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HAEMATOLOGIC PROFILE REVISITED: ADULT CHOLISTANI BREEDING BULLS AS A MODEL

U. Farooq[1], Ijaz, A., N. Ahmad[*], H. Rehman and H. Zaneb[**]

Department of Physiology, University of Veterinary and Animal Sciences, Lahore, Pakistan
[*]Department of Theriogenology, University of Agriculture, Faisalabad, Pakistan
[**]Department of Anatomy, University of Veterinary and Animal Sciences, Lahore, Pakistan
[1]Current address: University College of Veterinary and Animal Sciences, The Islamia University of Bahawalpur, Pakistan
Corresponding author: pathophysio@hotmail.com

ABSTRACT

Cholistani breed of cattle is a Zebu *(Bos indicus)* or humped breed of Indian origin which has a remarkable potential of thermo-tolerance and tick-resistance. It is being reared by the nomadic herders of Cholistan desert of Pakistan under pastoral system and is a vital socio-economic asset of local nomads. A pilot study was conducted to assess various haematologic parameters in five adult Cholistani breeding bulls aged 5-11 years. These bulls were kept under naturally prevailing climatic conditions at Semen Production Unit, Karaniwala, Bahawalpur, Pakistan. Blood samples were aseptically collected fortnightly during October, 2011 to January, 2012 and analyzed for various haematologic parameters. Mean values for Hb, Total Erythrocyte Count, PCV, MCV, MCH and MCHC were 12.50 ± 0.40g/dL, 6.42 ± 0.31×10^6/µL, 37.18 ± 1.15%, 58.05 ± 1.58fL, 19.52 ± 0.51pg and 33.65 ± 0.79g/dL, respectively. Similarly, the mean Total Leukocyte Count was 7.80 ± 0.69×10^3/µL. Differential leukocyte count revealed that lymphocytes were the predominant leukocytes (50.55 ± 1.18%), followed by neutrophils (45.00 ± 1.38%) and monocytes (2.85 ± 0.18%), while eosinophils showed the lowest count (1.60 ± 0.17%). The present work is the first of its kind in Cholistani breeding bulls and the results can be used as a baseline reference haematologic data which in turn, will be helpful in monitoring the health status of these animals.

Keywords: Cholistan, *Bos indicus,* haematological profile.

INTRODUCTION

The potential of Zebu *(Bos indicus)* cattle for thermo-tolerance and heat-resistance as compared to the European breeds has been well documented (Nogueira, 2004; Farooq *et al.,* 2010; Shahzad *et al*., 2010). Conversely, there are certain areas in the world where cold-tolerant cattle such as Scottish Highland, are more ideally suited to survive. These two breeds have physical and physiological characteristics (Hammond *et al.,* 1996) which enable them to survive in their respective extreme environments and hence, play a pivotal role in the uplift of socio-economic status of the local dwellers.

Hematological investigation has gained a global popularity as a prime diagnostic and management tool in veterinary practice. It ascertains the physiological, nutritional and pathological status of an organism (Doyle, 2006; Khaliq and Rahman, 2010; Khan *et al*., 2011) and helps distinguish the normal state from the state of stress, which can be nutritional, physical or environmental (Aderemi, 2004). The dovetailing of many factors such as species, breed, age, sex, nutrition, illness, exercise, transport and seasonal variation affects the haematologic parameters (Farooq *et al.,* 2011). Therefore, results from different breeds or species at a certain geographical location cannot be taken as norms for related animal or species in another locality (Gul *et al.,* 2007). This may lead to unnecessary additional investigations, misinterpretation and erroneous diagnosis.

Cholistani breed is a Zebu *(Bos indicus)* or humped breed of cattle of Indian origin, being reared by the nomadic herders of Cholistan desert of Pakistan. It is a large-sized flabby breed with small horns, long ears, well developed hump in males and large dewlap both in males and females (Farooq *et al.,* 2010). It is being used as a dual purpose breed *i.e.* for milk and drought and is a major source for the socio-economic uplift of Cholistani nomads (Ali *et al.,* 2009). High thermo-tolerance and tick-resistance make animals of this breed able to withstand severe heat stress without remarkably affecting their productive and reproductive performance.

However, there is little information on the haematological profiles of animals of this breed. Therefore, the objective of the present study was to ascertain normal haematologic profile in adult Cholistani breeding bulls being reared under desert conditions at the Semen Production Unit (SPU), Karaniwala, Bahawalpur, Pakistan. The present work is most probably the first of its kind in Cholistani breeding bulls.

MATERIALS AND METHODS

Experimental site: The present study was conducted at the Semen Production Unit (SPU), Karaniwala, Bahawalpur, located in the Cholistan Desert of Pakistan. The desert sprawls over an area of 26000 Km^2, located at latitudes 27º42´and 29º45´North, longitudes 69º52´and 75º24´East and at an altitude of 112m above the sea level. The climate of this area is arid, hot subtropical and monsoonal with the average annual rainfall of 180 mm (Ali *et al.,* 2009). The inconsistency in rainfall results in periodic droughts in the area.

Experimental animals: The study was conducted on five adult Cholistani breeding bulls, ranging between 5 and 11 years in age, and maintained at the SPU, Karaniwala, Bahawalpur, Pakistan under naturally prevailing climatic conditions. These bulls were fed good quality seasonal fodder at the rate of 10% of their body weight, with two to three kg of concentrate per bull per day. Vaccination against Hemorrhagic Septicemia and Foot and Mouth disease was carried out as per schedule. Preventive measures against worm infestation were undertaken twice in a year or whenever felt necessary.

Blood collection: Blood collection was carried out aseptically through a disposable syringe (fitted with a 18 gauge, 5 cm long needle) fortnightly from October, 2011 to January, 2012. About 5mL blood was collected from each animal and transferred into the screw capped tubes containing 0.5mL of 1% EDTA solution as an anticoagulant. A total of 40 blood samples were collected over a period of four months, with eight samples per animal. In order to minimize the stress to the animal, to standardize the collection procedure, and to remove diurnal variation, all the animals were restrained with the same technique and the blood collection was carried out by the same personnel and at the same time of the day *i.e* around 04:00 pm.

Haematologic profile: Blood samples were analyzed for Hb, Total Erythrocyte Count (TEC), PCV, Total Leukocyte Count (TLC) and Differential Leukocyte Count (DLC) using an automated haematology analyzer (Sysmex K21, Kobe, Japan) which was off-hand calibrated with human and bovine blood using multiple samples. The erythrocytic indices *viz.* MCV, MCH, and MCHC were computed, as described earlier (Jain, 1998; Njidda and Isidahomen, 2011). Means values (± SE) of various haematological parameters for individual bull were computed using the Statistical Package for Social Science (SPSS for Windows version 12, SPSS Inc., Chicago, IL, USA).

RESULTS AND DISCUSSION

Mean values (± SE) of various RBC and WBC indices are presented in Tables 1 and 2, respectively; whereas their comparison with the reported reference values for cattle (Jain, 1998) is presented in Table 3.

Red blood cell indices: The overall mean Hb concentration in the Cholistani breeding bulls was 12.50 ± 0.40 g/dL, ranging from 10.0 to 14.40 g/dL. KWC-24 showed the highest Hb concentration of 13.42 ± 0.48 g/dL. Our values are higher than those published earlier. Lower Hb concentration of 10.9 ± 0.62 g/dL was reported for Iranian bulls (Mirzadeh *et al.,* 2010). Similarly, Aengwanich *et al*. (2009) reported lower Hb concentration of 10.36 ± 1.92 g/dL for male crossbred beef cattle in Thailand, while Olayemi *et al*. (2007) reported the mean value of 11.18 ± 1.87 g/dL for indigenous African Sokoto bulls. The Hb concentration is mainly affected by the season, being higher in summer and decreases in winter (Koubkova *et al.,* 2002). Moreover, variability in age, physical status of the animal, feeding pattern, geological location of the farm and different laboratory protocol adopted can also influence the results (Awolaja *et al.,* 1997).

It is generally accepted that the TEC in Zebu cattle is higher than the European breeds, which helps to maintain the heat dissipating mechanism of the body in the former breed (Barger, 2003). The overall mean TEC recorded in Cholistani bulls was 6.42 ± 0.31×10^6/µL, ranging from 4.91-8.10×10^6/µL, which lies within the normal reference range of 5.0 to 10.0×10^6/µL for cattle reported by Jain (1998). Aengwanich *et al.* (2009) also reported a mean TEC of 6.34 ± 1.59×10^6/µL. However, a higher TEC of 9.63 ± 3.04×10^6/µL has been reported for African Sokoto male cattle (Olayemi *et al.,* 2007). Variations in age and health status of animals can be attributed to these differences in TEC among different studies.

The results of the present study indicate wide bull to bull variation in TEC, with KWC-28 and KWC-19 showing highest and lowest values (7.19 ± 0.25 ×10^6 and 5.46 ± 0.26 × 10^6/µL), respectively. Mirzadeh *et al.* (2010) also reported bull to bull variation in the same species while studying Holsteins, Brown Swiss and Semental breeds maintained under similar management regimen in Iran. These bull to bull variations can be attributed to physiological differences rather than pathological conditions because the animals were clinically healthy and did not show any abnormality.

The mean value of PCV in this study was 37.18 ± 1.15%, which was within the reference range of 24-46% for cattle (Jain, 1998). These results are in line with the work of Aengwanich *et al*. (2009), who reported a mean PCV of 36.50 ± 4.35% for crossbred male beef cattle in Thailand. Similarly, a mean PCV of 35.00 ±

6.67% has been reported for male Nigerian Sokoto cattle (Olayemi *et al.* 2007). However, Mirzadeh *et al.* (2010) reported a lower mean PCV of 28.45 ± 4.66% for Semental cattle in Iran. Thahar *et al.* (1983) reported higher PCV and Hb concentrations in bulls fed high concentrate diet. A higher TEC in zebu cattle correlates with the higher PCV.

Overall mean values for MCV, MCH and MCHC in the present study were 58.05 ± 1.58 fL, 19.52 ± 0.51 pg and 33.65 ± 0.79 g/dL, respectively. The values for MCV and MCHC are within the reference range of bulls given by Jain (1998), however the mean MCH is higher. Variable results have been reported in the literature regarding these erythrocytic indices. Mirzadeh *et al.* (2010) reported values of 51.83 ± 4.25 fL, 19.15 ± 2.34 pg and 36.90 ± 4.58 g/dL for MCV, MCH and MCHC, respectively. The variation in these erythrocytic indices can be attributed to variable RBC size and differences in oxygen carrying ability in the context of age and physiological state (Farooq *et al*., 2011).

Table 1: Mean (± SE) red blood cell indices in individual Cholistani breeding bulls

Bull #	Hb (g/dL)	TEC (10^6/µL)	PCV (%)	MCV (fL)	MCH (pg)	MCHC (g/dL)
KWC-19	11.02±0.44	5.46±0.26	32.82±1.61	60±0.26	20.17±0.16	33.65±0.31
KWC-21	12.48±0.44	6.0±0.24	37.36±1.63	62.16±0.2	20.76±0.15	33.46±0.33
KWC-24	13.42±0.48	6.91±2.97	39.56±1.60	57.22±0.19	19.42±0.65	33.94±0.16
KWC-27	12.85±0.60	6.56±0.28	38.27±1.97	58.20±0.64	19.55±0.13	33.57±0.20
KWC-28	12.74±0.42	7.19±0.25	37.90±1.45	52.68±0.22	17.72±0.05	33.64±0.19
Overall means	**12.50±0.40**	**6.42±0.31**	**37.18±1.15**	**58.05±1.58**	**19.52±0.51**	**33.65±0.79**
Range	**10.0-14.40**	**4.91-8.10**	**29.10-43.40**	**52.10-62.90**	**17.60-21.20**	**32.30-34.40**

Table 2: Mean (± SE) white blood cell values in individual Cholistani breeding bulls

Bull #	TLC (10^3/µL)	Neutrophils (%)	Lymphocytes (%)	Eosinophils (%)	Monocytes (%)
KWC-19	7.52±0.37	48±2.58	48.50±2.10	1.25±0.25	2.25±0.47
KWC-21	5.92±0.22	47.80±4.10	48.20±3.44	1.4±0.40	2.60±0.51
KWC-24	9.20±0.43	40.60±1.69	54.80±2.05	1.40±0.24	3.20±0.20
KWC-27	6.85±0.20	45.0±0.81	50.25±0.63	1.75±0.25	3.0±0.24
KWC-28	9.52±0.64	43.60±2.77	51.0±1.67	2.20±0.73*	3.20±0.86
Overall means	**7.80±0.69**	**45.0±1.38**	**50.55±1.18**	**1.60±0.17**	**2.85±0.18**
Range	**5.20-11.80**	**33-57**	**39-60**	**1-5**	**1-6**

Table 3: Comparative hemogram of Cholistani breeding bulls with reported reference ranges for bulls

	Red blood cell indices	
Parameters	**Values obtained**	**Reference Range***
Hb (g/dL)	12.50±0.40	8.0-15.0
TEC (10^6/µL)	6.42±0.31	5.0-10.0
PCV (%)	37.18±1.15	24.0-46.0
MCV (fL)	58.05±1.58	40-60
MCH (pg)	19.52±0.51	11-17
MCHC (g/dL)	33.65±0.79	30-36
	White blood cell values	
TLC (10^3/µL)	7.80±0.69	4.0-12.0
Neoutrophils (%)	45.0±1.38	15.0-47.0
Lymphocytes (%)	50.55±1.18	45-75
Eosinophils (%)	1.60±0.17	0.0-20.0
Monocytes (%)	2.85±.18	2.0-7.0

*Source = Jain (1998).

White blood cell values: The mean TLC for the Cholistani breeding bulls was 7.80 ± 0.69×10^3/µL, which is within the reference range (4.0 to 12.0×10^3/µL) for cattle reported by Jain (1998). However, Al-Shami (2003) and Aengwanich *et al.* (2009) reported higher TLC values of 14.6 ± 2.3 and 13.71 ± 2.9×10^3/µL for

Hassawi cattle in Saudi Arabia and crossbred beef cattle in Thailand, respectively. Differential Leukocyte Count revealed that the lymphocytes were the predominant leukocytes (50.55 ± 1.18%), followed by neutrophils (45.00 ± 1.38%) and monocytes (2.85 ± 0.18%), while eosinophils showed the lowest count (1.60 ± 0.17%). While studying age related effects on white blood cell indices of Holstein bulls kept at AI Centra, USA, Monke *et al.* (1998) reported a decrease in absolute number of lymphocytes in yearling bulls as compared to adults. Differences in breed, age, physiological status or stress prior to handling can influence leukocytic indices (Farooq *et al.,* 2011).

The haematologic values presented in the present paper include most of the tests of interest in a routine clinical pathology laboratory. Although the number of bulls used in the study was small due to less number of Cholistani bulls available at the SPU in Pakistan, yet it provides baseline data for extensive study of this indigenous breed of cattle in future.

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REFERENCES

Aderemi, F. A. (2004). Effect of replacement of wheat bran with Cassava root sieviate supplemented or unsupplemented with enzyme on the hematology and serum biochemistry of pullet chicks. Trop. J. Anim. Sci., 7: 147-153.Aengwanich, W., A. Chantiratikul and S. Pamok (2009). Effect of seasonal variations on hematological values and health monitor of crossbred beef cattle at slaughter house in North Eastern part of Thailand. Am. Eur. J. Agri. Environ. Sci. 5(5): 644-648.

Ali I, M. S. Chauhdry and U. Farooq (2009). Camel rearing in Cholistan desert of Pakistan. Pakistan Vet. J. 29(2): 85-92.

Al-Shami, S. A. (2003). Studies on normal haematological and biochemical parameters of Hassawi cattle breed in Saudi Arabia. Pakistan J. Biol. Sci. 6(14): 1241-1242.

Awolaja, O. A., R. E. Anita and A. Oyejide (1997). Trace element level in plasma/serum and erythrocytes of Keketu and White Fulani cattle. Trop. Anim. Health Prod. 29: 2-6.

Barger, A. M. (2003). The complete blood cell count: a powerful diagnostic tool. Vet. Clin. North Am., Small Anim. Pract. 33: 1207-1222.

Doyle, D. (2006). William Hewson (1739-1774): The father of hematology. Br. J. Haematol. 133: 375-381.

Farooq, U., H. A. Samad, F. Sher, M. Asim and M. A. Khan (2010). Cholistan and Cholistani breed of cattle. Pakistan Vet. J. 30(2): 126-130.

Farooq, U., H. A. Samad, A. Khurshid and S. Sajjad (2011). Normal reference hematologic values of one-humped camels *(Camelus dromedarius)* kept in Cholistan desert. J. Anim. Plant Sci. 21(2): 157-160.

Gul, S. T., M. Ahmad, A. Khan and I. Hussain (2007). Haemato-biochemical observations in apparently healthy equine species. Pakistan Vet. J. 27(4): 155-158.

Hammond, A. C., T. A. Olson, J. C. C. Chase, E. J. Bowers, R. D. Randel, C. N. Murphy, D. W. Vogt and A. Tewolde (1996). Heat tolerance in two tropically adapted *Bos taurus* breeds, Senepol and Romosinuamano, compared with Brahman, Angus and Hereford cattle in Florida. J. Anim. Sci. 74: 295-303.

Jain, N. C. (1998). Essentials of Veterinary Hematology. 2nd Ed. Lea & Febiger; Philadelphia (USA), pp: 65-68.

Khaliq, T. and Z. U. Rahman (2010). Haematological studies of Nili-Ravi buffaloes injected with recombinant bovine somatotropin. Pakistan Vet. J. 30(1): 53-57.

Khan, I. A., A. Khan, A. Hussain, A. Riaz and A. Aziz (2011). Hemato-biochemical alterations in cross bred cattle affected with bovine theileriosis in semi arid zone. Pakistan Vet. J. 31(2): 137-140.

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. J. Anim. Sci. 47: 309-318.

Mirzadeh, K., S. Tabatabei, M. Bojarpour and M. Mamoei (2010). Comparative study of hematologic parameters according to strain, age, sex, physiological status and season. J. Anim. Vet. Adv. 9(16): 2123-2127.

Monke, D. R., G. J. Kociba, M. DeJarnette, D. E. Anderson and W. H. Ayers Jr. (1998). Reference values for selected hematologic and biochemical variables in Holstein bulls of various ages. Am. J. Vet. Res. 59(11): 1386-1391.

Njidda, A. A. and C. E. Isidahomen (2011). Hematological parameters and carcass characteristics of weanling rabbits fed sesame seed meal (*Sesamum indicum*) in a semi-arid region. Pakistan Vet. J. 31(1): 35-39.

Nogueira, G. P., (2004). Puberty in South American *Bos indicus* (Zebu) cattle. Anim. Reprod. Sci. 82-83: 361-372.

Olayemi, F. O., C. N. Nwandu and J. O. Aiyedun (2007). Haematology of Sokoto Gudali cattle as influenced by sex and breed. J. Anim. Vet. Adv. 6(6): 816-818.

Shahzad, F., M. Yaqoob, M. Younas, U. Farooq, F. Sher, M. Asim, S. Qamar, M. Akbar and I. Irshad (2010). Factors affecting the birth weight of Cholistani cattle calves. Pakistan Vet. J. 30(4): 247-248.

Thahar, A., J. B. Moran and J. T. Wood (1983). Hematology of Indonesian large ruminants. Trop. Anim. Health Prod. 15(2): 76-82.