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A STUDY ON SOME METABOLIC ASPECTS PALLISENTIS OPHIOCEPHALI (THAPAR, 1930; BAYLIS, 1933) AN ACANTHOCEPHALAN PARASITE, INFECTING FRESH WATER FISH CHANNA PUNCTATUS

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ABSTRACT

Acanthocephala are exclusively endoparasites, Pallisentis ophiocephali infects the fresh water fish, Channa punctatus. They are dioecious and digenetic, life cycle involves an arthropod intermediate host and matured stage occurs in vertebrate host fish. The present study was undertaken to study different carbohydrate and protein levels. The glycogen content is 18.23 ±1.05 mg glucose/g fresh weights. The total carbohydrate levels are 19.59 ±1.97 mg glucose/g fresh weight and pyruvate content is 115± 2.64 µg pyruvate/g fresh weight. The total protein content is 131.50 ±5.0 mg protein /g fresh weight, soluble protein contents is 34.56 ± 3.49 mg protein/gm fresh weight and insoluble protein content is 51.14 ± 0.39 mg/g fresh weight. The amounts of free amino acids recorded were 1067.5 ± 3.63 µg amino acid/gm fresh weight of parasite. The results were analysed by ANOVA.

Keywords: *Acanthocephala, ANOVA, amino acids Channa punctatus, glycogen, Pallisentis ophiocephali, total carbohydrate and protein.*

I INTRODUCTION

The Acanthocephala (thorny-headed worms) are pseudo-coelomate endoparasites. Functionally, the body is divided in to two major regions, presoma with an armed proboscis for the attachment of the worm to the intestinal mucosa and metasoma (trunk). The life cycle involves an arthropod intermediate host, and they are dioecious. All the parasites spend their life cycles in two hosts. While larval stages are found in the intermediate host, which is invariably an arthropod, sexually mature parasites are present in the intestine of final host which is usually a vertebrate.

Most of the studies on feeding, nutrition, metabolism and related aspects in acanthocephalans have been limited to three species: *Moniliformis moniliformis, Machrocanthorhynchus hirudinaceus* and *Polymorphus minutus.* Glycogen is the main energy source and abundantly present in acanthocephalans. Glycogen is the major storage polysaccharide in *Machrocanthorhynchus hirudinaceus*[1], *Moniliformis moniliformis*[2], in *Neoechinorhynchus*. Several workers[3-6] histochemically demonstrated the presence of glycogen. Free amino acids levels were reported from *Raillietina tetragona*[7]. Different metabolites of glycolysis from *Moniliformis* were measured[8].
The aim of the present work is to study different carbohydrate metabolites protein levels and free amino acids in *Pallisentis ophiocephali*.

II MATERIAL AND METHODS

Pallisentis ophiocephali were collected from viscera of naturally infected fish, *Channa punctatus collected* from in and around local fish tanks and markets at Warangal. The intestine was dissected and parasites were collected and washed with 0.9% normal saline and washed in several changes to remove debris, mucus etc. Soon after the collection, they were screened for *Pallisentis ophiocephali* infection. Some of the worms were processed for taxonomic identification by following standard methods. Identification was carried out with the help of Acanthocephala, Systema Helminthum[9], Vo1. 5 and Helminths, arthropods and protozoa of domesticated animals[10].
Pyruvate was estimated by the method of Griedman and Haughen[11]. Total carbohydrates and glycogen content was estimated by Caroll[12]. The protein content in the tissue was estimated by Folin-phenol method[13]. Total free amino acids were determined by the method of Moore and stein[14].

The levels of glycogen, total carbohydrates and pyruvate levels of *Pallisentis ophiocephali* are presented in Histogram1and the total proteins, soluble, insoluble protein levels in *Pallisentis ophiocephali* are presented in histogram-2 respectively.

III RESULTS

The glycogen content is 18.23 ±1.05 mg glucose/g fresh weights. The total carbohydrate levels are 19.59 ±1.97 mg glucose/g fresh weight and pyruvate content is 115± 2.64 µg pyruvate/g fresh weight. The total protein content is 131.50 ±5.0 mg protein /g fresh weight, soluble protein contents is 34.56 ± 3.49 mg protein/gm fresh weight and insoluble protein content is 51.14 ± 0.39 mg/g fresh weight. The amounts of free amino acids recorded were 1067.5 ± 3.63 µg amino acid/gm fresh weight of parasite.

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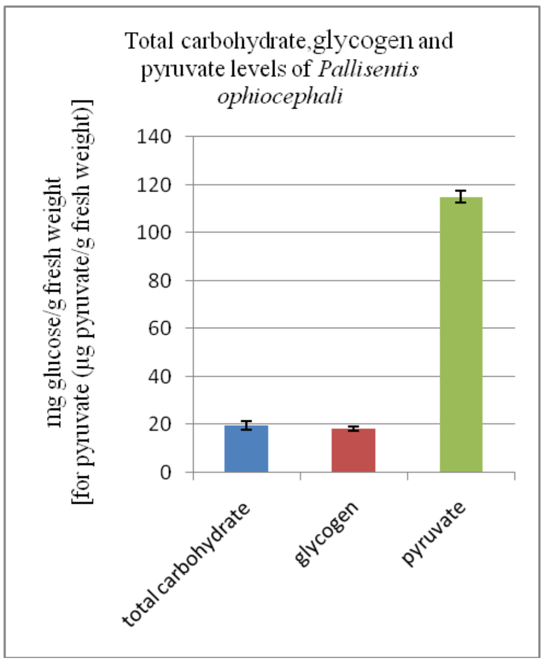
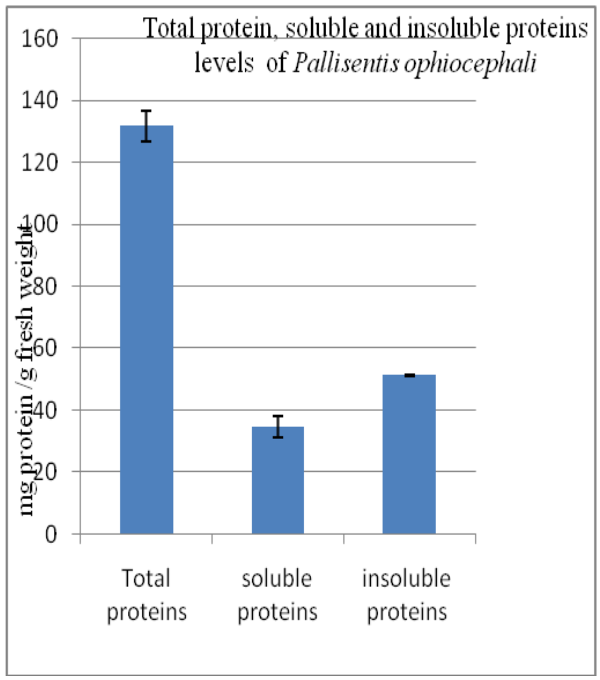
IV FIGURES AND TABLES

Histogram No.1. Showing The Levels Of Total Carbohydrate, Glycogen And Pyruvate In *Pallisentis Ophiocephali*

Histogram no.2. Showing the Levels of Soluble and Insoluble Proteins in *Pallisentis ophiocephali*





V DISCUSSION AND CONCLUSIONS

The present findings are in agreement with the previous reports. Glycogen as the energy source and storage form of polysaccharide was conformed[15]. Glycogen content was reported as 22-24 % of in its dry weight from *Moniliformis moniliformis*[16]. Glycogen levels ranging from 0.6-2.4g/100 g wet weight have been reported from freshly isolated worms of *Macracanthorhynchus hirudinaceus* females[17-18] and 7.4 and 12.7% of the dry masses of the female and male *Macracanthorhynchus hirudinaceus*[19] respectively. The impact of host organism on the glycogen levels of the parasite was ascertained[20]. Presence of glycogen was reported by several authors[21-23]. The amount of glycogen levels in the tissues of acanthocephalans varies from species to species from stage to stage of their life cycle and to season to season. Sexual differences in glycogen content have been reported from several species. Though the worms can survive in aerobic environment, primarily they depend on anaerobic mode of respiration. *Moniliformis dubius* ferments glucose, galactose, mannose, fructose and maltose to acidic metabolites under aerobic conditions too. The ability of acanthocephalans to carry out aerobic and anaerobic metabolism was exemplified [24] and they are more efficient anaerobes.

Pyruvate is the end product of glycolysis. Pyruvate is formed by pyruvate kinase, Mg^{+2} acts as cofactor. Under aerobic conditions pyruvate enters TCA cycle as acetyl CoA and breaks down completely. Under anaerobic conditions, pyruvate is converted to lactate by lactate dehydrogenase. Pyruvate as a keto acid serves as a source for amino acid synthesis and even acts as a link between lipid synthesis. Some amino acids like alanine, cysteine, cysteine, glycine, threonine and serine can convert into pyruvate. Pyruvate has been demonstrated in *Moneizia expansa*[25] and in *Ascaris lumbricoides*. Lactate is formed by reduction of pyruvate. Pyruvate production significantly decreased under aerobic condition, whereas lack of oxygen greatly increases succinate production. PEP is converted into pyruvate by pyruvate kinase, reduced to lactate by LDH and NADH, Mg^{+2}, K^{+} acts as co-factors. Pyruvate amount is correlated to glycogen content and pyruvate later converted in to lactate by LDH and excreted out. Low pyruvic acid levels were observed in the metabolically active regions.

It has been reported that the protein content is relatively low in helminths than that of other invertebrates. In parasitic helminthes, the protein usually constitutes between 20-40% of the dry weight and over 60% was reported for *Echinococcus spp*[26]. In some cases, it is as high as 70% of the dry weight, reported for *Macrachanthorhynchus hirudinaceus* and the infective larvae of *Nippostrongylus brasiliensis* reported higher total protein content in female *Pallisentis nagpurensis* than in male. In the present study insoluble protein content is higher when compared to soluble proteins; this is in agreement with the reports from *Raillietina tetragona*[27]. There are two protein fractions viz., soluble and in soluble. Soluble proteins include components like enzymes, glycoproteins, lipoproteins and antigens while insoluble proteins include keratin, collagen and sclerotin. Proteins of soluble and insoluble nature have been reported in the tissues of some trematodes, nematodes and in hooks of some cestodes scolices. Sclero and chromo proteins found in digeneans and pseudophylledean cestodes. Free amino acids are distributed in cytoplasm and serve as precursors for protein synthesis and the flux of amino acids depends on nutrient availability in intestinal lumen of the host.

High protein content of the present study is in agreement with high amount of free amino acids. The quantitative amino acid levels obtained in the present investigation are comparable with the values obtained by several workers[28].

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REFERENCES

[1] Brand, T. von (I939a): Chemical and morphological observations upon the composition of *Machracanthorhynchus hirudinaceus* (Acanthocephala). Journal of Parasitology, 25, 329-342.

[2] Starling, J.A. and Fisher, F .M. (1978): Carbohydrate transport in *Moniliformis dubius* (Acanthocephala) II. Post-absorptive phosphorylation of glucose and the role of trehalose in the accumulation of endogenous glucose reserves. Journal of Comparative Physiology, 126, 223- 231.

[3] Dunagan, T.T. (1964): Studies on the carbohydrate metabolism of Neoechinorhynchus spp. (Acanthocephala). Proceedings of the Helminthological Society of Washington, 31, 166--172.

[4] Bullock .W.L (l949b): Histochemical studies en the Acanthocephala II. The distribution of glycogen and fatty substances. Journal of Morphology, 84, 201-206.

[5] Crompton, D.W.T. (1965): A histochemical study of the distribution of glycogen and oxidoreductase activity in *Polymorphus minutus* (Goeze, 1782) (Acanthocephala), Parasitology, 55, 503 -514.

[6] N Brand T. (1979): Biochemistry and physiology of endoparasites (Oxford, Amsterdam, New York: Elsevier/NH and Biomed. Press).

[7] Achaiah, N (2013): A study on storage of free amino acid levels in *Raillietina tetragona* (Molin, 1858). Biolife, 1(3): 96-98.

[8] Cornish et al (1981b): The levels of some metabolites in *Moniliformis* .J.Parasit.67, 754-756.

[9] Yamaguti, S, (1963): Acanthocephala. In Systema Helminthum, Vo1. 5, pp. 1-423. New York and London: Wiley Interscience.

[10] Soulsby EJL. (1986): Helminths, Arthropods and protozoa of domesticated animals, 7th edn. London: Bailliere and Tindall, 809 p.University Park press.

[11] Friedman and Haughen (1943): In Hawk's physiological chemistry edited by Oser 1954, Mc Grawhill, New York.

[13] Lowry, O.H., Rosenbrough, N.J., Farr, A.L., and Randall, R.J. (1951): The method for protein estimation. J. Biol. Chem 193: 265 (The original method).

[14] Moore and Stein (1954): A modified Ninhydrine reagent for photometric determination of amino acids. J.Biol.Chem.211:907-913.

[15] Brand,T.von (I939a): Chemical and morphological observations upon the composition of *Machracanthorhynchus hirudinaceus* Acanthocephala). Journal of Parasitology, 25, 329-342.

[17] Brand, T. von (1939b): The glycogen distribution in the body of Acanthocephala. Journal of Parasitology, 25, 22.

[19] Brand. T. von (1940): Further observations upon the composition of Acanthocephala. Journal of Parasitology. 16, 301-307.

[18] Ward H.L. (1952): Glycogen consumption in Acanthocephala under aerobic and anaerobic condition, Journal of Parasitology, 38, 493- 494.

[19] Brand. T. von (1940): Further observations upon the composition of Acanthocephala. Journal of Parasitology. 16, 301-307.

[20] Graff and Allen, K. (1963). Glycogen content in *Moniliformis dubius* (Acanthocephala). Journal of Parasitology, 49, 204- 208.

[21] Brand.T.von (1940): Further observations upon the composition of Acanthocephala. Journal of Parasitology. 16, 301-307.

[22] Crompton, D.W.T. (1965): A histochemical study of the distribution of glycogen and oxido-reductase activity in *Polymorphus minutus* (Goeze, 1782) (Acanthocephala), Parasitology, 55, 503 -514.

[23] Crompton and Lee, 1963: structural metabolic components of acanthocephalan body wall. Parasit. 53, 3-4.

[24] Ward H.L. (1952): Glycogen consumption in Acanthocephala under aerobic and anaerobic condition, Journal of Parasitol0gy, 38, 493- 494.

[25] Bueding and Saz (1968): Pyruvate Kinase and Phospho Enol Pyruvate Kinase activities in Ascaris muscle and H.diminuta

[26] McManus D P, Smyth J D (1978): Differences in the chemical composition and carbohydrate metabolism of *Echinococcus granulosus* (horse and sheep strains) and *Echinococcus multilocularis*. Parasitology; 77: 103-109.

[27] Achaiah, N: Biochemical differentiation of proglottids of *Raillietina tetragona* (Molin, 1858).Ph.D thesis, (2013), Kakatiya University, Warangal, Telangana, India.

[28] Goodchild (1966): Amino acids in 7 species of cestodes. J parasite 52:60-62.