

Histochemical Localization of Carbohydrates in the Mucosal Epithelium of the Alimentary Tract of the Skink *Mabuya brevicollis*

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ABSTRACT. The PAS-Positive material, mucopolysaccharides (acid and neutral), and glycogen were histochemically investigated in the different regions of the alimentary tract of the skink *Mabuya brevicollis* (oesophagus, stomach, small and large intestine). The study showed that neutral mucopolysaccharides are evident in the gastric mucosa, while the acidic mucosubstances occur in the mucus-secreting cells (goblet cells) of the oesophagus, small and large intestine. Moreover, a low glycogen content was indicated into the different regions of the alimentary tract.

Introduction

A survey to the previous literature revealed the presence of a wide gap into the histochemical studies of the alimentary tract of local reptiles. Since Taib and Jarrar^[1,2] and Taib^[3] studied the histochemistry of the alimentary tract of *Chalcides levitoni*, *Mauremys caspica*, *Chalcides ocellatus* and *Uromastix microlepis*, respectively. This fact stimulated the present authors to carry more histochemical studies on the alimentary tract of selected local reptilian species from different localities of Saudi Arabia.

The present work represents a histochemical study on the carbohydrates in the mucosal epithelium of the different regions of the alimentary tract of the skink *Mabuya brevicollis*.

Material and Methods

The material used in the present study is the alimentary tract of the skink *M. brevicollis* (Family Scincidae). The animals were collected from Wadi Fatima (23 km from Makkah) at the western region of Saudi Arabia. The laboratory animals were dissected and the different parts of the alimentary tract: oesophagus, stomach, small and large intestine, were fixed in Carnoy's fluid and subsequently processed for sectioning.

The PAS-positive materials were demonstrated following the technique of Hotchkiss^[4]. Mowry's method was applied to demonstrate the mucopolysaccharides^[5]. The glycogen was stained by the Best's carmine method^[6] and PAS-technique. The latter reaction is controlled by diastase digestion.

Results

PAS-Positive material

Oesophagus

Application of the PAS-technique on the oesophagus of *M. brevicollis* recorded that the mucus-secreting cells (goblet cells) of the mucosal epithelium were heavily loaded with positively stained material while the cytoplasm of the columnar cells displayed a very weak reactivity for the same technique (Fig. 1).



FIG. 1. T.S. in the oesophagus of *M. brevicollis* showing the PAS-positive material ($\times 330$).

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FIG. T.S. in the oesophagus of *M. brevicollis* showing the PAS-positive material ($\times 330$).

Stomach

The columnar cells of the gastric mucosa and of the gastric glands displayed a strong reaction with the PAS-procedure (Fig. 2). It was indicated that the PAS-positive material is abundantly found in the luminal portion of the gastric epithelial cells. Their middle parts displayed a moderate reaction, while the innermost parts were lightly stained.

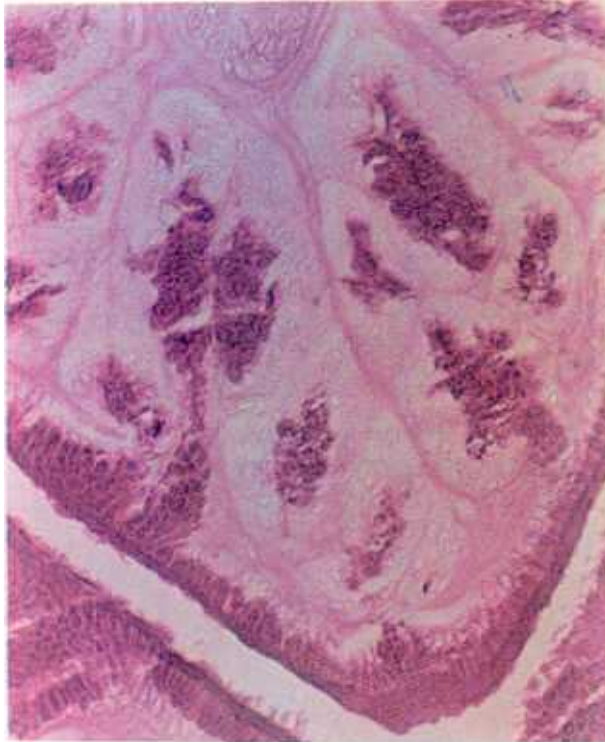


FIG. 2. T.S. in the stomach showing the PAS-positive material ($\times 330$).

Small Intestine

In the mucosal epithelium of the small intestine of *M. brevicollis*, the mucous secreting cells (goblet cells) and the luminal surface of the columnar cells show a strong positive reaction, while the rest of the cytoplasm of the columnar cells is slightly stained (Fig. 3).

Large Intestine

In the large intestine, the mucous secreting cells displayed a strong PAS-positive reactivity, while the reaction is very weak in the cytoplasm of the columnar epithelial cells (Fig. 4).



FIG. 3. T.S. in the small intestine showing the PAS-material ($\times 330$).

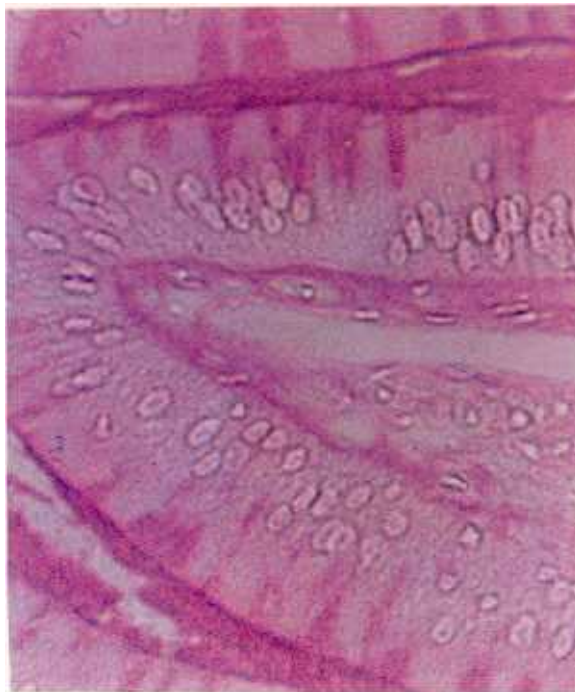


FIG. 4. T.S. in the large intestine showing the PAS-positive material ($\times 330$).

Mucopolysaccharides
Oesophagus

The Alcian blue PAS method showed that the mucous secreting cells of the oesophageal mucosa contain intense amount of acid mucopolysaccharides, while the cytoplasm of its columnar cells contains few traces of neutral mucopolysaccharides (Fig. 5).

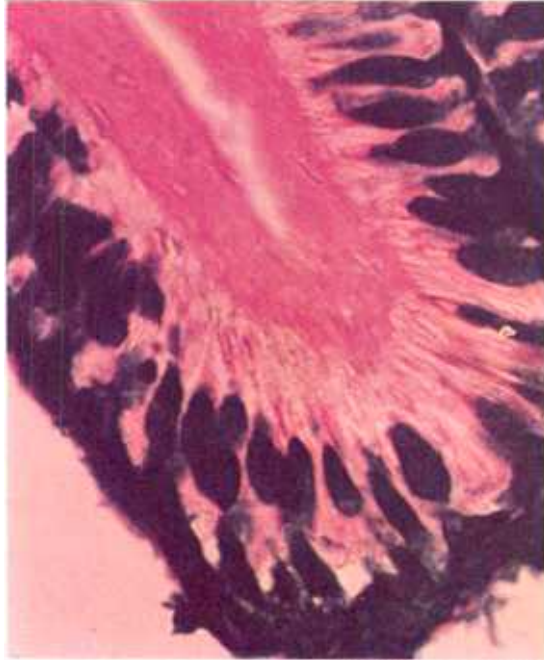


FIG. 5. T.S. in the oesophagus showing the distribution of mucopolysaccharides ($\times 330$)

Stomach

Neutral mucopolysaccharides were found in abundant in the luminal portions of the gastric mucosal cells, in the bodies of the gastric glands and also was found adhered on the luminal surface (Fig. 6).

Small Intestine

A considerable amount of acid mucopolysaccharides was found filling the goblet cells while the acid and neutral mucosubstances were found adhering on the luminal surface of the columnar mucosal cells. Their cytoplasm contains few traces of neutral mucopolysaccharides. (Fig. 7).



FIG. 6. T.S. in the stomach showing the distribution of mucopolysaccharides ($\times 330$).

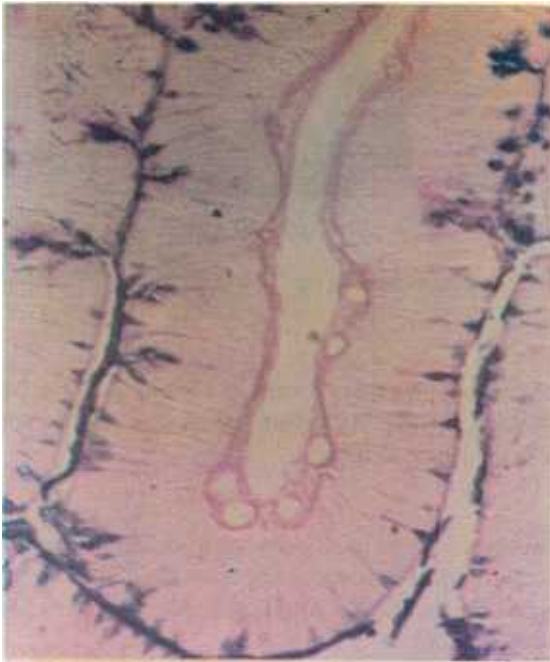


FIG. 7. Acid and neutral mucopolysaccharides in the small intestine ($\times 330$).

Large Intestine

In the large intestine a considerable amount of acid mucopolysaccharides was detectable in the mucous secreting cells (goblet cells) while the cytoplasm of the mucosal columnar cells displayed a weak neutral mucopolysaccharides reactivity (Fig. 8).



FIG. 8. T.S. in the large intestine showing the distribution of mucopolysaccharides ($\times 330$).

Glycogen

On treatment with diastase, a certain amount of PAS-material was removed from the different investigated regions of the tract. This means the presence of glycogen which is confirmed with Best's carmine. It gives a faint red colour, *i.e.*, a low glycogen content. (Fig. 9,10,11 and 12).



FIG. 9. T.S. in the oesophagus showing the glycogen content ($\times 330$)



FIG. 10. T.S. in the stomach showing the glycogen content ($\times 330$).

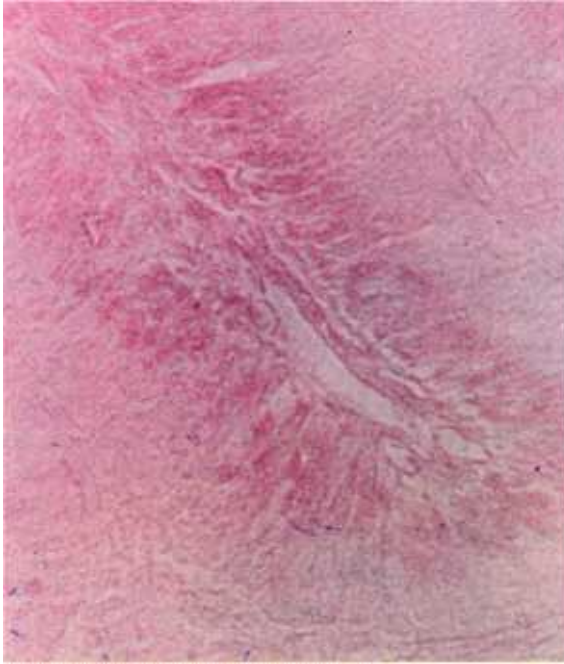


FIG. 11. T.S. in the small intestine showing the glycogen content ($\times 330$).

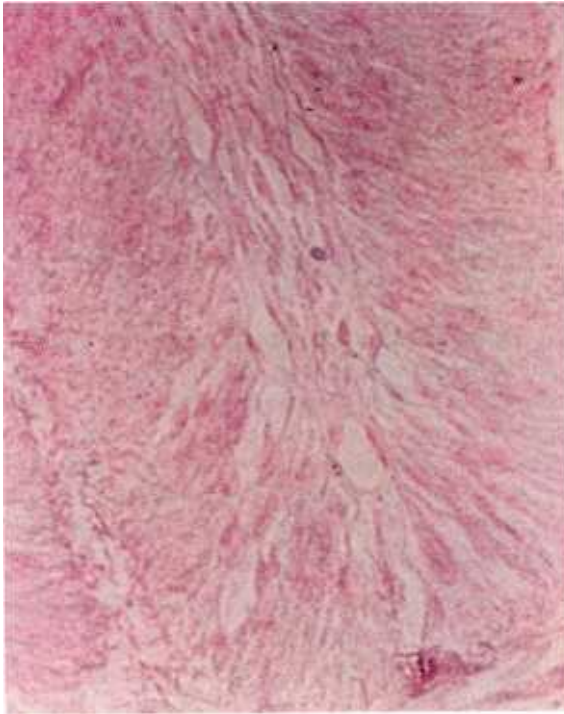


FIG. 12. T.S. in the large intestine showing the glycogen content ($\times 330$).

Discussion

The present study revealed the existence of an exaggerated amount of carbohydrates into the mucosal epithelium of the different investigated regions of the alimentary tract. Since the present work recorded the presence of acid mucopolysaccharides into the mucous secreting cells (goblet cells) of the oesophagus, small and large intestine, while in the stomach neutral mucopolysaccharides were demonstrated. These observations were in agreement with the results obtained by Sukanuma *et al.*^[7] on the reptilian species, the skink *Eumeces latistatus*, the turtle *Clemmys japonica*, and the snake *Elapha climacophora*; by Taib and Jarrar^[1] on the skink *Chalcides levitoni* and Taib^[3] on the terrepian *M. caspica*, and by Dehlawi and Zaher^[8] on the lizard *Acanthodactylus boskianus*. Moreover, the distribution of the mucopolysaccharides was slightly different, but in general agreement with some other vertebrate species such as most hamster, cat, bison, mule deer and baboon^[9]. This could conclude that the pattern of mucosubstance distribution throughout the entire alimentary tract is not correlated with the different orders of vertebrate species and appeared to be unrelated to diet.

The above mentioned observations were found to be in a disagreement with the findings of Mousa *et al.*^[10]. They stated that the lizard stomach gave a strong reaction for Alcian blue and the gastric glands of this lizard may be the source of acid mucopolysaccharides.

In the present study, the bulk secretion of the mucous secreting cells to acid mucopolysaccharides is a considerable adaptation for the oesophagus to perform its function, since it facilitates swallowing of prey and its transport to the stomach to be digested. Moreover, the presence of a large number of mucous secreting cells with their mucosubstance secretion compensates the absence of mucous glands in the oesophagus of *M. brevicollis*. Since in the mucosal epithelium of the different regions of the alimentary tract of skinks *E. latistatus*^[7], *C. levitoni*^[1] and as was obtained in case of *M. brevicollis*, there is a bulk secretion of acid mucosubstances through the mucous secreting cells, thus such a feature might be considered as a common character for family Scincidae.

In *M. brevicollis*, the histochemical reaction revealed the presence of numerous active secretory goblet cells in ileum than in rectum. But the reverse was observed in two Egyptian lizards *Mabuya quinquetaeniata* and *Chalcides ocellatus*^[11], where the rectum contains numerous active secretory cells as compared with the ileum. According to their protective and lubricant properties the authors agree with the opinion of Taib^[3] who postulated that acid mucosubstances may play some protective role against gastric reflux and aid in fecal discharge. While Mousa *et al.*^[10] supposed that these substances may carry lubricant and supportive function.

The presence of low glycogen content into the different investigated regions of the alimentary tract of *M. brevicollis* is an expected observation, since it does not store there, but it is used as a source of energy. This fact supports the findings of Anwar and Mahmoud^[11] and Mousa *et al.*^[10].

Acknowledgement

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دراسة هستوكيميائية للمواد الكربوهيدراتية في مخاطية المناطق المختلفة للقناة الهضمية
للمبويأ برفيكولس

غازي دهلوي و مصطفى زاهر

قسم الأحياء ، كلية العلوم التطبيقية ، جامعة أم القرى ، مكة المكرمة ، المملكة العربية السعودية
وقسم الأحياء ، كلية العلوم ، جامعة القاهرة ، مصر

عينت المواد ذات التفاعل الإيجابي مع معامل شيف ، وهديدات السكاكر المخاطية ،
والجليكوجين في طلائية المناطق المختلفة للقناة الهضمية لسحلية المبويأ برفيكولس (المريء
- المعدة - الأمعاء الدقيقة - والأمعاء الغليظة) .

ولقد أظهرت الدراسة ، أن عديدات السكاكر المخاطية ، المتعادلة إنها توجد في الخلايا
الكأسية لكل من المريء والأمعاء الدقيقة والأمعاء الغليظة . زيادة على ذلك فقد وجدت
نسبة منخفضة من الجليكوجين في الطلائية المخاطية للمناطق المختلفة للقناة الهضمية .