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Article

Gross anatomy and morphometry of selected visceral organs of broiler chicken at different age groups

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Abstract: A lot of diseases develop pathognomonic lesions in some visceral organs. It is important to know the normal anatomy, morphometry and color of these visceral organs to find out the changes due to specific diseases during necropsy. Considering these views, the research was planned to make a baseline data on the visceral organs of broiler chickens. A total of 50 broiler with the age of 2 and 4 weeks, 25 in each age groups, were euthanized and liver, lungs, spleen, bursa of Fabricius, and ceca were collected at necropsy. The length, breadth, thickness, weight and volume of each organ were recorded using measuring scale, electric balance and water displacement. The liver was flattened and deep reddish brown in color. The mean weight, length, width and thickness of right and left lobes at the age of 2 weeks were 12.94±1.34 g, 6.0±0.36 cm, 3.20±0.16 cm, 0.62±0.23 cm; and 5.70±0.14 cm, 1.80±0.22 cm and 0.62±0.14 cm, respectively. On the other hand, at 4 weeks they were 43.12±3.61 g, 9.07±0.31 cm, 4.73±0.38 cm, 0.83±0.17 cm; and 7.10±0.29 cm, 3.47±0.20 cm and 0.80±0.14 cm for the right and left lobes, respectively. The lungs were nearly rectangular, unlobed, bright red in color. The mean weight of lungs of 2 and 4 week were 1.94±0.15 g and 8.02±1.09 gm, respectively. The length, width and volume of lungs were 2.27±0.21 cm, 2.30±0.08 cm, 1.57±0.33 cc and 3.30±0.16 cm, 2.43±0.26 cm, 8.00±0.81 cc at the age of 2 and 4 weeks, respectively. The spleen was oval, reddish brown in color. The weight, length and diameter of spleen at 2 weeks were 0.56±0.25 g, 1.40±0.29 cm and 2.63±0.39 cm while those at 4 weeks were 1.90±0.41 g, 1.93±0.14 cm, and 4.10±0.28 cm. The bursa of Fabricius was round, cream colored having a diameter of 3.57±0.17 cm and 3.97±0.16 cm, respectively at 2 and 4 weeks of age. The diameters of left and right cecum at 2 and 4 week of age were 1.93±0.40 cm and 3.10±0.36 cm; 1.97±0.25 cm and 2.87±0.66 cm respectively.

Keyword: anatomy; morphometry; visceral organs; disease diagnosis.

1. Introduction

The poultry industry has occupied a leading role among agricultural industries in Bangladesh. The industry has been supplying quality protein to the people of Bangladesh at the lowest price. It contributes 1% to the country's GDP while at least 60 lakh people are involved in the sector. On an average 30% poultry birds die annually in Bangladesh due to outbreak of several diseases (Ahmed and Hamid 1992; Ali, 1994). Diseases in broiler significantly affect the productivity and health status (Chanie *et al*., 2009). In our country, still postmortem examination of chicken is the main technique for diagnosis of its diseases. A lot of diseases develop pathognomonic lesions in liver, lungs, spleen, proventiculus, duodenum, jejunum, cecum and bursa of Fabricius of chicken, as they act as predilections sites for various organisms. Liver is the largest gland and one of the most important organs which acts as a clearing house for toxic substances that enter the body (Sarkarati and Doustar, 2012). Salmonellosis, Colibacillosis, Pasturellosis, Lymphoid leucosis, and fatty change bring important changes in the liver (Sarker *et al*., 2019). The respiratory system is the most vulnerable and poses common threat to poultry farming. The avian respiratory apparatus, the lung-air sac system, is the most structurally complex and functionally efficient system (Maina, 2007). Mycoplasmosis, Aspergillosis and many other respiratory diseases bring pathological changes in lungs and air sacs (Wigle, 2000). Proventiculus is also known

as glandular stomach or true stomach in chicken. Newcastle and Gumboro diseases bring changes in mucosa of proventriculus (Etriwati *et al.*, 2017; Chowdhury *et al*, 1996). The small intestine is the major site for digestion and absorption of nutrients. The first part of this segment is the duodenal loop followed by jejunum and ileum. The ceca are blind sacs, helps in digestion of fiber. Fermentation of coarse materials and production of the eight B-vitamins also occur in the ceca. Bacterial enteritis, coccidiosis and other enteric diseases bring specific changes in the small intestine and ceca (Porter, 1998; Sharma *et al.,* 2015). Spleen, bursa and cecal tonsils are the important lymphoid organs of broiler frequently affected by organisms. Newcastle and Gumboro diseases bring specific changes in bursa and cecal tonsils (Etriwati *et al.*, 2017; Chowdhury *et al.*, 1996). Gumboro, Avian hepatitis E virus infection, big liver and spleen disease in broiler cause splenomegaly (Chowdhury *et al.*, 1996; Agunos *et al.*, 2008; Massi *et al.*, 2005).

To find out the changes due to specific diseases, normal anatomy (minimum, maximum and average values of length, breadth, thickness and color) of these visceral organs is very important during postmortem examination. As the information is scant in available academic records, this study was carried out to investigate gross anatomy of visceral organs of chicken to provide baseline information on color, shape, weight, length, breadth and thickness of broiler chickens at 2 and 4 week of age with color picture to support proper diagnosis of disease by necropsy.

2. Materials and Methods

The experiment was conducted on 50 apparently healthy broiler chickens (Cobb 300) irrespective of sex and at 2 and 4 weeks of ages, as mortality usually occurs at this age in farms. Each group consisted of 25 chickens. The chickens were purchased from selected poultry farms surrounding area of the Rajshahi City Corporation area.

2.1. Gross morphological evaluation

After taking the body weight, birds of specified age groups were sacrificed by halal method. Thereafter, various measurements including length, width, thickness, diameter, weight and volume of different organ such as liver, lungs, spleen, bursa, cecum, duodenum, jejunum and proventiculus were recorded using measuring tape, Vernier caliper, measuring cylinder and electric balance.

2.2. Statistical analysis

The means (X) and standard deviation (SD) for each gross anatomical parameter of broilers were computed using Microsoft Excel Software. Group means of length, width, thickness, diameter, and weight of visceral organs of broiler birds were compared using statistical computer software M Stat-C (Gomez and Gomez, 1983).

3. Results

The gross anatomical studies on the liver, lungs, spleen, bursa of Fabricius, proventiculus, duodenum, jejunum, cecum and colorectum of 50 broilers chickens (Cobb 300) were performed.

3.1. Liver

Liver is the largest gland in the body. It was more or less flattened and deep reddish brown in color (Figure 1). It was positioned ventral and caudal to the heart, closely associated to the proventiculus and spleen. It has two surfaces, parietal and visceral surface. Parietal surface was convex and visceral surface was concave (Figure 1). The liver was divided into two lobes without process. The lobes were right and left which were joined cranially at the midline. Right lobe was heart shaped and left lobe was prism shaped. The left lobe was partially subdivided into two parts. The right lobe was somewhat larger than the left lobe and contains gall bladder on its visceral surface. The liver secretes bile which enters into duodenum by two hepatic ducts. Biometrical measurement of liver of broiler is shown in the Table 1.

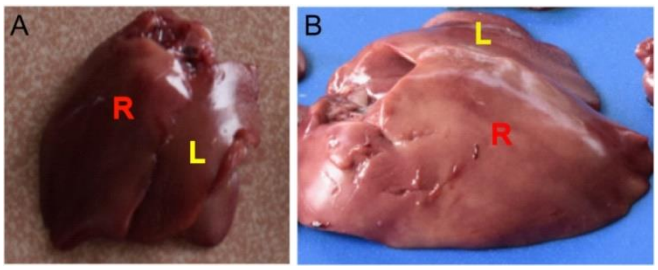

Figure 1. A: Photograph of liver of broiler at 2 weeks of age and parietal surface. B: Photograph of liver of broiler at 4 weeks of age and parietal surface. Right lobe, R; Left lobe, L.

Table 1. Biometric measurements of liver of broiler.

Parameters	2nd week		4th week	
	Min-Max value	Mean ± SD	Min-Max value	Mean ± SD
Weight of liver (gm)	11.90-14.74	12.94±1.34	38.32-47.07	43.12±3.61
Length of right lobe (cm)	5.50-6.30	6.00±0.36	8.80-9.50	9.07±0.31
Length of left lobe (cm)	5.50-5.80	5.70±0.14	6.80-7.50	7.10±0.29
Width of right lobe (cm)	3.00-3.40	3.20±0.16	4.20-5.00	4.73±0.38
Width of left lobe (cm)	1.50-2.00	1.80±0.22	3.20-3.70	3.47±0.20
Thickness of right lobe (cm)	0.55-0.70	0.62±0.23	0.60-1.00	0.83±0.17
Thickness of left lobe (cm)	0.45-0.80	0.62±0.14	0.60-0.90	0.80±0.14

The chance of weight of liver with gall bladder, length of right lobe, width of left lobe in between 2 and 4 week of broiler was highly significant ($P<0.001$), the length of left lobe and width of right lobe was significant ($P<0.01$) and the thickness of right and left lobe liver considered not significant ($P>0.05$).

3.2. Lungs

The lungs were relatively small, unlobed, bright red in color and soft to touch. They were nearly rectangular and flattened (Figure 2). Lungs had three surfaces dorsal, medial and ventral and four borders medial, lateral, cranial and caudal. Lungs were deeply indented by 2-6 thoracic vertebrae in the cranio-dorsal part of celom. Dorsal surface was convex. On the upper 2/3rd of the dorsal surface of lungs, impressions of ribs were seen (Figure 2). The visceral or ventral surface was concave; it had hilus in its middle. Cranial 1/3rd of the right lung was related to post crop esophagus, trachea, syrinx, primary bronchi and aorta. Middle part of lung was related to base of the heart. Caudal part of the lateral border of the right lung was in contact with rostral 1/3rd of the right lobe of liver. Small caudal part of left lung was related to proventriculus and caudal border was in contact with cranial part of testis in male. Medial borders of the both lungs were related to caudal venacava. Medial surface was rough and had the deep impression of the thoracic vertebrae. Cranial and lateral borders were thin, whereas medial borders were thick, had deep impression of thoracic vertebrae. Caudal border was thick and concave, gave opening for the abdominal air sac. Biometry of lungs of broiler is shown in Table 2.

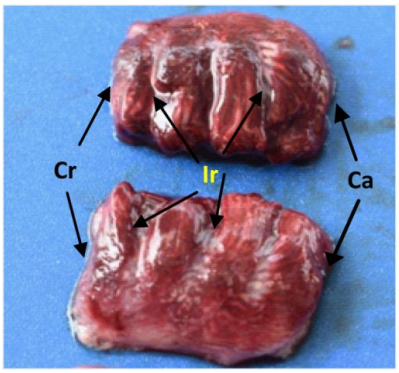

Figure 2. Lungs of broiler at 4 week of age. Cranial border (Cr), Caudal border (Ca), Impression of Rib (Ir).

Table 2. Biometric measurement of lungs of broiler.

Parameters	2nd week		4th week	
	Min-Max value	Mean ± SD	Min- Max value	Mean ± SD
Weight of lung (single) (gm)	1.74-2.10	1.94±0.15	6.92-9.52	8.02±1.09
Length of lungs (cm)	2.20-2.70	2.27±0.21	3.10-3.50	3.30±0.16
Width of lungs (cm)	2.20-2.40	2.30±0.08	2.20-2.80	2.43±0.26
Volume of lungs (cc)	1.20-2.00	1.57±0.33	7.00-9.00	8.00±0.81

The change of the volume of fresh lungs in between 2 and 4 week of broiler was considered highly significant ($P<0.001$), weight and length of lungs was significant ($P<0.01$), and the width of fresh lungs was not significant ($P>0.05$).

3.3. Spleen

The spleen located vertically on the left side of the cranial abdomen. It is small oval, reddish brown or purple color organ (Figure 3A). Spleen located alongside, to the right, of the proventriculus and was found caudodorsally to the liver . Biometry of spleen of broiler is shown in the Table 3.

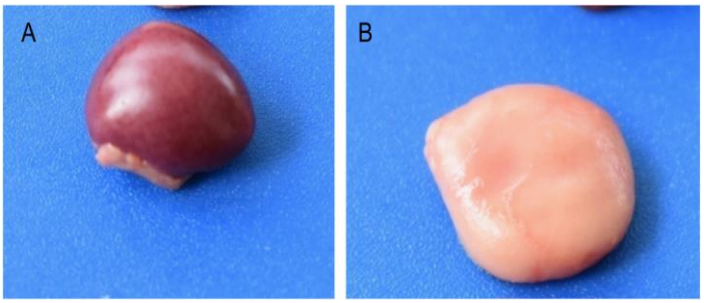

Figure 3. A: Spleen of broiler at 4 week of age. B: Bursa of broiler at 4 week of age.

Table 3. Biometric measurement of spleen of broiler.

Parameters	2nd week		4th week	
	Min- Max value	Mean ± SD	Min-Max value	Mean ± SD
Weight of spleen (gm)	0.32-0.90	0.56±0.25	1.42-2.42	1.90±0.41
Length of spleen (cm)	1.00-1.70	1.40±0.29	1.90-2.00	1.93±0.14
Diameter of spleen (cm)	2.10-3.00	2.63±0.39	3.90-4.50	4.10±0.28

The change in weight and diameter of spleen in between 2nd and 4th week of broiler was considered significant ($P<0.05$), the length of spleen considered not significant ($P>0.05$).

3.4. Bursa of Fabricius

The bursa Fabricius was an epithelial and lymphoid organ that is found only in birds. It was a blind, round shaped, sac located dorsal to the proctodeal wall of the cloaca (Figure 3B). Bursa is well developed in immature chicken. It is soft and creamy white in color. The luminal (interior) surface of the bursa was plicated with as many as 15 primary and 7 secondary plicae or folds. Biometry of Bursa of Fabricius of broiler is shown in Table 4.

Table 4. Biometrical measurement of Bursa of broiler.

Parameters	2nd week		4th week	
	Min-Max value	Mean ± SD	Min- Max value	Mean ± SD
Weight of Bursa (gm)	0.40-0.70	0.53±0.14	0.88-1.22	0.99±0.18
Diameter of Bursa (cm)	3.40-3.80	3.57±0.17	3.80-4.20	3.97±0.16
Volume of Bursa (cc)	0.60-1.20	0.90±0.25	1.20-1.50	1.33±0.13

The change in weight of bursa in between 2nd and 4th week of broiler was considered significant ($P<0.05$), the diameter and volume of fresh bursa considered not significant ($P>0.05$).

3.5. Proventiculus

Proventriculus was elongated, small, spindle shaped cream color organ and its wall was thicker than that of the esophagus located caudal to the crop (Figure 4 A). It was short enlargement at the end of esophagus. On the inner side there were the openings of the various glands, secrete gastric juice containing pepsin, mucous, HCl which help in digestion. Biometry of proventiculus of broiler is shown in the Table 5.

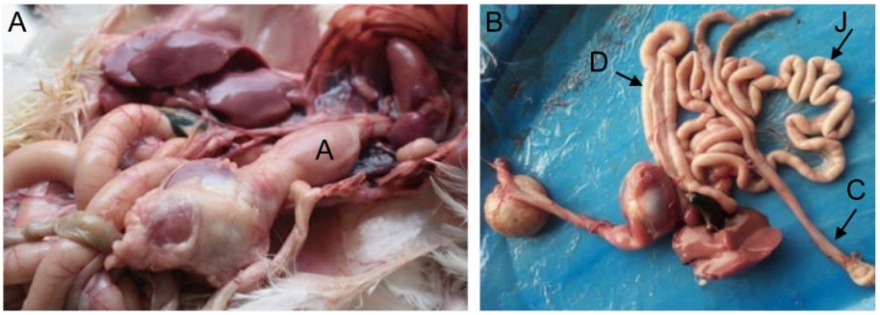

Figure 4. A: Proventiculus (P) of broiler 4th week of age. B: Digestive system of chicken. duodenum (D), jejunum (J), colorectum (C) at 2nd week.

Table 5. Biometric measurement of proventiculus of broiler.

Parameters	2nd week		4th week	
	Min- Max	Mean ± SD	Min- Max	Mean ± SD
Length of proventiculus (cm)	3.00-3.20	3.13±0.09	4.50-5.00	4.83±0.24
Diameter of proventiculus (cm)	4.40-4.50	4.47±0.04	5.50-7.90	6.70±0.98

The change in length of proventiculus in between 2nd and 4th week of broiler was highly significant (P<0.001) and the diameter was significant (P<0.05).

3.6. Duodenum

Immediately after gizzard, the duodenum formed an elongated loop where pancreas was situated (Figure 4 B). It was cream color but may vary according to the contents. After the duodenum, the small intestine formed a coil and was suspended from the dorsal abdominal wall by the mesentery a thin peritoneal membrane which carried the blood vessels associated with the intestine.

3.7. Jejunum

The part of intestine after duodenum is called jejunum which formed coil and similar or darker in color than duodenum. There was no clear demarcation between the jejunum and ileum. Meckel's Diverticulum was a constant feature about half way along the small intestine appearing as a small projection on the outer surface of the small intestine. This projection was where the yolk stalk attached during the development of the embryo (Figure 4 B).

3.8. Colorectum

It was the terminal part of the intestine, passing between the ileo-cecal junction and the cloaca. It was comparatively short and straight and had thick, muscular walls. The color of intestine varied from cream to dark according to their contents (Figure 4 B).

Biometry of duodenum, jejunum and colorectum of broiler chicken is shown on the Table 6.

Table 6. Biometric measurement of duodenum, jejunum and colorectum of broiler.

Parameters	2nd week		4th week	
	Min- Max	Mean ± SD	Min Max	Mean ± SDss
Diameter of duodenum (cm)	2.00-2.40	2.13±0.19	2.60-3.00	2.87±0.19
Diameter of jejunum (cm)	2.20-2.40	2.27±0.09	3.00-3.30	3.13±0.13
Diameter of colorectum (cm)	2.10-2.50	2.23±0.19	1.80-2.70	2.33±0.39

The change in diameter of duodenum and jejunum in between 2nd and 4th week of broiler was significant (P<0.05), and diameter of colorectum considered not significant (P>0.05).

3.9. Ceca

The ceca were blind sacs located at the junction of small intestine and large intestine (Figure 5). Ceca are two, left and right, each consisting of three parts: proximal or base, middle or body and distal or apex. The short

proximal part had a narrow lumen and a relatively thick wall, the long middle part was wider with thinner wall, the short distal part was extended to a pointed end. The wall of each cecum was thinner than other parts of intestinal tract and contained lymphoid tissue which was especially well developed in the proximal part where there was a cecal tonsil. A sphincter was present at the junction with colorectum. There were two ileo-cecal ligaments present in between the small intestine and caecum. The ceca act as a temporal storage organ of fecal material. Biometry of ceca of broiler is shown in the Table 7.

Figure 5. Photography of ceca of broiler at 4th week of age.

Table 7. Biometrical measurement of cecum of broiler.

Parameters	2nd week		4th week	
	Min-Max value	Mean ± SD	Min-Max value	Mean ± SD
Weight of ceca (gm)	3.36-3.66	3.55±0.13	5.36-10.90	8.38±2.29
Length of left cecum (cm)	12.00-14.70	12.90±1.27	18.00-20.00	18.73±0.90
Diameter of left cecum (cm)	1.60-2.50	1.93±0.40	2.80-3.60	3.10±0.36
Length of right cecum (cm)	11.50-14.60	12.57±1.44	17.00-19.90	18.30±1.20
Diameter of right cecum (cm)	1.70-2.30	1.97±0.25	2.00-3.60	2.87±0.66

The change in weight of ceca, length and diameter of left cecum and length of right cecum in between 2nd and 4th week of broiler was significant ($P<0.05$), and the diameter of right cecum considered not significant ($P>0.05$).

4. Discussion

4.1. Liver

The mean weight of liver with gall bladder of broiler at 2nd and 4th week of age was12.94 gm and 43.12 gm whereas Iqbal *et al.* (2014) observed 15.27 gm and 29.8 gm, respectively in Pakistan. These findings are slightly lower than Ishi *et al.* (2000) who observed that liver of broiler was weighing between 45 to 60 gm. We found the mean length of right lobe of liver of broiler at 2nd and 4th week 6 cm and 9.06 cm, respectively and that of left lobe was 5.70 cm and 7.10 cm, respectively. Whereas Iqbal *et al.* (2014) observed the corresponding length 3.64 cm and 5.60 cm in right lobe and 3.09 cm and 4.93 cm in left lobe, respectively at similar age. These findings are similar to the findings of Lucas and Denington (1956) who reported the length of right lobe 2.50 to 8.00 cm and length of left lobes 2.40 to 7.50 cm. Whereas Ishi *et al.* (2000) observed the length of left lobes ranging from 1.50 to 6.00 cm. According to present study the mean width of right lobe of liver of broiler at 2nd and 4th week of age was 3.20 cm and 4.73 cm, respectively whereas Iqbal *et al.* (2014) observed 1.74 cm and 2.61 cm, respectively. Lucas and Denington (1956) observed 1.10 to 4.50 cm and Ishi *et al.* (2000) observed 2.20 to 4.00 cm. We found the width of left lobe of liver 1.80 cm and 3.47 cm, respectively at 2nd and 4th week whereas Iqbal *et al*. (2014) observed 1.38 cm and 2.15 cm, respectively. Lucas and Denington (1956) reported its variation from 1.50 to 3.50 cm and Ishi *et al.* (2000) reported its variation from 1.50 to 3.30 cm which are very close to our observation. According to this study the mean thickness of right lobe of liver of broiler at 2nd and 4th week of age was 0.62 cm and 0.83 cm, respectively whereas Iqbal *et al*. (2014) stated 1.30 and 1.81 cm. respectively at the same age. Our finding is lower with that of Lucas and Denington (1956) which is 1.50 to 3.00 cm and Ishi *et al.* (2000) which is 1.50 to 2.50 cm, respectively. In present study the mean thickness of left lobe was 0.62 cm and 0.8 cm, respectively whereas Iqbal *et al*. (2014) found 1.14 and 1.56 cm, respectively. Our finding is lower with that of Lucas and Denington (1956) which was 0.90 to 2.00 cm and Ishi *et al.* (2000) which was 1.00 to 4.00 cm, respectively. Little variations in different liver parameters are due to different

strains of chicken and different environment and management system. For examples, Lucas and Denington (1956) use White Leghorn chicken and Iqbal *et al*. (2014) conducted research at Pakistan.

4.2. Lungs

The lungs were relatively very small, unlobed, bright red and soft to touch. These findings were in accordance to the description given by Ludders (2005) and Khan *et al*. (2008). They were nearly rectangular and flattened. Lungs had three surfaces dorsal, medial and ventral and four borders medial, lateral, cranial and caudal and deeply indented by 2- 6 thoracic ribs. These findings supported by the reports of King (1975); Nickel *et al.* (1977) and Dyce *et al.* (2009). The mean weight of lungs of broiler at 2nd and 4th week of age was 1.94 and 8.02 gm, respectively. Dewangan (2011) stated that, the weight of right lung and left lung of Aseel are 3.59 and 3.66 gm, respectively in grower (at 2-3 months).We found the mean of length of fresh lungs at 2nd and 4th week of age 2.27 and 3.30 cm, respectively. Whereas Dewangan (2011) reported 3.33 and 3.36 cm in right and left lungs, respectively in Aseel grower. The mean width of fresh lungs at 2nd and 4th week was 2.30 and 2.43 cm. These findings are similar with the findings of Dewangan (2011) and he reported that, width of right and left lungs are 2.27 and 2.28 cm, respectively in Aseel grower. The mean of volume of fresh lungs in present study was 1.57 and 8.00 cc at 2nd and 4th week, respectively. These findings are supported by the observation of Dewangan (2011) which were 4.14 and 4.29 cm, respectively in Aseel grower. The variations of lungs parameters were due to different breed and age of chickens.

4.3. Spleen

The spleen was a rounded, reddish-brown organ which lies close to the right side of the junction between the proventriculus and gizzard. This finding is similar to the observation of Hodge (1974). In this study the mean weight of spleen of broiler at 2nd and 4th week of age was 0.56 g and 1.9 g, respectively and the length was 1.4 and 1.93 cm, respectively. These findings were very similar to that of Khan *et al.* (2014) which were 0.517g and 1.97 g and 13.58 mm and 18.93mm, respectively at similar age. The mean diameter of fresh spleen of broiler from 2nd and 4th week of age was 2.63 and 4.10 cm, respectively.

4.4. Bursa of Fabricius

The bursa of Fabricius of chicken is a unique organ of the poultry. It was a blind, globular shaped, sac-like structure which was attached to the dorsal aspect of the proctodeum. This was supported by the observation of King (1975) and Hodges (1974). In this study the mean weight of bursa of broiler at 2nd and 4th week of age was 0.53 g and 0.99 g, respectively whereas Khan *et al*. (2014) 0.57 g and 0.98 g, respectively at similar age, both findings are very similar. The diameter of bursa was 3.57 cm and 3.97 cm, respectively, whereas Khenenou *et al.* (2012) observed that the growth of the Bursa of Fabricius reaches its maximum size (6 mm) from the first week to the 10th week of age. The volume of bursa at 2nd and 4th week of age was 0.9 cc and 1.33cc, respectively. Whereas Khenenou *et al.* (2012), stated that more the chicken grows; more the Bursa of Fabricius increase in volume, its weight is proportional to the age and with the weight of the subject.

4.5. Proventiculus

In this study the mean length of fresh proventiculus of broiler at 2nd and 4th week of age was 3.13 and 4.83 cm respectively. Whereas Nasrin *et al*. (2012) reported 2.83 cm and 3.70 cm, respectively at similar age. The mean diameter was 4.47 and 6.70 cm, respectively, whereas Das *et al.* (2013) observed 10.93 mm in Kadaknath fowl.

4.6. Duodenum

In this study the mean diameter of fresh duodenum at 2nd and 4th week of age was 2.13 and 2.87 cm, respectively. Diameter of duodenum of broiler was not reported in the available literature but Nasrin *et al.* (2012) reported the length was 26.25 cm and 34.13 cm, respectively at similar age.

4.7. Jejunum

In this study the mean diameter of jejunum of broiler at 2nd and 4th week of age was 2.27 cm and 3.13 cm, respectively. Diameter of jejunum of broiler was not reported in the available literature but Nasrin *et al.* (2012) observed the lengths of jejunum were 68.25 cm and 123.50 cm, respectively at similar age.

4.8. Colorectum

The mean diameter of fresh colorectum of broiler at 2nd and 4th week of age was 2.23 and 2.33 cm, respectively in this study which was not reported by any previous study.

4.9. Cecum

In this study mean length of left cecum of broiler at 2nd and 4th week of age was 12.90 and 18.73 cm, respectively whereas right cecum was 12.57 and 18.30 cm, respectively. These finding is similar to that of Nasrin *et al.* (2012), which was 10.25 cm and 18.125 cm, at respectively at similar age. Whereas the mean weight of ceca at 2nd and 4th week of age was 3.55 and 8.38 g, respectively, the mean diameter of left cecum was 1.93 cm and 3.10 cm, respectively and right caecum was 1.97 and 2.87cm, respectively. Weight and diameter of broiler was not reported in the available literature.

5. Conclusions

Postmortem examination is the main technique used for diagnosis of poultry diseases in Bangladesh. Liver, lungs, spleen, bursa of Fabricius, cecum, duodenum, jejunum and colorectum are the most important organs for diseases diagnosis at postmortem. Many infectious and noninfectious diseases bring pathognomonic lesions on these visceral organs of chicken with regards to change in color, size, shape and consistency. To identify these changes of those visceral organs we must know the normal color, size, shape, consistency of them at different ages. The anatomy and morphometric parameters obtained in this study will help proper diagnosis of disease by postmortem examination thus aid increased in poultry production, protein supply, income generation, poverty alleviation and protection of public health.

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Conflict of interest

None to declare.

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