http://www.pjbs.org

PJBS

ISSN 1028-8880

Pakistan Journal of Biological Sciences

ANSInet
Asian Network for Scientific Information
308 Lasani Town, Sargodha Road, Faisalabad - Pakistan

Pakistan Journal of Biological Sciences 10 (2): 302-309, 2007
ISSN 1028-8880

Blood Cell Characteristics, Hematological Values and Average Daily Gained Weight of Thai Indigenous, Thai Indigenous Crossbred and Broiler Chickens

Chinrasri Orawan and W. Aengwanich
Department of Agricultural Technology, Faculty of Technology, Mahasarakham University, Mahasarakham Province 44000, Thailand

Abstract: This investigation was carried at the Experimental Laboratory Unit, Division of Animal Production Technology, Faculty of Technology, Mahasarakham University, Mahasarakham, Thailand in August to December 2004. Three different breeds of poultry were used, i.e., Thai indigenous, Thai indigenous crossbred and broiler chickens. The experiment was laid in a split plot design with three replications. The three poultry breeds were used as main plots, whilst gender (male and female) and sampling periods were used as subplots. An assay on blood characteristics and blood counts of red and white blood cells were carried out. Feed intake and average daily gained weight (ADG)/week were determined. The results showed that the appearances on blood cells characteristics of erythrocyte of red blood cells and white blood cells of heterophil, eosinophil, monocyte, basophil and thrombocyte of the three poultry breeds were not different from one another. Hematological values of the three different breeds possessed normal blood values for normal growth and they fitted within a normal range of blood of normal chickens. Hemoglobin concentration (Hb) of Thai indigenous chickens was higher than both Thai indigenous crossbred and broiler chickens. White blood cells of heterophil of Thai indigenous crossbred chickens were higher than broiler chickens, whilst white blood of lymphocyte of female was higher than female. However, the differences found on hematological values of both male and female were not statistically significant. Daily feed intake/week and average daily gained weight increased/week of broiler chickens ranked the highest followed by Thai indigenous crossbred and the lowest was with Thai indigenous chickens.

Key words: Average daily gained weight, broiler, feed intake, hematological values, red blood cells, Thai indigenous, Thai indigenous crossbred, white blood cells

INTRODUCTION

It is commonly known that poultry products such as meat and egg are sources of proteins for human diets, thus poultry of different breeds are raised in many countries around the world. The products derive from poultry farms are numerous such as fresh and frozen meats, eggs and feathers and even poultry manure. Poultry meat has its important impact in national economy in most of the countries around the world since the products could be consumed domestically apart from exporting overseas. Thailand, one of the exporters of poultry products has many types and breeds of poultry being reared in all regions of the country. They include free ranges poultry rearing in most villages and on-farm closed systems for both broiler and egg production. In the 2003, the majority of exported products of Thailand went to three markets, i.e., 50% to Japan, 31% to the EU and 8% to Korea (Anonymous, 2004, 2005). In the 2004 Thailand exported fresh broiler meat mostly in forms of fresh boneless parts with an amount of 300,000 tonnes where the amount of the exported broiler meat within the 2004 decreased up to 43% due to the outbreak of a Highly Pathogenic Avain Influenza (HPAI) known as bird flu. Although the amount of the exported poultry meat was relatively high but this figure was even much lower than other countries such as the People's Republic of China, Brazil, EU and other exporters. This may be attributable to an inadequate amount of technological know how of the poultry raisers and the problem on diseases, especially the spread out of bird flu. At present, broiler fresh meat industry has shifted to cooked and other high-value processed products. This investigation aims to provide information on blood cell characteristics, hematological values and feed intake and live weight gained of three different breeds of poultry being reared for meat production. They include three different types of poultry, i.e., Thai indigenous, Thai indigenous crossbred and

Corresponding Author: Chinrasri Orawan, Department of Agricultural Technology, Faculty of Technology, Mahasarakham University, Mahasarakham Province 44000, Thailand

broiler chickens. These three different breeds of poultry are commonly reared in most regions of the country due to its economic importance. It seems more likely that published data on this respect is more or less limited, particularly in Thailand. This could have been due to many reasons, e.g., the limitation on the availability of equipment and research workers and many others. Thus it is necessary to carry out experiments on this particular context in order to provide adequate information for poultry raising business apart from academic anxiety so that poultry products could be produced with high efficiency. Blood examination has its tangible values in poultry rearing business e.g., it provides information on the assessment of poultry health such as the items on traumatic injury, parasitism, organic disease, bacterial septicemia and nutritional deficiency and also physiological changes in growth with time of broilers (Jain, 1993). Sturkie (1965) reported that hematological value in birds could be influenced by many factors such as age, gender, hormones, hypoxia and environmental conditions. He further added that hematological value has its significant impact on physiological changes and health status of poultry. The obtained information could possibly be of important value for poultry rearing business in Thailand apart from academic records for further investigations.

MATERIALS AND METHODS

This experiment was carried out from August to December 2004 at the Experimental Laboratory Unit, Division of Animal Production Technology, Faculty of Technology, Mahasarakham University, Mahasarakham Province, Thailand. 36 chickens of three different breeds namely Thai indigenous chickens (TIC), Thai indigenous crossbred chickens (TICC) and broiler chickens (BC) were obtained from a nearby commercial poultry farm at Mahasarakham Province, Northeast Thailand. Each chicken weighed approximately 1 kg of body live weight. Each type of breeds consisted of 12 chickens, i.e., 6 for male and another 6 for female. All of them were placed into individual wire cages where each cage has a volume of approximately 0.06 m^3 and two birds of the same gender and breed were reared together in each unit of a cage with environmental temperature of approximately 26±2°C. The three poultry breeds were given *ad libitum* of meat type ration of commercial feed available in most local markets. The design of the experiment used was a split plot design with three replications. The three poultry breeds were used as main plots, whilst gender (male and female) and sampling periods were used as subplots. The determinations on blood cells characteristics and hematological values were carried out at day 1 for initial values soon after allocated them into their respective rearing cages and then at one-week intervals commencing from the end of the first week of rearing and then at the end of the subsequent weeks, i.e., the 2nd, 3rd and 4th weeks, respectively. Therefore, five sampling periods were carried out within 28 days of the experimental period. At each sampling period, a quantity of 1 mL of blood from cervical vein of each chicken was taken out with the use of a 23-gauge needle being fixed to a 3 mL syringe (Campbell, 1995). Soon after the blood sample was taken out from each chicken then the blood sample was immediately transferred to a glass tube containing EDTA and then thoroughly shaking to mix both blood sample and EDTA together (Jain, 1993). The sample glass tubes were submerged in an icebox filled up with ice cubes to prevent the deterioration of the blood samples (Ritchie *et al*., 1994). An assay of the blood samples was carried out in the laboratory soon after the blood was successfully collected from the three breeds of chickens. A preparation for a single blood cell for each type of blood cells was done with the use of blood films. They were fixed and stained with the use of Wright-Giemsa's staining method. Manual counts on total red and white blood cells were carried out using hemocytometer (Campbell, 1995). A Packed Cell Volume (PCV) was measured with a standard technique using microhematocrit capillary tubes where the samples were centrifuged at 2500 rpm for 5 min. Hemoglobin concentration (Hb) was also determined with the use of Cyanmethemoglobin method. Erythrocyte indices, i.e., mean value of corpuscular volume (MCV), mean value of corpuscular hemoglobin (MCH) and also mean value of corpuscular hemoglobin concentration (MCHC) were carried out. The attained results were computed for Total Red Blood Concentration (TRBC), Packed Cell Volume (PCV) and hemoglobin concentration (Hb), respectively (Ritchie *et al*., 1994). The six plates of different types of blood cells illustrated in this study derived from the second sampling period at day 14, whilst those derived from other sampling periods were not included since they gave a similar structure of blood cells characteristics. An average value of daily feed intake of both male and female was measured and the recorded values were calculated into weekly figures from 1st week up to 4th week. Similarly, the measurements on the increases in live weight gained day^{-1} of both individual male and female were also carried out with the use of a weighing machine. The calculations being used for feed intake and weight gained were: 1. Average value of feed intake day^{-1} within a week (FI) = weekly intake of feed divided by number of days (7 days); 2. Average values of an increase in daily

weight gained (ADG) = average values of live weight increased day^{-1} of one week results were added together and then divided by number of rearing days (7 days). Thus the data were weekly presented starting from 1st week up to 4th week. The obtained results were statistically analysed where appropriate using a SAS Computer Programme (SAS, 1990).

RESULTS

Blood cell characteristics

Erythrocyte: With erythrocyte type of red blood cells of the three poultry breeds of meat type, i.e., Thai indigenous, Thai indigenous crossbred and broiler, the results showed that matured erythrocytes of the three poultry breeds possessed somewhat homogeneous in size, shape and colour with a typical oval shape where an oval nucleus is centrally located with a dense dark-stained chromatin. Nuclear chromatins clumped together, whilst red blood cells of polychromatophilic erythrocytes possessed slightly blue basophilic appearances and clumped together lesser than the matured erythrocytes (Fig. 1-6).

Heterophil: The results indicated that heterocyte type of white blood cells possessed rounded in shape or some possessed irregular with spindle shape of cytoplasmic granules. Matured heterophil blood cells exhibit a lobed nucleus with two or three lobes. The nucleus is obviously concealed by cytoplasmic granules (Fig. 1). It appears that Thai indigenous crossbred possessed somewhat smaller in size of blood cell than the rest.

Eosinophil: The results showed that blood cells of eosinophils of the three breeds possessed mostly rounded shapes with an abundant amount of cytoplasm containing a numerous distinctive number of oval shapes and many of them were rounded granules. The cytoplasmic granules of eosinophil blood cells seem to possess its shape and size smaller than heterophil blood cells (Fig. 2).

Lymphocyte: With lymphocyte blood cells, the results showed that microscopic appearances of these blood cells appeared to have its variation in the amount of cytoplasm. With this investigation, it was found that the three breeds possessed a similar amount of leukocyte blood cells with an average of approximately 70%. It is a rounded shape of blood cell and it has a nucleus centrally located within each blood cell. The nuclear chromatin is densely clumped and some of them exhibit reticulated (Fig. 3).

Table 1: Average value of hematological blood cells of different blood items in relation to breeds and gender of Thai Indigenous Chicken (TIC), Thai Indigenous Crossbred Chicken (TICC) and Broiler chicken (B) taken at day 28 after rearing in cages at Mahasarakham University, Northeast Thailand

	Breeds			Gender	
Tested parameters	TIC	TICC	BC	Male	Female
TRBC ($\times10^6$ cell μL^{-1})	2.39	2.35	2.39	2.39	2.36
Hb (g dL^{-1})	8.88^a	8.40^b	8.22^b	8.58	8.41
PCV (%)	31.87^a	29.75^b	30.73^{ab}	31.20	30.37
MCV (fl)	137.61^a	125.07^b	132.21^{ab}	131.98	131.29
MCH (pg)	37.39	36.35	34.76	36.42	35.90
MCHC (%)	29.10^a	27.29^b	26.79^b	27.73	27.73
TWBC ($\times10^4$ cell μL^{-1})	1.21	1.14	1.14	1.17	1.16
Lymphocyte (%)	73.13	71.00	75.45	73.74	72.64
Heterophil (%)	16.92^{ab}	18.30^a	15.83^b	16.72	17.31
Monocyte (%)	3.68	3.00	4.38	3.79	3.59
Eosinophil (%)	3.90	3.80	4.00	3.60	4.20
Basophil (%)	2.23	2.57	2.48	2.29	2.57

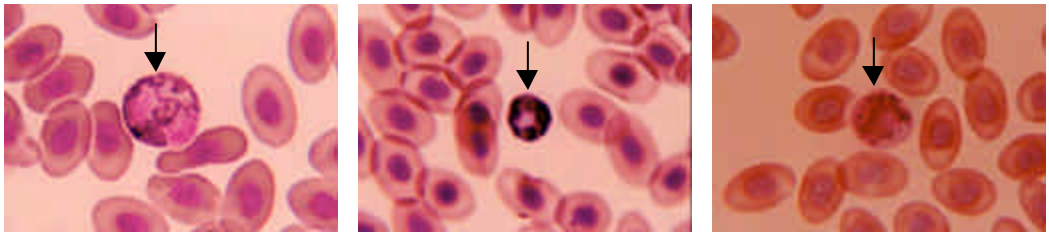
Letters within rows of each item indicate significant differences of Duncan's Multiple Range Test (DMRT) of the three breeds (excluded gender) with respect to different tested items at probability $p<0.05$. TRBC = Total Red Blood Concentration, Hb = Hemoglobin concentration, PCV = Packed Cell Volume, MCV = Mean value of corpuscular volume, MCH = Mean value of corpuscular hemoglobin, MCHC = Mean value of corpuscular hemoglobin concentration, TWBC = Total White Blood Cells Counted

Monocyte: The results showed that the three breeds of chicken possessed the largest amount of leukocytes found in the peripheral blood films. The nuclei shape varied from rounded to bilobed and possessed a colour of blue-gray with fine granular appearances (Fig. 4).

Basophil: With basophil blood cells, the results showed that the blood cells appeared to be somewhat rounded with nuclei centrally located and some of the cytoplasmic granules overlapping the nuclei and it has a slightly basophilic stained (Fig. 5).

Thrombocyte: For thrombocyte blood cells, the results showed that the structures of the thrombocyte blood cells appeared to be relatively small in size, oval and some were rounded in shapes with colorless appearances for both nucleus pyknotic and cytoplasm (Fig. 6).

Hematological values of the three breeds and its gender: With hematological values of the three breeds and its gender, the results showed that Total Red Blood Cells (TRBC) ranged from 2.35 to 2.39 ($\times10^6$ cells μL^{-1}) for Thai indigenous crossbred and broiler chickens, respectively. Thai indigenous chickens gave a similar value to that of broiler (Table 1). Both female and male gave mean values of 2.36 to 2.39 ($\times10^6$ cells μL^{-1}), respectively. There were no statistical differences found among the three different breeds and also between female and male. For hemoglobin concentration (Hb) with respect to breeds, the results showed that Hb values ranged from 8.22 to 8.88 (g dL^{-1}) for broiler chickens and Thai indigenous chickens,

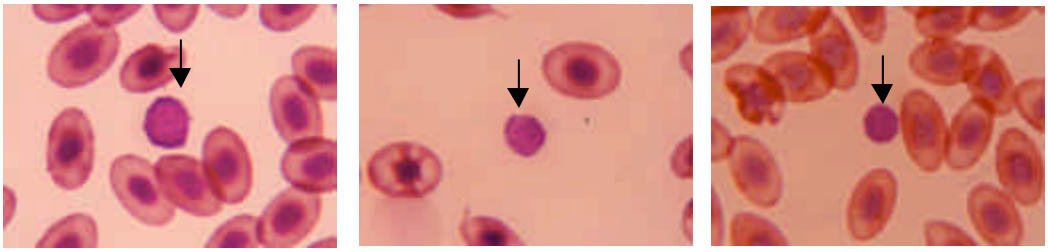


a b c

Fig. 1: Microscopic appearances of heterophil blood cells of (a) Thai indigenous, (b) Thai indigenous crossbred and (c) Broiler chickens. Arrows indicate heterophil blood cell of each chicken breed at 100X

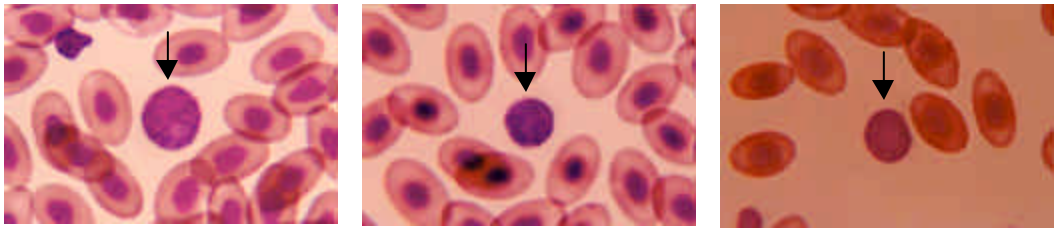
a b c

Fig. 2: Microscopic appearances of eosinophil blood cells of (a) Thai indigenous, (b) Thai indigenous crossbred and (c) Broiler chickens. Arrows indicate eosinophil blood cell of each chicken breed at 100X



a b c

Fig. 3: Microscopic appearances of lymphocyte blood cells of (a) Thai indigenous, (b) Thai indigenous crossbred and (c) Broiler chickens. Arrows indicate lymphocyte blood cell of each chicken breed at 100X

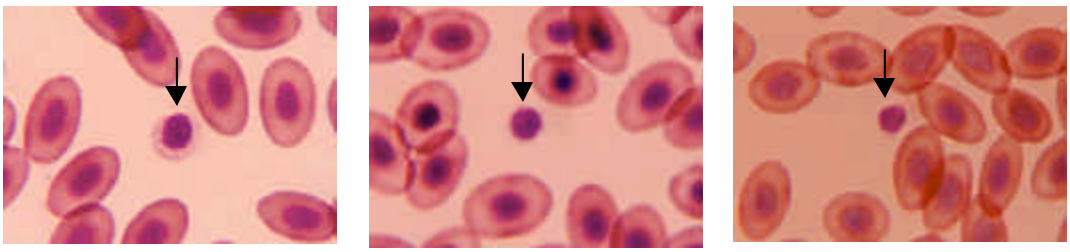


a b c

Fig. 4: Microscopic appearances of monocyte blood cells of (a) Thai indigenous, (b) Thai indigenous crossbred and (c) Broiler chickens. Arrows indicate monocyte blood cell of each chicken breed at 100X

a b c

Fig. 5: Microscopic appearances of basophil blood cells of (a) Thai indigenous, (b) Thai indigenous crossbred and (c) Broiler chickens. Arrows indicate basophil blood cell of each chicken breed at 100X



a b c

Fig. 6: Microscopic appearances of thrombocyte blood cells of (a) Thai indigenous, (b) Thai indigenous crossbred and (c) Broiler chickens. Arrows indicate thrombocyte blood cell of each chicken breed at 100X

respectively. The differences were large and statistically significant. The differences found between male and female on Hb values were not statistically significant. However, Hb value of male was slightly higher than female. With packed cell volume (PCV), PCV values ranged from 29.75 to 31.87% for Thai indigenous crossbred chickens and Thai indigenous chickens, respectively. The differences were large and statistically significant. Thai indigenous chickens gave the highest but similar to broiler chickens and the broiler chickens were similar to Thai indigenous crossbred chickens. There were no statistical differences found between male and female on this respect. A similar trend to that of PCV was found with mean values of corpuscular volume (MCV), i.e., Thai indigenous chickens gave the highest and the lowest was found with Thai indigenous crossbred chickens and there was no statistical difference found between male and female. For mean values of corpuscular hemoglobin (MCH), the results showed that MCH values ranged from 34.76 to 37.39 (pg) for broiler and Thai indigenous chickens, respectively. There were no statistical differences found on MCH values with respect to breeds and gender (male and female) of the tested chickens.

For mean values of corpuscular hemoglobin concentrations (MCHC), Thai indigenous chickens gave the highest followed by Thai indigenous crossbred and broiler chickens with values of 29.10, 27.29 and 26.79%, respectively. The differences were large and statistically significant. However, Thai indigenous crossbred chickens gave a similar level to that of broiler chickens. Total White Blood Cells (TWBC) ranged from 1.14 to 1.21 ($\times 10^4$ cell μL^{-1}) for broiler and Thai indigenous chickens, respectively. The differences found among the three breeds were not statistically significant. A similar result to that of the three breeds on TWBC was attained with both male and female, i.e., both gave a similar value. With lymphocyte blood cells, the results showed that lymphocyte values ranged from 71.00 to 75.45% for Thai indigenous crossbred chickens and broiler chickens, respectively. There was no statistical difference found among the breeds and also between male and female. For heterophil, the results revealed that heterophil was highest with Thai indigenous crossbred chickens followed by Thai indigenous and broiler chickens with values of 18.30, 16.92 and 15.83%, respectively. The differences were large and statistically significant. However, Thai indigenous chickens did not statistically different from Thai indigenous crossbred chickens although it gave the highest %, whilst broiler chickens gave a similar value to Thai indigenous chickens. Heterophil blood cells % of both male and female were similar and not statistically significant.

Table 2: Mean values of daily feed intake of both male and female of Thai indigenous, Thai indigenous crossbred and broiler being calculated from 1st week up to 4th week of rearing in cages at Mahasarakham Experimental Unit, Mahasarakham University, Thailand

	Thai indigenous		Thai indigenous crossbred		Broiler	
Weeks	Male	Female	Male	Female	Male	Female
1st	80.59	62.38	75.95	65.24	68.81	76.19
2nd	80.12b	65.76bc	82.14b	68.33bc	116.43a	118.57a
3rd	82.14de	66.19de	93.76cd	75.48de	125.95ab	140.24a
4th	80.00de	68.33de	94.29cd	75.24de	142.86a	147.86a

Letters within rows indicate significant differences of Duncan's Multiple Range Test (DMRT) at p = 0.05

Table 3: Mean values of daily gained weight (ADG) of both male and female of Thai indigenous, Thai indigenous crossbred and broiler being recorded from 1st week up to 4th week of rearing in cages at Mahasarakham Experimental Unit, Mahasarakham University, Thailand

	Thai indigenous		Thai indigenous crossbred		Broiler	
Weeks	Male	Female	Male	Female	Male	Female
1st	24.28bcd	16.10cd	23.30bcd	27.38a-d	44.28a	40.80ab
2nd	23.81de	22.14de	28.81cd	23.33de	57.86a	53.45a
3rd	22.14cde	15.95de	33.10bc	22.87c-e	53.57a	54.05a
4th	19.52bcde	10.24e	25.24abcd	19.53b-e	27.14a-c	18.33b-e

Letters within rows indicate significant differences of Duncan's Multiple Range Test (DMRT) at p = 0.05

With monocyte blood cells, the results indicated that monocyte values ranged from 3.00 to 4.38% for Thai indigenous crossbred and broiler chickens, respectively. There were no statistical differences found among the three breeds and also between male and female. The results on eosinophil blood cells showed that eosinophil ranged from 3.80 to 4.00% for Thai indigenous crossbred and broiler chickens, respectively. Again, there was no statistical difference found within the three breeds and gender on this respect. For basophil blood cells, the results revealed that basophil ranged from 2.23 to 2.57% for Thai indigenous chicken and Thai indigenous crossbred chickens, respectively. The differences found among the three tested breeds were not statistically significant.

Daily feed intake and average daily gained weights of both male and female: The results on daily feed consumption being counted at weekly interval showed that feed intake of male broiler chickens was the highest but similar to female broiler and Thai indigenous crossbred chickens, whilst the rest were, more or less, similar with values ranged from 16.10 to 44.28 g day^{-1} for female Thai indigenous and male broiler chickens, respectively (Table 2). With the second week, daily feed intake was highest for both male and female broiler chickens followed by Thai indigenous crossbred and the lowest was with Thai indigenous chickens with values ranged from 22.14 to 57.86 g day^{-1} for female Thai indigenous and male broiler chickens, respectively. For the third week, the results showed that broiler chickens of both male and female ranked the highest followed by Thai indigenous crossbred chickens and the lowest was found with Thai indigenous chickens with values ranged from 15.95 to 54.05 g day^{-1} for female Thai indigenous and female broiler chickens, respectively. The results on the forth week indicated that in most cases, feed intake for all three breeds of both male and female was much smaller than the initial week. Male broiler chicken gave the highest followed by male Thai indigenous crossbred chickens with mean values of 27.14 and 25.24 g day^{-1}, respectively. Feed intake of other tested chickens was much lesser than male chickens of Thai indigenous and Thai indigenous crossbred chickens. The differences were large and statistically significant.

With the results on average daily gained weight (ADG) of the four recorded weeks, the results showed that at the first sampling week, male broiler chickens attained the highest followed by female broiler and female Thai indigenous crossbred chickens where they ranked the highest, whilst the rest attained a similar level with mean values ranged from 16.10 to 44.28 g day^{-1} for female Thai indigenous and male broiler chickens, respectively. A similar trend was attained with the second, third and forth weeks of rearing, i.e. broiler chickens of both male and female ranked the highest followed by Thai indigenous crossbred chickens and Thai indigenous chickens attained the lowest. The differences were large and statistically significant (Table 3).

DISCUSSION

The results on blood cells characteristics revealed that the appearances of erythrocyte of red blood cells and white blood cells of heterophil, eosinophil, lymphocyte, monocyte, basophil and thrombocyte of Thai indigenous, Thai indigenous crossbred and broiler chickens exhibited a similar characteristic of blood cells. There were no distinctive differentiations found amongst the three different breeds of the tested chickens. The results agree with the reviewed work reported by Ritchie *et al.* (1994). In addition, the blood cells characteristics of these three breeds of poultry were similar to blood cells of a kind of birds namely Painted Stork (*Mycteria leucocephala)* being carried out by Aengwanich *et al.* (2002) and also that of Babary ducks (*Anatidae*) as also reported by Aengwanich *et al.* (2003). Furthermore, blood cells characteristics of the three breeds of poultry were similar to the results reported by Campbell (1995).

The results on hematological values of blood cells of the three different breeds of the tested chickens revealed that all mean values of blood cells possessed normal blood values for a normal growth of chickens and they fitted within a range of the values as reported by Jain (1993) and Ritchie (1994). The results indicated that health conditions of the three poultry breeds being used for this investigation could possibly be classified as normal conditions for normal growth of the poultry. Aengwanich (2002), Aengwanich and Chinrasri (2002) and Simaraks *et al.* (2004) carried out the experiments in Thailand with the use of broiler chickens, male of layer breed and Thai indigenous chickens, respectively. They attained the results similar to the results attained with the present investigation. However, Total Red Blood Cells (TRBC) of the three breeds of the present experiment were slightly lower than the results reported by Jain (1993) but higher than the results of the experiments on poultry layers reported by Aengwanich and Chinrasri (2002). The differences could have been attributed to the differences in rearing environmental temperatures and ages of the chickens as found with the experiments on Babary ducks (Aengwanich *et al.*, 2003). The results also revealed that mean value of hemoglobin concentration (Hb) of Thai indigenous chickens was higher than both Thai indigenous crossbred and broiler chickens, whilst red blood cells of erythrocyte of Thai indigenous chickens were higher than Thai indigenous crossbred chicken. It was also found that white blood cells of heterophil of Thai indigenous crossbred chickens were higher than broiler chickens. These results suggested that genetic traits of the breeds had its important effect on hemoglobin concentration and red blood of erythrocyte rather than the effect due to other factors such as ages and rearing environments. Simaraks *et al.* (2004) showed that hemoglobin concentration and red blood of erythrocyte of male chicken was higher than female, whilst white blood of eosinophil in male was also higher than female Thai indigenous chickens and a reverse was found with white blood of lymphocyte of female where this type of blood cells of female was higher than male. He pointed out that the differences could have been attributed to the effect of androgen hormone of male chicken affected mean values of blood cells of both types. However, with this work the differences on hematological values between male and female were not statistically significant. This may be attributable to a short studied period when the tested chickens just reached only its juvenile stage of growth. It may be possible that when they had reached a full maturity age then hormonal effect may have possessed a clearer effect on hematological values.

Ritchie *et al.* (1994) stated that percentages of Packed Cell Volume (PCV) of red blood cells and the mean values of hemoglobin concentration (Hb) obviously determine health conditions in chickens. Too low amount of heterophil of white blood cells may cause a vulnerable condition for disease infection. The results on PCV and Hb values of this work were in accordance with that of Jain (1993), thus all of the tested chickens were, more or less, at its healthy conditions. Similarly, Bush (1991) pointed out that low percentages of white blood cells of both eosinophil and basophil in chickens could also cause poor immunity against diseases and the low percentages may possibly indicate poor health conditions as a result of parasitic disturbances.

With feed intake for both male and female of the three poultry breeds, the results showed that amounts of feed intake for both male Thai indigenous and Thai indigenous crossbred chickens, in most cases, were higher than female except broiler chickens where amounts of feed intake of male were lesser than female although there were no statistical differences found between male and female of broiler chickens. The amounts of feed intake of broiler chickens of both male and female were significantly higher than Thai indigenous and Thai indigenous crossbred chickens. The differences may be attributable to genetic traits of vigorous growth of broiler chickens where poultry breeders had added more of dominant genes on a rapid growth for broiler chickens, thus feed intake was significantly higher than the rest. The effect on gene combination of Thai indigenous crossbred chickens was attained, i.e., hybrid vigor for this type of breed was attained where amounts of feed intake of the crossbred of both male and female chickens, in most cases, were higher than Thai indigenous chickens although there were no statistical differences found between the two breeds. However, hybrid vigor of the crossbred chickens had a lesser intensity on feed intake when compared with broiler chickens. The amounts of feed intake of the three poultry breeds resulted in an increase in daily live weight gained, i.e., the greater the amounts of feed intake the greater the average daily gained weight/week (ADG) of the three breeds of poultry. Male chickens of each breed gave slightly higher ADG than female although there was no significant difference found within the breed of both male and female chickens but significantly found among the three breeds of poultry being used. Average daily gained weight/week of broiler chickens ranked the highest followed by the crossbred and the least was with the native Thai indigenous chickens.

REFERENCES

Aengwanich, W., 2002. Effects of chronic heat stress on red blood cell disorders in broiler chickens. Mahasarakham Univ. J., 21: 1-10.

Aengwanich, W. and O. Chinrasri, 2002. Effect of heat stress on body temperature and hematological parameters in male of poultry laying breed. Thai J. Physiol. Sci., 15: 27-33.

Aengwanich, W., A. Tanomtong, R. Pattanarungson and S. Simaraks, 2002. Blood cell characteristic, hematological and serum biochemistry values of Painted Stork (*Mycteria leucocephala*). Songklanakarin J. Sci. Technol., 24: 473-479.

Aengwanich, W., O. Chinrasri, K. Sukwiwatkul, N. Namustisong and K. Sawatpanich, 2003. Effects of age and sex on hematological values, blood cell characteristics and blood profile of Babary ducks. Mahasarakham Univ. J., 22: 27-37.

Anonymous, 2004. Around the world-worldwide, Thailand Poultry Int., 43: 4-8.

Anonymous, 2005. Around the world-China, worldwide South Africa, India, Philippines. Poult. Int., 43: 4-8.

Bush, B.M., 1991. Interpretation of Laboratory Results for Small Animal Clinicians. Blackwell Scientific Publications, Oxford, pp: 31-220.

Campbell, T.W., 1995. Avian Hematology and Cytology. Iowa State University Press, Ames, Iowa, USA.

Jain, N.C., 1993. Essential of Veterinary Hematology. Lea and Febiger, Philadelphia, USA., pp:133-168.

Ritchie, B.W., G.J. Harrison and L.R. Harrison, 1994. Avian Medicine: Principles and Application. Wingers Publishing Inc., Lake Worth, Florida, USA.

SAS., 1990. SAS/STAT User's Guide. Statististical Analysis System Institute, Inc., Cary. NC.

Simaraks, S., O. Chinrasri and W. Aengwanich, 2004. Hematological, electrolyte and serum biochemistry values of the Thai indigenous chickens (*Gallus domesticus*) in northeastern, Thailand. Songklanakarin J. Sci. Technol., 26: 425-430.

Sturkie, P.D., 1965. Avian Physiology. 2nd Edn., Comstock Publishing Associates, Cornel University Press, New York, pp: 766.