INTERNATIONAL JOURNAL OF CURRENT RESEARCH IN CHEMISTRY AND PHARMACEUTICAL SCIENCES

(p-ISSN: 2348-5213: e-ISSN: 2348-5221)
www.ijcrcps.com

Research Article

SEASONAL STRESS ON AMMONIA CONTENT IN COMMON CARP FISHES WITH RELATION TO TOTAL PROTEINS

S.MD.M.N. IQBAL AND P. INDIRA

Department of Zoology, .SK.P. Government Degree College, Guntakal. Department of Zoology, Sri Krishnadevaraya University, Anantapuram.

Corresponding Author: mahaboobinooraiqbal@gmail.com,

Abstract

Summer season with 30^{o}C is taken as control, where as rainy season with 20^{o}C is taken as cold stress and winter season with 15^{o}C is taken as cold adaptation. *Catla catla, Labeo rohita, cyprinus carpio* is taken us experimental animals. With reference to seasonal variations, tissue variations and species variations has been studied under stress of 3 three seasons. During summer season to rainy season the total protein content inverses but the total ammonia content decreases due to cold stress. As for as tissue variation is considered the total protein content is more in osmotic tissue then that of non osmotic tissues. In case of ammonia content due to cold stress it is more non osmotic tissues then that of osmotic tissues in case of species variation due to cold stress the ammonia content is highest in *Cyprinus carpio* followed by labiorahitha on least in *Catla catla.* During rainy season due to cold adaptation the total protein content decreases but the ammonia content increases somewhat moderately. But never reaches to control.

Keywords: Cold stress, seasons, Common Carp, control, cold adaptation, tissues variation, species variation.

Introduction

Common carp fishes *i.e*, *Catla catla, Labeo rohita* and *Cyprinus carpio* have taken us experimental animals to study ammonia content in relation to total proteins. Summer season has taken (30^{o}C) as control, rainy season (15^{o}C) is considered as cold stress and winter season (15^{o}C) as cold adaptation. Seasonal; cold stress on ammonia in relation to total protein content in common carp has been studied. Ammonia content or total protein content is taken us indicator to seasonal cold stress of aquatic animals. The increase or decrease of ammonia content are total protein might be considered as operation of stress Phenomenon at the tissue level (Shakoori et al., 1977). The reduction in ammonia content suggest, Yes that the ammonia might have been converted into non toxic compounds, Glutamine and Urea during stress (Devid et al., 2004). Ammonia in moderate level promote protein synthesis (Wilson et al., 1969, and Dass., 1983). All the definition of stress however show the common premise of a stimulus acting on bio- logical system and subsequent reaction of a system (Pikering, A.D., 1981).

Materials and Methods

The common carp *i.e., Catla catla, Labeo rohita* and *Cyprinus carpio* were collected at 8:00 A.M. from fisheries departmental pond at Ananatapur, A.P., India, During their respective season. They have been imported to lab for blood and organ collection. The assay for total proteins and ammonia content have been carried out in the laboratory at -4^{o}C. Total proteins are estimated by Folin Phenol Reagent method described by Lowry, (1951) - as mg./Gram/Wet weight and ammonia as estimated by Bergmeyer (1965) method with slight modification – M moles of ammonia / Gram/Wet weight of Tissues.

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Results and Discussion

During summer season 30 °C (control) the total protein content decreases and ammonia content increases – Table -1, figure-1(a). This decrease in the protein content and the increase in ammonia content indicate that the ammonia content increases because due to high protease activity, protein break down leading to increase in amino acids, and its utilization cause increase in ammonia. Since the metabolism of ammonia is very sensitive the ambient ammonia (Schlinger and Mare,.1978, Roger., 1980.) so augmented occurs during summer season in common carp the enhanced ammonia levels in different tissues during summer season me lead to ammonotoxaemia and show deleterious effect on the fish metebolisim.

fig-1(a)

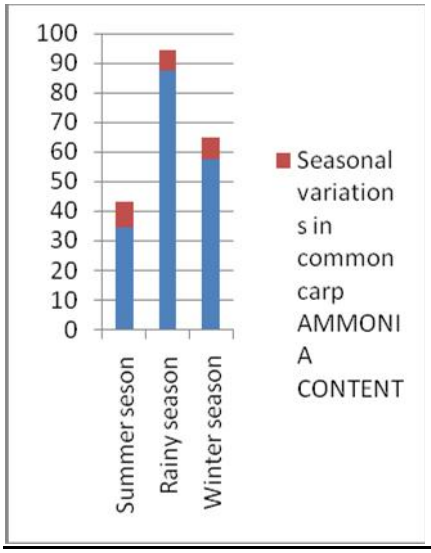

fig-1(b)

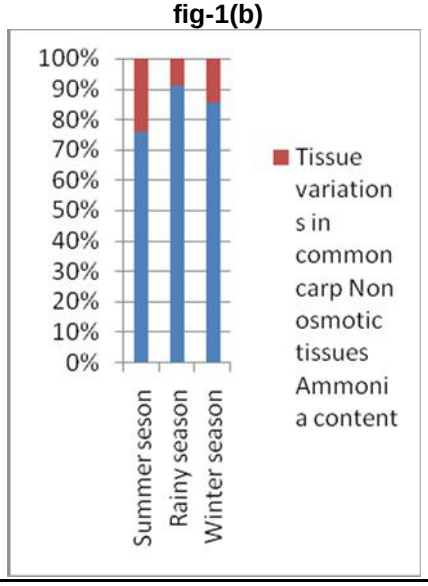

fig-1(c)

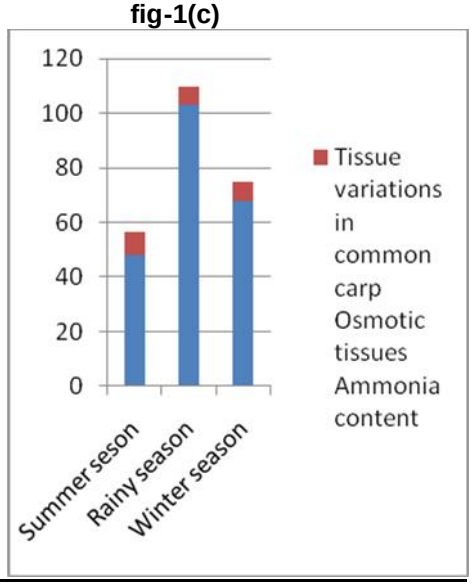

TABLE – I Seasonal variations and tissue variations in common carp fishes with relation to amonia content and total protein (µg of Acetyl choline hydrolyzed/mg protein/hour)

Seasons	Seasonal variations in common carp		Tissue variations in common carp			
	Total protein content	Ammonia content	Non osmotic tissues		Osmotic tissues	
			Total protein content	Ammonia content	Total protein content	Ammonia content
Summer seson	34.218	8.99	26.515	8.44	47.922	8.415
Rainy season	87.553	6.726	71.885	7.004	103.222	6.405
Winter season	57.388	7.521	47.222	8	67.555	7.103

TABLE – II Species variations in common carp

Seasons	Catla Catla		Labeo rohita		Cyprinus carpio	
	Total protein content	Ammonia content	Total protein content	Ammonia content	Total protein content	Ammonia content
Summer seson	53.833	8.533	24.996	7.997	32.83	8.955
Rainy season	85.666	7.305	82.333	6.615	94.67	6.25
Winter season	54.66	8.825	67.333	6.928	45.5	7.203

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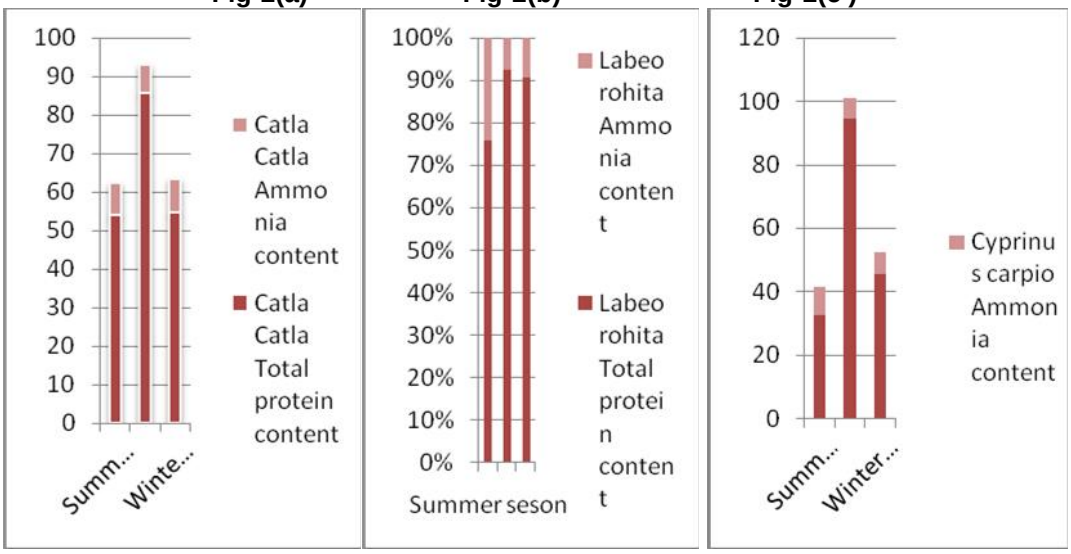
Fig-2(a) **Fig-2(b)** **Fig-2(c)**



Though ammonia is essential for the synthesis of important compounds such as pyramidines and non essential amino acids and also functions as a key factor in acid – based regulation it is toxic in non psychological concentration and excess ammonia there fore has to be disposed off (Murray etal., 2007). The elevation in the levels of ammonia corroborates with the increased levels of proteins hydrolysis, since ammonia forms the main product of protein catabolism (Campbell, 1973). Both transamination (Kabeer 1979) and deamination reactions seems to be boosted up at this stage adding more ammonia to the already exesting level. More over, elevation in the reaction of the Trans amination due to stress (Kabeer, 1979) was reported to augment energy demands which is met by feeding keto acids into glycolysis and TCA cycle. Further increased elimination of nitrogen from amino acids by way of transammination a possible elevation of purine nucleotide cycle GDH activity may be the factor for the enhanced ammonia level in the summer season. So ammonia bring about shift from aerobiosis to anaerobiasis. In control group of common carp the excess of ammonia thus created may disturb the invivo catabolism of ammonia to glutamine and impaired ammonia detoxification process thus affecting growth pattern at toxic tolerance (Mukhopadhyay etal., 1982) reported an increasing plasma ammonia level supposed due to an increase in amino acids catabolism be due to increased ammoniogenesis in treated fish (Begum 2007). As for as tissue variation is considered stepping up of ammonia content in non osmotic tissues compared to that of osmotic tissues.table-1, figure -1(b). As the muscle membrane has been adapted for the passage of ammonia. It has ineffective biochemical machinery to recycle it and buffer it through lactic acid production and there by avoiding alkolysis problem (Hisler, 1982). Liver also a organ where urea is formed utilizing ammonia and carbondioxide during rainy season due to cold stress.

During cold stress (rainy season- 22°C the ammonia content decreases table-1, figure – 1(a) . ammonia cannot be stored for longer period of time in the body as it leads to endogenous ammono toxicity. The reduction in ammonia content suggests that the ammonia might have been converted in to non toxic compounds, glutamine and urea during stress (Devid etal.,2004). Sreenivasulu Reddy and rao (1986) reported decreased ammonia content in tissues of Pinaeus indicus. The physiological levels of ammonia tolerated by a stressed animal is likely to vary with the species (Bandet etal, 1983; and Das 1983). showed that ammonia in a moderate level promotes protein synthesis in several animals. As per Roger 1980 ammonia was thought to interfere with protein synthesis but latter proved that ammonia has influence on protein turnover in biological systems. As for as tissue variation is considered stress is more in non osmotic tissues than that of osmotic tissues (table-1, figure -1(b) & (c)as non osmotic tissues like muscle and liver are engazed in ammonia metabolism. As for as species variation is considered highest stress can be seen in Cyprinus carpio followed by Labeo rohita and lowest in Catla catla(table-2, figure-2(a),(b),(c). Due to decrease in ammonia enzyme activity increases which cause protein synthesis. Elevation of total protein content in liver and muscle suggesting possible anabolic affect of exogenous ammonia in promoting tissue growth (golden etal, 1977; Roger, 1980). Protease activity decreases and protein synthesis increases which cause growth of the fish.

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During winter season (15°C-cold adaptation) in common carp ammonia content increases with out causing any physiological load on the part of the fish(table-1, figure-1). The amino acids are elevated the elevated amino acid content in the tissues were reported by several authors in different animals like (Jwiss 1980) in fasted Salmo Gairdineri (knapp and westeir 1981) in fish during temperature stress, (Gunasekhar 1989) in rana hexadactyla during solar radiation, (Neeraja 1980) in rana hexadactyla during induced ammoniam acetate stress. The elevated amino acids may be utilized for the synthesis of new types of essential proteins and enzymes to cope up with the toxic stress conditions to which the animal was exposed (Wilson and poe, 1974, Jwiss etal., 1979, 1980). The free amino acid pool becomes a fresh precursor for the synthesis of newly required proteins (Robert etal., and Pak 1979). The stored proteins which are synthesized and stored in rainy season are utilized to tied over winter season with out causing any burden on the fish during cold adaptation Rao and Neeraja (1989) reported that ammonia stress to fish causes reduction in tissue proteins. As for as tissue variation is considered it is highest in non osmotic tissues than that of osmotic tissues(tble-1,figure-1). Effect of ammonia induced acidosis on white muscle RNA, DNA, Serum protein concentration in rainbow trought and in chorhynchus mykiss Neeraja and Santha 1992 shows increased activity in liver of fresh water fish under vivo conditions. As for as species variation is considered it occurs in the following descending order (table-2, figure-2.)

Catla catla > Labeo rohita > Cyprinus carpio.

Catla catla is mostly adaptated to ammonia as it occurs on the surface water where as Cyprinus carpio is less adaptated to ammonia as it occurs in the bottom of pond In common carp fishes percent change is higher than that of percent recovery in tissue variation and species variation. During cold stress in common carp fishes and osmotic tissues statistically at ($P < 0.05$) stress and adaptation is significant, in non osmotic tissues stress is significant and adaptations are not significant. In Catla catla stress and adaptation are not significant in Labeo rohita and Cyprinus carpio stress and adaptations both are significant.

Conclusion

The ammonia content directly related to total protein metabolism the total protein increases the ammonia content decreases and the ammonia increases the total protein content decreases.

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