

SHORT COMMUNICATION

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

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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.

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Introduction

Fat-tailed sheep (Dhumba) are characterized by large hind-quarters 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].

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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.

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.

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.

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.

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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.

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