
SUMMARY
AND
CONCLUDING REMARKS

SUMMARY

The critical evaluation of the existing literature shows that the mucosubstances have been studied in the alimentary tract of some vertebrates. However, only the mammals and very few lower vertebrates have been considered for this purpose. Reptiles are the most neglected animals for such studies, particularly the chameleons have not been considered previously. An insight into the existing literature also pointed out that for the studies on mucosubstances in the alimentary tract, some authors have selected one region of the alimentary tract of a given reptilian species, others have selected altogether a different region of the different reptilian species. No one has studied histochemically all the parts of alimentary canal in one and the same reptilian animal simultaneously. Therefore, there exists scanty literature on histology and histochemistry of mucosubstances in the reptilian alimentary tract.

Some of the earlier workers have worked out the histology and histochemistry of mucosubstances in some organs of alimentary tract of reptiles. They reported the four typical layers in all the regions in the wall of the reptilian alimentary tract. However, there is no common agreement for the type of mucosal epithelial cells, goblet cells and glands and the nature of mucosubstances in particular histological site of a particular region of alimentary tract. Some

investigators have reported the presence of PAS reactive mucins or acidic mucins or acidic mucoproteins in a cellular site in the region of the alimentary tract of the animals investigated. The nature of mucosubstances was not identified further, whether they are sulfomucins or sialomucins or hyaluronic acid and so on. The histology of different regions of alimentary tract and histochemistry of mucosubstances in these regions in C. zeylanicus have not been studied except for stomach. Therefore, C. zeylanicus was selected for the present investigation.

The following is a brief summary of the histological sites in different regions of alimentary tract and the mucosubstances present in various histological sites in the different regions of the alimentary tract of the chameleon investigated.

Region	Layer	Histological site	Type and quantity of mucosubstances
Oesophagus	Mucosa	Ciliated epithelial cells	Neutral mucosubstances (moderate), Sulfomucins (trace) and Sialomucins (trace)
		Goblet cells	Neutral mucosubstances (poor to weak) and Atypical sulfomucins (poor to weak)
		Glands	Neutral mucosubstances (poor to weak) and Atypical sulfomucins (poor to weak).

Region	Layer	Histological site	Type and quantity of mucosubstances
	Submucosa	Connective tissue	Neutral mucosubstances (poor to weak) and Sulfomucins (trace)
	Muscularis	Muscles	Neutral mucosubstances (poor to weak) and Sulfomucins and Glycogen (trace)
	Serosa	-	Neutral mucosubstance (poor to weak) and Sulfomucins (trace)
Cardiac stomach	Mucosa	Epithelial cells	Neutral mucosubstances (intense)
		Glands :- Mucous neck cells	Neutral mucosubstances (poor to intense)
	Oxyntic cells	-	
	Submucosa	Connective tissue	Neutral mucosubstances (poor)
	Muscularis	Muscles	Neutral mucosubstances (poor to weak) and Glycogen.
Serosa	-	Neutral mucosubstances (poor to weak)	
Pyloric stomach	Mucosa	Ciliated cells	Neutral mucosubstances (moderate) and Sialomucins (moderate)
		Goblet cells	Sulfomucins (moderate)
		Glands-Type I	Neutral mucosubstances (intense)

Region	Layer	Histological site	Type and quantity of mucosubstances
		Glands-Type II	Sulfomucins (intense)
		Glands- Type III Cells- Type I	Neutral mucosubstances (intense)
		Cells- Type II	Sulfomucins (intense)
	Submucosa	Connective tissue	Neutral mucosubstances (trace) and Sulfomucins (trace)
	Muscularis	Muscles	Neutral mucosubstances (trace), Sulfomucins (trace) and Glycogen
	Serosa	-	Neutral mucosubstances (trace) and Sulfomucins (trace)
Duodenum	Mucosa	Columnar epithelial cells	Neutral mucosubstances (trace) and Sulfomucins (trace)
		Goblet cells:- - G ₁ - G ₂ - G ₃	Neutral mucosubstnaces (moderate)
			Sulfomucins (moderate)
	Neutral mucosubstances (poor) and Sulfomucins (weak)		
Submucosa	Connective tissue	Neutral mucosubstances (trace) and Sulfomucins (trace)	

Region	Layer	Histological site	Type and quantity of mucosubstances
	Muscularis	Muscles	Neutral mucosubstances (trace), Sulfomucins (trace) and Glycogen
	Serosa	-	Neutral mucosubstances (trace) and Sulfomucins (trace)
Ileum	Mucosa	Columnar epithelial cells	Neutral mucosubstances (poor) and Sulfomucins (trace)
		Goblet cells- - G ₁ - G ₂	Neutral mucosubstances (moderate) Sulfomucins (moderate)
	Submucosa	Connective tissue	Neutral mucosubstances (poor)
	Muscularis	Muscles	Neutral mucosubstances (poor to weak) and Glycogen.
	Serosa	-	Neutral mucosubstances (poor)
	Colon	Mucosa	Columnar epithelial cells
Goblet cells - - G ₁ - G ₂			Neutral mucosubstances (moderate) Sulfomucins (moderate)

Region	Layer	Histological site	Type and quantity of mucosubstances
		Glands - Cells -Type I	Neutral mucosubstances (moderate)
		Cells - Type II	Sulfomucins (moderate)
	Submucosa	Connective tissue	Neutral mucosubstances (poor to weak)
	Muscularis	Muscles	Neutral mucosubstances (poor to weak) and Glycogen
	Serosa	-	Neutral mucosubstances (poor to weak)
Rectum	Mucosa	Columnar epithelial cells	Neutral mucosubstances (poor) and Sulfomucins (poor)
		Goblet cells	Sulfomucins (moderate)
	Submucosa	Connective tissue	Neutral mucosubstances(pocr)
	Muscularis	Muscles	Neutral mucosubstances(pocr), Sulfomucins (poor) and Glycogen
	Serosa	-	Neutral mucosubstances (poor)

Thus, the neutral mucosubstances occur predominantly at the various histological sites in the different regions of alimentary tract of chamaeleon. Along with neutral mucosubstances sulfomucins also occur in some goblet cells, of duodenum, while some goblet cells secrete only sulfomucins. Atypical sulfomucins only occur in the goblet cells and glands of oesophagus.

Both the histological and histochemical observations revealed the absence of sexual dimorphism in alimentary tract of the chamaeleon.

CONCLUDING REMARKS

The present investigation entitled, "Histochemical studies on mucosubstances in the alimentary tract of C. zeylanicus" was undertaken to study the histological architecture of the various regions of the alimentary tract, sexual dimorphism, if any; histochemical reactivities of mucosubstances and the distribution of mucosubstances in the various histological sites and to compare the results obtained in the present investigation with that of existing literature. Following are the points of conclusion obtained at the end of the present investigation.

- 1) All the regions of alimentary tract of chamaeleon under present investigation consist of four typical layers; mucosa, submucosa, muscularis and serosa. The thickness of these layers varies in different regions. The mucosa is folded and lined with columnar epithelial cells in all regions and

interspersed with goblet cells in all regions except the cardiac stomach. The oesophagus, stomach and only intestine shows presence of glands. The submucosa consists of connective tissue. The muscularis shows presence of circular and longitudinal muscles while the serosa is thin and also shows presence of connective tissue.

- 2) The present investigation reveals no sexual dimorphism in alimentary canal of chamaeleon.
- 3) Histochemically neutral mucosubstances occur predominantly in various histological sites in all regions. Along with neutral mucosubstances sulfomucins also occur in some histological sites of some regions e.g. oesophagus- all histological sites except goblet cells and glands; pyloric stomach - submucosa, muscularis and serosa; duodenum - epithelial cells, G₃ type goblet cells, submucosa, muscularis and serosa; ileum - only epithelial cells; colon- epithelial cells and rectum- epithelial cells and muscularis. Some goblet cells secrete neutral mucosubstances while some secrete sulfomucins wherever they present. Glands secrete sulfomucins or neutral mucins. Oesophageal glands and goblet cells show the presence of atypical sulfomucins.
- 4) When the results obtained in the present investigation are compared with the existing literature on reptilian alimentary canal, it is found that the different regions of alimentary canal of chamaeleon show identical histological structure as

described earlier for other reptiles by previous authors with some variations. Similarly, histochemical results obtained in the present investigation matched with the results of the earlier workers in other reptilian species, with few exceptions regarding the type and quantity of mucosubstances.

Thus, it is hoped that the aims and objectives of the present investigations have satisfactorily been achieved.

While concluding the present dissertation however, the author would like to humbly state that the present investigation is by no means complete. The studies on quantitation of mucosubstances in the various regions of the alimentary tract would have supplemented the results. Though the bioassay studies gives a reliable information on quantities of the chemical substances in exact mathematical terms, they are not of much use to state the cellular origin of the given chemical substances. In this regard, the histochemical studies provide the information on cellular origin of the given chemical substance.

Therefore, recommended and well established histochemical methods were employed. The author is aware of his shortcomings. He has to depend entirely upon visually estimated intensities of staining to express the relative amount of mucosubstances. The studies on alimentary tract in reptiles can further be extended to find out their quantities by employing the biochemical methods and some of them such as sulfomucins should further be analysed for their exact

nature. By taking the animal as many as possible the alimentary tract mucosubstances should be studied to find out their relationship with feeding habits of animals, their functions in digestive physiology, phylogenic variations and sex dimorphism, if any, etc. However, the use of recent techniques such as autoradiography, immunohistochemical techniques and electron microscopy would have provided some additional informations and confirmed the results obtained in the present investigation with histochemical techniques.

Even with all these shortcomings and with available instruments as mentioned earlier, the author feels gratified that at least he has provided some preliminary data on mucosubstances in the alimentary tract of chamaeleon. There is unlimited scope for further researches on alimentary tract mucosubstances and their functional significance in the vertebrates.
