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EFFECT OF SPECIES AND STOCKING SYSTEM ON BIOCHEMICAL PROFILE OF SOME SERUM CONSTITUENTS IN FISH

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SUMMARY

This study was carried out on three different species of fish (Tilapia Zillii (T.z), Oreovhromis galileus (O.g) and Oreochromis niloticus (0.n), respectively, stocked by mono and polyculture systems. Analysis of variance of the obtained data showed that the stocking system significantly affect the T. cholesterol, T. lipids, urea, ALP and LDH levels in sera of examined fish. While, the species, stocking system interaction significantly influenced the all stdied parameters. The greatest values of T. proteins, albumin, globulins, T. cholesterol, T. lipids, Urea, ALP and LDH were observed in T. zillii monoculture followed by T. zillii polyculture.

INTRODUCTION

Intensive culture of tilapia must be associated with proper adjustment of their nutritional reguirements especially in case of polyculture system, where tilapia species showed many feeding habits ranged from facultative herbivorus to detrotus feeders (Jauncy and ross 1982). This wide range of feeding habits allowing tilapia fishes occupying different trophic niches in the water column and so, attacked different living water biota according to its trophic niche.

Fish chemistry should be effective as an aid in diagnosis of fish diseases. But without identification of what is the normal, it is difficult to differentiate between normal and diseased status of fish as well as nutritional status of the fish.

Assessment of normal values for fish is difficult bacause the body composition of fish can be influenced by many factors such as feeding level, nutrient composition, temperature, crowding and the availability of the food (Brown, 1957). Moreover, Barnhart (1969) reported that the blood components of fish were significantly influenced by strain, diet and/or age.

this study was planned to throw light on the effect of different tilapia species as well as stocking system on serum proteins, total lipids, total cholesterol, urea, alkaline phosphatase and lactate dehydroogenase activities.

MATERIAL AND METHODS

Experimental fish:-

Three fish speices belongs to family Cichlidae named tilapia zillii, Oreochromis galileus and Oreochromis niloticus respectively were used, they were identified morphologically by means of rays and spins according to Holden and Reed (1972). Fishes used were almost in the same initial body weight 25 ± 2 g/fish.

Experimental cages:-

Twelve cages each of 3 cubic meters size were used. The cages were made of metal scaffolding tubes and covered with netlon mesh size 15 mm, immersed in a concrete pond with dimensions of 10 x 20 x 1.5 meters depth supplied with fresh Nile water in which complete pond water renewal occurred every 15 days allowing natural feed production.

Experimental design:-

Fishes were identified and divided into 6 equal groups each of 20 fishes as following:-

No.	Culture system	Species involved
1)	Monoculture*	T.z (three replicates)
2)	Monoculture	O.g (three replicates)
3)	Monoculture	O.n (three replicates)
4)	Polculture**	T.z + O.g + O.n
5)	Polyculture	T.z + O.g + O.n
6)	Polyculture	T.z + O.g + O.n

Feeding regime:-

Natural feed was initiated through water enrichment using oganic fertilizers "poultry manur" in which phytoplanktons, zooplantons, water funa and other detrotus materials were available in large amount. Artificial supplementary feeding using 25% crude protein diet at a rate of 2% from the biomass was used once daily.

Water used during the experiment:-

Fresh Nile water was used during the experiment which lasts for four successive months starting from April 1st 1993, the following are the most important physico-chemical properties of the water used during this period:-

Item		range	average
Temperature	°C	23.0-31	27.00
Turbidity	Cm	30.0-45	37.50
pH value		7.5-8.5	8.20
Dissolved Oxygen[a]	p.p.m.	5.0-6.5	5.75
Hardness[a]	p.p.m.	190.0-255	217.50
Salinity[b]	p.p.m.	77.6-229.3	153.50
Chlorosity[b]	p.p.m.	43.0-127	85.00
Organic[c] matter[c]	p.p.m.	80.0-110	95.00
Ammonia[a]	p.p.m.	0.1-0.2	0.15

a: According to the American Public health Association standards (APHA) 1975
b: According to Swingle (1969).
c: According to Attia (1964)

* Monoculture = Culture of one species only.
** Polyculture = Culture of more than one species.

Blood sampling and analytical procedures:

Blood was collected by direct cardiac puncture. It was collected as long as it could be easily drawn into the syrings. After the blood had been coagulated and centrifuged, the clear non hemolyzed sera were kept frozen at -20°C until used for estimation of total serum proteins (Weichselbaum, 1946); albumin, (Bartholomov and Delancy, 1966); globulins (Coles, 1974), total cholesterol, (Zak et al., 1954), total lipids, (Frings, et al., 1972). Urea, (Fawcet and Scott, 1960), alkaline phosphatase, ALP, "EC 3.1. 3.1". (Kind and King, 1954) and lactate dehydrogenase, LDH, "EC 1.1.1.27" (Wootton, 1982).
The data obtained were statistically analyzed according to SAS 1987.

Model:-

$$X_{ijk} = U + S_i + C_j + e_{ijk}$$

Where:

U = general mean
S_i = effect of species
C_j = effect of culture system
e_{ijk} = general error

RESULTS

Table (1) showed that the serum values of biochemical parameters were increased in fish stocked by monoculture system, this increase is significant for T. cholestrol, T. lipids, urea, ALP and LDH but non significant for serum proteins

On the other hand the results obtained in Table (2) revealed that the highest values of all measured parameters were noticed in T. zillii stocked by monoculture and polyculture respectively.

Furthermore the data listed in Table (2) revealed that the lowest values of SALP were observed in O. niloticus monoculture while lowest values for SLDH were found in o. niloticus polyculture. Finally, the lowest values of t. cholestrol were obseved in O. galileus followed by O. niloticus polyculture.

Table (1): Effect of stocking system on some organic constituents in fish

Paramater	T. protein	Albumin	Globulin	T. cholestrol	T. protein	Urea	ALP	LDH
Stocking system	g%	g%	g% MS ± SE	mg%	mg%	mg%	K.A µ/dl	I.µ/l
Monoculture	3.43±0.11^a	2.16±0.12^a	1.27±0.11^a	351.70±86.69^a	893.40±129.65^a	11.92±2.07^a	5.41±1.16^a	301.62±25.76^a
	3.04±0.11^a	1.71±0.13^a	1.34±0.10^a	212.46±46.97^b	743.50±130.39^b	10.17±0.39^b	2.92±0.95^b	224.45±30.83^b

Table (2): Mean values of some serum organic constituents in three species of fish in mono and polyculture systen.

Paramater Mean±S.E. Species	T. protein g%	Albumin g%	Globulin g%	T. cholestrol mg%	T. protein mg%	Urea mg%	ALP K.AU/dl	LDH I.U/l
T. zillii*	4.26±0.19^a	2.58±0.11^a	1.68±0.13^a	434.66±96.50^a	1250±173.20^a	14.38±1.91^a	8.01±0.99^a	324.10±27.22^a
O. galileus*	3.08±0.11^b	2.00±0.18^b	1.08±0.10^b	313.99±45.34^b	625.20±88.40^c	10.70±0.26^b	4.91±0.21^b	296.11±11.76^b
O. niliticus*	2.95±0.14^b	1.90±0.04^b	1.05±0.11^b	306.57±61.23^b	774.6±79.10^c	10.68±1.3^b	3.31±0.97^c	284.65±50.60^b
T. zillii**	4.13±0.16^a	1.35±0.19^a	1.78±0.19^a	261.33±42.59^b	904.33±79.56^b	10.44±0.25^b	5.57±1.16^b	258.75±16.5^b
O. galileus**	2.22±0.15^c	1.14±0.13^c	1.08±0.16^b	190.25±61.44^c	615.50±61.49^c	10.20±0.08^b	1.90±0.20^d	226.3±18.9^b
O. niloticus**	2.80±0.10^b	1.63±0.18^b	1.17±0.11^b	203.79±10.38^c	705.8±4298^c	9.88±0.52^b	1.87±0.05^d	189.44±46.40^c

Different letters mean highly significant at ($P \leq 0.01$) while the same letters mean non significant.
* Monoculture.
** Polycuture.

DISCUSSION

Normal values of numerous blood constituents have been tabulated for many of the higher vertebrates and are useful diagnostic tools in human and veterinary clinical chemistry and medicine. In contrast data about the blood chemistry of fishes has been quite fragmentary until now, being especially limited in terms of expected normal ranges. Therefore the goal of the present study was to throw light on the effect of species differancies as well as stocking system on some serum biochomical constituents of fish.

The obtained results in Table (1) indicated tha the serum values of T. cholesterol, T. lipids, urea. ALP and LDH were significantly higher ($p < 0.01$) in fish stocked in monoculture system than those in polyculture system, while the T. proteins and albumin levels were non significantly altered. it is well known that the environmental changes such as growth, activity and feeding hebits has been the cause commonly suggested to explain the metabolic fluctuation in fish, (Barnhart, 1960). In general, the metablism of the fish is thought to be controlled by the environment. So we may attributed the significant increment of these measured parameters to the higher metabolic rate of fishes in monoculture system, Hence these fishes were found to grow more rapidly and also more active than those stocked in polyculture system, el-Bolok and Koura (1961).

The analysis of variance showed that the stocking system (Table 1) and species differences, (table 2) has a significant effect on T. cholestrol, T. lipids, Urea, ALP and LDH levels. The obtained data are nearly agree with those obtained by Barnhart, (1969) who reported that the diet and strain caused a significant variation in blood cholestrol

levels of trout fish, the author added that the diet was the greatest source of variation.

Generally, the high values of total serum cholestrol in fish may be due to inefficient fat metabolism in fish, (philips and podoliak, 1957 and Shell, 1961).

From the present investigaion it is evident (Table, 2) that the T. zillii, O.galileus and O. niloticus in monoculture possesses the higher T-cholesterol levels than the same species in polyculture. It is well known that the lipid is the main source of energy for metabolism in fish during stress (Ackman and Eaton, 1976). Furthermore, the lipid composition of fish is influenced by pattern of feeding. gametogenesis and also environmental conditions, (Clark, 1977, and 1980).

On the other hand, the obtained data give and evidence that both stocking system and species variation significantly affect the serum urea, ALP and LDH, (Tables 1,2). it is well known fact that the ALP and LDH are zinc metalloenzymes, and their activities were influenced by nutritional states, (Davidsohn and Henry 1974 and Agag, 1985). Moreover, the LDH activity is increased following sternuous exercise, (Henry. et al., 1974). Thus the variation in the feeding habits of these fishes. (Jauncy and Ross 1982), may be the cause of these alterations.

In the present work the largest variations in serum proteins levels were caused by fish species (table 2). These obtained data nearly agree with those reported by Barnhart, (1969) who concluded that the strain differences has a significant effect on serum proteins. However. Wedemeyer and Chatterton, (1970) reported that the variation in serum proteins of salmon fish may indicate dietary effects rather than pathological process. Also, Jauncy, and Ross (1982) and Mousa and Telbany, (1993) reported that the different feeding habits of fish, alterates the fish protein content. The highest values of T. protein was noticed in T. zillii in both mono- and polyculture which may be attributed to that these fish possesses the highest values of albumin and globulins fractions. Also the genetic factors may be the cause of significant changes in protein fractions (mandour, et al., 1992).

We can concluded that the stocking system significantly affect the all studied constituents except serum proteins, while the species differences alterates the all serum constituents. T. zillii stocked by mono-and polycultures possesses the highest values of serum proteins, T. cholesterol, T. lipids, urea, ALP and LDH respectively.

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