

## SOME COMPARATIVE HISTOLOGICAL STUDIES ON ALIMENTARY TRACT OF TILAPIA FISH (*TILAPIA SPILURUS*) AND SEA BREAM (*MYLIO CUVIERI*)

HEYAM ABDULLAH AL ABDULHADI

*Faculty of Science in Dammam in Saudi Arabia*

**Key word:** *Histology, Alimentary tract, Tilapia and sea bream.*

### ABSTRACT

The present work was carried out on ten mature Tilapia (*Tilapia spilurus*) and ten mature Bream fish (*Mylio cuvieri*) and the specimens were processed for histological studies.

The oesophagus of Bream fish is characterized by the presence of numerous mucous cells which react positively to P.A.S. and alcian blue.

While oesophagus of Tilapia is completely filled with mucous cells that react positively to P.A.S. only.

The stomach of Bream consists of one part while that of Tilapia consists of two parts (cardiac and pyloric). The mucosa of stomach of both types of fish reacted positively to P.A.S. the pyloric caeci of Bream fish showed numerous mucous cells that react positively to Alcian blue.

The small intestine of bream has thicker tunica muscularis than that of same layer in small intestine of Tilapia.

### INTRODUCTION

The digestive apparatus of fishes show marked diversity in its morphology and function. This is related to both the taxonomy and different feeding habits, as well as to body shape. The gross anatomy and histology of the alimentary tract of fish have been well documented Smith (1989) and Domeneghin *et al* (1998).

The histological structure of alimentary tract of four types of fishes differ in their habitat, the oesophagus of *tylosurus choram* (Carnivorous fish) and *therapon Jarbua* (Omnivorous fish) contain numerous mucous cells while its number decreases in *siganus rivulatus* (herbivorous fish) and *Rastelliger kanagurat* (piscivorous). Abuzinadah, (1990).

Groman, (1982) stated that cardiac stomach had a thicker tunica mucosa than the other parts of digestive tract and added that the cardiac stomach is formed from

epithelium, serous cardiac glands, lamina propria, granulosa layer and compactum and tunica muscularis.

The gut glycoconjugates are extensively studied in mammals where they are known to exert variety of functions, from those merely mechanical, through antimicrobial and anti-viral, to (osmotic) ones, in that they may link and transport different ions Allen, (1981)

The purpose of this study is to describe the histological and histochemical features of digestive tract of two important fishes of high importance in aquaculture especially the sea-bream fish which is euryhalin fish and carnivorous (bottom feeder) and Tilapia which is a fresh water fish, and herbivorous.

### MATERIAL AND METHODS

Ten mature Tilapia fish (*Tilapia spilurus*) were caught from fish farms in

Dammam City and ten mature Bream fish (*Mylio cuvieri*) were caught and collected from Arabian Gulf at Dammam City.

The alimentary tract of both fishes including oesophagus, stomach and intestine were investigated using normal histological methods.

Fixation of the samples was in 10% natural formalin, then the specimens were processed in ascending grades of alcohol. And impregnated in paraffin and cut with microtome at 5-7 $\mu$ .

The specimens were stained by the following stains:

- 1) Haematoxylin & eosin Harris, (1900) for normal histological structure.
- 2) Masson trichrome stain Sheehan & Harp ekek, (1980) for detection of connective tissue fibers and muscle.
- 3) Combined Alcian blue P.a.S. Mowry, (1956) for detection of neutral and mucopoly – saccharides.

## RESULTS

The oesophagus of *Mylio cuvieri* is found to have numerous folds lined by stratified epithelium which contains numerous mucous cells followed by lamina propria filled with collagen fibers. Fig. (1).

The tunica muscularis in the bream oesophagus is relatively thick, and consists of bundles of longitudinal smooth muscles layer Fig. (2). The covering epithelium of oesophagus is filled – with mucous cells the majority of it reacted positively to alcian blue while few number of them reacted positively to P.A.S., Fig. (3).

At the junction between oesophagus and stomach the folds become short and blunt and the bundles of the smooth muscles extend in the lamina propria and is surrounded by numerous collagen fibers Fig. (4).

The stomach of bream is characterized by mucosa which is formed by numerous tapered fold covered by simple columnar epithelium, the mucosa forms numerous pits open at the bottom of tubular glands, Fig. (5).

The sub mucosa is a wide layer composed of loose connective tissue which contains numerous collagenic fibers in the superficial layer and few smooth muscle. The submucosa is followed tunica muscularis which consists of smooth muscle layer arranged circularly, Fig. (6).

The covering epithelium of stomach reacted positively to P.A.S., Fig. (7).

The mucosa of small intestine of *Mylio cuvieri* is thrown into numerous folds covered by columnar cells which contain numerous goblet cells in between Fig (8). The submucosa layer is a thick layer containing numerous blood vessels engorged with blood, followed by thick tunica muscularis Fig. (9). The caecae of *Mylio cuvieri* show elongated fold lined with columnar cells and numerous mucous cells which react positively to alcian blue, Fig (10).

The terminal part of intestine is characterized by thick tunica muscularis which contains numerous bundles of pancreatic acini in between muscles Fig. (11).

The oesophagus of *Tilapia spilurus* is characterized by numerous muscularis folds which are lined by stratified epithelium filled with mucous cells, wide submucosa and tunica muscularis that is less in thickness than that of bream fish, Fig (12). The oesophagus of *Tilapia* differs from that of bream in that the mucous cells in *Tilapia* were more numerous and all the cells reacted positively to P.A.S. Fig. (13).

The stomach of *Tilapia* is formed from cardiac and pyloric stomach. The cardiac stomach is characterized by wide fold covered with columnar cells, in between them alveolar glands opened at the bottom of gastric pits which reacted positively with P.A.S., (14, 16).

The lamina propria contains tubular glands followed by submucosa and narrow tunica muscularis, Fig. (14). The cardiac stomach of *Tilapia* showed wide submucosa with thick bundles of collagen fibers beneath the smooth muscles and outer serosa, Fig. (15).

The pyloric stomach in *Tilapia* is characterized by the absence of tubular glands and alveolar gland (gastric glands) which were present in cardiac stomach only. Also the core of folds in pyloric stomach is characterized by presence of numerous eosinophils in connective tissue core of folds, Fig. (17). The epithelium of pyloric stomach reacts positively to P.A.S., Fig. (18).

At the junction of stomach with the intestine there were an increase in the number of mucous cells which react positively with P.A.S., Fig. (19). Also the tunica muscularis at the previous junction appears as scattered longitudinal bundles in between the collagen fibers, Fig. (20).

The first part of intestine of *Tilapia* is characterized by mucosal folds which appears swollen and bulging towards the lumen that contains numerous mucous cells which reacts positively to P.A.S. Fig. (21).

The small intestine of *Tilapia* is characterized by narrow tunica muscularis arranged circularly and wide serosa, Fig. (22).

## DISCUSSION

The oesophagus of different teleost fish like those of most vertebrates, function in transporting food particles, so it is provided with cells that secrete mucous and stratified squamous epithelium. However, the complex morphology and histochemistry of oesophagus may indicate additional functions Mugallid, (1989).

The present study revealed that the oesophagus of *Mylio cuvieri* exhibit a diversity of morphologically and histochemically recognizable type of mucous cells, where it showed more tortuous folds and two types of tortuous mucous cells. The superficial mucous react positively to P.A.S. indicating that their contents are of neutral muco- polysacchrides and the other types (more numerous) react positively to alcian blue indicating their content of acidic mucopolysaccharides. These results are in accordance with Reidel & Travill, (1977) and Domeneghini *et al.* (1998) who explained

these variations of reactions to be due to stages of maturation and age.

The present work shows that the nature of the *Mylio cuvieri*. Is the reason of the increase of mucous cells to help the rapid passage of food, The stratified epithelium protects the oesophagus from injuries during the passage of solid porticles in oesophagus.

The oesophagus of *Tilapia* has less folds and all the mucous cells in its mucosa reacted positively to P.A.S. due to its contents of neutral mucco polysaccharides which is in accordance with Reidel & Trairl, (1977). Who stated that Teleost fish contain different types of mucous cells which produce two types or more of carbohydrates and explains this to be according to different stages of maturation.

Concerning the tunica muscularis it appears more thicker in *Mylio cuvieri* than in *Tilapia spilurus* this strengthens the wall of oesophagus and protect it from being engored during swallowing soild materials, Domenehini, *et al.*, (1998).

The present results revealed that the mucosa of stomach of *Mylio cuvieri* reacts positively to P.A.S. and the glands were developed in comparison with the tubular glands in the stomach of *Tilapia* which reacted also positively to P.A.S. these results are in accordance with Abo- Zinadah, (1990) and Al- ghandi (1998). The last author added that the cellular inclusions of lining epithelium of the stomach was neutral mucopolysccharids and this may be related to absorption of lipids which takes place in the stomach of teleost fish Buddington & Doroshov, (1986). They are similar to herbivorous fish in that the glands were undeveloped and sometimes absent.

The well developed tubular glands which appears in cardiac stomach of *Tilapia* (herbivorous) in the present study is in accordance with Salem (1991) in her study on *Siganus* fish (herbivorous fish).

According to the present study, the intestine of bream fish contains numerous goblet cells in the mucosa which reacts positively to alcian blue indicating its content

of acid mucopolysaccharides while that in Tilapias intestine gave positive reaction to P.A.S. (neutral mucopolysaccharides) these results depend on the degree of maturation of goblet cells.

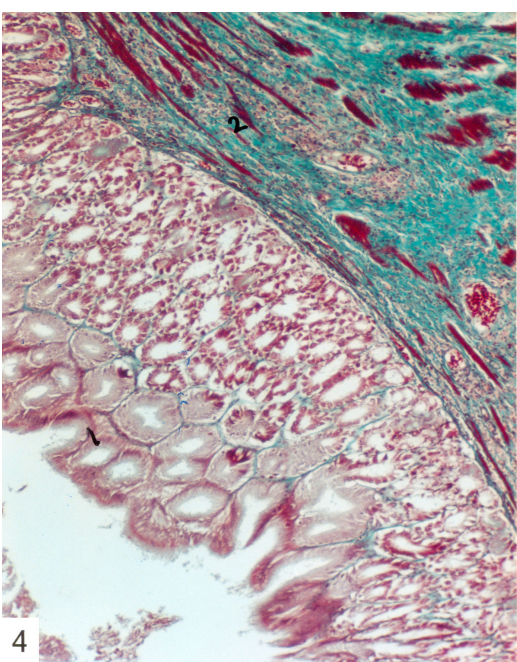
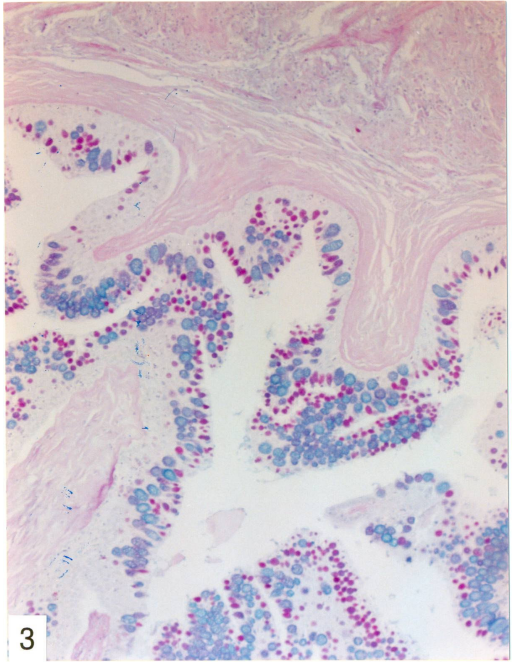
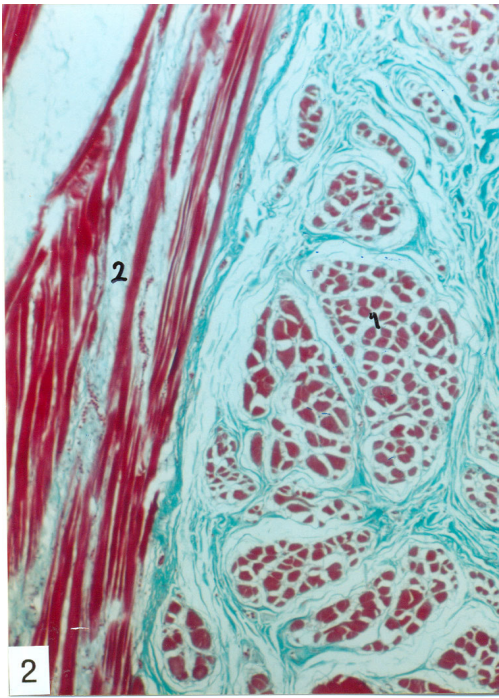
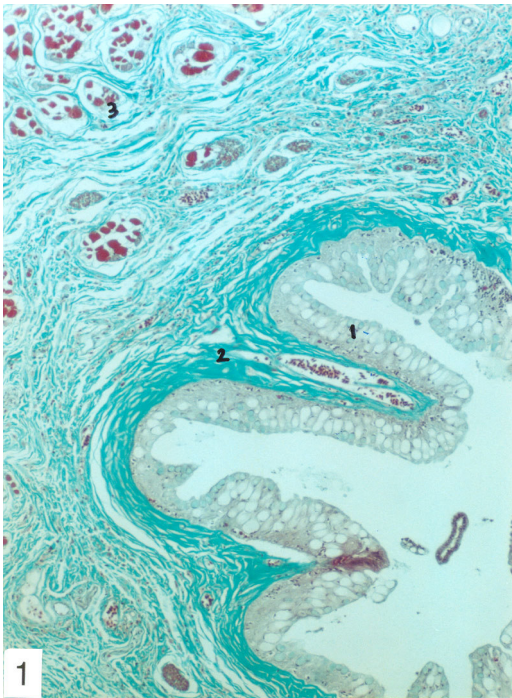
The presence of caecae in bream fish and absence of it in Tilapias is not related and affected by nature of habitat. Hoar, et al., (1979) and Ismail, (1994).

Numerous goblet cells in the mucosa of digestive tract of both species were detected in the present study Abu – Zinadah, (1990) mentioned the ability of this epithelium in synthesizing a mixture of neutral and acid glycoconjugates especially sulphated form. The variation in these secretions possibly are caused by changes in environmental conditions that may in turn sustain functional alterations of the digestive apparatus Domeneghini *et al.* (1998).

#### REFERENCES

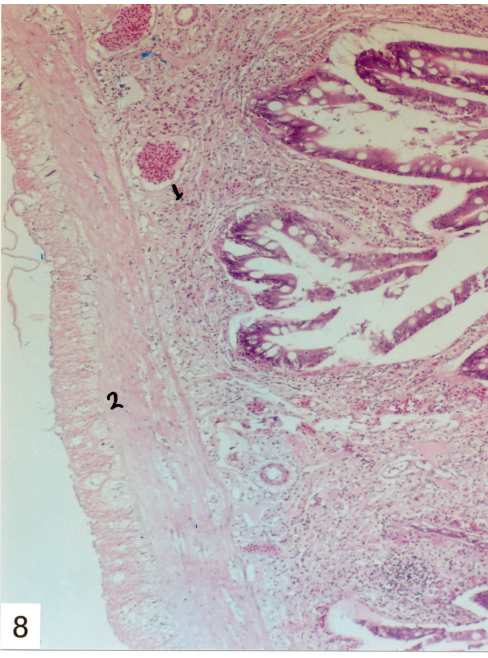
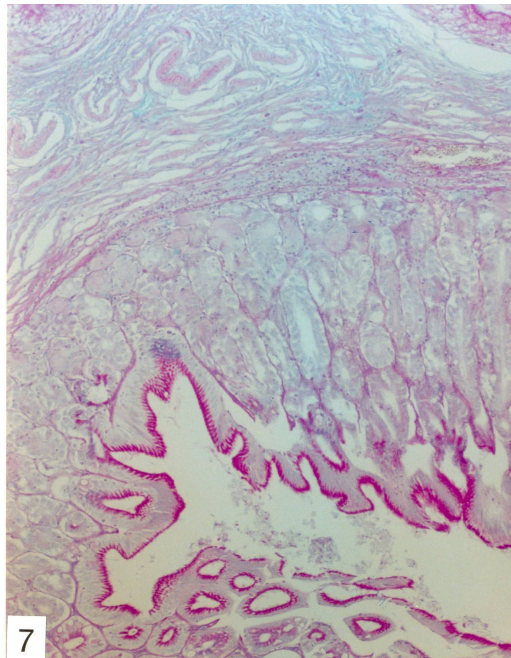
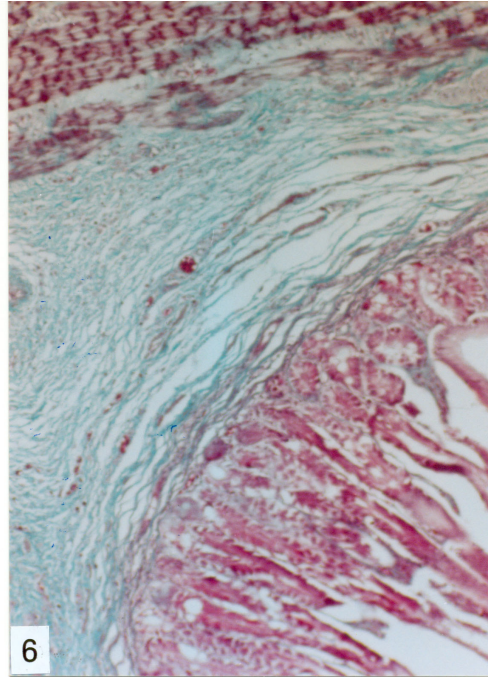
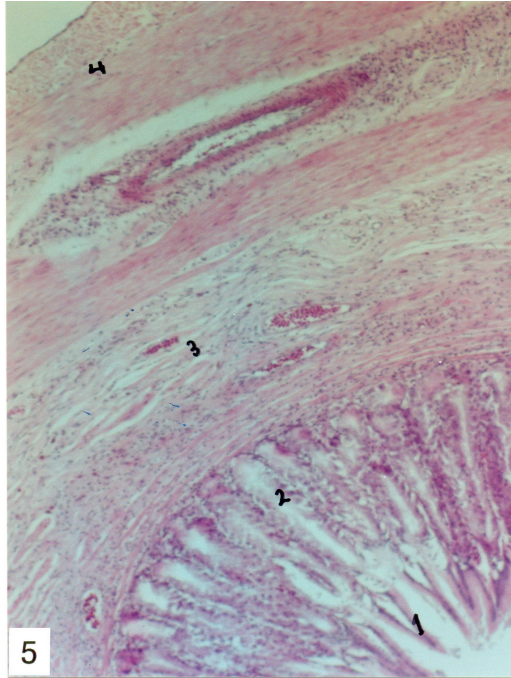
- 1- Abu- Zinadah, O.A. (1990): Studies on Red Seafish Ph.D.Dep. Zoology School of Biological Science. University Coolege of Swan Sea.
- 2- Al-Ghamdi, Z.H. (1998): Morphological and anatomical studies on the alimentary canal of sigan groupers fish in Arabian Gulf. M.Sc. dept. of Zoology- Faculty of Science Dammam. Saudi Arabia.
- 3- Allen, A. (1981): Structure and function of gastrointestinal mucus. In: Physiology of the gastrointestinal tract. Johnson L.R. (ed). Raven Press. New York., pp. 617-639.
- 4- Buddington, R.K. and Doroshov, S.L. (1986): Structural and functional relations of white sturgeon alimentary canal (*Acipenser transmontanus*) J. of Morph. 190: 201-213.
- 5- Domeneghini, C., Ponnelli, S.R. and Veggetti, A. (1998): Gut Glycoconjugates in spasm ovratal (Pisces, Teleostei). Comparative histochemical study in larval and adult ages Histol Histopathol. 13(2):359-372
- 6- Groman, D.B. (1982): Histology of the bass. American fisheries society. Bethesda, Maryland U.S. (Striped): 21-30
- 7- Harris, H.F. (1990): On the rapid Conversion of Haematoxylin into haernation in staining reactions. J. Applied Microscopic Laboratory Methods, 3:777.
- 8- Hoar. W.S. Randall, D.J. and Brtt, J.R. (1979): Fish Physiology Academic. Press, Ine Vol. VIII., 161-260.
- 9- Ismail, S.V.M (1994): Histological and cytological studies on the Gastrointestinal tract of some Nile fish species with special references to ages variations. Ph.D. Thesis Faculty of Vet. Med Zagazig Univ. Egypt.
- 10- Mowery, R.w. (1956): Observation on the use of sulphuric acid for the sulphation of hydrdroxyl groups in tissue sections. J. Histochem. Cytochem., 4:407
- 11- Mujallid, M.S. (1989): Anatomical studies on the fresh – water fish, *Barbus arabius* from Saudi Arabia. M.Sc. Thesis Faculty Science. K.A.U. Jeddah, Saudi Arabia.
- 12- Reifel, G.W. and Travill, A.A., (1978): Structure and carbohydrates histochemistry of stomach in eight species of teleosts. J. Morph. 158: 155-168.
- 13- Salem, H.F.A. (1991): Comparative morphological studies on oesophagus and stomach of catfish, Tilapia and Mugil fishes. Egypt. J. Sci., 6(5): 95-106.
- 14- Sheehen, D.C. and B.B. Hrapchak (1980): Theory and Practice of Histotechnology, eds. Columbus, Dhio, Battelle Press.
- 15- Smith, L.S. (1989): Digestive function in teleost fishes in: Fish nutrition 2<sup>nd</sup> ed. Halver J.E. (ed). Academic Press. London PP.331-341



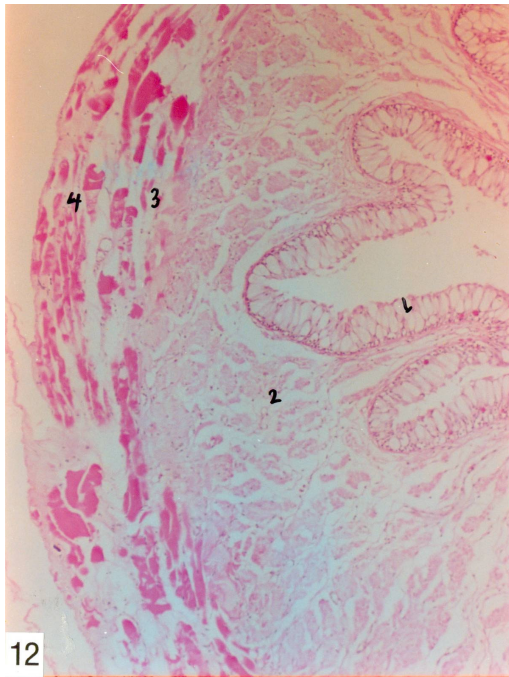
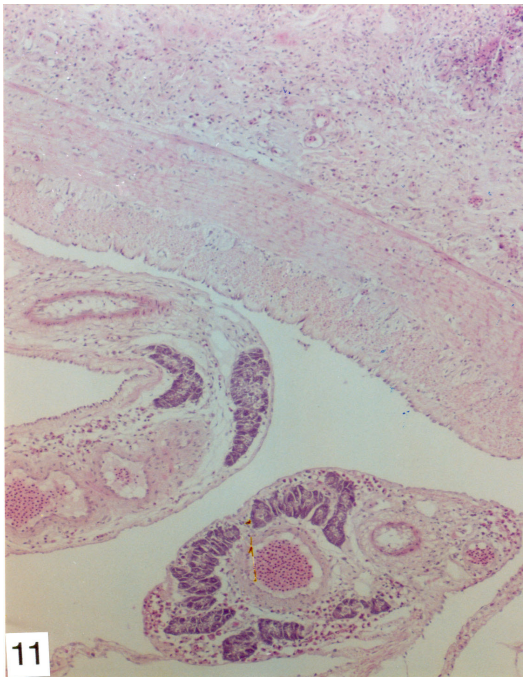
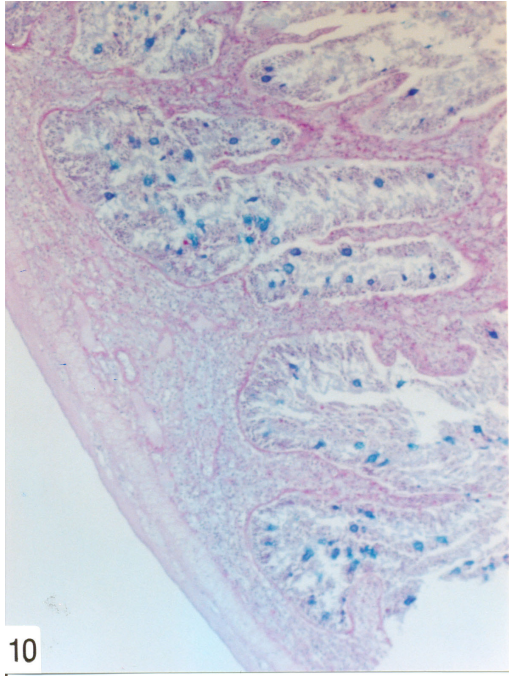
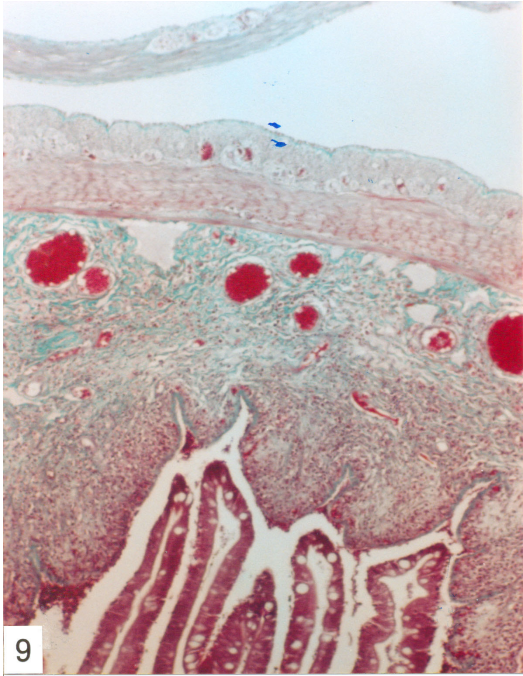




SOME COMPARATIVE HISTOLOGICAL STUDIES ON ALIMENTARY TRACT OF TILAPIA FISH (*TILAPIA SPILURUS*) AND SEA BREAM (*MYLIO CUVIERI*)

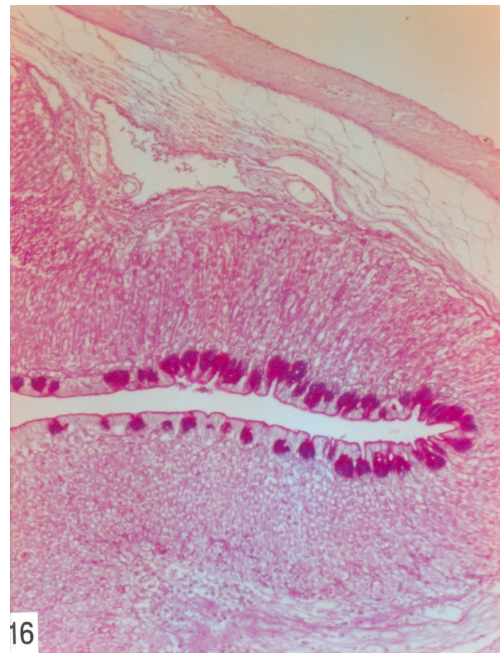
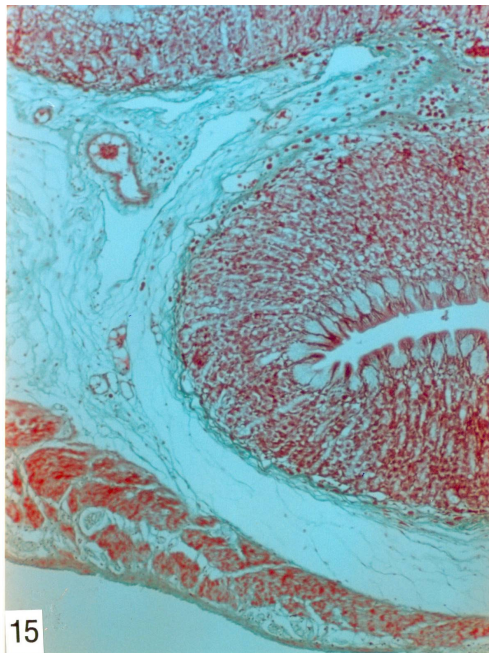
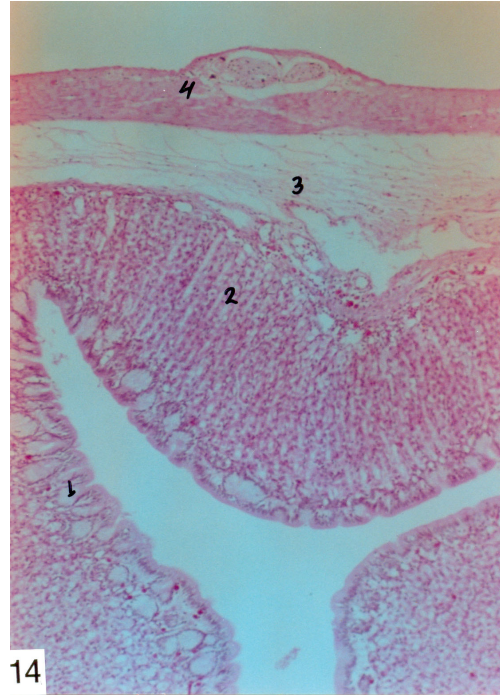
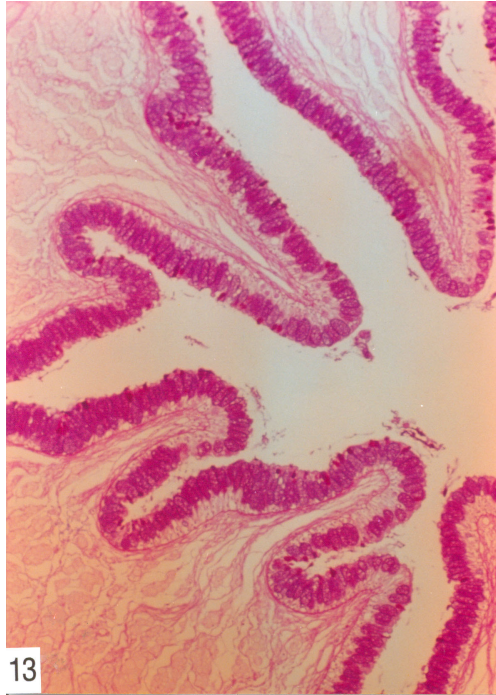




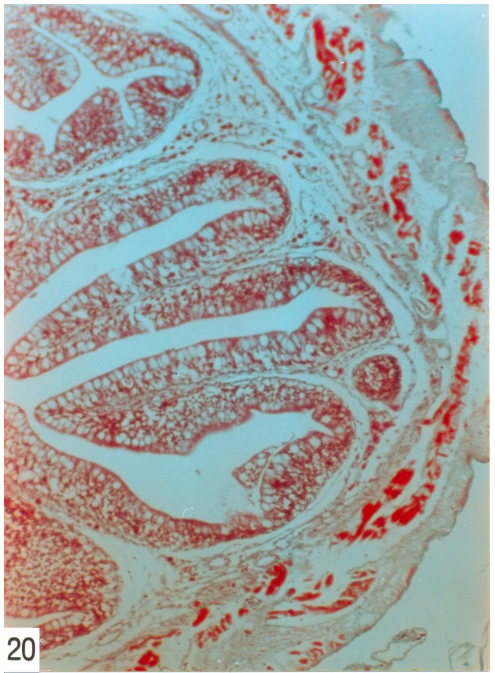
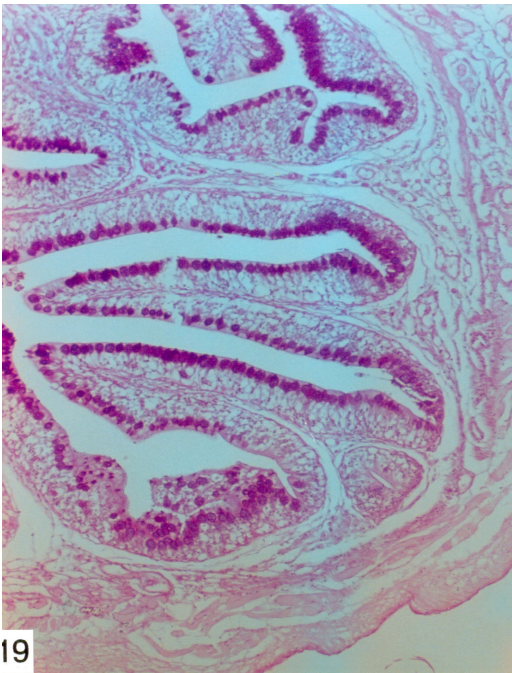
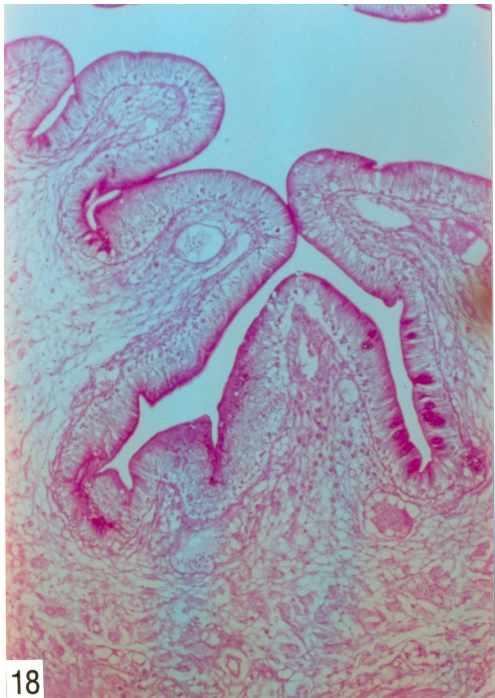
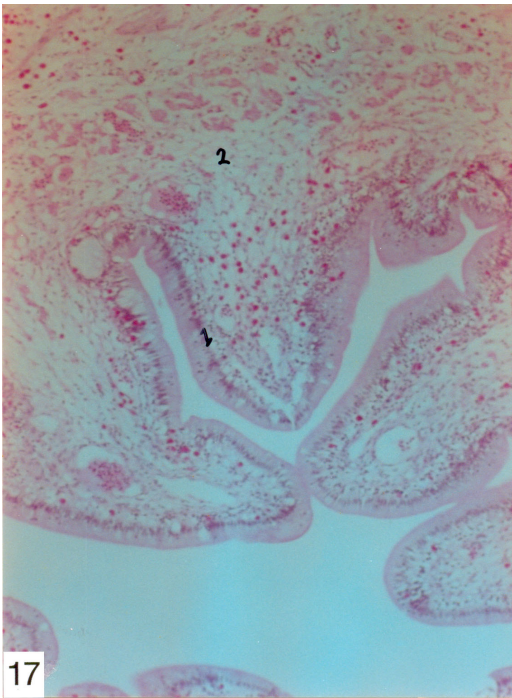




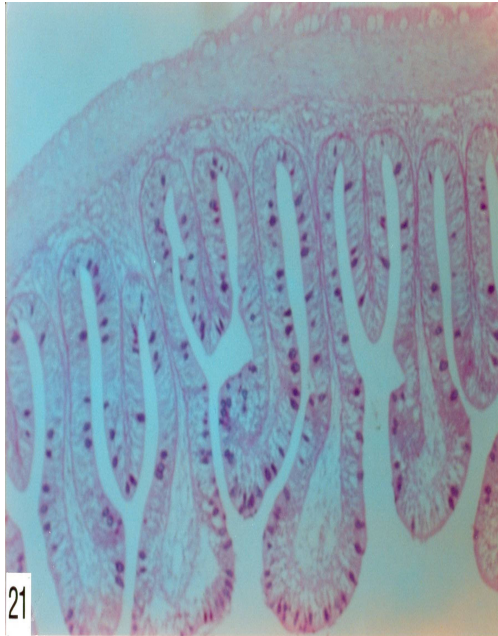
SOME COMPARATIVE HISTOLOGICAL STUDIES ON ALIMENTARY TRACT OF TILAPIA FISH (*TILAPIA SPILURUS*) AND SEA BREAM (*MYLIO CUVIERI*)







SOME COMPARATIVE HISTOLOGICAL STUDIES ON ALIMENTARY TRACT OF TILAPIA FISH (*TILAPIA SPILURUS*) AND SEA BREAM (*MYLIO CUVIERI*)



### LEGEND OF FIGURES

- Fig. (1): Oesophagus of Bream fish showing: mucosal folds covered by stratified epithelium (1) numerous collagen fibers in the core of folds (2) and longitudinal bundles of muscles (3) Masson Trichrome stain X10.
- Fig. (2): Oesophagus of Bream fish showing: thick tunica Musculairs consisted of irregular bundles of longitudinal muscles surrounded by numerous collagen fibers (1) outer thick circular muscle (2) Masson Trichrome stain X10.
- Fig. (3): Oesophagus of Bream fish showing: numerous goblet cells in stratified epithelium which most of them reacted positively with alcian blue and few numbers reacted positively to P.A.S. Alcain blue- P.A.S. X10.
- Fig. (4): Junction between oesophagus and stomach : of Bream fish fold of stomach (1), bundles, of muscles arising from muscularis mucosa of oesophagus surrounded by numerous collagen fibers (2). Masson Trichrome stain X4.
- Fig. (5): Stomach of Bream fish showing : the mucosal fold (1) gland (2) submucosa (3) Tunica muscularis (4) H&E. X10.
- Fig. (6): Stomach of Bream fish showing : submucosa isolated few bundles of smoothy muscle tunica muscularis, mosson trichome X10.
- Fig. (7): Stomach of Bream fish showing : the covering epithelium of mucosa reacted positive with P.A.S. Alcian blue. P.A.S. X10.
- Fig. (8): The small intestine intestine of Bream fish showing : numerous goblet cells in the mucosa (1). Thick fold and submucosa (2) H&E X10.
- Fig. (9): The small intestine of Bream fish showing : numerous blood vessels engorged with blood in submucosa (1). Very thick muscularis (2) Masson Trichrome stain X10.
- Fig. (10): Pyloric caecae of Bream fish showing : numerous mucosa cells which reacted positively with alcian blue. P.A.S. X10.
- Fig. (11): The terminal part of intestine of Bream fish containing bundles of pancreas in between bundles of tunica muscularis in outer most layer H&X10.
- Fig. (12): Oesophagus of Tilapia fish showing : mucosal folds covered by stratified epithelium filled with mucous cells(1), thick submucosa (2), inner circular (3) and outer longitudinal (4). H&E. X10.
- Fig. (13) :Ooesophagus of Tilapia fish showing : the mucous cells reacted positively with P.A.S. Alcian blue- P.A.S. X10.
- Fig. (14): Cardiac stomach of Tilapia fish showing : mucosal folds which contain numerous gastric pits in between (1). The lamina propria contains numerous tubular glands (2) submucosa contains blood vessels (3) and tunica muscularis (4) H&E.X10.
- Fig. (15): Cardiac stomach of Tilapia fish showing : thick submucasa and tunica muscularis consisted of oblique and circular smooth muscle and outer serosa. Masson Trichrome X10.
- Fig. (16): Cardiac stomach of Tilapia fish showing : alveolar circular gland which open into mucosa gave an intense reaction with P.A.S. and tubular gland gave moderate reaction to P.A.S. Alcian blue P.A.S. X10.
- Fig. (17): Pyloric stomach of Tilapia fish showing : mucosal folds covered with columnar cells containing numerous crowded nuclei (1), followed by laminaa propria contained numerous eosinophillic cells and dense connective tissue (2) H&E.X10.
- Fig. (18): Pyloric stomach of Tilapia fish showing : the lining epithelium reacted positively with P.A.S. Alcian p.A.S. X10.
- Fig. (19): Junction of stomach with intestine showing : increasing mucous cells which reacted positively with P.A.S. Alcian blue P.A.S. X10.
- Fig. (20): Junction of stomach and intestine showing the arrangement of smooth muscles of tunica muscularis. Masson trichrome X10.
- Fig. (21): First part of intestine of Tilapia fish showing mucosal flolds appeared swollen and bulging towards the lumen and lined columnar cells containing numerous mucous cells reacted positively with P.A.S. Alcian blue- P.A.S. X10.
- Fig. (22): First part of intestine of Tilapia fish showing the arrangement of muscles in the tunica muscularis. Masson trichrome X10.s