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Histomorphological and Histochemical Studies on Caecal Tonsils of Kadaknath Fowl

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Abstract

Histomorphological and histochemical studies were conducted on the caecal tonsils of Kadaknath fowl at different age groups from day old to more than 32 weeks of age. The proximal dilated part of the caecum considered for caecal tonsil was composed of all four histological layers. The epithelium of mucosal villi was composed of simple columnar with goblet cells. The lymphatic tissue was present in the mucosa and submucosa of the caeca in the form of diffused and encapsulated lymphatic nodules. The number and size of encapsulated lymphatic nodule was increasing with the advancement of the age. The height of the mucosal villi was decreasing with the advancement of age whereas the lumen of the caeca was increasing with the advancement of age. PAS and AMPS activity was more in younger age groups than the older groups.

Introduction

Kadaknath is only Black Meat Chicken (B.M.C.) breed of India. The bird is very popular among the 'adiwasis' mainly due to its adaptability to the local environment, disease resistance, tasty meat quality, texture and flavor. Most of the internal organs of the Kadaknath breed also showed intense black coloration due to deposition of melanin pigment in the organs (Rao and Thomas, 1984). The lymphoid tissue plays an important role in the defense against microorganisms. The chicken has primary/central (thymus and bursa of Fabricius) and secondary/peripheral (spleen and all mucosa associated lymphoid tissue) lymphoid organs (Akter *et al*., 2006). The lymphoid organs play a major role in avian immunity, functional immune cells (T-cells and B-cells) leave primary/central lymphoid organs and accumulate in the secondary lymphoid organs, such as spleen, bone marrow and gland of Harder (Zahirul *et al.,* 2010). The ceacal tonsils are considered the largest lymphoid aggregates of avian gut associated lymphoid tissue and these elicit protective immune responses against bacterial and viral pathogens in the intestinal tract of avian species (Heidari *et*

al.,2015). Perusal of literature reveals that no work done on caecal tonsils of Kadaknath in India and abroad, therefore, this work has been proposed to investigate the characteristic features in relation to the their age and establish the fact about disease resistant of Kadaknath and the contribution of its immune system and immunocompetent among all domestic birds. It is anticipated that the results obtained by this study will fill the lacuna in the scientific literature on the anatomy of secondary lymphoid organs.

Materials and Methods

The present study was conducted on caecal tonsils of 30 Kadaknath breed of fowl (*Gallus domesticus*) irrespective of sex obtained from Veterinary College Poultry Farm, Mhow (M.P.). These birds were divided into five groups with each of six birds, Group I (Day old to 8 week), Group II (>8 weeks to 16 week), Group III (>16 weeks to 24 week), Group IV (>24 weeks to 32 week) and Group V (>32 week old birds). The age of fowl was determined by the record available in the farm.

These birds were dissected very carefully from the ventral aspect to expose and exteriorized the caeca from the thoracoabdominal cavity after the detailed in situ study. The proximal dilated part of the caeca and fixed in neutral buffer formalin and tissue sections of 5 µm thickness were cut for histological and histochemical staining.

Results and Discussion

The Caeca were paired and approximately equal in length, with separate lateral or ventrolateral openings into the colon (colorectum). The initial portion of each base of caecum included a slightly swollen area suggestive of caecal tonsil (Fig. 1). Similarly Majeed *et al.* (2009) and Akter *et al.* (2006) in broiler chicken reported that the caecal tonsil was located near the opening of each cecum in the proximal one third of paired tubular caecum with broad tubular in shape. However, Ragaa *et al*. (2017) reported that in quail caeca began with dome like protrusions which were hemispheric or spherical in shape and represented ceacal tonsil.

In the present study, the Ceacal tonsil was composed of all four histological layers i.e. tunica mucosa, submucosa, muscularis and serosa (Fig. 2). Mucosal villi covering epithelium contained simple columnar with goblet cells. The bases of the mucosal folds (villi) were broad and the apexes were pointed or rounded in all age groups of chickens (Fig. 2) which were similar to the findings of Akter *et al.* (2006) in broiler chickens, Hodges (1974) in white leghorn chicken, Khalil Mohsin *et al*. (2002 & 2003) and Rahman *et al*. (2003) in native chicken. Similar to the findings of Kannan *et al.* (2012) in chicken the caecal tonsil revealed two types of lymphoid aggregations (germinal centre), the first type had an incomplete capsule and the second type was found encapsulated with connective tissue, and the germinal centre consisted of lymphoblasts, lymphocytes of various sizes, reticular cells, plasma cells, mast cells and macrophage (Fig. 3).

In the present study the ceacal tonsil showed an irregular and protuberant appearance. More diffuse lymphoid tissue and unorganized lymphatic nodules were present both in the mucosa and submucosa of the chicken (Fig.2 & 4) which was similar with the finding of Akter *et al.* (2006) in broiler chickens. However, Kitagawa *et al*. (1998) in chicken reported moderately developed aggregated lymphoid nodules in a ceacal tonsil and Samia *et al*. (2017) in birds reported that the ceacal tonsils were consisted of the aggregated masses of lymphocyte, forming a multiple nodule and encapsulated by muscle fibers. In older age groups the length of villi was shorter with wider lumen whereas in younger age groups villi were high with small lumen. In the mucosa and submucosa of the caecum network of reticular fibers was present (Fig. 6). Few collagen fibers were surrounding the lymphatic nodule (Fig. 5).

In the present study the average length and width of lymphatic nodule in group – I, II, III, IV and V were 57.6 ± 17.2 µm x 62.4 ± 4.39 µm, 100.8 ± 5.9 µm x 84.2 ± 5.29 µm, 115.2 ± 9.6 µm x 91.2 ± 4.39 µm, 158.4 ± 21.2 µm x 117.6 ± 14.6 µm, and 355.13 ± 17.9 µm x 314.2 ±18.78 µm, respectively. However, Akter *et al.* (2006) in broiler chickens reported that the length and breadth of the lymphatic nodules of the ceacal tonsil were 255.20 ± 20.46 µm and 186.08 ± 24.90 µm, respectively.

Fig 1 :- Photograph showing caecal tonsil (CT) at ileo- caecal junction (13th week)

Fig 2:- Photomicrograph of caeca (20th week) showing mucosal villi (MV), lumen (L), simple columnar epithelium (E) and mucosa (M), submucosa (SM), muscularis (Mus) and serosa (S) (H & E, 40x)

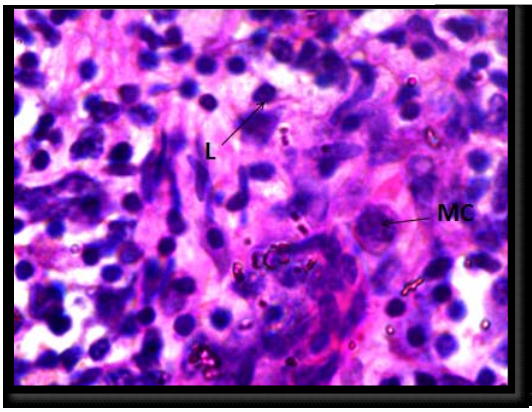

Fig 3:- Photomicrograph of caecal tonsil (28thweek) showing mast cell (MC) and lymphocyte (L) (H & E, 1000x)

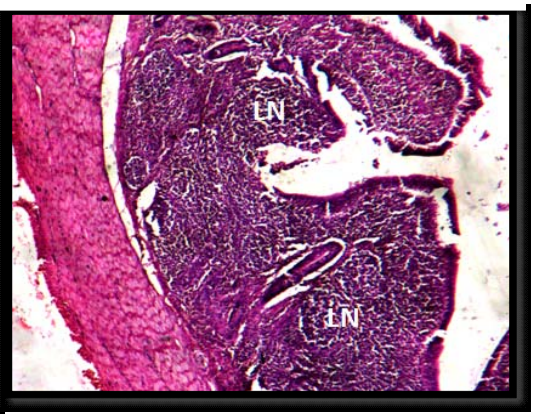

Fig 4:- Photomicrograph of caecal tonsil (50th week) showing lymphatic nodules (LN) in mucosa (H & E, 40x)

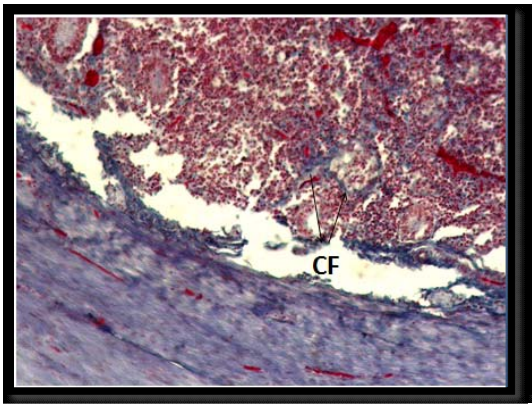

Fig 5:- Photomicrograph of caeca (24th week) showing collagen fibers (CF) in mucosa and submucosa (Masson's trichrome stain, 100x)

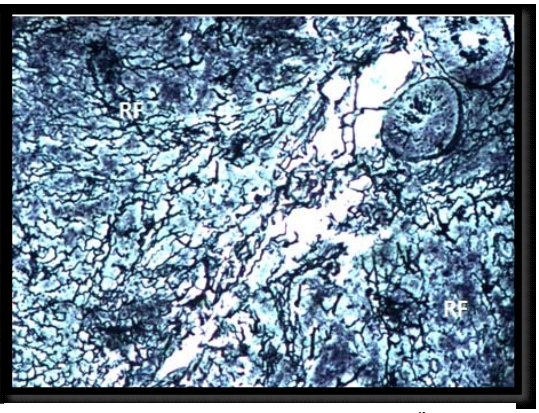

Fig 6:- Photomicrograph of caeca (18thweek) showing reticular fibers (RF) in mucosa and submucosa (Gomori stain, 200x)

In the present study, different components of the proximal dilated part of caeca showed mild to moderate PAS activity in younger age group whereas older age group showed the activity in traces. However, Pandit*et al*. (2018) in Uttara fowl reported PAS activity in the villus epithelium and the crypts of Lieberkuhn in the caeca, they further demonstrated that lamina propria had strong PAS reaction in 28 days and 112 days age groups, while moderate and weak reaction was observed in 7th and day old age groups. Younger age group showed mild to moderate activity of acid mucopolysaccharide (AMPS) reaction in lymphatic nodule, while older age group showed trace activity of AMPS reaction in lymphatic nodule. However, Pandit *et al*. (2018) in Uttara fowl reported that villus epithelium, goblet cells and crypts of Lieberkuhn had strong AMPS reaction in 28 days and 112 days age group, while moderate and weak AMPS reaction in 7th and day old age groups, respectively.

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