INFLUENCE OF AGE AND BODY WEIGHT ON SPLEEN PARAMETERS IN WHITE PEKIN DUCKS

V.R. Indu[1], J.J. Chungath[2], K.R. Harshan[3] and N. Ashok[4]
Department of Veterinary Anatomy and Histology
College of Veterinary and Animal Sciences
Mannuthy- 680 651, Thrissur, Kerala

Received - 29.03.10
Accepted - 07.06.10

Abstract

A study was conducted using 45 White Pekin ducks from day old to 155 days to ascertain the influence of age and body weight on the spleen of ducks. A multiple regression fit was applied to the data. Simple as well as partial correlation coefficient between the different factors were calculated and tested for significance. The size and weight of spleen increased with age and body weight of birds. But body weight had a greater influence on the development of spleen. Thus heavier birds of a particular age will tend to have heavier spleen. A well developed spleen is a representative of a strong immune system. Hence, it can be concluded that by scientific management practices when the body weight of the birds would increase, the spleen might attain its maximum immunological functions at an early age. This will help to meet the demands of the body in development of systemic immunity, thus improving the flock health.

Keywords: *duck, influence of age and bodyweight, spleen development*

The avian spleen has been frequently used in studies of avian ecology, parasitology and evolution to infer immune system status in birds (Smith and Hunt, 2004). It is a peripheral lymphoid organ dependent on both the thymus and bursa of Fabricius (Firth, 1977). Weight of the spleen varies consid erably with breed, age, body weight, health status and environment. The studies made on heritable differences indicate that the size of spleen apparently has a relationship with the quantity of lymphocytes produced. The objective of this study was to correlate the size and weight of spleen to the age and body weight in White Pekin ducks in order to ascertain which of the two had the maximum influence.

Materials and Methods

Fourty five apparently healthy male White Pekin ducks of various age groups were used for the study. The birds were selected randomly from a single hatch and reared under intensive system of management. Material was collected at five days interval from the day of hatch up to 20 days, ten days interval up to 50 days and thereafter at 15 days interval up to 155 days of age. After recording the live body weight, the birds were sacrificed and the spleen was collected and weighed. A multiple regression of the spleen weight on the body weight and age (in days) was fitted to the data. Significance of regression fit was carried out by analysis of variance technique. Simple as well as partial significant coefficients between the different factors were calculated and tested for significance following Snedecor and Cochran (1989).

1. Assistant Professor,
2.Professor and Head, CVAS, Pookode
3 Professor (Retd.)
4. Professor and Head

Results and Discussion

The increase in weight of the spleen was in accordance with growth of the bird until 80 days of age (Table1). It almost doubled (1.86 times) from 80 to 110 days of age with a maximum weight of 1.10 g at 110 days of age. At this age, the body weighed 1.90 kg and the contribution of spleen to body weight was 0.06%. Thereafter, a gradual decline in spleen weight was noticed. But in the case of chicken, Wolfe *et al.* (1962) reported a maximum mean weight of 6.45g at 20 weeks of age. Relationship between body weight, spleen weight and spleen size are shown in table 2.

The maximum spleen weight relative to body weight (0.12%) was recorded at 20 days of age. Thereafter, the proportion showed a decreasing trend throughout the period of study. This indicates that after 20 days of age, the growth rate of spleen was not proportionate to the body growth rate. The whole body grew at a faster rate compared to the spleen. Dieter and Breitenbach (1968) obtained maximum spleen weights to body weight percentage (nearly 0.3%) at 5 to 11 weeks in cockerels.

In the present study, highly significant positive correlation was observed between age, body weight and the weight of spleen (Table 2). Estimating a multiple correlation coefficient of 0.951 it can be inferred that 90.48 percent of the total variation in the weight of spleen occurred due to the variation in the age and bodyweight of the birds. Thus weight of spleen was observed to increase with the advancement of age and body weight as reported by Gillie and Salomon (1999) in ducks and by Al-Dabargh and Abdulla (1963) in chicken. But this joint accounting of variables did not actually indicate which of the two parameters (age or body weight) had a greater influence on the weight of spleen.

The partial correlation coefficient between the weight of spleen and the age of bird keeping body weight constant was –0.254 ($p<0.05$) whereas that between the weight of spleen and body weight when age of the bird was held constant was 0.622 ($p<0.01$). Thus when the body weight of the bird was kept constant, only 6.45 percent of total variation in weight of spleen was accounted for by age and when age of bird was kept constant 38.69 percent of the variation in the weight of spleen was due to changes in the body weight. This indicates that body weight had a greater influence on the weight of spleen than the age of the bird. Dieter and Breitenbach (1968) noticed that after six weeks, the splenic weight had a direct relationship to the body weight.

Table 1. Body weight and parameters of spleen in White Pekin ducks at different ages.

Age	Body weight (g)	Spleen weight (g)	Spleen length (cm)	Spleen width (cm)	Percentage weight of spleen to body weight
Day old	32	0.01	0.40	0.30	0.04
5	40	0.04	0.52	0.40	0.11
10	95	0.07	0.64	0.40	0.07
15	120	0.13	0.70	0.53	0.11
20	182	0.21	1.20	0.61	0.12
30	510	0.25	1.20	0.80	0.05
40	710	0.30	1.31	0.80	0.04
50	1200	0.52	1.60	1.00	0.04
65	1300	0.58	1.70	1.00	0.05
80	1600	0.59	1.70	1.00	0.04
95	1700	0.76	2.50	1.51	0.04
110	1900	1.10	2.50	1.60	0.06
125	2100	1.01	2.21	1.52	0.05
140	2200	0.71	1.83	1.43	0.03
155	2220	0.74	1.74	1.24	0.03

Table 2. Correlation coefficient between pairs in White Pekin ducks.

Age and body weight	0.978 **
Age and spleen weight	0.900**
Body weight and spleen weight	0.939**
Age and percent weight of spleen to bw	–0.582*
Age and spleen length	0.818 **
Body weight and spleen length	0.879 **
Age and spleen width	0.899**
Body weight and spleen width	0.938**

**p<0.05; ** p<0.01*

There was a progressive increase in length and width of spleen up to 110 days of age (Table1). Thereafter, a decline in both the dimensions was noticed up to 155 days of age. Table 2 shows highly significant positive correlation between the length and width of spleen to the age and body weight of birds. 81.72 percent of total variation in the length of spleen and 86.36 percent of total variation in the width of spleen was explained by the variation in the age and body weight of birds estimating a multiple coefficient correlation of 0.904 and 0.929, respectively. Similar reports in ducks are not available for comparison.

When body weight was kept constant, the partial correlation coefficient between the length of spleen and the age of bird was –0.414 ($p<0.05$) and between the width of spleen and the age of bird was –0.243 ($p<0.05$). When age of the birds was kept constant the partial correlation coefficient between length of spleen and weight of bird was 0.625 ($p<0.01$) and between width of spleen and weight of bird was 0.641 ($p< 0.01$). From these results it can be derived that 17.14 percent of total variation in spleen length and 5.90 percent of total variation in spleen width was accounted for by age when the body weight was kept constant. Whereas, when the age of birds was kept constant 39.10 percent of the total variation in spleen length and 41.12 percent of the total variation in spleen width was accounted for by change in body weight. This indicated that body weight was the main factor that influenced the weight, length and width of spleen. These observations were in accordance with the reports of Dieter and Breitenbach (1968) in chicken.

References

Al-Dabargh, M.A. and Abdulla, M. 1963. Correlation of sizes and weights of livers and spleens to the ages and body weights of normal chicks with a note of histology of these organs in chicks. *Vet. Rec*., **75**:397-400.

Dieter, M.P. and Breitenbach, R.P. 1968. The growth of chicken lymphoid organs, testes and adrenals in relation to the oxidation state and concentration of adrenal and lymphoid organ vitamin C. *Poult.Sci.,* **47**:1463.

Firth, G.A. 1977. The normal lymphatic system of the fowl. *Vet.Bull***., 47**:167-179.

Gillie, U. and Salomon, F.V. 1999. Age related changes in the avian primary lymphoid organs. *Anat. Histol. Embryol*., **28**:229-233.

Smith, K.G. and Hunt, J.L. 2004. On the use of spleen mass as a measure of avian immune system strength. *Oecologia.*, **138**:28-31.

Snedecor, G.W. and Cochran, W.G. 1989. *Statistical Methods*. 6th ed. Oxford and IBH Publishing Co., New Delhi. 313 p.

Wolfe, H.R., Sheridan S.A., Wilstal, M.N. and Johnson, M.A.1962. The growth of lymphoid organs and testes of chicken. *Anat.Rec*., **142**:485-493.

❑