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The malate dehydrogenase activity of *Anonchotaenia gaugi* (Cestode)

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Abstract
Malate dehydrogenase (MDH) is linked to a co-enzyme NADH which was responsible for the conversation of malate to oxaloacetate in the Tricarboxylic acid cycle. MDH activity was estimated in *Anonchotaenia gaugi*. Significant activity of MDH was observed in helminth parasite. The role of MDH is fixing carbon dioxide and in production of succinate have been discussed.

Keywords: malate dehydrogenase, *Anonchotenia gaugi*, helminth parasite, carbon dioxide

Introduction
Malate dehydrogenase is linked to a co-enzyme NADH (Nicotinamide adenine dinucleotide hydrogen) which is responsible for the conversion of malate to oxaloacetate in Tricarboxylic acid cycle. The enzyme is found in large amounts in the mitochondria and sacro some's and also in cytoplasm. MDH found in mitochondria is identified as an m-MDH which is soluble and that found in cytoplasm is known as S-MDH (Delbsruck *et al*., 1959) [6]. Malic enzyme occurs in a variety of forms but their physiological importance remains uncertain. The cytoplasmic enzyme (S-MDH) is generally considered to take part in the cytoplasmic side of malate shuttle, which transports NADH equivalents in the form of malate across mitochondria membrane. The malate after entering the mitochondria is subjected to a redox simulation. The m-MDH in addition to its role in other half of malate shuttle is also necessary component of citric acid cycle(Boyer, 1975).MDH was demonstrated in Hymenolyepis diminuta (Read, 1952, 1953, Waitz and Schardein, 1964; Bueding and saz,1968) [11] Hymenolepis microstoma (Pappus and Schroeder, 1979) [10]; Schistosoma mansoni (Coles, 1970, 1971). The effect of p^H reveals a most interesting feature in Hymenolepis diminuta when the enzyme is in sensitive of p^H changes expect at high p^H values and relatively high v max/km Values (Moon *et. al*., 1977) [7].

Material and Methods
Anonchotenia gaugi a common parasite of Turdoides Sommerville was selected for the present investigation. These birds were sacrificed in the laboratory. The intestine were then cut open and the parasites were flushed into saline water and repeatedly washed in ice cold saline water to remove adhering mucus and food particles. Generally mature and live worms of same size and length were taken for biochemical studies. The parasites were then transferred to Whatman's Filter No.1 to remove the adhering moisture. Then the parasites were weighed and homogenised for the experiment. The enzyme activity was assayed by the modified method of Nachala's *et al*, (1960).

Results
The regional distribution values of the malate dehydrogenase activity in *Anonchotenia gaugi* for Immature 1.313 + 0.133, Mature 2.336+ 0.125, Gravid 3.735 + 0.090 µ moles formazan/mg protein/hour respectively (Table 1).

Table 1: Malate dehydrogenase activity in *Anonchotenia gaugi*

S.NO	Immature	Mature	Gravid
1.	1.329	2.546	3.858
2.	0.992	2.019	3.303
3.	1.029	2.662	3.912
4.	1.801	2.319	3.809
5.	1.620	1.920	3.721
6.	1.199	2.550	3.810
Mean	1.313	2.336	3.735
S.E. +	0.113	0.125	0.090

Discussion
The malate dehydrogenase in parasitic helminths Was known to produce malate from oxaloacetate (Bueding and saz,1968) and linked to NADH coenzyme. The activity of malate dehydrogenase was very high in the direction of malate formation than the activity of lactate dehydrogenase. This was shown in unpurified preparation of MDH from Hymenolyepis diminuta (Bueding and saz, 1968). Similar results were reported by Moon *et al*., (1977) [7] in H. diminuta and by Pappas and Schroedar (1979) [10] in H. micro stoma.

The present investigation showed that MDH activity in the parasite *Anonchotenia gaugi* was very high in the direction of malate formation than lactate dehydrogenase activity. The parasite living in high tension of CO_2 environment seem to resort to fixation of Carbon dioxide in preference to glycolytic pathway (Barrett, 1976). In anaerobic metabolism, helminth parasites fix Carbon dioxide at the phosphoenol pyruvate stage and the results in the formation of oxaloacetate is reduced to malate (Bueding and saz, 1968). The malate so formed enters the mitochondria and further reduced to succinate via fumarate. The steps involving the reduction of oxaloacetate to succinate are observed to be in the reverse direction of the general kreb cycle, hence it is known as "Partial reverse "of Kreb cycle. This mechanism was adopted by most parasites because it yields more energy. Fumerate reduction to succinate was coupled to an electron transport mediated production of ATP (Kmetec and Bueding, 1961).

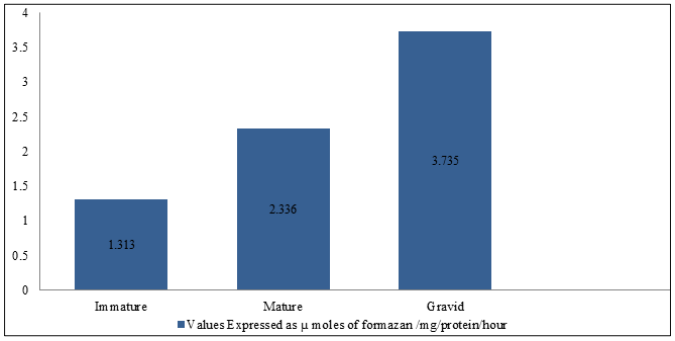

Fig 1: Malate dehydrogenase activity in *Anonchotenia gaugi*

The increasing gradient in the values of MDH activity from immature region to gravid region observed in the present study might reflect the existence of quantitative metabolic differences along strobila, which is turn possibly due to strobilla of worm, containing proglottids in different stages of development. The MDH activity of *Anonchotenia gaugi* is compared with activity of Hymenolyepis diminuta. The present investigation in the parasite *Anonchotenia gaugi* live in the anaerobic medium with very low oxygen tension as many other helminth parasites can fix carbon dioxide and high activity of SDH proves that they follow the metabolic pathway leading to succinate formation. The LDH activity showed that they have a normal glycolytic pathway. Hence, a similar conclusion could be made with regard to *Anonchotenia gaugi*. The alternative pathway help the parasite in adopting to its environment

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