Vet.Med.J.,Giza.Vol.40, No.2.(1992):121-127.

SOME METABOLIC HYDROLASES AND BLOOD CHEMISTRY VALUES IN PLASMA OF NILE CATFISH "*Clarias lazera*"

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(Recived : 12.1.1992)

INTRODUCTION

Catfish species are teleostean omnivorous(mostly carnivorous) fresh-water fish living in different countries e.g. Egypt, India and U.S.A. Catfish spawn and hatched at water temperature 24-31°C (Roy & Pal, 1986 and El-Bolock, 1973). It's a muscular fish of a good eating quality and commercially important as its protein content is higher and fat contant lower (Zeinab, 1984) than in major carp (Roy and Pal, 1986). The fish can be cultivated in all types of fresh water such as rivers, canals, swamps, ponds, ditches and derelict water areas. Nutritive, metabolic and biochemical studies of this species are still scarce.

Nutrition and metabolism in marine fish have been extensively reviewed by Cowey and Sargent (1979) and Walton and Cowey (1982) and it is clear that fish differ from mammals with respect to the relative roles of dietary carbohydrates, lipid and protein in the production of metabolic energy. The major portion of the energy requirements of many species of fish are met by catabolism of dietary protein and lipid whereas dietary carbohydrates is poorly utilized as an energy source. This is in contrast to homoiothermic mammals where the major amount of metabolic energy for body heat and physical activities is gained from efficient carbohydrate catabolism (Madge, 1975). The effects of relatively high carbohydrate/fat diets for fish are variable depending on the species being considered, e.g. Yellowtail fish (Seriola quinqueradiata) fed high carbohydrate diet showed impaired growth and inefficient digestion of carbohydrate (Shimeno et al., 1979). Similarly the protein utilization reported for juvenile turbot fed on high lipid diets (Bromley, 1980) also resulted in undesirable effects including the production of a carcass with excess lipid deposition. On the other hand, no adverse effects were reported to accompany improved protein conversion in plaice fish, fed carbohydrate supplemented diets (Cowey et al., 1975). In considering a particular species, information on the ability of that species to digest, absorb and metabolise particular nutrients is therefore useful in formulating diets which will give the

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most economic food to product conversion.

Although there are reports on digestive lipases, carbohydrases and proteas in the alimentry tract of different marinefish species , there are scarce references to metabolic hydrolases and blood chemistry values in blood of Nile catfish "Clarias Lazera".

The present study aimed to investigate:

1. Plasma level of some metabolic hydrolases responsible for lipid and carbohydrate metabolism as well as:

2. Plasma total protein, glucose, total calcium, inorganic phosphorus and potassium; in both sexes of Nile catfish *Clarias lazera.*

MATERIALS AND METHOS

1 using a heparinized syringe. Plasma was separated and stored in plastic vials at -20°C in a deep freeze till assay:

(1) Lipase activity was analysed using kit, according to the method adopted by **Weisshaar (1981).**

(2) Amylase activity was assayed using kit, according to the method adopted by **Smith and Roe (1957).**

(3) Total protein was estimated by the method of **King and Wotton (1959).**

(4) Glucose level was estimated using kit, according to the method of **Trinder (1969).**

(5) Total calcium (using kit) according to **Weisssman and Pilleggi (1974).**

(6) Inorganic phosphorus (using kit adopted by **Tietz (1970).**

(7) Potasium electrolyte was determined (using flame photometer) according to **Varley, et al. (1980).**

Statistical analysis was done according to **Snedecor and Cochran (1967)** using **"t" test.**

RESULTS

The data presented in Table (1) revealed that plasma lipase activity in male *Claras lazera* fish (2396.51 ± 50.62 U/L) was significantly higher than that in female fish (1835.70 ± 35.44 I/L) at $P < 0.01$.

Plasma amylase activity in male fish (110.30 ± 8.50 U/dl) was significantly higher than that in female fish (76.70 ± 4.82 U/dL) at $P < 0.01$. Plasma total protein level in male fish (5.50 ±0.35 gm%) was statistically significant higher than in fish (3.13 ± 0.42 gm%) at $P < 0.01$. Plasma glucose level in male fish (109.76 ± 4.83 mg%) was significantly elevated than that in female fish (88.43 ± 3.93 mg%) at $P < 0.01$. Moreover, plasma total calcium level in male fish (7.85 ± 0.31 mg%) was significantly higher than that in female fish (5.87 ±

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Table (1): Some metabolic hydrolases and blood chemistry values in plasma of Nile catfish "*Clarias lazera*".

Assay / Sex	Lipase (U/L)	Amylase (U/dl)	Total Protein (gm %)	Glucose mg %	Total Calcium (mg %)	Inorganic Phosphorus (mg %)	Potassium (mEq/dl)
Male (♂)	2396.51** ± 50.62	110.30** ± 8.50**	5.50** ± 0.35	109.76** ± 4.83	7.85** ± 0.31	5.82* ± 0.73	5.30 ± 0.70
Female (♀)	1835.70** ± 35.44	76.70** ± 4.82	3.13** ± 0.42	88.43** ± 3.93	5.87** ± 0.50	3.77* ± 0.52	5.66 ± 0.63

- Mean ± S.E.
- Values having the same asterisk(s) between both sexes are significantly different from each other:
** at P< 0.01
* at P<0.05

0.50 mg%) at P < 0.01. However, plasma phosphorus level in male fish (5.82 ± 0.73 mg%) was statistically significant higher than that in female fish(3.77 ± 0.52 mg%) at P < 0.05. While no significant difference in plasma potassium level was oserved in both sexes of Clarias lazera fish.

DISCUSSION

The present study indicated that plasma lipase activity are influenced by sex factor of Clarias lazera fish. Effficiency of hydrolysis of fatty acid esters (triglycerides) in fish species in relation to lipase activity in fish plasma is still questionable.

Scarce references are available for normal lipase assay and activity in fish plasma **Kapoor, et al. (1975)** reported that lipases are mainly secreted from teleostean diffuse pancreas, that hydrolyze neutral fat (triglycerides) into diglycrides, monoglycerides, glycerol and free fatty acids. **Patton, et al. (1975)** found lipase activity in the bile of marine fish e.g. Jack mackerel. **Robinson and Wing (1971)** found thattriacylgl crols in mammals can not pass through the intestinal mucosa to blood circulation without being cleaved to glycerol and fatty acids by lipoprotein lipase enzyme.

Cowey and Sargent (1979) detected some plasma lipoprotein particles similar in size to chylomicron of triacylglycerols particles or very low density lipoproteins in fish intestinal mucosal blood capillaries. **Robinson and Mead (1973)** found that lipid hydrolysis in the fish intestine leading to free fatty acids.

Free fatty acids, are absorbed and transported by portal vein via"Enterohepatic circulation" to the liver where synthesis and export of triacylglycerols follow. The cyclostomes and elasmbranchs

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contain \ waxy fatty acid in their blood plasma (**Benson and Lee, 1975**). However, **Bilinski (1974)** detected a lysosomal triacylglycerols lipase in lateral line tisssue of rainbow trout, that involved in intracellular degradation of triacylglycerols and could be translocated from cells to be present infish muscle. **Patton et al. (1975)** found that fish bile lipase had a positional specificity similar to that of mammalian pancreatic lipase.

Present results indicated that plasma amylase level are influenced by the sex of male has a higher activity than female. In Tilapia (herbivorous fish), amylase enzyme has been found in all parts of digestive tract (**Nagase, 1964**). Moreover, he added that intestinal amylase of Tilapia is more active than gastric amylase in carbohydrate digestion. **Bergot (1981)** suggested that diffuse ramified non compasct pancrease of carnivorous fish is responsible for pancreatic amylase secretion. **Kapoor, et al. (1975)** found that intetina amylase activity is higher in herbivorous fishes such as carp than in the intestinal caseca of more carnivorous species such as Salmon, Cod and Flounder. **Glass, et al. (1987)** found that O< -amylase was principally located in pyloric caeca and foregut in marine flatifish and atlantic halibut. **Clark, et al. (1984)** found that amylase of carnivorous fishes was activated by calcium ions. Therefore, the significant elevation of plasma amylase level in male fish may be referred to rise in free Ca++ions in plasma of male clarias fish.

Moreover, the results in the present investigation revealed that plasma total protein levels are influenced by sex factor of Clarias lazera fish. Present results are in agreement with **Matthews (1975)** who concluded that the absorption efficiency of degradation products of protein from intestinal content (amino acids or peptides) might influence the circulating plasma total protein. Contrary, **Haschemyer (1973)**4y sex. Male has a higher Ca & P levels than females. This might be due to the influence of female sex hormone (estrogens) on calcium absorption in female fish. Estrogens have been found to decrease growth by reduction in body weight and retardation of skelton development in channel catfish "body fish" (**Bulkley, 1972**). **Ogino and Takeda (1976)** found that 1, 25 dihydroxycalciferol (precursor of Vit. D) is essential for uptake of calcium from intestine of carp. However, the elevation of plasma calcium and phosphorus level in male Clarias fish might be due to indircet effect of androgenic hormones on Ca and P absorption via enhancement their uptake from the intestine. Moreover, the results in the present investigation may help in the formulation of catfish meal in fish culture. **Sakamoto and Yone (1973)** round that best somatic growth of marine fish species require a dietary calcium: phosphorus ratio (1:2) in the proteinaceous

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dietary meal of cultivated red sea bream fish, but this ratio is very different from that of freshwater fish. Results in this work , showed that Ca:p ratio in plasma of Clarias lazera fish is about (1.5:1). No significant difference in plasma potassium levels in both sexes of Clarias lazera fish.

Present results revealed that plasma levels of lipase & amylase activity, total protein, glucose, calcium and phosphorus are significantly different from male to female in Clarias lazera fish, this difference may thus be regarded as a sex-response. However, most male fish have a higher anabolic and muscular activity than female. **Fagerlund and McBride (1977)** reported that 17 O< methyltestosterone causes and increase in food conversion and utilization efficiency in salmon.

In conclusion, the present work shows that plasma values of lipase, amylase, total protein, glucose, calcium, phosphorus and potassium in Clarias lazera fish have been proved.

SUMMARY

In the present study some metabolic hydrolases and plasma chemistry values were studied in Clarias lazera, the obtained results showed that:

(1) Plasma lipase level in male Clarias lazera fish (2396.51 ± 50.62 U/L) was significantly higher than that in female fish (1835.70 ± 35.44 UI) at P < 0.01.

(2) Plasma amylase level in male fish (110.30 ± 8.50 U/dl) was significantly higher than that in female fish (76.70 ± 4.82 U/dl) at P < 0.01.

(3) Plasma total protein level in male fish (5.50 ± 0.35 gm%) was significantly higher than that in female fish (3.12 ± 0.42 gm%) at P < 0.01.

(4) Plasma glucose level in male fish (109.76 ± 4.8mg%) was significantly higher than that in female fish (88.43 ± 3.93 mg%) at P <0.01 (5) Plasma total calcium level in male fish (7.85 ± 0.31 mg%) was significantly elevated than that in female fish (5.87 ± 0.50 mg%) at P < 0.01.

(6) Plasma inorganic phosphorus level in malr fish (5.82 ± 0.73 mg%) was significantly higher than that in female fish (3.77 ± 0.52 mg%) at P < 0.05.

(7) No significant difference in plasma potassium level in both sexes of Clarias lazera fish.

REFERENCES

Benson, A.A. and Lee, R.F. (1975): The role of wax in oceanic food chains. Sci. Am. 232 : 76-86.

Bergot, P. (1981): Structure and function of pyloric caeca. In Nutrition des poisons (Edited by Fontaine), pp. 45-53. Actes Coll. (NERNA) Paris, France

Bilinski, E. (1974): Biochemical aspects of fish swimming. In "Biochemical and J.R. Sargent, eds), Vol. 1, pp. 239-288, A.P. , New York.

Bromley, P.J. (1980): The effect of dietary protein, lipid and energy content on the growth of turbot (Scophthalmus maximus L.) Aquaculture, 19, 359-369.

Bulkey, R.V. (1972): Diethylstilbosterol

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in catfish feed. Trans. Am. Fish. Soc. 101, 537-539.

Clark, J., McNaughton, J.E. and Stark, J. R. (1984): Metabolism in marine Flatfish-I. Carbohydrate digestion in Dover sole. Comp. Biochem. Physiol. 77B, 821 827.

Cowey, C.B., Adron, J.W., Brown, D.A. and Shanks, A.M. (1975): Studies on the nutrition of marine flatfish. The metabolism of glucose by plaice (Plewronectes platessa). Br. J. Nutr. 33, 219-231.

Cowey, C.B. and Sargent, J.R. (1979): Nutrition. In Fish Physiology (Edited by Hoar, W.S., Randall, D.J. and Brett, J.R.), Vol. VIII, pp. 1 69. Academic Press, New York.

El-Bolock, A.R. (1972): The use of vertebrae for vertebrae for determining age and growth of the Nile carfish, Clarias lazera, in the A.R.E.E. Bull. Inst. Ocean and Fish, A.R.E., Vol. 2, pp. 53-82.

El Bolock, A.R. (1973): Studies on spawning and spawning behaviour of Clarias lazera Cuv. & Val. in fish farms of A.R.E. Zool. Soc. Egypt, Vol. 25-32.

Fagerlund, U.H.M., and McBride, J.R. (1977): Effect of 17-O< methyltestosterone on growth, gonad development, external features and proximate composition of muscle of coho and pink salmon. Fish. Mar. Serv. Tech. Rep. No. 716.

Glass, H.J.; MacDonald, N.L; Moran, R.M. and Stark, J.R. (1989): Digestion of protein in different marine species. Comp. Biochem. Physiol. Vol. 94B, No. 3, pp. 607-611.

Glass, H.J.; A.E.V. (1973): Kinetic analysis of synthesis and secretion of plasma proteins in a marine teleosts. J. Biol. Chem. 248: 1643-1649.

Inui, Y, and Yokote, M. (1974): Gluconeogenesis in eel. I. Gluconeogenesis in the fasted eel. Tans. Suis. Kenk. Ken. Hoko. 24: 33 46.

Kapoor, B.G.; Smit, H., and Verighina, I.A. (1975): The alimentary canal and digestion in teleosts. Adv. Mar. Biol. 13: 109 239.

King, E.J. and Wotton, I.D.P. (1959): Microanalysis in Medical biochemistry. Churchill, London.

Lied, E.; Gjerde, J. and Braskkan, O.R. (1975): Simple and rapid technique for repeated blood sampling in Rainbow trout. J. Fish. Res. Board. Can. 32 (5), 699 701.

Madge, D.S. (1975): The Mammalian Alimentary System. A Functional Approach. 195 pp. Special topics in Biology Series. Edward Arnold. London.

Matthews, D.M. (1975): Intestinal absorption of peptides. Physiol. Rev. 55; 537-608.

Nagase, G. (1964): Contribution to the physiology of digestion in Tilpapia mossambica: Digestive enzymes and the effect of diet on their activity. Z. Vgl.. Physiol. 49: 270 284.

Ogino, C. and Takeda, H. (1976): Mineral requirements in fish. III. Calcium and Phosphorus requirements in carp. Nippon Sussian Gakkaishi, 42: 793 799.

Patton, J.S.; Nevenzel, J.C.; and Benson, A.A. (1975): Specificity of digestive lipases in hydrolysis of was esters and triglycerides studies in anchovy and other selected fish. Lipids, 10: 575 583.

Robinson, F.S. and Mead, J.F. (1973): Lipid absorption and deposition in rainbow trout (Salmo gairdneri). Can. J. Biochem. 51: 1050 1058.

Robinson, D.S. and Wing, D.R. (1971): Studies on tissue clearing factor lipase related to its role in the removal of lipoprotein triglyceride from the plasma. Biochem. Soc. Symp. No. 33, pp: 123-135.

Roy, S. and Pal. B.C. (1986): Quantitative and Qualitative analysis of spawning behaviour of Heteropneustes fossilis (Bloch.) (Siluridae) in laboratory aquaria. J. Fish. Biol. Vol. 2/3, 247-254.

Sakamoto, S. and Yone, Y. (1973): Effect of dietary calcium/ phosphorus ratio upon growth, feed efficiency and blood serum calcium and phosphorus level in red sea bream. Nippon Suis. Gakka. 39, 343-348.

Shimeno, S.; Hoskawa, H. and Takeda, M. (1979): The importance of carbohydrate in the diet of a carnivorous fish. In Proc. World Symp. on Finfish Nutrition and Fish-feed Technology, Hamburg, June 1978 (Edited by Halver, J.E. and Tiews, K.), pp. 127-143, Vol. 1.

الممسوحه ضوئيا بـ CamScanner

Smith, B. and Roe, J. (1957): Colorimetric determination of Amylase activitity. J. Biol. Chem. 227:357.

Snedecor, G.W. and Cochran, W.G. (1967): Statistical methods. 6th Ed. IOWA. State College Press, U.S.A. Tietz, N.W. (1970): Fundamentals of Clinical Chemistry W.B. Saunders Philadelphia.

Trinder, P. (1969): Determination of blood glucose using and oxidase-peroxidase system with a non-carcinogenic chromogen. J. Clin. Pathol. 22, 158 161.

Varley, H.; Gwenbck, A.H. and Bell, M. (1980): " Practical clinical chemistry, Bol. 1, General Topical commoner Test. 5th Ed. London, William Heinemann medical Books LTd.

Walton, M.J. and Cowey, C.B. (1982) Aspects of intermediary metabolism in salmonid fish. Comp. Biochem. Physiol. 73, 59 79.

Warner, M.C. and Williams, R.W. (1977): Comparison between serum values of pond and internsive raceway cultured channel catfish, Ictalurus punctatus. J. Fish. Biol. 11: 385-391.

Weisshaar, H.D. (1981): Colorimetric determination of Lipase activity. Dtsch. Med. Wschr. 106:239.

Weissmann, N. and Pilleggi, V.J. (1974): In clinical chemistry principles and Technics. 2 nd R.H. Henry, et al. Eds. Hrper, Row, Hagerstown M.D. pp. 646 669.

Zeinab, A.S. (1984): Further physiological studies on fishes and nutritional value of Clarias at different stages of development. Ph. D. Thesis, Faculty of ?Vet. Med. Cairo University.

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