A Comparative Evaluation of the Activities of LDH and SDH in the Small intestine of Pangolin anis tricuspis and Bat Eidolon helvum

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Citation

D Ofusori, A Adelakun, O Adesanya, G Ojo, K Oluyemi, K Ajeigbe, A Ajisafe. *A Comparative Evaluation of the Activities of LDH and SDH in the Small intestine of Pangolin anis tricuspis and Bat Eidolon helvum* . The Internet Journal of Veterinary Medicine. 2007 Volume 4 Number 2.

Abstract

The aim of this study was to biochemically investigate the conventional pathways of carbohydrate metabolism adopted by the small intestine of the two mammals in meeting their energy demand with reference to the varied diet, morphometric and histological differences in their intestines. Ten pangolins and ten bats were used for this investigation. The activities of succinate dehydrogenase (SDH) for the kreb citric acid cycle and lactic dehydrogenase (LDH) for the glycolytic pathway were assessed as marker enzymes for carbohydrate metabolism. The results showed that Embden Mayerhoffs pathway is actively utilized by the small intestine of bat for its metabolic processes in contrast to the Krebs citric acid cycle path way in pangolin. This present study had shown that the small intestine of the two mammals utilizes different metabolic pathways in meeting their energy demand.

INTRODUCTION

A biochemical study of the activities of some enzymes in a particular tissue provide useful information on the state of tissue under normal and diseased conditions and may also reflect some of the metabolic processes presumably occurring within the tissue at the time of the study [1].

Every living cell is known to undergo metabolic processes. This is carried out via different conventional pathways involved in the breakdown of glucose to release energy in the form of ATP which the organisms utilize for its daily activities [2]. It is therefore worth while to comparatively investigate the conventional pathways of carbohydrate metabolism the two mammals (pangolin and bat) have adopted in meeting their energy demand. This is inline with the peculiar diets of the mammals as well as different morphological and morphometric records in some parts of the gastrointestinal tract (GIT). For instance, Ofusori and Caxton-Martins [3] reported that the mucosa of the ileum of the pangolin is modified in to plicae circulares which is absent in bats. Also, Hildebrand and Goslow [4] reported that there is no colon in pangolin unlike the bat. Furthermore, the epithelial lining of the stomach of pangolin was observed to consist of stratified squamous keratinized and simple columnar epithelium in contrast to the simple columnar found in bats [3]. Pangolin and bat are both mammals with different diets and morphological adaptations [4]. Pangolins feed on insects and termites [5], [6] and commonly found in the south west zone of Nigeria. They are often used as meat because they are rich in protein [7]. Eidolon helvum are fruit eating bats [8], [9]. They were found in roosting colony at the Obafemi Awolowo University, Nigeria. Their natural posture (up-side-down) makes it a unique mammal [10], [11].

The small intestine which consisted of the duodenum, jejunum and ileum are very important in the process of digestion and gut motility [12]. The histological view revealed various modification which enables proper function.

All these differences have raised more dust as to whether the small intestine in these two mammals could be utilizing the same conventional pathways of carbohydrate metabolism in meeting their energy demand despite lots of anatomical differences they have adopted in coping with their respective diets.

MATERIALS AND METHODS

CARE OF ANIMALS

Ten Pangolin and ten bats were used for this investigation. The pangolins were procured 24 hours prior to sacrifice while bats were harvested from their roosting colonies at Obafemi Awolowo University campus, Ile-Ife, Nigeria. They were kept in the animal holdings of the department of anatomy and cell biology, Obafemi Awolowo University. They were fed with ripe bananas and water liberally. The animals were carefully accessed, screened, and confirmed to be presumably free of any pathological conditions. The care and maintenance of the animals were in conformity with the rules and guidelines of the animal right committee of the Obafemi Awolowo University, Ile ife, Nigeria.

EXCISION OF THE SMALL INTESTINE

Midline abdominal incision was performed on the animals after anesthesia with diethyl ether. The small intestine was excised and splitted into regional parts (Duodenum, Jejunum & Ileum).

BIOCHEMICAL ASSAYS

A 10% homogenates of the tissues in chilled phosphate buffer was immediately prepared with Polter-Elvhjem homogenizer. The homogenate were centrifuge (5000rmp) for 10 minutes, the supernatants were immediately stored in the freezer (-20EC) and assayed within 48 hours. The SDH activities in the tissues were determined by the method of Neufeld et al.[13]. The enzymatic activities of LDH were estimated according to the procedure of Anosike and Ejiofor [14] using a commercially available kit (Randox Lab. Ltd. UK).

STATISTICAL ANALYSIS

Values were reported as mean ± S.E.M and data were analyzed using student's t-test using the statistical software STATISTICA VERSION 5 at confidence interval $p<0.05$.

RESULTS

The results obtained in the present study showed that there is a significant increase in the activities of lactate dehydrogenase in the small intestine of Bat ($p<0.05$) as compared with that of Pangolin (Table 1). The activities of SDH on the other hand, was higher in the small intestine of Pangolin ($p<0.05$) in contrast to that of Bat (Table 2).

Figure 1

Table 1: Activities of Lactate dehydrogenase (LDH) in the small intestine of Pangolin and Bat (μmol/min/mg)

PARTS OF SMALL INTESTINE	PANGOLIN Mean	BAT Mean
Duodenum	0.256	1.304
Jejunum	0.251	1.299
Ileum	0.315	1.310

* p<0.05- Significantly different pangolin vs. bat; n=10

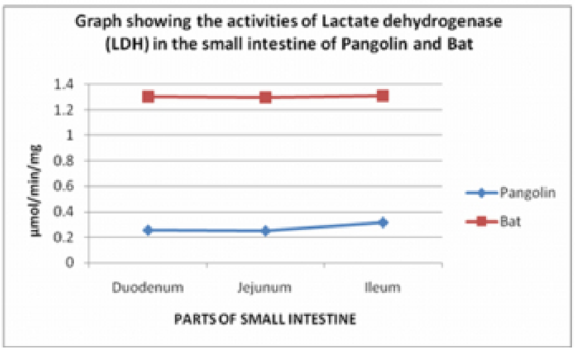
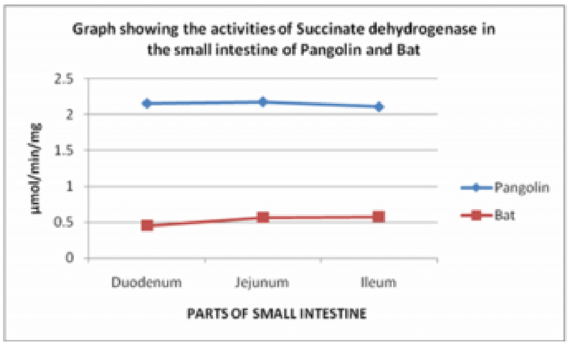


Figure 2

Table 2: Activities of Succinate dehydrogenase in the small intestine of Pangolin and Bat (μmol/min/mg)

PARTS OF SMALL INTESTINE	PANGOLIN Mean	BAT Mean
Duodenum	2.158	0.452
Jejunum	2.180	0.567
Ileum	2.110	0.578

* p<0.05- Significantly different pangolin vs. bat; n=10



DISCUSSION

The results of the present investigation revealed the various activities of SDH and LDH in the small intestine of pangolin and bat. These marker enzymes are pointer to the conventional pathways of carbohydrate metabolism adopted by the small intestine of the two mammals in meeting their energy demands. The activity of LDH is higher in Bats than Pangolin ($p<0.05$, Table 1). The enzyme converts pyruvate into lactic acid during anaerobic metabolism. Hence, its presence is indicative of late glycolysis, anaerobic lactate synthesis and ATP synthesis, thereby confirming that the Embden-Meyerhof pathway is operative in the small intestine of the bat where the activity of the enzyme is higher [2]. LDH is located in the mitochondria. The higher activity of the enzyme in the small intestine of the bat may be due to a high proportion of mitochondria needed to cope with the high energy demand of the anti-gravity peristaltic movement of the chyle which characterized the entire gut due to their natural up-side-down position. This is also prevalent in strenuous exercise when muscle tissue lacks enough oxygen. The present findings conform to the earlier report of Martins et al.[15].

Succinate dehydrogenase activity was higher in the small intestine of pangolin ($p<0.05$) in contrast to bat (Table 2). SDH is an oxidative enzyme and is involve in the Kreb cycle for the breakdown of glucose. The high activities of the enzyme in the small intestine of pangolin as compared with that of bat may be related to the greater aerobic metabolism of muscularis external during peristaltic movement. This may be related to the bulk of food which characterizes the intestinal contents [5], [16] and therefore need lots of contractility to modify the pulsatile peristaltic movement which ensure easy passage of the chyle. The lesser activity in bat could be due to low aerobic metabolism of the muscularis external during contraction. These findings and their probable implications are in agreement with Blanco et al.[17].

The results of this study provide relevant information on the conventional pathway of carbohydrate metabolism adopted by the small intestine of the two mammals in meeting their energy demand. Embem-Meyerhof pathway is actively utilized anaerobically by the small intestine of bat for its metabolic processes in contrast to that of pangolin which adopts Kreb citric acid cycle pathway.

ACKNOWLEDGEMENTS

The authors are very grateful for the technical assistance of Kola Oyewole, Oluwaseun Timothy and E. Gbela of the Obafemi Awolowo University, Ile-Ife, Osun state, Nigeria.

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