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Gross and morphometrical studies on the thymus, spleen and bursa of Fabricius of day old Kadaknath chick

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Abstract

The present study was carried out on the six day old chicks of Kadaknath fowl procured from the Instructional Poultry Farm (IPF), Nagla, GBPUA&T, Pantnagar, Uttarakhand. The thymus was reddish-black in colour and consisted of two long chains of lobes located on either side of neck, which were embedded in the subdermal connective tissue. The spleen was globular in shape and bright red in colour. It was located on the right side of the junction between the proventriculus and gizzard. The bursa of Fabricius originated from the proctodeal wall of the cloaca and was placed dorsal to the rectum. It was oval in shape and whitish with blackish tinge in colour. The biometrical data revealed variable results that were specific for this breed.

Keywords: Gross, biometry, thymus, spleen, bursa of Fabricius, Kadaknath

Introduction

Poultry production in India has taken a quantum leap in the last four decades, emerging from an unscientific farming practice to commercial production system with state-of-the art technological inventions [29]. Kadaknath is locally called as 'Kalamasi' as it is having black flesh. It is a native breed of Jhabua region of Madhya Pradesh, India. These birds are generally reared by tribals and rural poor farmers as an earning source and fulfillment of daily requirement of protein and minerals. It is also quite popular in Uttarakhand state whose poultry population has increased by 7.01% per annum from 2003 to 2007 [9, 10]. The major lymphoid organs of this bird consisted of thymus, spleen and bursa of Fabricius. The major components of body defense mechanism are the innate and acquired or adaptive immunity. Innate immunity includes physical barrier like skin and mucous membrane, complement and cells like granulocytes, thrombocytes, macrophages and natural killer cells. On the other hand, acquired or adaptive immunity is mediated by immunocompetent cells viz., humoral response B-cells, cell mediated response T-cells and some other cells like phagocytic and adherent cells [2]. All these immunocompetent cells are located mostly in the lymphoid organs. With the advancement of bird age, the distinction between the primary and secondary lymphoid organs becomes less apparent [23]. Though some work on lymphoid system of broiler chicken [13], domestic chicken [12], Japanese quail [22], duck [27], turkey [1] has been done, but still the knowledge on the thymus, spleen, bursa of Fabricius of day old chicks of Kadaknath fowl has not been explored. Keeping this fact in mind and viewing the increased popularity of the Kadaknath fowl, the present study was undertaken to develop a baseline data in this breed.

Materials and methods

The present study was carried out on the six day old chick of Kadaknath fowl procured from the Instructional Poultry Farm (IPF), Nagla, GBPUA&T, Pantnagar. The birds were sacrificed by cervical sub-luxation method. Feathers were removed manually and the organ of interest i.e. right and left thymus glands, spleen and bursa of Fabricius were carefully dissected out. The weight of all these organs were recorded separately by using digital balance (Sartorius, TE 214S) and the volume of these organs were measured by water displacement method. Thereafter, the length, width and thickness of each lobe of thymus, longitudinal diameter, transverse diameter and thickness of the spleen and bursa of Fabricius were recorded by using digital Vernier calipers (0-150mm). All the measurements recorded were statistically analyzed by estimating the Arithmetic Mean (A.M.), Standard Deviation (S.D.) and Standard Error (S.E.) as per the standard statistical methods given by [26].

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Results and Discussion

The thymus consisted of two long chains of lobes located on either side of neck embedded in the subdermal connective tissue in day old Kadaknath chick (Fig. 1). They were termed as left and right thymus. The left and right thymus comprised of 5 lobes. While ^[3] found 7-9 lobes in the thymus of fowl, ^[14] found 4-7 lobes in the thymus of birds, ^[4] found 6-9 and 5-9 lobes in the right and left thymus respectively of native geese and ^[20] observed 6-8 lobes in the thymus of turkey. The posterior lobes were closely associated with thyroid on each side of the neck as described by ^[15] in birds and ^[20] in turkeys. The first lobe of left thymus was located 14.70±1.87 mm caudal to the occipito-atlantal articulation of skull, whereas the last lobe of left thymus was located 5.66±0.89 mm cranial to the base of the heart in day old Kadaknath chick. Similarly, the first lobe of right thymus was located 11.52±1.79 mm caudal to the occipito-atlantal articulation of skull, whereas the last lobe of right thymus was located 4.81±0.68 mm cranial to the base of the heart in day old Kadaknath chick. The thymus in day old Kadaknath chick consisted of irregular elliptical shaped pale pinkish black coloured lobes (Fig. 1). This observation was contradicting with that of Sultana *et al.* (2011) in ducklings and ^[18] in Aseel chicken, who stated that each lobe was pale white to yellowish white. This might be attributed to breed difference. The dorsal surfaces of the lobes were slightly convex with flattened ventral surfaces in day old Kadaknath chick.

The average weight of the left and right thymus was 0.081±0.01 gm and 0.054±0.02 gm respectively in day old Kadaknath chick (Table 1). The average length of first, second, third, fourth and fifth lobe of left thymus was 5.33±0.63 mm, 3.71±0.16 mm, 5.11±0.27 mm, 4.95±0.23 mm and 5.55±0.44 mm respectively, where as in right thymus it was 3.78±0.17 mm, 4.12±0.65 mm, 3.37±0.19 mm, 4.28±0.35 mm and 4.84±0.23 mm respectively in day old Kadaknath chick (Table 2). The average cranial width of first, second, third, fourth and fifth lobe of left thymus was 2.93±0.12 mm, 2.64±0.14 mm, 2.54±0.17 mm, 1.91±0.21 mm and 1.94±0.09 mm respectively, where as in right thymus it was 2.50±0.23 mm, 2.06±0.18 mm, 1.24±0.12 mm, 1.91±0.14 mm and 1.60±0.16 mm respectively in day old Kadaknath chick (Table 2). The average middle width of first, second, third, fourth and fifth lobe of left thymus was 2.51±0.11 mm, 2.13±0.13 mm, 2.42±0.12 mm, 1.47±0.11 mm and 2.35±0.21 mm respectively, where as in right thymus it was 2.62±0.24 mm, 1.81±0.09 mm, 1.69±0.20 mm, 1.84±0.13 mm and 1.75±0.11 mm respectively in day old Kadaknath chick (Table 2). The average caudal width of first, second, third, fourth and fifth lobe of left thymus was 2.37±0.25 mm, 1.93±0.13 mm, 2.23±0.18 mm, 1.45±0.27 mm and 2.75±0.16 mm respectively, where as in right thymus it was 2.93±0.28 mm, 2.07±0.14 mm, 1.65±0.07 mm, 1.98±0.34 mm and 1.99±0.18 mm respectively in day old Kadaknath chick (Table 2). The average cranial thickness of first, second, third, fourth and fifth lobe of left thymus was 1.75±0.09 mm, 1.15±0.12 mm, 1.06±0.07 mm, 1.53±0.16 mm and 2.02±0.11 mm respectively, where as in right thymus it was 0.96±0.10 mm, 0.85±0.27 mm, 0.98±0.03 mm, 0.96±0.12 mm and 1.05±0.21 mm respectively in day old Kadaknath chick (Table 2). The average middle thickness of first, second, third, fourth and fifth lobe of left thymus was 1.45±0.25 mm, 1.47±0.54 mm, 1.63±0.32 mm, 1.97±0.21 mm and 1.58±0.12 mm respectively, where as in right thymus it was 1.20±0.36 mm, 1.57±0.12 mm, 1.05±0.14 mm, 0.99±0.08 mm and 1.13±0.16 mm respectively in day old Kadaknath chick

(Table 2). The average caudal thickness of first, second, third, fourth and fifth lobe of left thymus was 1.57±0.32 mm, 1.02±0.21 mm, 1.68±0.49 mm, 1.20±0.18 mm and 1.83±0.09 mm respectively, where as in right thymus it was 1.13±0.13 mm, 1.27±0.32 mm, 0.97±0.52 mm, 1.21±0.26 mm and 1.05±0.11 mm respectively in day old Kadaknath chick (Table 2).

The spleen was located at the distance of 1.59±0.48 mm from proventriculus, 3.81±1.09 mm from the origin of the proventriculus and at the distance of 2.10±0.59 mm from the junction of proventriculus and gizzard in day old Kadaknath chick. The spleen was located on the right side of the junction between the proventriculus and gizzard which was similar to the findings of ^[6] and ^[21]. The spleen was almost globular in shape with rounded edges and bright reddish in colour in day old Kadaknath chick (Fig. 2). These observations were different to the findings of ^[6] and ^[21] in fowl where they found a small reddish-brown coloured spleen.

The average weight and volume of the spleen was 0.012±0.03 gm and 0.11±0.02 cc respectively in day old Kadaknath chick (Table 1 and Table 3). Again, the average longitudinal diameter, transverse diameter and thickness of the spleen was 3.42±0.18 mm, 2.43±0.14 mm and 1.80±0.13 mm respectively in day old Kadaknath chick (Table 3).

The bursa of Fabricius in day old Kadaknath chick originated from the proctodeal wall of the cloaca and was placed dorsal to the rectum (Fig. 3). It was connected to the dorsal wall of the proctodeum of the cloaca by a small stalk. This observation was in accordance with ^[4, 5, 8, 11, 16, 17, 19, 28] in native geese, chicks, turkey, ducklings, domestic fowl, Carishyama and Vanaraja breeds of poultry, quail and Khaki Campbell ducks respectively. In day old Kadaknath chick, the bursa was located 2.15±0.39 mm caudal from the left kidney and 1.53±0.22 mm caudal from the right kidney. The bursa of Fabricius in day old chick was oval in shape (Fig. 3). These findings were in agreement with ^[5, 8, 11, 16, 25] in helmeted guinea fowl, turkey, Carishyama and Vanaraja breeds of poultry, quail and keets respectively. In contrast, ^[7] and ^[28] stated that the bursa of Fabricius occurred as a cylindrical, caecum like structure with a pointed apex in the two month old White Pekin ducklings. These differences might be due breed and strain variation.

It was whitish with blackish tinge in colour in day old Kadaknath chick which was dissimilar to the observations of ^[16, 19, 25, 28] in chicks, keets, ducklings and ducks, who stated that the colour of bursa of Fabricius was pale yellowish in colour. But ^[11] in turkeys stated that the colour of bursa of Fabricius was pale pink after 5 months of age. This difference might be due to the variation in the age, breed, strain and nutritional status.

The average weight and volume of the bursa of Fabricius was 0.053±0.02 gm and 0.26±0.02 cc respectively, in day old Kadaknath chick (Table 1 and Table 3). Again, the average longitudinal diameter, transverse diameter and thickness of the bursa of Fabricius was 5.78±0.28 mm, 3.59±0.18 mm and 3.09±0.29 mm respectively in day old Kadaknath chick (Table 3).

Conclusion

The gross and morphometrical studies on the thymus, spleen and bursa of Fabricius of day old Kadaknath chicks were successfully studied in this case. The present work revealed that the consisted of two long chains of lobes located on either side of neck. The globular spleen was present on the right side of the junction between the proventriculus and gizzard.

Further, the bursa of Fabricius was placed dorsal to the rectum. The average length of first, second, third, fourth and fifth lobe of left thymus was 5.33 ± 0.63 mm, 3.71 ± 0.16 mm, 5.11 ± 0.27 mm, 4.95 ± 0.23 mm and 5.55 ± 0.44 mm respectively, where as in right thymus it was 3.78 ± 0.17 mm, 4.12 ± 0.65 mm, 3.37 ± 0.19 mm, 4.28 ± 0.35 mm and 4.84 ± 0.23 mm respectively in day old Kadaknath chick. The average longitudinal diameter, transverse diameter and thickness of the spleen was 3.42 ± 0.18 mm, 2.43 ± 0.14 mm and 1.80 ± 0.13 mm respectively. Further, the average weight and volume of the bursa of Fabricius was 0.053 ± 0.02 gm and 0.26 ± 0.02 cc respectively.



Fig 1: Photograph showing left thymus (red arrow) and carotid artery (white arrow) in day old Kadaknath



Fig 2: Photograph showing spleen (white arrow) and junction between proventriculus-gizzard (yellow arrow) in day old Kadaknath

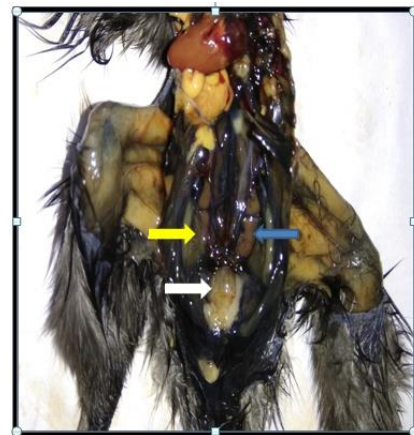


Fig 3: Photograph showing bursa of Fabricius (white arrow), right kidney (yellow arrow) and left kidney (blue arrow) in day old Kadaknath

Table 1: Body weight (in gm) and weight (in gm) of thymus, spleen and bursa of day old Kadaknath chick.

Parameters	Day old
Body weight	47 ± 0.98
Wt. of left thymus	0.081 ± 0.01
Wt. of right thymus	0.054 ± 0.02
Wt. of Spleen	0.012 ± 0.03
Wt. of Bursa	0.053 ± 0.02

Table 2: Various biometrical parameters of first, second, third, fourth and fifth lobe of thymus of day old Kadaknath chick.

Parameters	Left					Right				
	1 st lobe	2 nd lobe	3 rd lobe	4 th lobe	5 th lobe	1 st lobe	2 nd lobe	3 rd lobe	4 th lobe	5 th lobe
Length (mm)	5.33 ± 0.63	3.71 ± 0.16	5.11 ± 0.27	4.95 ± 0.23	5.55 ± 0.44	3.78 ± 0.17	4.12 ± 0.65	3.37 ± 0.19	4.28 ± 0.35	4.84 ± 0.23
Cranial width (mm)	2.93 ± 0.12	2.64 ± 0.14	2.54 ± 0.17	1.91 ± 0.21	1.94 ± 0.09	2.50 ± 0.23	2.06 ± 0.18	1.24 ± 0.12	1.91 ± 0.14	1.60 ± 0.16
Middle width (mm)	2.51 ± 0.11	2.13 ± 0.13	2.42 ± 0.12	1.47 ± 0.11	2.35 ± 0.21	2.62 ± 0.24	1.81 ± 0.09	1.69 ± 0.20	1.84 ± 0.13	1.75 ± 0.11
Caudal width (mm)	2.37 ± 0.25	1.93 ± 0.13	2.23 ± 0.18	1.45 ± 0.27	2.75 ± 0.16	2.93 ± 0.28	2.07 ± 0.14	1.65 ± 0.07	1.98 ± 0.34	1.99 ± 0.18
Cranial thickness (mm)	1.75 ± 0.09	1.15 ± 0.12	1.06 ± 0.07	1.53 ± 0.16	2.02 ± 0.11	0.96 ± 0.10	0.85 ± 0.27	0.98 ± 0.03	0.96 ± 0.12	1.05 ± 0.21
Middle thickness (mm)	1.45 ± 0.25	1.47 ± 0.54	1.63 ± 0.32	1.97 ± 0.21	1.58 ± 0.12	1.20 ± 0.36	1.57 ± 0.12	1.05 ± 0.14	0.99 ± 0.08	1.13 ± 0.16
Caudal thickness (mm)	1.57 ± 0.32	1.02 ± 0.21	1.68 ± 0.49	1.20 ± 0.18	1.83 ± 0.09	1.13 ± 0.13	1.27 ± 0.32	0.97 ± 0.52	1.21 ± 0.26	1.05 ± 0.11

Table 3: Volume (in cc), diameter (in mm) and thickness (in mm) of spleen and bursa of Fabricius of day old Kadaknath chick

Parameters	Day old	
Volume	Spleen	0.11 ± 0.02
	Bursa of Fabricius	0.26 ± 0.02
Longitudinal diameter	Spleen	3.42 ± 0.18
	Bursa of Fabricius	5.78 ± 0.28
Transverse diameter	Spleen	2.43 ± 0.14
	Bursa of Fabricius	3.59 ± 0.18
Thickness	Spleen	1.80 ± 0.13
	Bursa of Fabricius	3.09 ± 0.29

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