JOURNAL OF ADVANCED VETERINARY AND ANIMAL RESEARCH
ISSN 2311-7710 (Electronic)
http://doi.org/10.5455/javar.2018.e302
A periodical of the Network for the Veterinarians of Bangladesh (BDvetNET)

December 2018
VOL 5, NO. 4, PAGES 481–484

SHORT COMMUNICATION

Hematological reference values for healthy fat-tailed sheep (Dhumba) in Bangladesh

Shariful Islam[1,2], Md Kaisar Rahman[1,2], Jinnat Ferdous[1,2], Muhammad Belal Hossain[3], Mohammad Mahmudul Hassan[4], Ariful Islam[1]

[1]EcoHealth Alliance, NY, USA
[2]Institute of Epidemiology, Disease Control and Research (IEDCR), Dhaka, Bangladesh
[3]Infectious Disease Division, International Center for Diarrheal Disease Research, Bangladesh
[4]Department of Physiology, Biochemistry, and Pharmacology, Faculty of Veterinary Medicine, Chittagong Veterinary and Animal Sciences University, Bangladesh.

ABSTRACT

Objective: There is scarce literature regarding hematology profile of fat-tailed sheep (Dhumba). The study was conducted to determine reference intervals for their hematology profile in the context of Bangladesh.

Materials and methods: Blood samples were collected from 32 healthy fat-tailed sheep from Dhaka, Bangladesh, during September–October, 2015. Hemoglobin (Hb), packed cell volume (PCV), erythrocyte sedimentation rate (ESR), total leukocyte count (TLC), total erythrocyte count (TEC), lymphocyte, monocyte, eosinophil, basophil, and neutrophil counts were measured.

Results: The levels showed a wide range and variation based on age and sex. Adult sheep had significantly ($p = 0.01$) higher Hb level than that of juvenile (<6 months of age). Other parameter values were almost similar for both adult and juvenile. The only two hematological parameters, showing noteworthy differences between male and female, were TLC and Basophil level ($p < 0.05$) in blood.

Conclusion: The study sets baseline for future research and diagnosis of diseases in fat-tailed sheep. It also helps for profitable production of fat-tailed sheep in Bangladesh.

ARTICLE HISTORY

Received 09 April 2018
Revised August 07, 2018
Accepted 10 August 2018
Published November 30, 2018

KEYWORDS

Bangladesh; fat-tailed sheep; hematology; reference values interval

Introduction

Fat-tailed sheep (Dhumba) are characterized by large hindquarters and tails. The name "Fat-Tailed Sheep" has given because they deposit up to 20% of their carcasses weight as tail fat [1–3], which help them to adapt in broad range of environment [4]. They constitute almost 20%–25% of the world sheep population [5]. The common breeds under fat-tailed sheep include Adal sheep, Afghan Arabi, Afrikaner, Awassi, Balkhi, Blackhead Persian, Karakul, Pedi, Red Massai, Tunis, and Zulu [6]. They are commonly found in central Asia, Somalia, Western China, Africa, the Middle East, Pakistan, Afghanistan, Iran, and North India [5]. Fat-tailed sheep have socio-cultural values in diverse communities live in Bangladesh [4]. Like other countries, many farmers of Bangladesh are rearing this sheep for meat, fat, and wool [4, 7]. The sheep can be considered as living bank against various natural calamities such as crop failure, drought, and flood. The consumption of the meat of sheep is high, leading to an increase in its price due to rapid urbanization [8]. In addition, they can contribute in the traditional economy of Bangladesh where livestock play substantial role to keep the rural economy viable [9, 10].

Blood profile is important to assess the physiological condition as well as to evaluate the management practices, nutrition, and diagnosis of health condition [11]. The hemato-biochemical parameters influence the productive and reproductive capability of animals [12], while their variation are associated with several internal and external factors including altitude, feeding, age, sex, breed, season, temperature, and physiological status of animal [13].

Correspondence Ariful Islam ✉ arif@ecohealthalliance.org EcoHealth Alliance and PREDICT Country Coordinator, USAID EPT-2 Program, IEDCR, Mohakhali, Dhaka 1212, Bangladesh

How to cite: Islam S, Rahman MK, Ferdous J, Hossain MB, Hassan MM, Islam A. Hematological reference values for healthy fat-tailed sheep (Dhumba) in Bangladesh. J Adv Vet Anim Res 2018; 5(4):481–4.

In Bangladesh, fat-tailed sheep is gradually becoming popular, especially during Eid ul Adha. But Farmers and practitioners are not well experienced about this emerging species of livestock and how can they contribute in the economy of Bangladesh. For successful rearing of fat-tailed sheep in subtropical countries such as Bangladesh, it is important to evaluate the health status of animals. Blood parameters are an important and reliable medium for estimating the health status of individual animals, which is easy, less time-consuming, and economic to perform. In Bangladesh, there is no information available on hematological and biochemical parameters of fat-tailed sheep, and there are very few published data on hematology profile of these sheep in the world [14]. Therefore, the present study was aimed to determine the hematological profile of imported fat-tailed sheep in Bangladesh.

Materials and methods

Ethical approval

The protocol of the study was reviewed and approved by the Animal Ethical Experimentation Committee (AEEC) of Chittagong Veterinary and Animal Sciences University (CVASU), Bangladesh (CVASU/Dir (R&E) AEEC/2015/927).

Study site, sample collection, and laboratory examination

A total of 32 fat-tailed sheep were sampled from one market and from a farm in Dhaka city between September and October, 2015. Five milliliter of blood was collected from each sheep via jugular venipuncture and transferred to a sterile vial containing ethylene diamine tetra acetic acid (EDTA) (1 mg/ml of blood) for estimating hematological parameters such as hemoglobin (Hb), packed cell volume (PCV), erythrocyte sedimentation rate (ESR), total leukocyte count (TLC), total erythrocyte count (TEC), lymphocyte, monocyte, eosinophil, basophil, and neutrophil counts. The procedure of estimating these parameters are described elsewhere [15–17]. All samples were processed and tested at the biochemistry laboratory of the Department of Physiology, Biochemistry, and Pharmacology, CVASU, Bangladesh.

Data analysis

The data were stored in Microsoft Excel 2007 (Microsoft Corporation, Redmond, WA 98052-6399 USA) and then exported to MedCalc Statistical Software version 17.5.5 (MedCalc Software bvba, Ostend, Belgium; http://www.medcalc.org; 2017) for estimating mean, standard deviation (SD), and reference intervals (RI) [18, 19]. Ninety percent of the confidence intervals (CIs) were calculated for each RI using bootstrap methods. Differences between the hematological parameters of adult and juvenile sheep were analyzed using Student's *t*-test. A value of $p < 0.05$ was considered as significant.

Results and discussion

Hematological parameter values for total 32 fat-tailed sheep were presented in Table 1. The minimum and maximum values with their 90% RIs were also documented for better understanding. Some parameters have wide RI such as PCV, TLC, Lymphocyte, Neutrophil, Eosinophil, and Monocyte.

Hb level was found slightly lower in Kashmir sheep (9.3±1.0) [20] and in Coimbatore sheep (9.53±0.36) [21] than our study. However, some studies reported higher Hb concentration in Awassi sheep (10.4±0.2) [14] and European mouflon sheep (16.96±0.97) (*Ovis orientalis musimon*) [22]. Similarly, PCV value in fat-tailed sheep was much lower than Karadi (28.73±0.16), Awassi (27.00±0.46), and Naimy (26.33±0.46) sheep breeds [13]. Fat-tailed sheep are normally reared in hot areas, which may require high level of Hb for adaptation comparing to the sheep reared in cold region of the world. Stress, hormonal influences, hydration status, dietary differences, or adaptations to warm environment can be resulted in differences in RBC mass.

Table 1. Reference intervals and mean values for hematological parameters for fat-tailed sheep (Dhumba) (*N* = 32), Bangladesh, 2015.

Parameters	Mean	SD	Min	Max	RI lower limit (90% CI)	RI Upper limit (90% CI)
HB (gm/dL)	9.8	1.1	8	11.6	7.7 (7.2/8.3)	11.9 (11.4/12.6)
PCV (%)	33.7	6.1	20	43	21.8 (18.7/24.9)	45.8 (42.6/48.9)
ESR (mm/h)	0.5	0.4	0	1	−0.3 (−0.5/−0.11)	1.2 (1/1.4)
TLC (thousand/Cumm)	6.4	1.3	4.2	8.4	3.8 (3.1/4.5)	9.1 (8.3/9.7)
TEC (million/Cumm)	4.4	0.9	2.9	6.1	2.7 (2.3/3.2)	6.1 (5.7/6.6)
Lymphocyte (%)	54.2	5.7	39	65	43.1 (40.2/45.9)	65.3 (62.5/68.2)
Neutrophil (%)	34.7	4	28	45	26.8 (24.8/28.9)	42.6 (40.5/44.6)
Eosinophil (%)	6.1	2.5	2	12	1.3 (0.2/2.6)	10.9 (9.6/12.1)
Monocyte (%)	4.8	1.3	3	8	2.2 (1.6/2.9)	7.4 (6.7/8.1)
Basophil (%)	0.6	0.5	0	1	−0.3 (−0.6/−0.1)	1.6 (1.3/1.8)

SD = standard deviation, RI = reference interval.

Table 2. Comparison of hematology between clinically healthy adult and juvenile fat-tailed sheep (Dhumba), Bangladesh, 2015.

Parameters	Age group (*n*)	Mean ± SD	95% CI	*P* value
HB (gm/dL)	Adult (25)	10.1 ± 0.9	9.7–10.5	0.01
	Juvenile (7)	8.9 ± 1.1	7.9–9.9	
PCV (%)	Adult (25)	33.4 ± 6.6	30.6–36. 1	0.54
	Juvenile (7)	35 ± 3.8	31.5–38.5	
ESR (mm/h)	Adult (25)	0.4 ± 0.3	0.3–0.6	0.72
	Juvenile (7)	0.5 ± 0.4	0.1–0.8	
TLC (thou/Cumm)	Adult (25)	6.4 ± 1.3	5.8–6.9	0.99
	Juvenile (7)	6.4 ± 1.6	4.8–7.9	
TEC (mill/Cumm)	Adult (25)	4.5 ± 0.8	4.1–4.8	0.38
	Juvenile (7)	4.2 ± 1.2	3.1–5.2	
Lymphocyte (%)	Adult (25)	54.2 ± 6.2	51.6–56.7	0.91
	Juvenile (7)	54.4 ± 3.3	51.4–57.5	
Neutrophil (%)	Adult (25)	34.7 ± 4.2	33.1–36.5	0.78
	Juvenile (7)	34.2 ± 3.6	31.1–37.6	
Eosinophil (%)	Adult (25)	6.1 ± 2.2	5.2–6.9	0.71
	Juvenile (7)	6.4 ± 3.4	3.3–9.5	
Monocyte (%)	Adult (25)	4.7 ± 1.4	4.1–5.3	0.19
	Juvenile (7)	5.4 ± 0.6	4.9–5.9	
Basophil (%)	Adult (25)	0.6 ± 0.5	0.4–0.8	0.16
	Juvenile (7)	0.9 ± 0.4	0.5–1.0	

SD = standard deviation, RI = reference interval.

Table 3. Comparison of hematology between clinically healthy male and female fat-tailed sheep (Dhumba) (*N* = 32), Bangladesh, 2015.

Parameters	Sex group (*n*)	Mean ± SD	95% CI	*P* value
HB (gm/dL)	Male (15)	9.9 ± 1.2	9.2–10.5	0.83
	Female (17)	9.8 ± 0.9	9.3–10.4	
PCV (%)	Male (15)	34.2 ± 5.6	31.1–37.3	0.70
	Female (17)	33.3 ± 6.8	29.8–36.9	
ESR (mm/h)	Male (15)	0.4 ± 0.38	0.18–0.61	0.47
	Female (17)	0.5 ± 0.39	0.29–0.7	
TLC (thou/Cumm)	Male (15)	6.9 ± 1.1	6.3–7.4	0.04
	Female (17)	5.9 ± 1.5	5.2–6.7	
TEC (mill/Cumm)	Male (15)	4.4 ± 1.1	3.8–4.9	0.96
	Female (17)	4.4 ± 0.7	4.1–4.8	
Lymphocyte (%)	Male (15)	54 ± 5.2	51.2–56.8	0.84
	Female (17)	54.4 ± 6.2	51.2–57.7	
Neutrophil (%)	Male (15)	34.6 ± 3.8	32.5–36.7	0.94
	Female (17)	34.7 ± 4.3	32.4–36.9	
Eosinophil (%)	Male (15)	6 ± 2.6	4.6–7.5	0.78
	Female (17)	6.2 ± 2.3	5.1–7.4	
Monocyte (%)	Male (15)	4.9 ± 0.95	4.4–5.5	0.72
	Female (17)	4.8 ± 1.6	3.9–5.6	
Basophil (%)	Male (15)	0.8 ± 0.5	0.6–1	0.05
	Female (17)	0.5 ± 0.5	0.2–0.7	

SD = standard deviation, RI = reference interval.

The values for different hematological parameters were also determined based on age and sex. Table 2 documented these values according to age group whereas Table 3 documented the values based on sex of sheep. Adult sheep had significantly (p = 0.01) higher Hb level than that of juvenile. A prior study also found similar result and reported significantly higher Hb from Iraq [13]; however, another study reported high RBC mass in juvenile (<2 years) Bighorn sheep than that of adult one [23]. Other parameter values were almost similar for both adult and juvenile sheep, and there is no significant difference among the values. However, several previous studies from across the world reported age-related variation in hematological parameters [13, 24]. This is may be attributed to small number of juvenile sheep in the study. Larger number of juvenile sheep in future will help to refute the problem.

Hb and PCV level in male and in female fat-tailed sheep had no significant variation. These results were in agreement with [13, 25, 26]. However, the levels for male (Hb: 10.8–17.6; PCV: 33.2–56.3) and for female (Hb: 14.4–18.2; PCV: 44.3–56.2) free-ranging desert bighorn sheep were observed to be higher than the one in our study sheep [23]. The only two hematological parameters showing noteworthy differences between male and female were TLC and Basophil level ($p < 0.05$) in blood. Male sheep had higher TLC and basophil than that of female, which may be due to stress-induced infection in male.

Conclusion

Fat-tailed sheep rearing is increasing in different countries day by day. Estimating their hematological profiles with reference interval will set forth some guidelines for future researchers as well as for diagnosis and treatment of the animal.

Acknowledgment

We thank Pitu Biswas, Md. Gafur Sheikh, Abdul Hai, Md Billal Uddin, and Abdullah-Al-Mamun for assistance in the field work and technical support, and to the staffs of the Departments of Physiology, Pharmacology, and Biochemistry, CVASU, for laboratory support that made this work possible. This study was made possible by the generous support of the American people through the United States Agency for International Development (USAID) Emerging Pandemic Threats PREDICT. The contents are the responsibility of the authors and do not necessarily reflect the views of USAID or the United States Government.

Conflict of Interest

The authors have no conflict of interests.

Authors' Contribution

AI conceptualized and supervised the study work, SI, and MKR collected the samples, carried out the lab examination

and data curation and formal analysis, SI and JF prepared the original draft, MBH, MMH, and AI reviewed and edited the manuscript.

References

[1] Baghcheghi Y, Shahneh AZ, Ganjkhanlou M, Motlagh MK, Yousefi AR. Effect of hypothyroidism on growth performance, carcass composition and meat quality of fat-tailed Lori-Bakhtiari lambs. Anim Prod Sci 2015; 55(10):1324–31. https://doi.org/10.1071/AN14516

[2] Kang D, Zhou G, Zhou S, Zeng J, Wang X, Jiang Y, et al. Comparative transcriptome analysis reveals potentially novel roles of Homeobox genes in adipose deposition in fat-tailed sheep. Scientific Rep 2017; 7:14491.

[3] Uğurlu M, Teke, B, Akdağ F, Salman M, Ekiz B, Kaya I. Slaughter and carcass characteristics of Herik male lambs raised under a finishing system. Turkish J Vet Anim Sci 2017; 41:556–62. https://doi.org/10.3906/vet-1612-28

[4] Abate Z. Performance evaluation of Bonga rams and their progenies in different agro-ecologies of southern Ethiopia. Jimma University, Jimma, Ethiopia, 2018.

[5] Mohapatra A, Shinde A. Fat-tailed sheep-an important sheep genetic resource for meat production in tropical countries: an overview. Ind J Small Ruminants 2018; 24(1):1–17. https://doi.org/10.5958/0973-9718.2018.00020.X

[6] Galall E. Sheep germ plasm in Ethiopia. Anim Genet Res Info 1983; 1:5–12.

[7] Tulu A, Khushi YR, Challi DG. Supplementary value of two Lablab purpureus cultivars and concentrate mixture to natural grass hay basal diet based on feed intake, digestibility, growth performance and net return of Horro sheep. Int J Livestock Prod 2018; 9(6):140–50.

[8] Rekik M. Review of the reproductive performances of sheep breeds in Ethiopia. J Biol Agric Healthc 2018; 6(9):117–26.

[9] Islam S, Moni SP, Barua SR, Parvez MA. Clinical manifestations and diseases of cattle and goats in Gopalganj, Bangladesh. Eco-Friendly Agric J 2015; 8(6):81–5.

[10] Hassan MM, Shaeef Z, Alam M, Hossain ME, Islam S, Uddin MB. Perception of smallholding goat farmers on diseases condition of Bangladesh. Int J Nat Sci 2016; 6(1):43–8.

[11] Sitmo MS. Effect of gender on some plasma biochemical parameters of sheep from Southern Al Jabal Al Akhdar in Libya. J Am Sci 2014; 10(8):74–7.

[12] Abdel-Fattah M, Hashem A, Shaker Y, Ellamei A, Amer H. Effect of weaning age on productive performance and some plasma biochemical parameters of Barki lambs in Siwa Oasis, Egypt. Global Veterinaria. 2013; 10(2):189–202. https://doi.org/10.5829/idosi.gv.2013.10.2.1104

[13] Oramari RA, Bamerny AO, Zebari HM. Factors affecting some hematology and serum biochemical parameters in three indigenous sheep breeds. Adv Life Sci Technol 2014; 21:56–62.

[14] Jawasreh K, Awawdeh F, Ismail ZB, Al-Rawashdeh O, Al-Majali A. Normal hematology and selected serum biochemical values in different genetic lines of Awassi ewes in Jordan. Int J Vet Med 2010; 7(2):12.

[15] Sharma IJ, Singh HS. Students laboratory manuals of veterinary physiology. 1st edition, Kalyani Publishers, New Delhi, 2000.

[16] Gupta SL, Tyagi PK, Tyagi PK, Mandal A, Dinani O, Rokade J. Feeding effect of rice based dry distillers grains with soluble on hemato-biochemical and egg sensory attributes during 45th to 54th week of laying. Int J Pure Appl Biosci 2017; 5(6):1521–7. http://dx.doi.org/10.18782/2320-7051.5890

[17] Siddiqe MZF, Islam MS, Islam SS, Islam MS, Islam MS, Das BC. Haematobiochemical changes in subclinical mastitis affected high yielding dairy cows in Chittagong district. Int J Nat Soc Sci 2015; 2(4):30–4.

[18] Friedrichs KR, Harr KE, Freeman KP, Szladovits B, Walton RM, Barnhart KF, et al. ASVCP reference interval guidelines: determination of de novo reference intervals in veterinary species and other related topics. Vet Clin Pathol 2012; 41(4):441–53.

[19] Stacy NI, Bjorndal KA, Perrault JR, Martins HR, Bolten AB. Blood analytes of oceanic-juvenile loggerhead sea turtles (Caretta caretta) from Azorean waters: reference intervals, size-relevant correlations and comparisons to neritic loggerheads from western Atlantic coastal waters. Conserv Physiol 2018; 6(1):coy006. https://doi.org/10.1093/conphys/coy006

[20] Bhat SA, Mir MR, Reshi AA, Ahmad SB, Husain I, Bashir S, et al. Impact of age and gender on some blood biochemical parameters of apparently healthy small ruminants of sheep and goats in Kashmir valley India. Int J Agric Sci Vet Med 2014; 2(1): 22–7.

[21] Devendran P, Jayachandran S, Visha P, Nanjappan K, Panneerselvam S. Hematology and blood profile of Coimbatore sheep. Ind J Small Ruminant 2008; 15:98–101.

[22] Mašek T, Konjević D, Severin K, Janicki Z, Grubešić M, Krapinec K, et al. Hematology and serum biochemistry of European mouflon (*Ovis orientalis musimon*) in Croatia. Eur J Wildlife Res 2009; 55:561. https://doi.org/10.1007/s10344-009-0276-1

[23] Borjesson DL, Christopher MM, Boyce WM. Biochemical and hematologic reference intervals for free-ranging desert bighorn sheep. J Wildlife Dis 2000; 36(2):294–300.

[24] Egbe-Nwiyi T, Nwaosu S, Salami H. Haematological values of apparrently healthy sheep and goats as influenced by age and sex in arid zone of Nigeria. Afr J Biomed Res 2000; 3:109–15.

[25] Kiran S, Bhutta AM, Khan BA, Durrani S, Ali M, Iqbal F. Effect of age and gender on some blood biochemical parameters of apparently healthy small ruminants from Southern Punjab in Pakistan. Asian Pac J Trop Biomed 2012; 2:304–6. https://doi.org/10.1016/S2221-1691(12)60028-8.

[26] Zakari FO, Ayo JO, Rekwot PI, Kawu MU. Effect of age, sex, physical activity and meteorological factors on haematological parameters of donkeys (Equus asinus). Comp Clin Pathol 2016; 25(6): 1265–72. https://doi.org/10.1007/s00580-014-2026-3