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Postnatal development of duodenum in broiler

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ABSTRACT

Present experiment was undertaken to find out the postnatal development (gross) of the duodenum in broiler chicken with regard to their location, shape, size and weight. A group of five chickens, each at day 1 (D1), day 7 (D7), day 12 (D12), day 24 (D24) and day 34 (D34), total 5, were killed and their digestive tracts were dissected. After that, samples of duodenum were prepared and the length, width and muscle diameter of duodenum of different ages were recorded. The average length of duodenum were significantly higher in broilers at day 34(30.55cm) than that at day 24(28.12cm), day 12(19.50cm), day 7 (17.25cm) and day 1(14.95cm). On the other hand, the width were significantly higher in broilers at day 34(7.1mm) than that at day 24(5.25mm), day 12 (4.70mm), day 7(4.35mm) and day 1(2.75mm). In diameter of the muscle of duodenum also maintain this order. Hence, it can be concluded that, length, width and muscle diameter of duodenum might be increased with the age of broiler.

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Introduction

In avian species food conveys via digestive tract to stomach. This digestive tract comprises of mouth cavity, crop (temporary store house of food), esophagus, proventriculus (glandular stomach), gizzard (muscular stomach), intestine and vent or cloaca (Hassouna, et al., 2001). The anterior portion of digestive tract is responsible for ingestion, storage and partial digestion of food. The structure of the avian digestive system is very simple compare to other animals, so the high quality diet should provide for their easy digestion if the birds is used for productive performance (Noy et al., 2001). Nutrient absorption is very much important for growth and production that mainly takes place in small intestine especially intestinal crypts and villi of the epithelium (Choct, 2009; Barszcz and Skomiał, 2011). The total length and

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weight of the small intestine varied among the different species of birds (Hassouna et al., 2001). Development of the absorptive epithelium may be responsible for changes in absorption capacity of birds (Verdal et al., 2010). In broilers, morphological development and consequent maturation of the small intestine occur during the first 10 days of life. Villi area and size rapidly increase between five and 10 days post-hatch (Uni et al., 1995). After hatching, the small intestine of poultry grows faster, weight-wise, than total body mass. In broiler, relative growth of small intestine reaches its peak between six and 10 days of age (Sklan, 1978; Zavarize et al., 2012). However, feed intake stimulates the development of the gastrointestinal tract (GIT) (Jiménez-Moreno et al., 2009), and duodenum develops earlier than the jejunum and the ileum (Uni et al., 1998). After the duodenum, the small intestine forms a coil and is suspended from the dorsal wall of the abdominal wall by a thin membrane- the mesentery. This membrane carries the blood vessels associated with the intestine (Yamauchi et al., 1992). The duodenum starts at the gizzard and forms and elongated loop about 20 centimeters long. The pancreas lies between the arms of the loop and being attached to each arm of the duodenum actually holds the arms together (Noy et al., 1995). Therefore, the current study was conducted to describe the anatomical changes (length, width and muscle diameter) of duodenum of broilers at different ages of groups that may be depend on several criteria like location, shape, size, nutrition, management and weight of chicken.

Materials and Method

A total of five chickens (broilers) from each of 1st day, 7th day, 12th day, 25th day, and 34th day old were collected from poultry farm of Bangladesh. All the chickens were reared in the Department of Anatomy and Histology with food and water adlibitum. After Cervical subluxation, the digestive tracts were collected for gross and histological study.

Length, width and muscle diameter of the segments of digestive tract (duodenum) of broilers were considered for gross study. The present experiment was undertaken to find out the postnatal development of the small intestine (duodenum) of broilers. The experiment was carried out in the laboratory of Department of Anatomy and Histology, Faculty of Veterinary Medicine, Chattogram Veterinary and Animal Science University (CVASU). All procedures were approved by the Animal care and Welfare Committee of the institute.

Study population: A total of 05 (five) chickens-"Cobb-500" broiler chickens of both sexes were collected from "CP poultry farm",Mirsarai upazilla, Chittagong. Physical examinations of the broilers were performed that had no developmental disorders and detectable diseases which may influence this study. Then sample (duodenum) was collected from the selected broilers.

Design of the experiment: After collecting the samples, they were carried directly to the laboratory of Department of Anatomy and Histology, Faculty of Veterinary Science, Chittagong Veterinary and animal Sciences University (CVASU), these birds were divided into five sections. Section-1(day 1), Section-2(day 7), Section-3(day 12), Section-4(day 24), Section-5 (day 34).

Sacrificing of boilers: There are several methods of slaughtering .The birds were sacrificed by Halal method.

Sample collection: After cessation of respiration and heartbeat, the abdomen was cut open, and entire small intestine from the pylorus to the ileo-cecal sphincter was removed for gross and histological study. The small intestine comprises 3 segments. The first segment, termed the duodenum, extends from the pylorus to extend from the distal portion of the duodenal loop to Meckel's diverticulum. The third segment is the ileum that extends Meckel's diverticulum to the ileocecal junction, with its distal portion connected to a pair of ceca via mesenteric tissue. The total length and diameter of the duodenum was determined in those broilers of different ages.

Results and Discussion

Post natal development (gross characteristics) of the small intestine (duodenum) of broilers: The duodenum started at the gizzard and formed an

an elongated loop. The pancreas lies between the arms of the loop and being attached to each arm of the duodenum actually holds the two arms together. After the duodenum, the small intestine formed a coil and was suspended from the dorsal abdominal wall by a thin membrane- the mesentery.

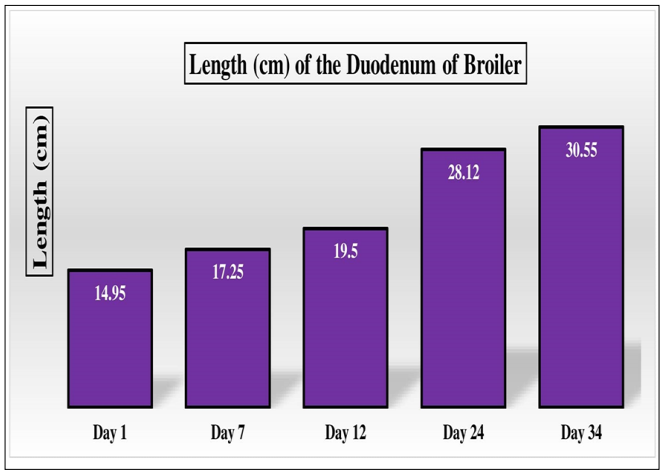

Figure 1. Comparative representation of the length (cm) of duodenum according to age. The chart illustrates the length of five different ages of duodenum that was highest at day 34 and lowest at day 1.

This membrane carried the blood vessels associated with the intestine. Present study also revealed that the length and diameter of the duodenum increase with the ages of the broilers (Table 1; Figure 1-2), this finding is similar to Wang and Peng, (2008), where the author stated that the average length of duodenum increased gradually with the ages of birds.

Table 1. Gross morphometric of duodenum of broiler chicken

Age (Days)	Length (cm)	Width (mm)	Muscle diameter (cm)
1	14.95	2.75	20.44
7	17.25	4.35	26.24
12	19.50	4.70	27.4
24	28.12	5.25	30.46
34	30.55	7.1	30.75

On the other hand, muscle diameter was recorded highest at day 34 (D34) and lowest at day 1 (D1) (Table 1; Figure 3). This observation was also similar with Hassonuna (2001), where the author stated that length of the duodenal loop and its parts as its shape and extension varied in birds with ages.

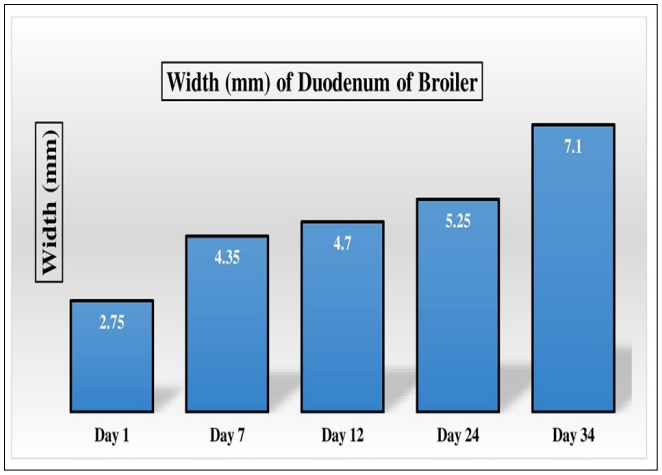

Figure 2. Comparative representation of the width of duodenum according to age. The chart shows the width of five different ages of duodenum was recorded highest at day 34 and lowest at day 1.

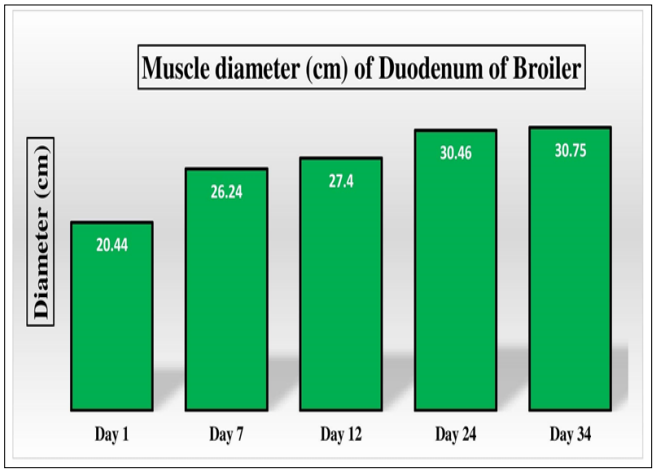

Figure 3. Comparative representation of the muscle diameter of duodenum according to age. The chart provides the information of muscle diameter of five different ages of duodenum specifically recorded highest at day 34 and lowest at day 1.

Conclusion

The average length, width and muscle diameter during postnatal development of the Cob-500 broilers increased day by day with their age. The average lengths, width and muscle diameter of Duodenum of small intestine were significantly higher at day 34 than that at day 24, day 12, day 7 & day 1. This gradual growth may depends on their daily diet. So, further study also needed to clarify how this development occurs in broiler with age.

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