the elements of minerals are also to be taken into consideration when interpreting the direct effect of a diet on the whole of body concentration of a single element since a subnormal level of one element may be the result of inadequate retention of another element. Study on calcium phosphate in red tilapia is important to the process of physiological as well as carcass scale, bone, gill, and muscle.

4. Conclusion

Level of 1 and 1,5% Calcium and phosphate in diet C3 will be better used for the formulation of feed were give to Red Tilapia but not more than that.

References

[1] Robinson E H, La-Bomascus D, Brown P B, and Linton T L 1987 Dietary calcium and phosphorus requirements of *Oreochromis aureus* reared in calcium-free water *Aquaculture* **64** 267-276.
[2] Silva S S D and Anderson T A 1995 *Fish Nutrition in Aquaculture* (London: Capman and Hall) p 318.
[3] Dabrowska H, Gunther K D and Meyer-Burgdorff K 1989 Availability of various magnesium compounds to Tilapia (*Oreochromis niloticus*) *Aquaculture* **76** 269-276.
[4] Shearer K D 1994 Factors affecting the proximate composition of cultured fishes with emphasis on salmonids *Aquaculture* **119** 63-88.
[5] El-Sayed A F M, Mansour C R and Ezzat A A 2003 Effects of dietary protein level on spawning performance of Nile tilapia (*Oreochromis niloticus*) brood stock reared at different water salinities *Aquaculture* **220** 619-632.
[6] El-Sayed A F M and Thesima S I 1992 Protein and energy requirements of Nile tilapia, *Oreochromis niloticus*, fry *Aquaculture* **103** 55-63.
[7] Keembiyehetty C N and Wilson R P 1998 Effects of water temperature on growth and nutrient utilization of sunshine bass (*Morone chrysops* x *Morone saxatilis*) fed diet containing different energy/protein ratios *Aquaculture* **166** 151-162.
[8] Ai Q, Mai K, Li H, Zhang C, Zhang L, Duan Q, Tan B, Xu W, Ma H, Zhang W and Liufu Z 2004 Effects of dietary protein to energy ratios on growth and body composition of juvenile Japanese sea bass, *Lateolabrax japonicus Aquaculture* **230** 507-16.
[9] Salhi M, Bessonart M, Chediak G, Bellagamba M and Carnevia D 2004 Growth, feed utilization and body composition of black catfish, *Rhamdia quelen* and fry fed diets containing different protein and energy levels *Aquaculture* **231** 435-44.
[10] AOAC 1990 *Official methods of analysis (17th ed.)* (Gaithersburg, MD. USA) Association of Official Analytical Chemists.
[11] Norusis 1990 *SPSS-PC+ Advanced Statistics Guide*. Second edition. (Chicago: SPSS) p 229.
[12] Abdelghany A E 2003 Replacement of herring fish meal by soybean flour in practical diets for red tilapia, *Oreochromis niloticus* x *O mossambicus* growth in concrete tanks *J. Appl. Aquacult* **14** 69-87