THE EFFECT OF TRANSPORTATION STRESS ON HAEMATOLOGY AND IMMUNOLOGICAL RESPONSES OF INDONESIAN NATIVE DUCKS *(ANAS PLATYRHYNCHOS)*

Oleh :

R. Dharsana, [1] R.E. Abdelsamie [2] and A. Lasmini [3]

ABSTRACT

Two trials were conducted to study the effect of transportation stress on haematology and immune responses of Alabio ducks *(Anas platyrhynchos)*. Measurements were also made for egg production and organ weights (liver, thymuse, spleen and bursa of Fabricius).

Erythrocyte counts in blood collected 18 h after the stress significantly decreased ($P < 0,05$). The pack cell volume (PCV) and leukocytes counts tended to decrease as the result of stress, however, the decrease was not significant. The heterophil/ lymphocyte ratio was highest in the stress group 18 h after the treatment. The stress due to both transportation and handing of animals for collection of blood had a profound effect on egg production.

Transportation stress reduced the ability of ducks to produce anti sheep red blood cell than anti Brucella abortus antigens, indicating that the effect to the stress in ducks in on the T cell dependent immune response. No significant differences in body weight and organ weights were observed.

Keywords : Ducks, transportation stress, blood components, immune response, egg production, organ weights.

ABSTRAK

Dua percobaan telah dilakukan untuk melihat pengaruh stres akibat transportasi terhadap hematologi dan reaksi kebal dari itik alabio *(Anas platyrhynchos)*. Produksi telur dan bobot organ yaitu liver, thymuş, splees dan bursa fabricius juga dilakukan.

Jumlah eritrosit didarah yang diambil 18 jam sesudah stres menunjukan penurunan secara nyata ($P < 0.05$). Pack cell volume (PCV) dan jumlah leukosit juga cenderung mengalami penurunan meskipun tidak berbeda nyata. Rasio hetorofil dan limfosit paling tinggi diketemukan didarah 18 jam setelah stres. Baik stres akibat transportasi maupun akibat penangkapan itik-itik tersebut dalam pengambilan darah menyebabkan penurunan produksi telur.

Stres akibat transportasi menurunkan kemampuan itik untuk memproduksi arti butir darah domba dari pada anti Brucella abortus, iini menunjukan bahwa pengaruh stres tersebut pada itik adalah pada reaksi kebal yang tergantung pada T sel. Bobot badan dan bobot organ tidak menunjukan perbedaan yang nyata antara kelompok itik yang mengalami stres transportasi dan itik kontrol.

INTRODUCTION

Ducks are very sensitive to stress arising from altered regimes of management. Crowding or mixing with strange animals and other forms of stress appear to influence the rate of egg production (Setioko *et al.* 1985). The herding system of management commonly prakticed in rice growing areas in South East Asia where ducks are frequently shifted following rice harvest subjects them to a plethora of stimuli. Stressors during transportation include handling, inversion, partial immobilization, continement, noise, vibration, air movements, temperature and humidity changes and food and water deprivation. Most of these stimuli have been demonstrated by several workers as stressors in poultry (Freeman, 1984).

Physiological changes associated with stress in chickens include enlargement of the anterior pituitary and the adrenals, depletion of adrenal cholesterol, a rice in the level of plasma cortico-

1) & 3) Balai Penelitian Ternak, Research Institute for Animal Production P.O. Box 123, Bogor 16001, West Java, INDONESIA.
2) Present Address: CSIRO, PARD P.O. Box 260, Civic Square ACT 2608 Australia

sterone; atrophy of the thymus and the bursa of fabricius, changes in the number of circulating leukocytes and in the levels of plasma glucose and free fatty acids; retardation of growth and loss of weight has been reported in chickens (Hill, 1983). Immunological responses have also been suggested by Siegel (1985) as indicators of stress.

Most available information on stress and its effects were derived from work conducted on chickens. Little information on the effects of stress have been reported in ducks. The present study was undertaken to determine the haematology and the immune responses of Indonesian native ducks when subjected to transpotation stress.

MATERIALS AND METHODS

Experiment 1. Effect of stress on blood components and egg production.

Twenty Alabio laying ducks individually housed in wire laying cages were divided into two equal groups. One group was transferred into a wire crate and transported in a van for about one hour (a distance of 40 km), and then returned to their individual cages. The other group remained in their individual cages and served as control. Ducks were bled before, two h and 18 h after transportation. The control group was also bled at about the same times. Measurements of pack cell volume (PCV), leukocytes and erythrocyte counts and differential leukocyte counts were made on all blood samples. Records were kept on daily egg production for a week before and a week after the transportation treatment.

Experiment 2. Effect of stress on the immune responses.

Thirty-nine two month old Alabio drakes were used in this experiment. They were divided into two groups of 19 and 20 birds. One group (19-drakes) was subjected to transportation stress as in experiment 1. The other group remained in their individual cages and served as control. All ducks were given intraperitonial injection of one ml of a suspension of 1/50 diluted killed Brucella abortus (10 x normal strenght) with 10 % washed sheep red blood cell (SRBC) in physiological saline just before the stress treatment. Blood and sera samples were collected from all drakes before the injection and six d after the treatment when all of the animals were sacrificed.

The carcases were weighed, the bursae, spleens, thymuses and livers were dissected, weighed expressed as percentage of body weight. Antibodies against sheep red blood cells were titrated using a microtitration haemaglutination technique (Toivanen *et al.* 1972). Brucella angglutins were titrated using the same method. The test antigen used was 1 in 20 dilution of stained Brucella milk ring test antigen.

Throughout the studies all birds were fed on a commercial layer diet. Feed and water were *ad libitum*. Data were subjected to analysis of Variance.

RESULTS

The effect of transportation stress on blood components and egg production are precented in Table (1). The pack cell volume (PCV), leukocytes and erythrocyte counts to decrease as a result of transportation as well as after the blood collection . However, the decrease was largely not significant except for erythrocyte counts in blood collected 18 h after ducks were subjected to the stress treatment which showed a significant ($P < 0.05$) decrease when compared with the stressed and control groups before the treatment. Nevertheless, 18 h after treatment the erythrocyte counts in the stressed and control groups were not significantly different. In the differential leukocyte counts, heterophila tended to increase and lymphocyte tended to decrease after the treatment whereas in the control group the heterophil and lymphocyte were back to normal at 18 h. The heterophil/lymphocyte retio was highest in the stress group 18 h after the treatment.

Transportation caused a decrease in the rate of egg production on the order of 32 % compared with egg production before the treatment. In the control group egg production also decreased, but by only 18 % of the pre treatment level.

Transportation stress reduced the ability of ducks to produce anti SRBC than anti Brucella abortus antigens. Only 84 % of the stress group responded to SRBC stimulation (Table 2). There were ni significant differences between both groups in body and organ weihts and blood Components (Table 3).

DISCUSSION

Experiment 1. The effect to transportation stress on the blood components of duks were generally in agreement with those found in stressed

chickens. Decrease in the leukocyte counts, increase in the number of heterophils and heterophil/lymphocyte ratio have been suggested as the best indicators of assessing stress in the domestic fowl (Ben Nathan *et al.*, 1976; Gross and Siegel, 1983; Wolford and Ringer, 1962). In the present study the heterophil/Lymphocyte ratio appears to be a more reliable indicators of stress then the increase of heterophil or decrease in leukocyte counts which did not show significant differences. This lack of response could have been due to the shortness of the journey. Ducks are generally transported for longer distances and durations during the year in search of harvested rice fields, and a more consistent evidence of decrease in leukocyte and increase in heterophil counts may be found under these conditions.

The erythrocyte counts seems to be affected by handling of the ducks for blood collection, however, the difference between blood collected before the treatment (first collection) and 18 hours after the treatment (third collection) did not reach a significant level for samples collected from the control group while the differences in blood collected at the same periods from the stressed group were significant. Blood collection for periods beyond 18 hours for futher monitoring was not possible since large number of ducks developed haematoma on both wings.

The study also showed that transportation stress caused a sharp drop in egg production despite the adequate nutrition received except during the short period (one hour) of transportation. It was evident that even relatively minor stress imposed by handling of the control group during collection caused a drop in egg production.

Experiment 2. Immune responses have been shown to be sensitive to a wide array of physiological and environmental factors (Siegel, 1983). A sensitivity which is not surprising since the lymphoid system is comprised of some the most actively dividing and synthesizing cells in the body. Any alteration of metabolic processes could be expected to be reflected rapidly in an impairment of normal activities of the tissue. In this experiment SRBC was used to see the effect to the transportation stress on T cell dependent immune response while Brucella abortus antigen was used to see the effect on B cell dependent immune response. The suggest that the effect of the stress in ducks is on the T cell dependent immune response as shown in Table 2 . Not all the transported ducks produced antibody response against SRBC and the mean titre was lower than the control (2.68 vs 3.60). It is possible the increase of the corticosteroids in stressed ducks caused this immune depression. The avian adrenal can be stimulated to produce increased a mounts of corticosteroids in response to stressors (Freeman *et al.*, 1980) and most evidence suggest that the promary immunological affect of the corticosteroids in chickens is on the T cell population (Mayer *et al.* 1984; Pardue and Thaxlon, 1984; Sato and Glick, 1970).
1970).

The reason for not getting significant differences between stressed and control groups in the blood components and body and organ weights (Table 3) might be due to the shortness of the journay and the fact that sampling was delayed until 6 days after the journey had been completed. Six days after the treatment was meant to give the ducks sifficient time to produce antibody response.

The results suggest that the effects of stress in ducks and chickens are similar; the changes of blood component values especially heterophil/lymphocyte ratio can bee good indicators of stress if the blood sampling is nade on the second day after stress and T cell dependent immune response can be a good indicator if made a week after stress.

ACKNOWLEDGEMENTS

We thank the staft of the Veterinary Laboratory of BPT Ciawi for the technical assistance.

REFERENCES

1. Ben Nathan, D., E.D. Heller and M. Perek (1976). The effect of short heat stress upon leukocyte count, plasma corticosteroid level, plasma and leukocyte ascorbic acid contents. *British Poultry Science* 17 : 481 – 485

2. Duncan, I.J.H (1974). A scientific assessment of welfare. *Proceedings British Society for Animal Production* 3 : 9 – 12.

3. Freeman, B.M. (1984). Transportation of poultry. *World's Poultry Science Journal* 40: 19 – 30.

4. Freeman, B.M., A.C.C. Manning and I.H. Flack (1980). Short-term stressor effects of food withdrawal on the immature fowl *Comparative Biochemistry and Physiology.* 67 A: 569 – 574.

Tabel 1. Effect of transportation stress on blood components and egg production

Parameters	Pre treatment		Post treatment			
			2 hours		18 hours	
	Stress group	Control group	Stress group	Control group	Stress group	Control group
Blood components						
Hematocrit (%)	36.3± 2.52	35.3± 2.99	33.4± 3.26	32.3± 3.01	32.5± 1.71	31.7± 2.54
Haemoglobin g/100 ml	12.9± 0.90	12.4± 1.00	11.5± 1.49	12.0± 1.00	12.6± 0.90	
Leukocytes (10^3)	15.1± 4.70	12.4± 4.39	15.8± 6.78	11.4± 3.07	13.7± 3.20	11.8± 4.28
Erythrocyte (10^4)	215.8±37.33	199.6±22.78	191.8±51.89	180.3±24.94	157.5±17.24*	161.0±36.18
Heterophils (%)	28.1± 8.46	21.0± 7.86	32.8±11.22	30.8± 6.26	40.0± 1.11	23.0± 6.72
Lymphocyte (%)	62.3±11.73	66 ±11.20	54.8±10.21	56.78± 4.68	50.89±14.52	67.12± 7.1
Ratio of heterophils/ lymphocytes	0.45	0.32	0.6	0.54	0.79	0.39
Eosinophils (%)	8.4± 6.40	10.7± 6.96	9.9± 5.75	11.8± 5.56	6.0± 3.77	6.8± 3.85
Monocytes (%)	2.6± 0.92	2.0± 1.53	2.7± 1.73	1.5± 0.76	4.2± 3.46	3.7± 2.07
Egg prod. (egg/wk)	44	45[1]			30.0	37.0[2]
Reduction (%)	-	-			31.8	17.8

* $P < 0.05$ compared to stress group before transportation.
1 Egg production during one week before the treatment.
2 Egg production during one week after the treatment.

Tabel 2.
Effect of transportation stress on production of antibody to SRBC and Brucella abortus (BA) in ducks.

Treatment	No. of	Before treatment SRBC	Before treatment BA	6 days after treatment SRBC	6 days after treatment BA
Control	20	-	-	3.6[a] (100%)[b]	4.55 (100%)
Stress	19	-	-	2.68 (84%)	4.05 (100%)

a = Mean antibody titre of positive sera (log_2)
b = Percentage of ducks responding

Tabel 3.
Blood components body weight and organ weight of ducks six days after transportation.

Parameters	Control group	Stress group
Blood components		
Hematocrit (%)	28.38 ± 3.85	30.89 ± 3.85
Haemoglobin (g/100 ml)	9.77 ± 1.54	10.1 ± 1.11
Leukocytes (10^3)	11 ± 4.26	12.28 ± 3.18
Erythrocytes (10^4)	209.83 ± 66.54	20.2 ± 39.47
Heterophils (%)	12.35 ± 5.04	15.47 ± 7.44
Lymphocytes (%)	79.05 ± 7.5	76.42 ± 11.3
Heterophils/lymphocytes Ratio	0.16	0.20
Eosinophils (%)	1.55 ± 0.73	2.54 ± 2.22
Monocytes (%)	6.8 ± 5.8	4.89 ± 3.12
Body weight	623.75 ± 91.58	577.78 ± 117.85
Organ weight (% body weight)		
Liver	3.3 ± 0.34	3.4 ± 0.67
Thymus	0.18 ± 0.07	0.20 ± 0.09
Spleen	0.09 ± 0.05	0.09 ± 0.03
Bursa of Fabricus	0.13 ± 0.06	0.13 ± 0.08