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A study on the protein content of cyclophyllidean cestode, *Raillietina tetragona* (Molin, 1858) infecting domestic chick, *Gallus gallus*

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Abstract
Raillietina tetragona is an endogenous helminth parasite infecting domestic chick. In the present study, total proteins, soluble and insoluble proteins levels in immature, mature and gravid proglottids of *Raillietina tetragona* have been undertaken. The total proteins in immature, mature and gravid proglottids are 96.42 ± 1.8, 90.37 ± 2.1 and 62.16 ± 1.1 mg protein/g fresh weight respectively. Soluble protein levels are 48.95 ± 1.9, 46.57 ±1.0, 42.23 ±1.5 and insoluble protein levels are 52.37 ±1.5, 39.43 ±1.0, and 35.85 ±1.9 mg protein /g fresh weight respectively. The data obtained from immature, mature and gravid segments of adult worm supports the transition in proteins levels in relation to the differentiation of proglottids. The reason for higher protein content in immature region indicates rapid proliferation rate, as it is involved in strobilisation which in turn requires amplified metabolic activity. The same was observed for soluble and insoluble proteins too and the data was statistically analysed by ANOVA.

Keywords: Differentiation of proglottids, *Raillietina tetragona*, total proteins, soluble and insoluble proteins, ANOVA

Introduction
Cestodes are parasitic helminths. They occupy alimentary canal. Livestock in the tropics generates substantial revenue, provides employment, supplies manure and animal protein. Their health status and productivity to fulfill these multipurpose functions is sometimes sub-optimal because of diseases. Helminthosis remains one of the world's most prevalent and economically significant parasitosis of man and domestic animals. Gastro-intestinal cestodes have been identified as one of the causes for production loses which arise primarily through mortality, severe weight loss, decreased egg and meat production, impaired metabolic and reproductive activities.

Cestodes depend on their hosts for energy sources [1]. Carbohydrates are most commonly used source of energy in cestodes [2]. Glycogen is the major energy source under both aerobic and anaerobic conditions [3]. However, large reserves of proteins were detected in cestode worms.

Several workers reported the protein levels from the whole worm, in the present study an attempt was made to study the differential distribution of protein in different proglottids of the adult worm. It has been reported that protein content was reported as lower than that of the invertebrates.

In parasitic helminths, the protein usually constitutes between 20-40% of the dry weight [4-5], over 60% have been reported for *Echinococcus spp* [6]. In some cases, it is as high as 70% of the dry weight, reported from *Macrachanthorhynchus hirudinaceus*, and the infective larvae of *Nippostrongylus* brasiliensis [7] and 32% of protein content was reported from *Hymenolepis diminuta*. Differential distribution of protein in immature, mature and gravid regions of cestode parasites *Avitellina lahorea* and *Stylesia globipunctata* was reported [8]. Some quantitative studies on proteins of some cestodes collected from different hosts and localities of Western Maharashtra were made [9]. Several workers reported protein levels from different helminth parasites infecting different hosts [10-15].

The material and methods

Raillietina tetragona is a poultry cestode, infects domestic fowl *Gallus gallus*. Worms were collected from viscera of naturally infected birds from freshly slaughtered chicks at Warangal abattoir. 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. Identification was carried out with the help of Systema Helminthum [16] and Helminths, arthropods and protozoa of domesticated animals [17]. The protein content in the tissue was estimated by Folin-phenol method as described by Lowry *et al* [18].

Results and Discussion

The total proteins, soluble and insoluble protein values in *Raillietina tetragona* are summarized in table-1 and histogram-1 respectively. The total proteins in immature, mature and gravid proglottids are 96.42 ± 1.8, 90.37 ± 2.1 and 62.16 ± 1.1 mg protein/g fresh weight respectively.

Soluble protein levels are 48.95 ± 1.9, 46.57 ±1.0, 42.23 ±1.5 and insoluble protein levels are 52.37 ±1.5, 39.43 ±1.0, and 35.85 ±1.9 mg protein /g fresh weight respectively.

Table no.1 showing the levels of different protein fractions (Each value is a mean of six values with ±SE)

Content	Immature	Mature	Gravid
Total proteins	96.42 ± 1.8	90.37 ± 2.1	62.16 ± 1.1
Soluble proteins	48.95 ± 1.9	39.43 ±1.0	42.23 ±1.5
Insoluble proteins	52.37 ±1.5	39.43 ±1.0	35.85 ±1.9

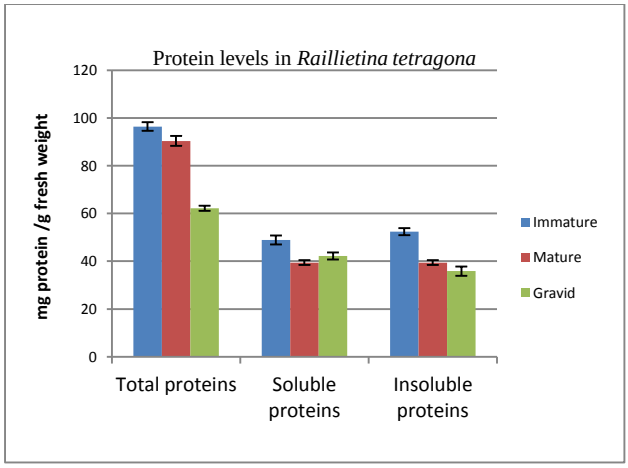

Fig 1: showing the levels of different protein fractions.

There exists a difference in the distribution of protein along the strobilar region, with the highest value in immature followed by mature and gravid regions. The mature and gravid regions had about 6% and 2% less protein content in relation to that of immature region. The values of total proteins for *Raillietina tetragona* are comparable with the previous reports. The decrease in protein content is in agreement with the findings of from *Hymenolepis diminuta* [19].

A total of 32% protein content was reported in *Hymenolepis diminuta* [20] and some authors reported higher content of protein in mature proglottids of *Hymenolepis diminuta* [21]. Fast growth of cestodes needs a high rate of synthesis of proteins. Protein synthesis was highest in immature proglottids [22]. The total proteins were studied by PAGE and iso-enzyme pattern and it is found that in all parts it is similar [23].

In *Cittotenia perplexa* 21% of protein, 22% from *Moneizia expansa* [24], 61% from *Echinococcus granulosus* [25], 36% from *Raillietina cesticillus* [26] and from *Taenia taenaeformis* larva it was 29% and in adults it was 45% [27].

Protein content depends on age, degree of maturation and previous metabolic history of organism. 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 [28]. Sclero and chromo proteins found in digeneans and pseudophylledean cestodes [29]. Chromo protein is the food for many helminth parasites as it contains oxidative pigments like haemoglobin. The highest content in immature region may be due to its proliferation rate which requires more protein. The reason for higher protein content in immature region indicates rapid proliferation rate, as it is involved in strobilisation which requires amplified metabolic activity. The same was observed for soluble and insoluble proteins.

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