

HAEMATOLOGIC PROFILE REVISITED: ADULT CHOLISTANI BREEDING BULLS AS A MODEL

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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 ± 0.40 g/dL, $6.42 \pm 0.31 \times 10^6/\mu\text{L}$, $37.18 \pm 1.15\%$, 58.05 ± 1.58 fL, 19.52 ± 0.51 pg and 33.65 ± 0.79 g/dL, respectively. Similarly, the mean Total Leukocyte Count was $7.80 \pm 0.69 \times 10^3/\mu\text{L}$. Differential leukocyte count revealed that lymphocytes were the predominant leukocytes ($50.55 \pm 1.18\%$), followed by neutrophils ($45.00 \pm 1.38\%$) and monocytes ($2.85 \pm 0.18\%$), while eosinophils showed the lowest count ($1.60 \pm 0.17\%$). 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 Km², located at latitudes 27°42' and 29°45' North, longitudes 69°52' and 75°24' 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 (\pm 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 (\pm 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 \pm 0.40 g/dL, ranging from 10.0 to 14.40 g/dL. KWC-24 showed the highest Hb concentration of 13.42 \pm 0.48 g/dL. Our values are higher than those published earlier. Lower Hb concentration of 10.9 \pm 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 \pm 1.92 g/dL for male crossbred beef cattle in Thailand, while Olayemi *et al.* (2007) reported the mean value of 11.18 \pm 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 \pm 0.31 $\times 10^6/\mu\text{L}$, ranging from 4.91-8.10 $\times 10^6/\mu\text{L}$, which lies within the normal reference range of 5.0 to 10.0 $\times 10^6/\mu\text{L}$ for cattle reported by Jain (1998). Aengwanich *et al.* (2009) also reported a mean TEC of 6.34 \pm 1.59 $\times 10^6/\mu\text{L}$. However, a higher TEC of 9.63 \pm 3.04 $\times 10^6/\mu\text{L}$ 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 \pm 0.25 $\times 10^6$ and 5.46 \pm 0.26 $\times 10^6/\mu\text{L}$), 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 \pm 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 \pm 4.35% for crossbred male beef cattle in Thailand. Similarly, a mean PCV of 35.00 \pm

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 $28.45 \pm 4.66\%$ 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 (\pm SE) red blood cell indices in individual Cholistani breeding bulls

Bull #	Hb (g/dL)	TEC ($10^6/\mu\text{L}$)	PCV (%)	MCV (fL)	MCH (pg)	MCHC (g/dL)
KWC-19	11.02 \pm 0.44	5.46 \pm 0.26	32.82 \pm 1.61	60 \pm 0.26	20.17 \pm 0.16	33.65 \pm 0.31
KWC-21	12.48 \pm 0.44	6.0 \pm 0.24	37.36 \pm 1.63	62.16 \pm 0.2	20.76 \pm 0.15	33.46 \pm 0.33
KWC-24	13.42 \pm 0.48	6.91 \pm 2.97	39.56 \pm 1.60	57.22 \pm 0.19	19.42 \pm 0.65	33.94 \pm 0.16
KWC-27	12.85 \pm 0.60	6.56 \pm 0.28	38.27 \pm 1.97	58.20 \pm 0.64	19.55 \pm 0.13	33.57 \pm 0.20
KWC-28	12.74 \pm 0.42	7.19 \pm 0.25	37.90 \pm 1.45	52.68 \pm 0.22	17.72 \pm 0.05	33.64 \pm 0.19
Overall means	12.50\pm0.40	6.42\pm0.31	37.18\pm1.15	58.05\pm1.58	19.52\pm0.51	33.65\pm0.79
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 (\pm SE) white blood cell values in individual Cholistani breeding bulls

Bull #	TLC ($10^3/\mu\text{L}$)	Neutrophils (%)	Lymphocytes (%)	Eosinophils (%)	Monocytes (%)
KWC-19	7.52 \pm 0.37	48 \pm 2.58	48.50 \pm 2.10	1.25 \pm 0.25	2.25 \pm 0.47
KWC-21	5.92 \pm 0.22	47.80 \pm 4.10	48.20 \pm 3.44	1.4 \pm 0.40	2.60 \pm 0.51
KWC-24	9.20 \pm 0.43	40.60 \pm 1.69	54.80 \pm 2.05	1.40 \pm 0.24	3.20 \pm 0.20
KWC-27	6.85 \pm 0.20	45.0 \pm 0.81	50.25 \pm 0.63	1.75 \pm 0.25	3.0 \pm 0.24
KWC-28	9.52 \pm 0.64	43.60 \pm 2.77	51.0 \pm 1.67	2.20 \pm 0.73*	3.20 \pm 0.86
Overall means	7.80\pm0.69	45.0\pm1.38	50.55\pm1.18	1.60\pm0.17	2.85\pm0.18
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

Parameters	Red blood cell indices	
	Values obtained	Reference Range*
Hb (g/dL)	12.50 \pm 0.40	8.0-15.0
TEC ($10^6/\mu\text{L}$)	6.42 \pm 0.31	5.0-10.0
PCV (%)	37.18 \pm 1.15	24.0-46.0
MCV (fL)	58.05 \pm 1.58	40-60
MCH (pg)	19.52 \pm 0.51	11-17
MCHC (g/dL)	33.65 \pm 0.79	30-36
	White blood cell values	
TLC ($10^3/\mu\text{L}$)	7.80 \pm 0.69	4.0-12.0
Neutrophils (%)	45.0 \pm 1.38	15.0-47.0
Lymphocytes (%)	50.55 \pm 1.18	45-75
Eosinophils (%)	1.60 \pm 0.17	0.0-20.0
Monocytes (%)	2.85 \pm 0.18	2.0-7.0

*Source = Jain (1998).

White blood cell values: The mean TLC for the Cholistani breeding bulls was $7.80 \pm 0.69 \times 10^3/\mu\text{L}$, which is within the reference range (4.0 to $12.0 \times 10^3/\mu\text{L}$) 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 $13.71 \pm 2.9 \times 10^3/\mu\text{L}$ for

Hassawi cattle in Saudi Arabia and crossbred beef cattle in Thailand, respectively. Differential Leukocyte Count revealed that the lymphocytes were the predominant leukocytes ($50.55 \pm 1.18\%$), followed by neutrophils ($45.00 \pm 1.38\%$) and monocytes ($2.85 \pm 0.18\%$), while eosinophils showed the lowest count ($1.60 \pm 0.17\%$). 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.

Acknowledgements: The authors are grateful to Dr. Syed Aamer Mehmood, Deputy Director; Dr. Nasir Lateef, Veterinary Officer and Mashook Ali, Laboratory Assistant at SPU, Karaniwala, Bahawalpur, Pakistan for their skillful guidance and help for the smooth implementation of the research project.

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