American-Eurasian J. Agric. & Environ. Sci., 5 (5): 644-648, 2009
ISSN 1818-6769

Effect of Seasonal Variations on Hematological Values and Health Monitor of Crossbred Beef Cattle at Slaughterhouse in Northeastern Part of Thailand

[1]*W. Aengwanich,* [2]*A. Chantiratikul and* [1]*S. Pamok*

[1]Stress and Oxidative Stress in Animals Research Unit,
[2]Faculty of Veterinary Medicine and Animal Science,
Mahasarakham University, Maha Sarakham 44000, Thailand

Abstract: Blood samples were collected from jugular vein of ninety adult male crossbred beef cattle in winter (n=30), summer (n=30) and rainy season (n=30) from slaughterhouse in northeastern part of Thailand. Hematological values of each cattle were determined. Comparisons of hematological values between seasons were performed. Clinical pathology of each cattle was monitored by comparing hematological values with reference range. The results revealed the following information: hematological values of cattle at slaughterhouse in winter, summer and rainy season were not significantly different ($P>0.05$). Hematological values of each cattle in the present study showed varying results under physiological and pathological response in their body. This study showed that season had not effect to hematological values of crossbred cattle in northeastern part of Thailand. Finally, hematological changes which related to physiological and/or pathological changes of each cattle were observed.

Key words: Season · Beef cattle · Slaughterhouse · Thailand

INTRODUCTION

Blood examination is performed for screening procedure to assess general health [1-3] and the body's ability to flight infection. The complete blood count (CBC) is an important and powerful diagnostic tool as a component of a minimum database. It can be used to monitor response to therapy, to gage the severity of an illness, or as a starting point for formulating a list of differential diagnoses. Interpretation of the CBC can be broken down into three sections: evaluation of the erythrocyte, leukocyte and platelets. Each of these parameters can be interprete individually; however, integration of the data is important for the highest diagnostic yield [4]. Hematological values such as total red blood cell count[5], packed cell volume [6], mean corpuscular volume, mean corpuscular hemoglobin and mean corpuscular hemoglobin concentration and hemoglobin concentration [7] and white blood cell [1] i.e. lymphocyte and monocyte are indicated adaptability to adverse environmental condition. Moreover, hematological values are used for indicating stress and welfare [8]. At present, neutrophil/ lymphocyte ratio is a well–accepted indicator for stress in animals [9-14]

Infection disease is by definition, the consequences of infection by microorganism such as bacteria, viruses or parasites. However, the manifestations of infectious disease are the result of both the action of the infecting organism and the animal's response not only attention to the means by which the host response to its presence. Every animal response to the presence of a foreign organism by invoking a number of physiological changes [15]. Many diseases of cattle are outbreak in Thailand such as Trypanosomiasis, *Trypanosoma evansi* [16,17,]; food and mouth disease [18]; brucellosis [19], leptospirosis [20]; *Neospora caninum* and *Toxoplasma gondii* [17]; Strongyloid, *Fasciolar* spp., *Paramphistomum* spp. and *Schistosoma* spp. [21]; Taeniasis, Cysticercosis and Ecchinococcosis [22] etc.

Corresponding Author: Dr. W. Aengwanich, Stress and Oxidative Stress in Animals Research Unit, Faculty of Veterinary Medicine and Animal Science, Mahasarakham University, Maha Sarakham 44000, Thailand

In Thailand, the government allowed private section establishing small slaughterhouse in each sub-district under health monitoring by veterinary section of sub-district organization administration. Whereas, data about the effect of season on hematological values and health status of cattle before slaughtered at slaughterhouse in Thailand and other countries were limited.

Therefore, our work concentrated on to determine the effect of season (summer, rainy and winter season, respectively) on hematological values and health status of crossbred beef cattle which considered by comparing with reference range at slaughterhouse in northeastern part of Thailand. Basic knowledge of this study is important for creating a model for health monitor of cattle at slaughterhouse and as a tool for prevention zoonoses which transmitted to consumers in Thailand and other countries.

MATERIALS AND METHODS

Ninety crossbred adult male beef cattle (30 samples in summer; 30 samples in rainy and 30 samples in winter season, respectively) were blood sampled. The beef cattle were kept on the five slaughterhouses in northeastern part of Thailand. Health of cattle in slaughterhouses were monitor by veterinary section of sub-district organization administration. Blood was removed from the jugular vein into a vacutainer with ethylenediaminetetraacetic acid (EDTA) as an anticoagulant using disposable syringes. In order to reduce the variation associated with diurnal rhythms in blood, samples were taken from cattle at the same hours (14.00 -16.00 h). All tubes were placed immediately on ice and were transferred to the laboratory.

The hematocrit was determined using a heparinized capillary tube and centrifuging the blood in a micro-hematocrit centrifuge for 5 min at 2,500 rpm. Hemoglobin concentration was measure by adding 20 µl of mixed blood to 5 ml of Drabkin's solution and obtical density was measured in a spectrophotometer set at 540 nm. The erythrocyte number (RBC) was counted in Neubauer's hemocytometer after the sample was diluted (1:200) in Grower'solution. The leukocyte count was determined on blood diluted 1:50 in Turk solution by means of a Neubauer's hemocytometer. In order to avoid aggregation of white cells, fresh blood kept on ice was always used. Immediately, selected smears were fixed with methanol and stained with Giemsa-wright solution and then used for differential count of the white blood cells. Mean corpuscular volume (MCV=hematocrit x 10/ RBC), mean corpuscular hemoglobin (MCH=hemoglobin x 10/ RBC) and mean corpuscular hemoglobin concentration (MCHC=hemoglobin x 100/ hematocrit) were calculated.

Data were analyzed by using of the ANOVA procedure of Statistical Analysis System [23]. Means were separated by Duncan's multiple range tests. The level of significance was determined at $P< 0.05$. All data are expressed throughout as mean±standard deviation.

Health monitor of cattle were performed by comparing hematological values of each cattle with reference range of Jain [2]. The results are expressed as percentage.

RESULTS AND DISCUSSION

Data of seasonal variation on hematological values of beef cattle at slaughterhouse in northeastern part of Thailand and health monitor are presented in Tables 1, 2 and 3.

Seasonal Variation: Generally, the hematological profile is importance for indicating the physiological changes of animals [2,7]. In the present study, hematological values of cattle in summer, rainy and winter season were not significantly different (P>0.05) (Table 1). This was different from the report of Kumar and Pachauri [7]. They found that in summer; hemoglobin concentration, mean corpuscular volume, mean corpuscular hemoglobin and mean corpuscular hemoglobin concentration were increased. On the other hand, packed cell volume during winter decreased. Gutierrez –De La R. *et al*. [1] found that under high environmental temperature, mean corpuscular volume and mean corpuscular hemoglobin of cattle were decreased, but red blood cell, white blood cell, packed cell volume and hemoglobin concentration were not changes. Moreover, El-Nouty *et al*. [6] reported that during summer season resulted in reduction in hemoglobin, packed cell volume, mean corpuscular volume, mean corpuscular hemoglobin, but had not effect on red blood cell, mean corpuscular hemoglobin concentration and white blood cell. Besides, under high environmental temperature, Koubkova *et al*. [5] reported that packed cell volume and red blood cell rose. Furthermore, in the present study, neutrophil/ lymphocyte ratio of crossbred cattle in summer, rainy and winter were not significantly different (P>0.05). This indicated that climate in each season around the year had not effect to stress in these cattle.

Table 1: Comparisons of hematological values of crossbred beef cattle at slaughterhouse in north- eastern part of Thailand

Parameters	Season Summer (n=30)	Rainy (n=30)	Winter (n=30)	Reference range*
TRBC ($x10^6$ cell/µl)	6.347±1.591	6.590±1.648	6.435±1.527	5.0-10.0
Hb (g/dl)	10.715±1.893	10.360±1.922	10.680±1.849	8.0-15.0
PCV (%)	36.500±4.352	35.166±5.819	35.933±5.271	24.0-46.0
MCV (fl)	60.378±14.128	56.502±16.832	58.269±13.807	40.0-60.0
MCH (pg)	17.696±4.825	17.035±6.458	17.570±5.598	11.0-17.0
MCHC (%)	29.286±3.261	30.405±8.589	30.149±6.673	30.0-36.0
TWBC (x 10^4cell/µl)	1.371±0.290	1.294±0.259	1.311±0.257	4,000.0-12,000.0
Neutrophil (%)	24.00±11.395	28.066±8.220	25.100±12.089	15.0-47.0
Lymphocyte (%)	63.533±13.132	60.066±10.663	62.266±13.766	45.0-75.0
Monocyte (%)	2.433±3.125	3.966±3.925	3.266±4.143	2.0-7.0
Eosinophil (%)	9.933±6.389	7.533±5.888	9.300±5.350	0.0-20.0
Basophil (%)	0.100±0.305	0.366±0.555	0.066±0.253	0.0-2.0
N/L ratio	0.43±0.32	0.50±0.23	0.47±0.34	-

* reference range of Jain (1993); RBC=red blood cell; Hb=hemoglobin concentration; PCV=packed cell volume; MCV=mean corpuscular volume; MCH=mean corpuscular hemoglobin; MCHC= mean corpuscular hemoglobin concentration; TWBC=total white blood cell count.

Table 2: Health monitor by using hematological values of crossbred beef cattle in each season (summer (n=30), rainy (n=30) and winter (n=30)) at slaughterhouse in north- eastern part of Thailand

	Clinical monitoring Summer			Rainy			Winter		
Parameters	Decreased	Normal	Increased	Decreased	Normal	Increased	Decreased	Normal	Increased
TRBC	6 (20.0%)	24 (80.0%)	-	4(13.3%)	26(86.7%)	-	4(10.0%)	26(86.7%)	-
Hb	-	30 (100.0%)	-	5(16.7%)	25(83.3%)	-	3(13.3%)	27(90.0%)	-
PCV	-	30 (100.0%)	-	-	30(100%)	-	-	30(100.0%)	-
MCV	-	17 (56.67%)	13 (43.3%)	-	21(70.0%)	9(30.0%)	-	20(66.7%)	10 (33.3%)
MCH	-	17 (56.67%)	13 (43.3%)	5(16.7%)	13(43.3%)	12(40.0%)	1(3.3%)	17(56.7%)	12(40.0%)
MCHC	15 (50.0%)	15 (50.0%)	-	15(50.0%)	10(33.3%)	5(16.7%)	16(53.3%)	12(40.0%)	2(6.7%)
TWBC	-	10 (33.3%)	20 (66.7%)	-	17(56.7%)	13(43.3%)	-	15(50.0%)	15(50.0%)
Neutrophil	4 (13.3%)	26 (86.7%)	-	-	29(96.7%)	1(3.3%)	4(13.3%)	23(76.7%)	3(10.0%)
Lymphocyte	2 (6.7%)	23 (76.7%)	5 (16.7%)	3(10.0%)	25(83.3%)	2(6.6%)	5(16.7%)	20(66.7%)	5(16.7%)
Monocyte	14 (46.7%)	12 (40.0%)	4 (13.3 %)	6(20.0%)	19(63.3%)	5(16.7%)	14(46.7%)	12(40%)	4(13.3%)
Eosinophil	-	29 (96.7%)	1(3.3%)	-	30(100%)	-	-	30(100%)	-
Basophil	-	30 (100%)	-	-	30(100%)	-	-	30(100%)	-

Table 3: Overall health monitor by using hematological values in crossbred beef cattle (n=90) at slaughterhouse in north- eastern part of Thailand

Parameters	Clinical monitoring (n=90) Decreased	Normal	Increased
TRBC	14 (15.6%)	76 (84.4%)	-
Hb	8 (8.9%)	82 (91.1%)	-
PCV	-	90 (100.0%)	-
MCV	-	58 (64.4%)	32 (35.6%)
MCH	6 (6.7%)	47 (52.2%)	37 (41.1%)
MCHC	46 (51.1%)	37 (41.1%)	7 (7.8%)
TWBC	-	42 (46.7 %)	48 (53.3%)
Neutrophil	8 (8.9%)	78 (86.7%)	4 (4.4%)
Lymphocyte	10 (11.1%)	68(75.6%)	12 (13.3%)
Monocyte	34 (37.8%)	43(47.8%)	13 (14.4%)
Eosinophil	-	89(98.9%)	1 (1.1%)
Basophil	-	90 (100.0%)	-

The reason for describing this phenomenon that the parents stock of crossbred beef cattle in this study were mainly improved breeding in northeastern part of Thailand for 35 years. Therefore, they could adapt to the climate of this area. This was similar to the report of Moberg [24], he found that when animals were subjected to repeated stress, in the first few first days after exposure they usually show an increased response and then later the response decreased. Moreover, sample collection from cattle was performed at the same time and nearly the same environment and each of cattle were maintained in housing for 12-24 hours after arrived to the slaughterhouse before slaughtered. Thus, hematological values of cattle in summer, rainy and winter were not different.

Health Monitor: When comparing hematological values of ninety cattle with reference range of Jain [2], clinical pathological evaluation of cattle in each season are presented in Table 2 and the overall of the results were divided into 3 groups i.e. decreased, increased and fall in reference range (Table 3), respectively. In practices, red blood cell, packed cell volume, hemoglobin concentration are helpful in the evaluation of anemia [25,26]. Anemia is characterized by a reduction in the overall erythrocyte content, number of erythrocytes, or hemoglobin concentration [27]. Anemia may develop when there is blood loss through hemorrhage or blood sucking parasites, accelerated erythrocyte destruction and reduced or defective erythropoeisis [25,27]. Increased MCV may be seen in vitamin B12, folate deficiency and blood parasites infestation i.e. *Babesia* spp., *Theileria* spp., [25,27], *Anaplasma* spp. and *Trypanosoma* spp. [25]. On the other hand, decreased MCV may be seen in iron deficiency, chronic blood loss. Falling MCH may give an early clue of impending iron deficiency, since MCH falls before MCV and decreased MCHC occurs in iron deficiency anemia. The main causes of neutropenia are occurring with severe infections [28,27] such as peritonitis, pyometra and aspiration pneumonia etc [26]. Besides, Spivak [29] reported that nutritional deficiency that occurs in starvation or anorexia are causes of neutropenia. Causes of lymphopenia are stress, glucocorticoid therapy [28], acute phase of viral infection, septicemia or endotoxemia. Whereas, monocytopenia is not clinically significant. Causes of neutrophilia are physiological response (fear, excitement and exercise) [26,28,29], stress/ corticosteroid-induced [27] and acute inflammatory response (bacterial infection, necrosis, neoplasia etc.) [26,29]. The causes of lymphocytosis are strong immune stimulation (e.g. chronic infection, viremia or immune-mediated disease) [26] and fear or excitement [28]. Causes of monocytosis are chronic inflammation [26] such as tuberculosis [29], tissue necrosis, stress and glucocorticoid therapy. Possible causes of eosinophilia are parasite infestation [26,28].

Although health monitor by using hematological values of the present study showed document about physiological and pathological response in beef cattle at slaughterhouse, but hematological values were not indicated the real causes of body changes, because of cattle that arrived to slaughterhouse were came from different sources and managements. Inspector or veterinarian should be using history, physical examination and serological test, if necessary cooperated with hematological values for evaluation health status of each cattle before permitting to slaughter. Moreover, results from post-mortem inspection were an importance document for interpreting the abnormality in each cattle before send to other processes.

CONCLUSION

Hematological values of crossbred beef cattle were determined at slaughterhouse during summer, rainy and winter season all around the year in northeastern part of Thailand for studying the effect season and health monitor. The results found that season had not effects to hematological values of crossbred beef cattle in northeastern part of Thailand. Hematological values of crossbred cattle divided into three groups were decreased, increased and fall in reference range. These indicated that crossbred cattle in northeastern part of Thailand could adapt to climate during summer, rainy and winter season in Thailand. Finally, hematological value was an efficiency tool for evaluation body response which was relation to health status of cattle before slaughtering.

ACKNOWLEDGEMENT

This research was funded by Mahasarakham University, Thailand

REFERENCES

1. Gutierrez-De Lar J.H., A.C. Warnick, J.J. Cowley and J.F. Hentages Jr., 1971. Environmental physiology in the sub-tropics. I. Effect of continuous environmental stress on some hematological values of beef cattle. Journal of Animal Science, 32: 968-973.
2. Jain, N.C., 1993 Essentials of Veterinary Hematology. Lea & Febiger, Philadelphia,: pp: 1-18.
3. Peinado, V.I., J.F. Celdran and J. Palomeque, 1999. Basic hematological values in some wild ruminants in captivity. Comparative Biochemical and Physiology Part A, 124: 199-203.
4. Barger, A.M., 2003.The complete blood cell count: a powerful diagnostic tool. Veterinary Clinics of North America, Small Animal Practice, 33: 1207-1222.
5. Koubkova, M., I. Knizkova, P. Kunc, H. Hartlova, J. Flusser and O. Dolezal, 2002. Influence of high environmental temperatures and evaporative cooling on some physiological, hematological and biochemical parameters in high-yielding dairy cows. Czech Journal of Animal Science, 47: 309-318.

6. El-Nouty, F.D., A.A. Al-Haidary and M.S. Salah, 1990. Seasonal variation inhematological values of high-and average yielding Holstein cattle in semi-arid environment. Journal of King Saudiarabia University, 2(2): 173-182.
7. Kumar, B., S.P. Pachaura, 2000. Haematological profile of crossbred dairy cattle to monitor herd health status at medium elevation in central Himalayas. Research in Veterinary Science, 69: 141-145.
8. Anderson, B.H., D.L. Watson and I.G. Colditz, 1999. The effect of dexamethason on some immunological parameters in cattle. Veterinary Research Communication, 23: 399-413.
9. Puppe, B., M. Tuchscherer and A. Tuchschserer, 1997. The effect housing conditions and social environment immediately after weaning on the agonistic behaviour, neutrophil/ lymphocyte ratio and plasma glucose level in pigs. Livestock Production Science, 48: 157-164.
10. Gibb, D.J., K.S. Schwartzkopf-Genswein, J.M. Stookey, J.J. Mckinnon, D.L. Godson, R.D. Wiedmeier and T.A. Mcallister, 2000. Effect of a trainer cow on health, behavior and performance of newly weaned beef calves. Journal of Animal Science, 78: 1716-1725.
11. Swanson, J.C. and J.Morrow-Tesch, 2001. Cattle transport: historical, research and further perspectives. Journal of Animal Science, 79 (suppl.): E102-109.
12. Bueno, A.R., R. Rasby and E.T. Clemens, 2003. Age at weaning and the endocrine response to stress. Arq. Bras. Med. Vet. Zootec., 1: 1-7.
13. Smith, D.L., D.L. Wiggers, L.L. Wilson, J.W. Comerford, H.W. Harpster, T.R. Noonan, F.H. Cross, R.A. Reynolds and R.L. Murphree, 2001.Effects of age, season and reproductive activity on hemograms of female Hereford cattle. American Journal of Veterinary Research, 39: 433-440.
14. Stanger, K.J., N. Ketheesan, A.J. Parker, C.J. Coleman, S.M. Lazzaroni and L.A. Fitzpatrick, 2005. The effect of transportation on the immune status of *Bos indicus* steers. Journal of Animal Science, 83: 2632-2636.
15. Godson, D.L., M. Campos, S.K. Attah-Poku, M.J. Redmond, D.M. Cordeiro, M.S. Sethi, R.J. Harland and L.A. Babiuk, 1996. Serum haptoglobin as an indicator of the acute phase response in bovine respiratory disease. Veterinary Immunology and Immunopathology, 51: 277-292.
16. Tunasuvan, D., N. Sarataphan and H. Nishikawa, 1997. Cerebral trypanosomiasis in native cattle. Veterinary Parasitology, 73: 357-363.
17. Suteeraparp, P., S. Pholpark, M. Pholpark, A. Charoenchai, T. Chompoochan, I. Yamane and Y. Kashiwazaki, 1999. Seroprevalence of antibodies to *Neospora caninum* and associated abortion in daily cattle from central Thailand. Veterinary Parasitology, 86: 49-57.
18. Kitching, R.P., 1999. Foot-and-mounth disease: current world situation. Vaccine, 17: 1772-1774.
19. Paitoonpong, L., M. Ekgatat, P. Nunthapisud, T. Tantawichain and C. Suankratay, 2006. Brucellosis: the first case of King Chulalongkorn Memorial Hospital and review of the literature. Journal of Medical Association of Thailand, 89: 1331-1337.
20. Kusum, M., N. Boonsarthorn, M. Biaklang, U. Sina, P. Sawanpanyalert and P. Naigowit, 2005. Comparison of leptospiral serovars identification by serology and cultivation in northeastern region, Thailand. Journal of Medical Association of Thailand, 88: 1098-1102.
21. Padungtod, P., J.B. Kaneene, D. Jarman, K. Jones, R. Johnson, A. Drummond, Z. Duprey and I. Chaichanpunpol, 2001. Enteric parasitosis in northeastern Thailand daily heifers and heifer calves. Preventive Veterinary Medicine, 48: 25-33.
22. Waikagul, J., P. Dekumyoy and M.T. Anantaphruti, 2006. Taeniasis, cysticercosis and echinococcosis in Thailand. Parasitology International, 55: 175-180.
23. SAS, 1990. SAS/STAT User's Guide: statistics. Release 6.04 Edition. SAS Institute, Inc., Cary, NC.
24. Moberg, G.P., 1985. Animal Stress. CAB International, NewYork, pp: 37-49.
25. Schalm, O.W., N.C. Jain and E.J. Carroll, 1975. Veterinary Hematology, 3rd edition. Lea & Febiger. Philadelphia, pp: 405-470.
26. Davidson, M., R. Else and J. Lumsden, 1998. BSAVA Manual of Small Animal Clinical Pathology. British Small Animal Veterinary Association, Cheltenham UK, pp: 33-60.
27. Birchard, S.J. and R.G. Sherding, 2006. Saunders Manual of Small Animal Practice. Sanders Elsevier, Missouri, pp: 231-255.
28. Candyce, M.J., P.M. Watson and M.S. Donovan, 2003. Veterinary Technician's Daily Reference Guide:Canine and Feline. Lippincott Williams & Wilkins, Maryland, pp: 349-363.
29. Spivak, J.L., 1984. Fundamentals of Clinical Hematology, Harper & Row, Publishers, Inc., Pennsylvania, pp: 123-134.