

## Histochemical Studies of Chickens Digestive Tract

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A HISTOCHEMICAL study of the digestive tract was made on chickens of different ages, at hatch (both sexes), 6 months (both sexes at sexual maturity), 12 months (peak of egg production) and 18 months (nonlaying hens). Frozen sections were used. Acid phosphatase, alkaline phosphatase and neutral fats were detected according to the method of Gomori (1950), Gomori (1952) and Cook (1974) respectively.

Alkaline phosphatase reaction was observed in the inner membrane lining lumen of the whole digestive tract.

This indicates that the alkaline phosphatase plays an important role in absorption.

Acid phosphatase reaction appears in lamina propria of jejunum, ileum. This suggests that this enzyme plays a central role in molecular transport of material rather than participating in secretion.

Negative reaction appears in the whole digestive tract for neutral fats.

The reaction for alkaline phosphatase was moderately positive in inner edge of the lining membrane throughout the whole digestive tube of the four day old chick but reactivity waned steadily thereafter (Moog, 1944).

Allenspach and Hamilton (1962) found that alkaline phosphatase was moderately active in both the mesenchyme and epithelium of the esophagus at five days of embryo. At eight to nine days the reaction in the mesenchyme was weak and only the nuclei of the epithelium remain slightly active.

Hinsch (1967) found that the alkaline phosphatase located in the connective tissue surrounding the glands tubules of the proventriculus of chick embryos and chicks of one day, two days and three weeks of age.

Hinsch (1966) found that, at all stages of development the epithelium of the chick esophagus gave a positive reaction of acid phosphatase. With the development of the mucous glands, the inner layer of the epithelium lost their positive reaction. Moog (1944) reported the presence of acid phosphatase in the epithelium of the proventriculus through the eight first day of embryo life.

Negative reaction for neutral fats and triglycerides in all tissues of esophagus, proventriculus, gizzard, intestine reported by Aitken (1958) and Hinsch (1966 and 1967).

### Material and Methods

The specimens described thereafter were obtained from twelve Faoumi chickens ranging in age from one day to 18 months, distributed as follows: 2 males and 2 females of one day old, 2 males and 2 females of 6 months old (almost at sexual maturity), 2 females of 12 months (peak of egg production) and 2 females of 18 months (nonlaying hens). In each case specimens were taken from esophagus, crop, proventriculus, gizzard, duodenum, jejunum and ileum caecum and rectum. Tissues were fixed in cold calcium formal at 4° to 24 hr before histochemical procedures run. Tissues were frozen and 8  $\mu$  sections were cut. Alkaline phosphatase was studied in the tissues of the digestive tract by using the method described by Gomori (1952). Acid phosphatase was identified in the digestive tract tissues by using the method of Gomori (1950). Neutral fats and triglycerides were studied by the method of Book (1974).

### Result and Discussion

#### *Alkaline phosphatase*

Esophagus and crop tissues reacted the same to the histochemical treatments. At hatch, the reaction for alkaline phosphatase was moderate within the stratified epithelium. At 6 and 12 months of age it showed dark shade in the basal portion of the epithelium indicating high activity. Moderate reaction was observed at 18 months of age in basal portion of the epithelium. Basement membrane of mucous glands exhibited a positive reaction in all ages. However, the phosphatase activity was absent in the mucous glands and persisted only in scattered nuclei located at the base of the cells of the glands.

In proventriculus, in all conditions, alkaline phosphatase was found in the connective tissue either that surrounding the glands or that beneath the surface epithelium. The surface epithelium of the inner folds never exhibited a positive phosphatase reaction.

In gizzard, in all ages and sexes, the test for alkaline phosphatase revealed a very heavy enzymatic reaction in the area beneath the keratinized layer and pale reaction in the glandular area. Also, the keratinized layer exhibited a pale positive reaction.

In small intestine, all the examined specimens showed intensive alkaline phosphatase activity in the cells lining the villi and crypts of Lieberkuhn of small intestine.

In rectum, the test for alkaline phosphatase revealed a pale enzymatic activity in the cells lining the villi of the rectum in both ages and sexes examined.

On the other hand, the cells lining the crypts of Lieberkuhn exhibited a negative reaction at all the stages.



In caecum, at all the conditions examined, the epithelium lining the villi of caecum exhibited a heavy reaction while the cells lining the crypts of lieberkuhn exhibited a negative reaction.

These results indicate that alkaline phosphatase appears in the basal layer of esophagus epithelium.

The reaction is moderate at hatch and 18 months of age while at 6 and 12 months of age it is heavy. This suggests that the alkaline phosphatase increase the absorption of soluble materials from the esophagus during the ages when the birds are active such as the age at sexual maturity or during the periods of high egg production.

However, during the stages of life when the birds were not so active as observed at hatch or when the birds were at 18 months of age when they were not laying, less activity was observed. In proventriculus, alkaline phosphatase appears in connective tissue surrounding the glands. This indicates that active formation of enzymes are performed due to active sypplementations insured through this connective tissue. In gizzard, alkaline phosphatase appears intensively in the area beneath the keratinized layer more than any part of the digestive tract. This layer may be the more active portion of the digestive tract as it progressively regenerate the keratinized layer of the gizzard in all the ages studied. In intestine and caecum, alkaline phosphatase appears in the cells lining the villi.

The villi is the center of all the activities of molecular transport and absorption. Accordingly, the region secreting these activities gave the highest reaction with alkaline phosphatase. The reaction of this enzyme is pale in the rectum. This indicates that the rectum do not play important role in transport of materials across its tissues.

#### *Acid phosphatase*

All tissues of esophagus, crop proventriculus, duodenum and caecum exhibited a negative reaction for acid phosphatase of all the stages. In gizzard, at hatch, the test for acid phosphatase was strongly positive in the surface edge of glandular area of gizzard, but the glandular area gave a pale reaction. On the other hand, acid phosphatase was particularly active in the surface edge of the keratinized layer of gizzard at the other ages in both sexes. The glandular area exhibited negative reaction. In jejunum and ileum and rectum, at hatch, the reaction of acid phosphatase was absent. At other ages in both sexes acid phosphatase exhibited a strong positive reaction in the lamina propria of the villi.

The results indicate that the alkaline phosphatase reaction appears almost in the inner lining layer of the whole digestive tract, while acid phosphatase appears only in the gizzard, jejunum. At hatch, acid phosphatase reaction appears in the area between the two main layers (glandular and keratinized) indicating higher enzymatic activity of the glands at this age. The disappearance of acid phosphatase reaction from this area with advancing age and its appearance on the

surface of keratinized layer indicate an enzymatic secretion in this layer. Positive acid phosphatase reaction in jejunum and ileum and rectum confirmed its role in molecular transport.

However, its concentration in the core of villi and its absence from the glands suggest that this enzyme plays a central role in molecular transport of material rather than participating in secretion.

#### *Neutral fats and triglycerides*

No positive reaction for neutral fats and triglyceries were obtained in the tissues of the whole digestive tract in all the ages in both sexes.

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#### دراسات هستوكيميائية على القناة الهضمية للدجاج

جمال قمر ، مختار عبد الفتاح قيقة و عبد الفتاح عبد المعطى درويش

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أجريت الدراسة الهستوكيميائية على أعمار مختلفة هي عند الفقس - ٦ أشهر - ١٢ شهر و ١٨ شهر . وفي هذه الدراسة أجريت القطاعات المجردة لتحديد الفوسفاتيز القاعدي والفوسفاتيز الحمضي والدهن المتعادل . وكانت أهم النتائج هي :

١ - يشاهد الفوسفاتيز القاعدي في الغشاء الداخلي للبطن للقناة الهضمية وهذا يدل على أن هذا الانزيم يلعب دور مهم في عملية الامتصاص .

٢ - يشاهد الفوسفاتيز الحامضي في الصفيحة الوسيطة للأعضاء الدقيقة ( باستثناء الاثنى عشر ) والمستقيم وهذا يدل على أن هذا الانزيم يلعب دور مهم في عملية انتقال المواد الغذائية أكثر مما يلعب في عملية الافراز . لم يلاحظ أى تفاعل لتحديد الدهن المتعادل في كل أجزاء الجهاز الهضمي .