

HISTOCHEMICAL ACTIVITY OF ACID PHOSPHATASE AND ADENOSINE TRIPHOSPHATASE IN PANCREAS OF BUFFALO CALVES (*BUBALUS BUBALIS*) DURING RUMEN DEVELOPMENT

M. S. SETIA, G. S. KHATRA* AND P. N. VERMAN

Department of Veterinary Physiology, Punjab Agricultural University, Ludhina 141 001, India.

*Department of Anatomy and Histology.

ABSTRACT

The acid phosphatase activity increased slightly in alpha cells but decreased in beta cells of pancreatic islets from preruminant to ruminant stage while no such activity was seen in exocrine pancreas during this period. The adenosine triphosphatase activity remained constant in the exocrine portion of the gland whereas this enzymic activity increased uniformly both in alpha and in beta cells of endocrine part during various stages of development of rumen in buffalo calves.

INTRODUCTION

THE histochemistry of the pancreas has been described in man and a number of animals¹⁻¹⁰. The purpose of the present study was to investigate the acid phosphatase and adenosine triphosphatase enzymes histochemically in pancreas during the early postnatal period in buffalo calves in relation to the development of rumen.

MATERIALS AND METHODS

Six buffalo calves from the buffalo farm of the University, apparently healthy and showing no clinical signs of any disease, were utilized in this study. These animals were divided into three age groups according to the stage of rumen development *i.e.* preruminant (birth to three weeks), transitional (3-8 weeks) and ruminant (8-12 weeks)¹¹. These calves were maintained and fed according to standard schedule. Thin pieces of pancreas were collected immediately after sacrifice from each buffalo calf and preserved in liquid nitrogen. Cryostat sections (10 micron thick) were obtained at -20°C . The sections were stained with nuclear fast red and Mayor's haematoxylin for better localization of the enzymes. Positive and negative controls were carried out. The enzyme acid phosphatase (ACPase) was studied by simultaneous-coupling azo-dye method using Naphthol AS-TR phosphate and hexazonium pararosanilin¹² and the enzyme adenosine triphosphatase (ATPase) by lead method¹². In both the methods the incubation time was 90 minutes.

RESULTS AND DISCUSSION

The histochemical activity of ACPase and ATPase both of the endocrine and exocrine tissues in pancreas

of buffalo calves is presented in table 1. The significance of these enzymes has not been described earlier for the pancreas of buffalo with relation to age. However, keeping in view the significance of these enzymes in the intestinal absorptive cell it can safely be said that ATPase is vital for metabolic activities of alpha, beta and acinar cells of the pancreas; whereas the physiological significance of ACPase is associated with the normal turnover of cell components¹³.

The activity of ACPase increased slightly in the alpha cells whereas it was observed to be reverse in the

TABLE I

Histochemistry of pancreas in postnatal buffalo calves of different age group

	Age Group (weeks)		
	Up to 3	3-8	8-12
<i>Adenosine Triphosphatase</i>			
<i>Endocrine Tissue</i>			
Alpha cells	a	b	c
Beta cells	a	b	c
Exocrine tissue	b	b	b
<i>Acid Phosphatase</i>			
<i>Endocrine Tissue</i>			
Alpha cells	a	b	b
Beta cells	b	a	a
Exocrine tissue	d	d	d

a - present b - moderate c - strong d - absent

beta cells of the endocrine portion of the pancreas during the advancing growth from the preruminant stage to the ruminant stage in buffalo calves. This is in agreement with the presence of ACPase activity in alpha and beta cells of pancreas in adult sheep¹⁰, but differs with the findings of higher ACPase activity in beta cells compared to alpha cells in the pancreatic islets of adult cattle⁹. While no such activity was observed in the exocrine portion in buffalo calves, in agreement to similar findings in adult sheep¹⁰, these results disagree with the presence of ACPase activity noted in the exocrine pancreas of adult cattle⁹. The ACPase activity was reported to be directly related to the insulin status during the postnatal development of rat pancreas¹⁴. This lysosomal marker enzyme probably assists in decreasing the number of beta cells, thus affecting the insulin concentration with advancing age.

The reports in cattle and sheep pancreas^{9,10} showed no ATPase activity in the exocrine tissue which is in contrast to the present findings of the presence of this enzyme whose activity remained constant in the preruminant, the transitional and the ruminant stages in the buffalo calves. The activity of ATPase in the endocrine pancreas increased uniformly with age in both alpha and beta cells in buffalo calves. This is in agreement to the similar presence of this enzyme in these two types of cells in adult sheep pancreas¹⁰ which is in contrast to a strong activity in beta cells as compared to the alpha cells in cattle⁹, with the conclusion that the high enzymic activity illustrated very intense metabolic processes in beta cells. The relatively increased ATPase activity in the endocrine part indicated the more active stage of endocrine pancreas, as compared to the exocrine part in the buffalo calves, suggesting a higher turn over rate of insulin and glucagon during early postnatal stages of rumen development.

These differences in the histochemistry of the pancreatic islets of the growing buffalo calves are, in our opinion, an expression of peculiarity of this species of farm animals.

1. Bjorkman, N., Hellerstrom, C., Hellman, B. and Petterson, B., *Z. Zellforsch.*, 1966, **72**, 425.
2. Wegmann, R., Lageron, A., Guha, S. and Petkov, P., *Ann. Histochem.*, 1967, **12**, 137.
3. Gepts, W. and Toussaint, D., *Ann. Endocr. (Paris)*, 1963, **24**, 688.
4. Petkov, P., Verne, J. and Wegmann, R., *Ann. Histochem.*, 1965, **10**, 257.
5. Petkov, P., *Histochemie.*, 1967, **11**, 305.
6. Petkov, P., Galabova, R. and Gospodjnov, C., *Histochemie* 1968, **15**, 318.
7. Sotelo, O. and Wegmann, R., *Ann. Histochem.*, 1969 **9**, 35.
8. Bjorkman, N., Hellerstrom, C., Hellman, B., Peterson, B. and Rothman, U., *Z. Zellforsch.*, 1963, **59**, 535.
9. Petkov, P., Gospodinov, C. and Chrand Galabova, R., *Histochemie.*, 1970, **23**, 127.
10. Galabova, R., Gospodinov, Chr., Qgneva, V. and Petkov, P., *Ann. Histochem.*, 1971, **16**, 91.
11. Leat, W. M. F., in *Physiology of Digestion and Metabolism in the ruminant*, (ed.) A. T. Philipson, Newcastle upon Tyne, England: Oriel Press, 1970.
12. Barka, T. and Anderson, P. J., *Histochemistry theory, practice and bibliography.*, Hoeber Medical Division, Harper and Row Publisher Inc., New York, 1963.
13. Michael, E., *Vet. Review.*, 1976, **24**, 59.
14. Puri, R. B., Sahib, M. K., Kidwai, J. R. and Anjaneyulu, K., *Indian J. Exp. Biol.*, 1976, **14**, 478.

ANNOUNCEMENT

INTERNATIONAL CONFERENCE ON SPACE PHYSIOLOGY

The Centre National D'Etudes Spatiales (CNES) will organise an international conference on Space Physiology on Toulouse (France) from 1 to 4 March 1983.

Five main topics covered during the Conference are:

(1) Programme and results of the first French manned space flight; (2) Sensory-Motor Physiology; (3) Circulation and Hydro-Mineral Balance; (4) Calcified tissues, Muscles, Bone and Calcium Metabolism;

(5) Prospects. The programme for the poster session will be as follows: (2) Sensory Motor Physiology; (3) Circulation and Hydro-Mineral Balance; (4) Calcified tissues, Muscles, Bone and Calcium Metabolism. The abstracts of paper should be sent before 15th November 1982.

Further information may be had from: Centre National Detudes Spatiales, Department des Affaires Universitaires, 18 avenue Edouard Berlin—31055 Toulouse Cedex.
