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Original Research

Histochemical Studies on the Major Lymphoid Organs in Various Chicken Genotypes

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Abstract

A total number of eighteen-day old Hansli chicks and eighteen-day old Vencobb broiler chicks were both divided into three age groups viz. group I (up to 1 month), group II (1-3 months) and group III (3-6 months) with six birds in each age group. On each observation day (4th week, 12th week and 24th week), six birds from each breed were used for the study of histochemical features of the thymus, spleen and bursa of Fabricius. It was found that the capsule, septa and tunics of blood vessels revealed age-specific PAS activities, whereas the Alcian blue activities varied with age and was restricted to the thymic capsule and trabeculae. The splenic capsule, tunics of blood vessels and intercellular region of splenic white pulp revealed age-specific PAS positive activity, whereas the Alcian blue activity was only reported in the splenic capsule of 12th week age Hansli chicken and Vencobb broiler chicken. The apical borders of both follicles associated epithelium and interfollicular epithelium, sub-epithelial region, cortico-medullary junction, medulla of the lymphoid follicle, interfollicular connective tissue, central connective tissue core of bursal plicae, walls of blood vessels, tunica muscularis and tunica serosa revealed age-specific PAS activities. In contrast, the apical borders of follicle associated epithelium (FAE), interfollicular epithelium (IFE) and goblet cells of lining surface epithelium, tunica muscularis and tunica serosa showed age-specific Alcian blue activities in both the birds.

Keywords: Bursa of Fabricius, Hansli, Histochemical, Spleen, Thymus, Vencobb

Introduction

The organized poultry sector contributes about 70 per cent of the total output of the poultry industry and the remaining 30 per cent is shared by the unorganized sector (Ali, 2015). Besides, providing nutritious chicken egg and meat for consumption, the native fowl play an incredible role in giving the subsidiary income to the rural poor and marginalized section of the people in our country (Padhi, 2016). The Hansli chicken is especially reared in the Mayurbhanj district and in some parts of its nearby districts like Keonjhar of Odisha (Mohapatra *et al*., 2016). The Hansli chicken is very well adapted to the hot and humid tropical climates of Odisha and has been mainly reared for meat, egg and game purpose (Dahariya *et al*., 2020a and Dahariya *et al*., 2020b).

Several works have been reported on the lymphoid system of broiler chicken (Khan *et al.*, 2014), domestic chicken (Kannan *et al.*, 2015), Japanese quail (Senapati *et al.*, 2015) and turkey (Ali, 2016), but very scarce literature is available on the lymphoid system of Hansli chicken and Vencobb broiler chicken till date. Viewing the increased popularity of the Hansli chicken and Vencobb broiler chicken in Odisha, the present study is carried out on the histochemical characterization of major lymphoid organs in these breeds with age.

Materials and Methods

A total number of eighteen-day old Hansli chicks and eighteen-day old Vencobb broiler chicks were purchased from Mayurbhanj district and Eastern Hatcheries Pvt. Ltd., Bhubaneswar, Odisha (A subsidiary of Venkateswara Hatcheries Group, Pune) respectively to study the post-hatched development of major lymphoid organs such as thymus, spleen and bursa of Fabricius. The birds (Hansli chicken and Vencobb broiler chicken) were divided into three age groups viz. group I (up to 1 month), group II (1-3 months) and group III (3-6 months) with six birds in each age group. On each observation day (4^{th} week, 12^{th} week and 24^{th} week), six birds from each breed were used for the histochemical study of the thymus, spleen and bursa of Fabricius. The representative tissue samples were collected after careful dissection of the organs. The tissue samples were dehydrated through the ascending grades of ethyl alcohol (70%, 80%, 90%, 95% and absolute alcohol) and cleared in xylene. The paraffin impregnation was done inside a thermostatically controlled hot air oven and the paraffin tissue blocks were prepared. The paraffin blocks were cut with the help of a semi motorized rotary microtome (Leica RM 2245, Germany) to obtain the serial tissue sections of 5-to-7-micron (µm) thickness after trimming. The desired sections were selected and flattened in hot water bath at 37^0C. They are finally mounted on clean, grease free, albumenized glass slides and air-dried. Sections were subjected to the Combined PAS-Alcian blue (ABPAS) staining method for the presence of acid and neutral mucins as per the standard method given by Bancroft and Stevens (1996).

Results and Discussion

Thymus

The presence of neutral and acid mucopolysaccharides in the thymus was confirmed by Periodic acid-Schiff and Alcian blue activities. The thymic capsule and connective tissue septa or trabeculae revealed moderate PAS activity, whereas very weak Alcian blue activity was noted in the thymic capsule in 4^{th} week age Hansli chicken. Moderate PAS activity was recorded in the capsule and septa, whereas the complete absence of Alcian blue activity was noted in the thymic capsule in 4^{th} week age Vencobb broiler chicken. Very strong PAS activity was reported in the capsule, connective tissue septa or trabeculae and tunics of blood vessels (Fig. 1 and Fig. 2) with the complete absence of Alcian blue activity in 12^{th} week age Hansli chicken. Moderate PAS activity was reported in the capsule, connective tissue septa or trabeculae and tunics of blood vessels with very strong Alcian blue activity in the capsule and connective tissue septa (Fig. 3) in 12^{th} week age Vencobb broiler chicken. Very strong PAS activity was reported in the capsule, connective tissue septa or trabeculae and tunics of blood vessels (Fig. 4 and Fig. 5) with the complete absence of Alcian blue activity in 24^{th} week age Hansli chicken. The present observations were in accordance with the reports given by Bhattacharya (1983) in chicken, Gulmez and Aslan (1999) in native geese and Mahanta (2018) in local hill fowl of Uttarakhand and RIR.

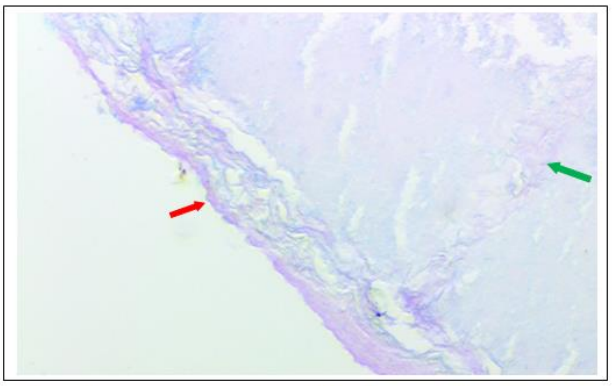

Fig. 1: Photomicrograph showing intense PAS activity in capsule (red arrow) and trabeculae (green arrow) of thymus of Hansli chicken (12th week age) (ABPAS ×400)

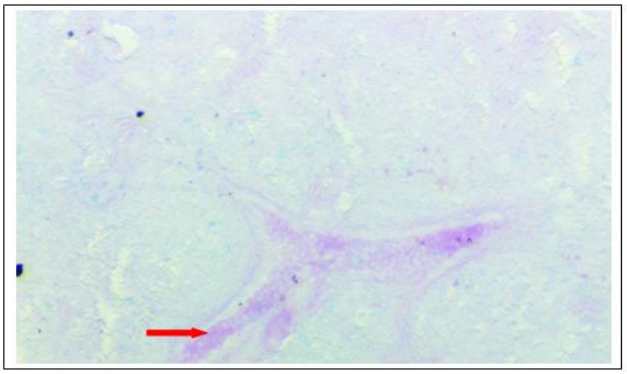

Fig. 2: Photomicrograph showing intense PAS activity in the tunics of blood vessels (red arrow) of thymus of Hansli chicken (12th week age) (ABPAS ×400)

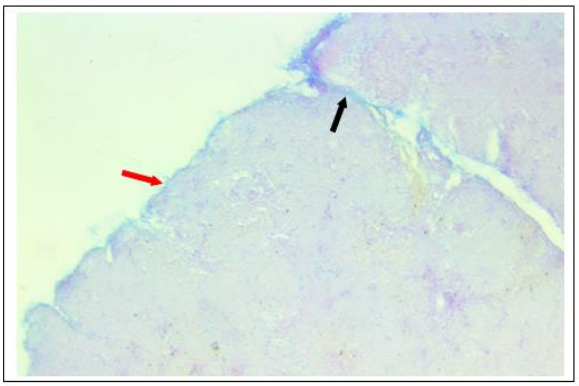

Fig. 3: Photomicrograph showing intense Alcian blue activity in capsule (red arrow) and trabeculae (black arrow) of thymus of Vencobb broiler chicken (12th week age) (ABPAS ×400)

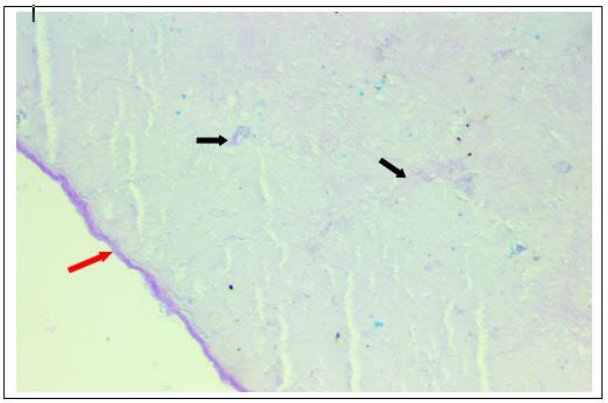

Fig. 4: Photomicrograph showing intense PAS activity in capsule (red arrow) and tunics of blood vessels (black arrows) of thymus of Hansli chicken (24th week age) (ABPAS ×400)

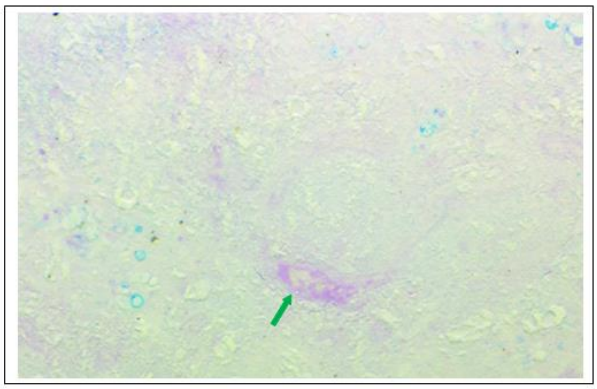

Fig. 5: Photomicrograph showing intense PAS activity in the tunics of blood vessels (green arrow) of thymus of Hansli chicken (24th week age) (ABPAS ×400)

Spleen

The presence of neutral and acid mucopolysaccharides in the spleen was confirmed by Periodic acid-Schiff and Alcian blue activities. The splenic capsule revealed very weak PAS activity, whereas moderate PAS activity was noted in the tunics of blood vessels and intercellular region of splenic white pulp in 4th week age Hansli chicken and Vencobb broiler chicken. No Alcian blue activity was reported in the spleen of 4th week age Hansli chicken and Vencobb broiler chicken. Very weak PAS and Alcian blue activities were observed in the capsule of 12th week age Hansli chicken and Vencobb broiler chicken. Very strong PAS activity was noted in the tunics of blood vessels (Fig. 6), whereas moderate PAS and Alcian blue activities were observed in the capsule of the spleen in 12th week age Hansli chicken and Vencobb broiler chicken. Moderate PAS activity was noted in the capsule and intercellular region of splenic white pulp in 24th week age Hansli chicken and Vencobb broiler chicken. Very strong PAS activity

was observed in the tunics of blood vessels (Fig. 7); whereas the Alcian blue activity was completely absent in the spleen of 24th week age Hansli chicken and Vencobb broiler chicken. The present observations were in accordance with the reports given by Singh (2004) in keets and Mahanta (2018) in local hill fowl of Uttarakhand and RIR.

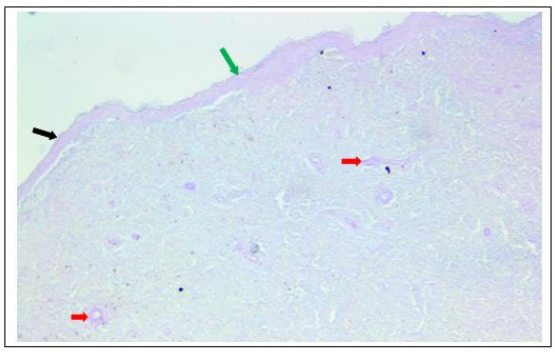

Fig. 6: Photomicrograph showing intense PAS activity in the tunics of blood vessels (red arrows) with moderate PAS (black arrow) and Alcian blue activities (green arrow) in the capsule of spleen of Hansli chicken (12th week) (ABPAS ×400)

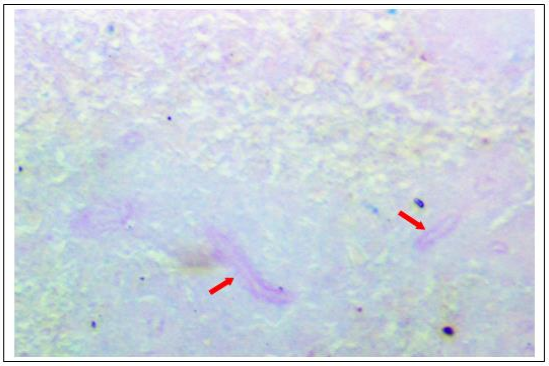

Fig. 7: Photomicrograph showing intense PAS activity in the tunics of blood vessels (red arrows) of spleen of Hansli chicken (24th week) (ABPAS ×400)

Bursa of Fabricius

The presence of neutral and acid mucopolysaccharides in the bursa of Fabricius was confirmed by Periodic acid-Schiff and Alcian blue activities. The apical borders of both follicle associated epithelium (FAE) and interfollicular epithelium (IFE), sub-epithelial region, cortico-medullary junction, medulla of the lymphoid follicle, interfollicular connective tissue, walls of blood vessels, tunica muscularis and tunica serosa revealed moderate PAS activity in 4th week and 12th week age of Hansli chicken. Intense PAS activity was reported in the bursal follicles and tunica muscularis of bursa in 4th week age Vencobb broiler chicken (Fig. 8). Intense PAS activity was also seen in the centre of bursal plica in 4th week and 12th week age of both the birds (Fig. 9). Further, the apical borders of follicle associated epithelium (FAE), interfollicular epithelium (IFE) and goblet cells of lining surface epithelium revealed very strong Alcian blue activity in 4th week and 12th week age of both Hansli chicken and Vencobb broiler chicken (Fig. 10). The epithelium and tunica serosa showed intense Alcian blue activities in 4th week age of Vencobb broiler chicken. Very weak PAS activity was recorded in the apical borders of both follicle associated epithelium (FAE) and interfollicular epithelium (IFE), sub-epithelial region, cortico-medullary junction, medulla of the lymphoid follicle, interfollicular connective tissue, walls of blood vessels, tunica muscularis and tunica serosa in 24th week age of both Hansli chicken and Vencobb broiler chicken. Similarly, no Alcian blue activity was noted in the apical border of follicle associated epithelium (FAE), interfollicular epithelium (IFE) and goblet cells of lining surface epithelium of 24th week age in both Hansli chicken and Vencobb broiler chicken. The present observations were in accordance with the reports given by Gulmez and Aslan (1999) in native geese, Indu *et al*. (2005) in White Pekin ducks, Jayachitra *et al*. (2009) in turkeys and Mahanta (2018) in local hill fowl of Uttarakhand and RIR.

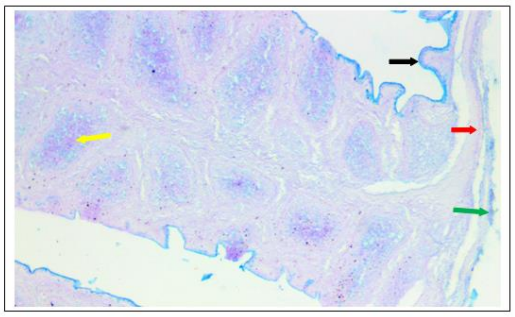

Fig. 8: Photomicrograph showing intense Alcian blue activity in the epithelium (black arrow) and tunica serosa (green arrow) with intense PAS activity in the bursal follicle (yellow arrow) and tunica muscularis (red arrow) of bursa of Fabricius in Vencobb broiler chicken (4th week) (ABPAS ×100)

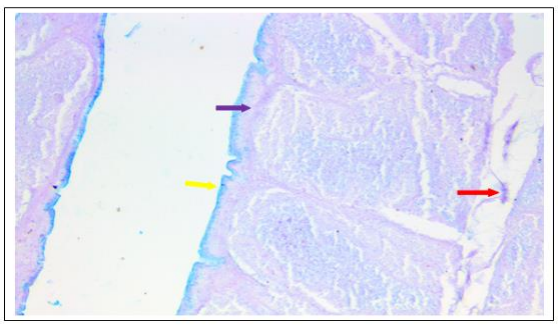

Fig. 9: Photomicrograph showing intense PAS activity in the centre of plicae (red arrow) and around bursal follicles (violet arrow) with strong Alcian blue activity in the epithelium (yellow arrow) of bursa of Fabricius in Hansli chicken (4th week) (ABPAS ×100)

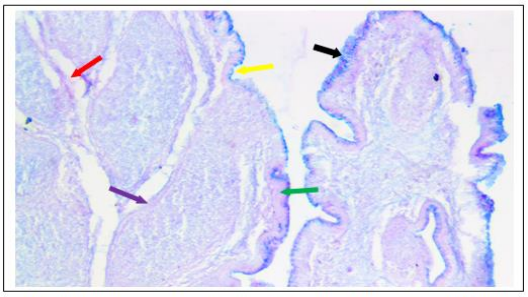

Fig. 10: Photomicrograph showing intense Alcian blue activity in the apical borders of follicle associated epithelium (black arrow), interfollicular epithelium (yellow arrow) and goblet cells of lining surface epithelium with moderate PAS activity in the epithelium (green arrow), between follicles (violet arrow) and centre of plicae (red arrow) of bursa of Fabricius in Vencobb broiler chicken (12th week) (ABPAS ×100)

Conclusion

The present histochemical study provided detailed baseline data on the presence of neutral and acid mucopolysaccharides in different parts of thymus, spleen and bursa of Fabricius in Hansli chicken and Vencobb broiler chicken with progressing age. Further, this type of research study can be mingled with advanced molecular techniques and could also be carried out in other indigenous breeds of the poultry of India to establish a baseline data.

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Conflict of Interests

There is no conflict of interest.

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