



# HISTOLOGICAL STUDY OF SMALL INTESTINE DURING TWENTY DAY AGE IN IRAQI PIGEON (*COLUMBA LIVIA*)

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## Abstract

Our study aimed to investigate the histological results of the small intestine during 20 day age in Iraqi pigeon (*Columba livia*). The study was carried out 16 Iraqi pigeons (*Columba livia*). These pigeons were supplied from local supplier in Fallujah market. The histological results observed that the wall of small intestine similar during tunics of the three segments. The present study showed small intestine of Iraqi pigeon which has duodenum, jejunum and ileum. The first segment is called duodenum is characterized long villi with less numbers of goblet cells comparison with two other segments. The villi of jejunum and ileum were shorter leaf-like with increase numbers of goblets cells. The study proved increase in the density of goblet cell from duodenum toward the ileum. The study showed intestinal glands during entire small intestine. The duodenum of Iraqi pigeon has no Brunner's glands during sub mucosa. Statistics analysis revealed entire four tunics (mucosa, sub mucosa, muscularis and serosa). The study recorded thickness of Mean mucosa was (543±5.65µm), thickness of sub mucosa was (22.21±0.21µm), thickness of tunica muscularis was (654.6±4.65µm) and serosa was recorded about (54.56±0.65µm). Either thickness Mean of jejunum, where the study recorded mucosa thickness about (463±5.55µm), while Tunica submucosa was (12.5±0.11µm), tunica muscularis thickness was (655.54±6.65µm) and tunica serosa was (49.10±0.32µm). Mean of ileum thickness mucosa was (476±5.55µm), sub mucosa thickness was (10.03±0.02µm), Third layer of tunicae is called tunica muscularis was (543.54±5.76µm) in thickness. Either the last layer is called tunicae serosa. The mean thickness of this layer recorded about (47.09±0.31µm).

**Key words:** pigeon, small intestine, histology, *Columba livia*

## Introduction

The birds are wide distribution in the world, there more than eight thousand styles of scattered birds (King and Mclelland, 1975). Iraqi pigeon (*Columba livia*) is one of these birds which it's back the domestic pigeons. In avian, the small intestine consists of duodenum, jejunum and ileum (Nickel *et al.*, 1977; Dibner and Richards, 2004). Histologically, the small intestine included four basic tunics: mucosa, submucosa, muscularis and serosa respectively. All layers were observed under light microscope (Al-Samawy, 2015). Generally, the mucosa is first tunica, where consisted of epithelium, lamina propria and muscularis may not present always. Otherwise, mucosa of small intestine contained on villi, which extension processes of mucosal surface, lengths of villi are different between three segments (duodenum, jejunum and ileum), (Halse, 1985). The lamina propria contains on intestinal glands and crypts. It's called

Lieberkuhn's crypt, these appear as tubular duct and it opened between the villi. Intestinal crypts is lined by simple columnar epithelium, a special type of glands distinguished by its tubular duct that developed between the villi inside lamina propria (Bezuidenhout and Vanswegen, 1990; Booth and Oshae, 2002). Tunica sub mucosa formed a thin layer of loose connective tissue separated between the mucosa and tunica muscularis (Dawood, 2013 and Rodrigues, 2012). The tunica muscularis is well developed and contain on outer layer is longitudinal muscle fibers and inner bundle is circular in shape. Either final tunica is called serosa, thin layer included a loose connective tissue covered by mesothelium (Al-Kafagy, 2016 and Wilczynska, 1999).

## Materials and Methods

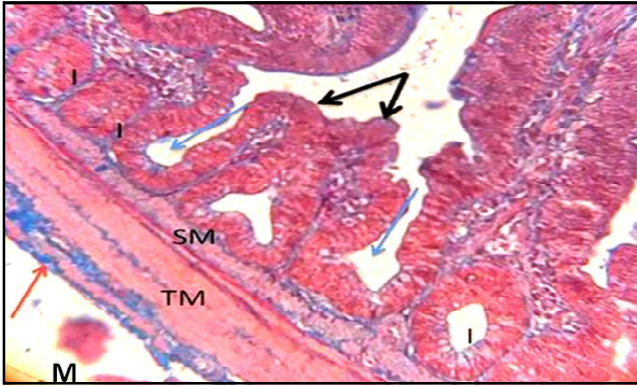
Sixteen Iraqi pigeon (*Columba livia*) were used in current study. Pigeon were taken from Fallujah market. The pigeons were sacrificed after give injection sodium

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pentobarbitone (70 mg/kg) at intravenous (Mitchell & Smith, 1991). We fixed pigeons on dissected board for anatomy and later we are done mid-line incision in pigeon's abdomen, then washed small intestine via distil water for clean contents of small intestine foods, after that we cut small intestine to three segment (duodenum, jejunum and ileum) for histological preparation. The samples kept inside 10% buffer formalin for fixative. The histological technique for the sample dehydration by passing them across alcohol for each two hour (70, 80, 90 and 100%) and then that specimens were clearing by xylene through one hour after that embedded inside paraffin wax and block and the section serially about (6µm) in size and then staining by Hematoxylin and Eosin for general structure, Masson's trichroms for connective tissue and Alcian blue ph 2.5 (Luna, 1968).

## Results and Discussion

The histological results of the entire small intestine

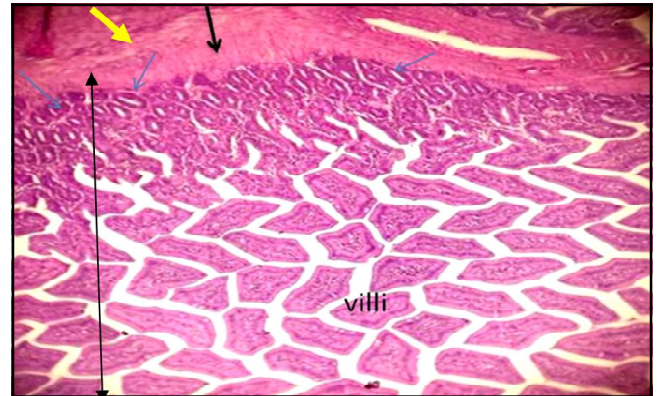


**Fig. 1:** Histological section of (Iraqi pigeon) 20 day age shows: villi (black arrow), epithelial crypts (blue arrow), intestinal glands (I), Muscularis Mucosa (MM), tunica muscularis (TM) and tunica serosa (red arrow). Masson Trichrom stain, 400X.

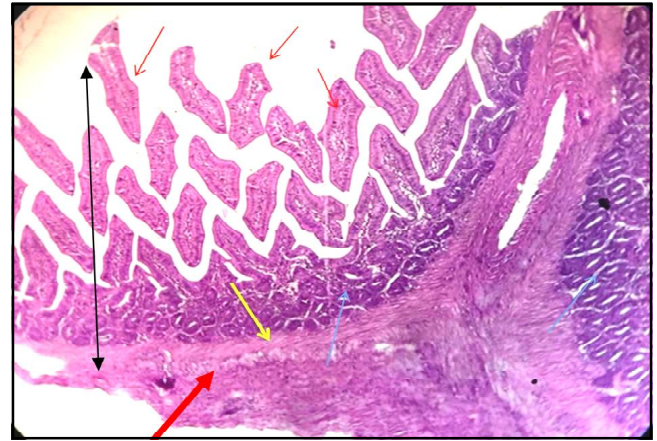


**Fig. 2:** Histological section of duodenum (Iraqi pigeon) 20 day age shows: mucosa (black arrow), intestine glands (blue arrow), tunica sub mucosa (purple arrow), tunica muscularis (TM) and tunica serosa (green arrow). H&E stain, 100X.

(duodenum, jejunum and ileum) of Iraqi pigeon (*Columba livia*) during 20 day age showed four tunics of tubular tract that were; first layer is called mucosa, submucosa, muscularis and serosa Fig. 2, 3 and 4. This results were similar with that said (Hamdi *et al.*, 2013) in black winged kite. Also this result reported by (Albideri and Jawad, 2015) in adult rock dove. Our study showed tunica mucosa of duodenum in Iraqi pigeon included epithelium lining by simple columnar and lamina propria which represent in core of villi and muscularis Fig. 5 and 8. Tunica mucosa were included projected extension processes called villi. The study showed differences between lengths of villi during three segments, where was longer in duodenum than other two segments Fig. 2 and 10. In pigeon's duodenum don't observe Brunner glands during sub mucosa. This result conflicted with reported by (Al-Saffar and Nasif, 2019) in Guinea pig. The study accepted with (Halse, 1985). In addition to crypts of Lieberkuhn which extended between villi and lining via simple



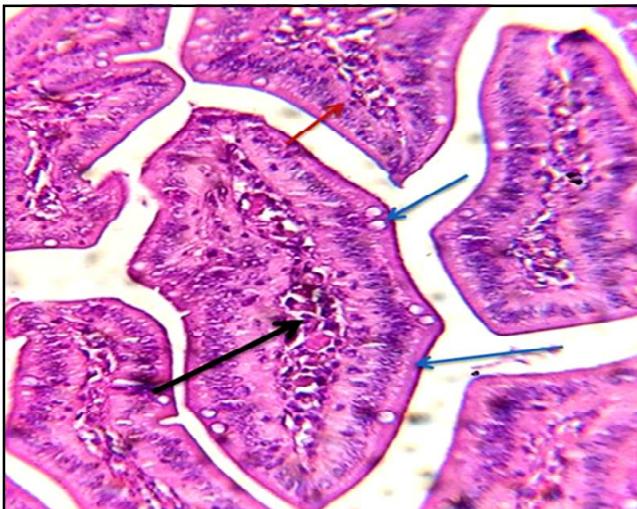
**Fig. 3:** Histological section of jejunum (Iraqi pigeon) in 20 day age shows: mucosa (long black arrow), villi, intestinal glands (blue arrow), tunica muscularis (black arrow) and sub mucosa (yellow arrow). H&E stain, 100X.



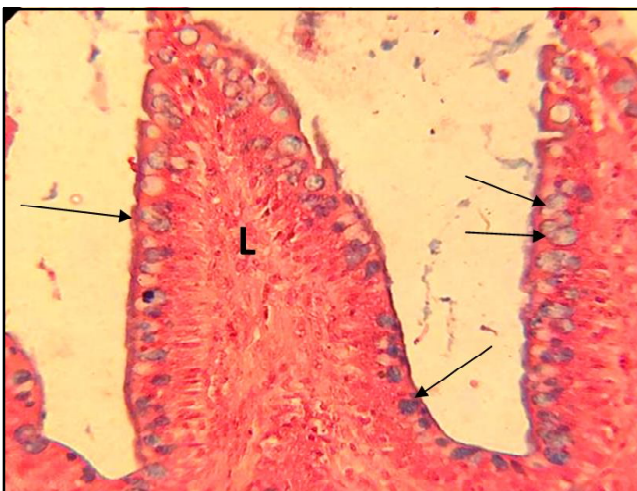
**Fig. 4:** Histological section of jejunum (Iraqi pigeon) in 20 day age shows: mucosa (long black arrow), villi (small red arrow), intestine glands (blue arrow), mucosa muscularis (yellow arrow) and sub mucosa (large red arrow). H&E stain, 400X.

columnar epithelium Fig. 1. These observed accepted with that whom said (Nasrin *et al.*, 2012) in chicken and Rodrigues *et al.*, 2012) in yellow and blue macaws, also accepted with (Rana *et al.*, 2016) in Uttara fowl. The study showed intestinal glands which it's distributed inside lamina propria of entire three segments (duodenum, jejunum and ileum), Fig. 1, 2, 3, 4, 8, 9 and 10. Either mucosa muscularis is well developed and clear represented by longitudinal smooth muscle fibers Fig. 9. These findings were similar with that whom said (Dawood, 2013) in mallard, (Kalita *et al.*, 2012; Al-Saffar and Al-Samawy, 2015) in kadaknath fowl and owl respectively. Generally tunica sub mucosa of small intestine in Iraqi pigeon was appeared a thin layer and poorly developed and almost lack or difficult observation, it noticed on way found a large blood vessels, where

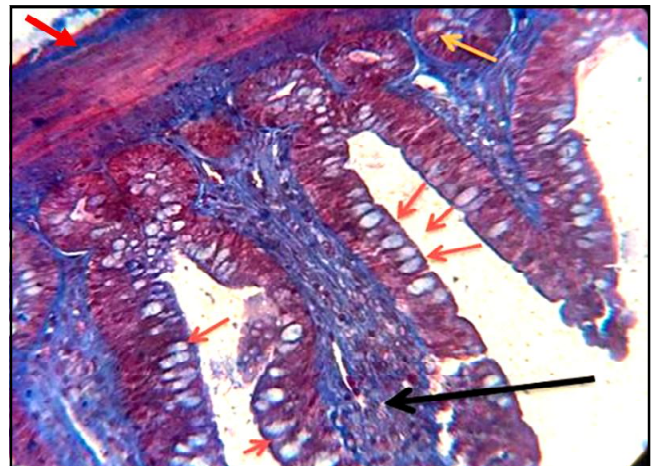
represented irregular dense collageneous connective tissues Fig. 2, 3 and 4. This results parallel with that stated whom (Dawood, 2013) in duck and (AL- Samawy, 2015) in pigeon. Tunica muscularis of small intestine was well development and contained from outer longitudinal bundles of smooth muscle fibers while inner layer included circular bundles and more thickness to be higher in duodenum than that jejunum and ileum Fig. 9 and 10. These results accepted as (Hodges, 1974) in fowl. While (Sivakumar and Vijayaragavan, 1989) in Japanese quail that reported an increase of thickness of tunica muscularis in duodenum. The last tunica of small intestine was called serosa, a thin layer was formed from a connective tissue contain on collagen fibers Fig. 1 and 7. These observations



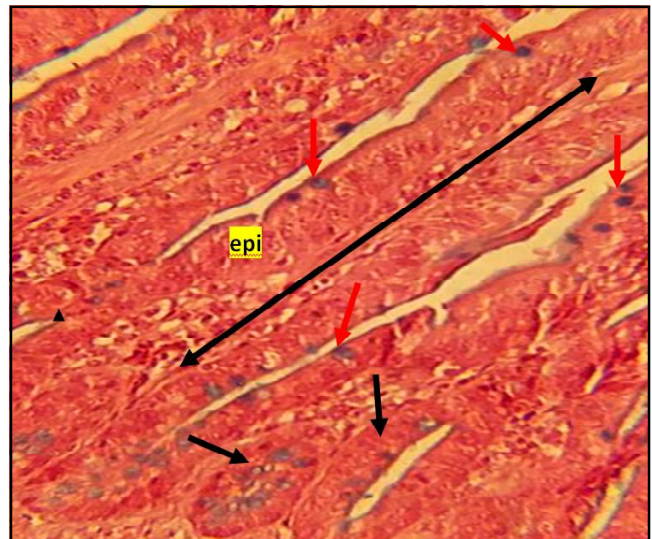
**Fig. 5:** Histological section of jejunum (Iraqi pigeon) in 20 day age shows: epithelial cells (red arrow), goblet cell (blue arrow), and lamina propria (black arrow). H&E stain, 400X.



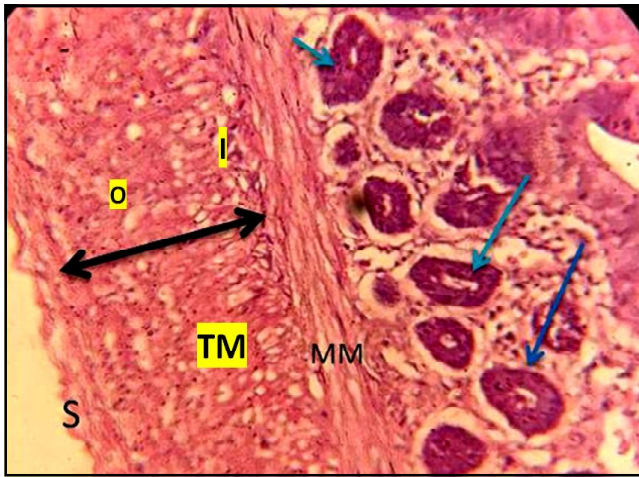
**Fig. 6:** histological section of ileum (Iraqi pigeon) in 20 day age shows villi and goblets cells (black arrow), lamina propria (L), Alcian blue, ph 2.5 stain, 400X.



**Fig. 7:** Histological section of ileum (Iraqi pigeon) in 20 day age shows: core of villus (black arrow), goblet cells (orange arrow), serosa (red arrow) and intestinal gland (yellow arrow). Masson Trichom stain, 400X.



**Fig. 8:** Histological section of duodenum (Iraqi pigeon) in 20 day age shows: length of villi (long arrow), simple columnar epithelium (epi), intestinal glands (black arrow) and goblet cells (red arrow) Alcian blue ph 2.5 stain, 400X.

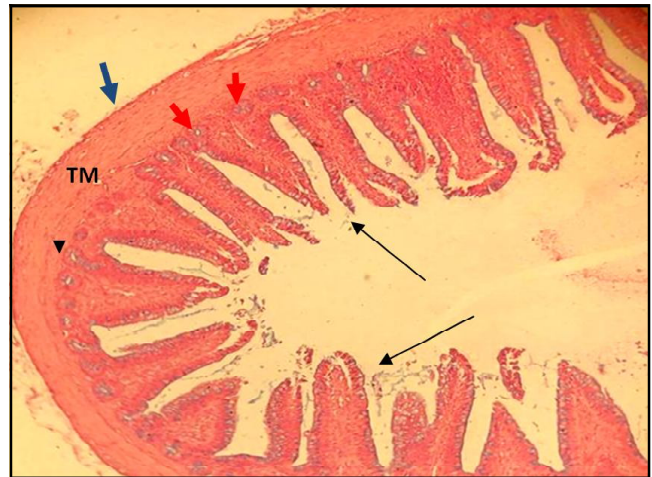


**Fig. 9:** Histological section of duodenum (Iraqi pigeon) in 20 day age shows: intestinal glands (blue arrow), muscularis mucosa (MM), Tunica muscularis (black arrow), and tunica serosa (S). H&E stain, 400X.

corresponding with that said whom by (Al-Kafagi, 2016 and Wilczynska, 1999). The study revealed histological measurements for four tunics of entire small intestine. Where the study recorded Mean thickness of duodenum mucosa was  $(543 \pm 5.65 \mu\text{m})$ , thickness of sub mucosa was  $(22.21 \pm 0.21 \mu\text{m})$ , thickness of tunica muscularis was  $(754.6 \pm 4.65 \mu\text{m})$  and serosa was recorded about  $(54.56 \pm 0.65 \mu\text{m})$ . Also the statistics analysis showed Mean thickness of jejunum mucosa was  $(463 \pm 5.55 \mu\text{m})$ , Tunica submucosa was recorded about  $(12.5 \pm 0.11 \mu\text{m})$ , while tunica muscularis thickness was  $(655.54 \pm 6.65 \mu\text{m})$  and tunica serosa was  $(49.10 \pm 0.32 \mu\text{m})$ . Mean of ileum thickness mucosa was  $(476 \pm 5.55 \mu\text{m})$ , sub mucosa thickness was  $(10.03 \pm 0.02 \mu\text{m})$ , Third layer of tunicae is called tunica muscularis composed from smooth muscle fibers, this layers arranged by external layer be longitudinal layer and inner layer is circular smooth muscle. The mean this tunicae about  $(543.54 \pm 5.76 \mu\text{m})$  in thickness. Either the last layer is called tunicae serosa is constructed by loose connective tissue, blood vessels lymphatic vessels and nerve which is covered by simple squamous epithelium. The mean thickness of this layer recorded about  $(47.09 \pm 0.31 \mu\text{m})$ .

### Conclusions

- 1- Pigeon's small intestine consist of four tunics (mucosa, sub mucosa muscularis and seroso) similar in histological structure.
- 2- The entire small intestine has intestinal glands.
- 3- Brunner glands don't present in pigeon's duodenum.
- 4- Goblet cells are more density of ileum than other two segments.



**Fig. 10:** histological section of ileum in 20 day age shows villi (black arrow), intestinal glands (red arrow), mucosa muscularis (arrow head), Tunica muscularis (TM) and serosa (blue arrow), Alcian blue Ph 2.5 100x.

### References

- Al-Bideri, A.W. and A.N. Jawad (2015). Comparative Anatomical and Histological study of the Doudenum between Laughing Dove *Streptopelia senegalensis* and white breasted Kingfisher Halcyon Smyrnensis. *Zoology Classification* QL 801-950.
- Albideri, A.W., M.K. Haba and M.J. Kadum (2011). Histological study of gastrointestinal tract in Rock dove (*Columba livia*). *Al- Kufa University, J. Bio.*, **2(3)**:
- Al-Kafagy, S.M. and S. Ahmed (2016). A comparative Gross and Histochemical study between Small Intestine of adult Kestrel (*Falco tinnunculus*) and white-eared bulbul (*Pycnonotus leucotus*). Master thesis. Anatomy and Histology department. Collage of Veterinary Medicine. Baghdad University Pp.
- Al-Saffar, I.F.J. and E.R.M. Al-Samaway (2015). Histomorphological and histochemistry studies Mallard (Anas Platyrhynchos) in South Iraq *I.J.S.N.*, **8(4)**: 2017, 757-764.
- Al-Saffar, I.F.J., Nasif Riyadh and Hameed (2019). Histoarchitecture and Histochemistry Study of the Duodenum in Adults Guinea pigs (*Cavia porcellus*), *Indain J. of Natural Sciences*, **10(27)**:
- AL-Samawy (2015). Histomorphological and Histochemical comparison of the stomach and small intestine of the Domestic Pigeon (*Columba livia domestica*), Striated Scope Owl (*Otus brucei*) and Mallard (*Anas platyrhynchos*). Ph.D. Thesis, Anatomy and Histology department, collage of Veterinary Medicine, Baghdad University Pp:
- Bezuidenhout, A.J. and G. Vanswegen (1990). A light microscopic and immunocytochemical study of the gastrointestinal tract of the Ostrich (*Struthio camelus*). *Onderstepoort J. Veter. Rese.*, **57(1)**: 37-48.
- Booth, C., O. Booth and J. Shea (2002). Isolation and culture of intestinal epithelial cells. In: culture of epithelial cells.

- Second edition. R. Ian Freshney and Mary G. Freshney Eds. Wiley-Liss, Inc. pp: 303-335.
- Dawood, G.A. (2013). Anatomical and histological study of the small intestine between male and female indigenous ducks. M.sc. thesis. *Anatomy and Histology department, Collage of veterinary medicine, Baghdad University*, pp:
- Dibner, J.J. and J.D. Richards (2004). The digestive system challenges and opportunities. *J. Appl. Poult. Ref.*, **13**: 86-93.
- Halse, S.A. (1985). Diet and size of the digestive organs of Spur-winged Geese. *Wild Fowl*, **36**: 129-134.
- Hamdi, H., A. El-Ghareeb, M. Zaher and F. AbuAmod (2013). Anatomical, histological and histochemical adaptations of the avian alimentary canal to their food habits: II- *Elanus caeruleus*. *J. of S. and E.R.*, **4(10)**: P: 1355-11364.
- Hodges, R.D. (1974). The histology of the fowl. Academic press. London., pp: 101-112.
- Kalita, P.C., G.K. Singh and A. Kalita (2012). Gross morphological and morphometrical studies of small intestine in post hatched kadaknath fowl. *Indian Journal of Veterinary Anatomy*, **24(2)**: 74-75.
- King, A.S. and J. Mclelland (1975). Outline of Avian Anatomy, 1<sup>st</sup> edition. Bailliere, Tindall, London, pp: 33-39.
- Luna, L.G. (1968). Manual of histologic staining methods of armed forces institute of pathology 3rd. *New York, U.S.A.* pp: 123.
- Mitchell, M.A. and M.W. Smith (1991). The effects of genetic selection for increased growth rate on mucosal and muscular weights in the different regions of the small intestine of Domestic fowl (*Gallus domesticus*). *Comp. Biochem. Physiol.*, **99A**: 251-258.
- Nasrin, M., M.N.H. Siddiqi, M.A. Masum and M.A. Wares (2012). Gross and histological studies of digestive tract of broilers during postnatal growth and development. *J.B.A.U.*, **10(1)**: 69-77.
- Nickel, R., A. Schummer and E. Seiferle (1977). Anatomy of the domestic birds. Berlin Verlag, 46-56.
- Rana, J., B.S. Dhote, T.K. Ambwani and S. Kumar (2016). Histochemical studies on small intestine of Uttara Fowl. *International Journal of Science, Environment and Technology*, **5(3)**: 1181-1188.
- Rodrigues, M.N., J.A.P. Abreu, C. Tivane, P.G. Wagner, R. Campos, D.B. Guerra, R.E.G Rici and M.A. Miglino (2012). Microscopical study of the digestive tract of Blue and Yellow macaws. *Current Microscopy Contributions to Advances in Science and Technology*, **28**: 414-421.
- Sivakumar, M.N. and H.D. Vijayaragavan (1989). Gross and Microscopic Changes in ileum of Male and Female Domestic quail. *New York Sci. J.*, **3(10)**: 108-111.
- Wilczynska, B. (1999). Histological surface area of the alimentary canal of *Apodemus flavicollis*. *Acta Theriologica.*, **44(1)**: 29-36.