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Comparison of physical, physiological and haematological parameters of Malabari and Attapaddy black goats in hot-humid tropics

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Abstract
The present study was conducted to assess the health and nutritional status of Malabari and Attappady Black goats adapted to hot-humid tropical climate. Data on physical, physiological and hematological parameters of 30 adult animals each (2-3 years) were collected. Body weight of adult Malabari goats (24.92 ± 1.65 kg) was higher when compared to Attappady Black (21.91 ± 1.16 kg) goats. Average body measurements of adult Malabari goats were; body length (BL) 64.94 ± 1.47 cm, height at withers (HW) 64.89 ± 1.26 cm and chest girth (CG) 67.47 ± 1.44 cm. Body length of Attappady Black goats was 62.45 ± 1.28, height at withers measured 65.40±0.89 cm and chest girth was 65.36 ± 1.12 cm. The mean rectal temperature of Malabari goats were 102.54 ± 0.01 and average pulse rate was 93.70 ± 2.12/ min. Rectal temperature of Attappady Black goats (102.46 ± 0.12) was not significantly different from that of Malabari goats. But the pulse rate was lower in Attappady goats (91.56 ± 1.87/min).The white blood cells count was higher than the normal range reported for goats in both Malabari and Attappady Black goats. Lymhocyte count was very low in both the breeds but monocytes, red blood cells, Hb, HCT and MCV were in the normal range. But MCV was comparatively higher in Attappady goats.

Keywords: physical, physiological, haematological parameters, Malabari and Attapaddy

Introduction
Small ruminants play a pivotal role in food production and strengthen the economy of India. According to the 20th Livestock census, India has a goat population of 148.88 million and ranks second in the world. At present the country has 34 (NBAGR report, 2018) [4] recognized goat breeds, of which two breeds, *viz*. Malabari and Attappady Black are native to Kerala. Malabari goats are renowned for its high prolificacy, milk and meat production and are distributed throughout the state. These goats are supposed to be evolved centuries ago by crossing native feral goats with Arab, Surti and Mesopotamian goats. The coat colour of the breed is non-uniform and may be black, white, brown or an admixture of these colours. Attappady Black breed, seen exclusively in Attappady hill region of Palakkad district, is mainly reared by the Irula, Muduka and Kurumba tribal communities of the region. The breed, mainly raised for mutton is adaptable to extreme climates and resource poor conditions. Animals are medium sized, lean and slender bodied, black in colour with bronze coloured eyes. The present study was undertaken to compare the two breeds based on their physical, physiological and hematological parameters.

Materials and Methods
The study was conducted at Livestock Research Station, Thiruvazhamkunnu, Palakkad district under Kerala Veterinary and Animal Sciences, University. The station is located at 11003' N latitude, 76 º 36' E longitudes and at an altitude of 35 m above the mean sea level. Sixty sexually mature, non-pregnant goats of 2-3 years age, maintained under uniform conditions of feeding and housing (intensive system) were selected from both Malabari (n=30) and Attappady Black (n=30) breeds. Data on physical, physiological and hematological parameters were analysed for comparison of the breeds.
Body weight was measured using a standard weighing balance. Body measurements like body length (BL), height at withers (HW) and chest girth (CG) were also measured after placing the animals squarely on their feet with head upright. All the body measurements were taken using a standard measuring tape as described by Rotimi *et al*. (2015) [9].

Body length was measured as distance from the point of shoulder to the posterior extremity of the pin bone of the tail region. Height at withers was measured as the vertical distance from the withers (highest point on the dorsum of the animal) to the platform at the level of the forelegs while the animal was standing. The chest girth was measured at the point of smallest circumference of the body, immediately behind the shoulders and perpendicular to the body axis. The tape was pressed tight enough to lay the hair down. Rectal temperature (RT) was recorded using a digital thermometer and pulse rate (PR) was measured manually at femoral artery in the inner thigh region. Blood samples were collected using vacutainer needles of 20 gauge from jugular vein in EDTA coated vacutainer vials from all the animals for the hematological analysis/complete blood count (CBC). Collected samples were processed within 45 minutes in the laboratory and CBC was assessed using an automated hematology analyser.

Results and Discussion

a. Physical Parameters

The mean body weight and body measurements of Malabari and Attappady Black goats are presented in Table 1.

Table 1: Average body weight and biometry of Malabari and Attappady Black goats

Parameter	Malabari	Attappady Black
BW (kg)	24.92±1.65	21.91± 1.16
BL (cm)	64.94±1.47	62.45±1.28
HW (cm)	64.89±1.26	65.40±0.89
CG (cm)	67.47±1.44	65.36±1.12

Body weight (BW): Body weight of adult Malabari goats (24.92 ± 1.65 Kg) was higher when compared to Attappady Black (21.91± 1.16 Kg) goats. Verma *et al*. (2009) [12] had reported an average adult body weight of 36.31kg in Malabari goats, which is significantly higher than the present result. Stephen *et al*. (2005) [10] reported an average body weight of 35±1.1kg and 31±0.4 kg in adult Attappady Black males and females (above 18 months), respectively. The result of the present study is much lower than that reported earlier.

Biometry: Average body measurements of adult Malabari goats were; body length (BL) 64.94±1.47 cm, height at withers (HW) 64.89±1.26 cm and chest girth (CG) 67.47±1.44 cm. Verma *et al*. (2009) [12] obtained body length, height at withers and heart girth of Malabari goats as 70.30cm, 68.41 cm and 73.17 cm, respectively. Body length of Attappady Black goats was 62.45±1.28, height at withers measured 65.40±0.89 cm and chest girth was 65.36±1.12 cm. Stephen *et al*. (2005) [10] reported an average body length of 63±0.4 cm, height at withers of 69±0.4 cm and chest girth of 69±0.4 in adult Attappady goats. The observed average body measurements of both the breeds were lesser than the earlier reports.

b. Physiological parameters

RT and PR: The mean rectal temperature of Malabari goats were 102.54 ± 0.01 and average pulse rate was 93.70± 2.12/ min. Rumen motility was 1-2/ 2 minute. Rectal temperature of Attappady Black goats (102.46±0.12) was not significantly different from that of Malabari goats. But the pulse rate was lower in Attappady goats (91.56± 1.87/min). RT and heart rate of Attappady goats in the present study was different from that reported by Thomas *et al*. (2015) [11], at the same research station. Pulse rate of both the breeds was higher than the normal range of 70-90 beats/ min in goats. Heat stress in tropics could lead to an increased cardiac output and cutaneous blood flow to facilitate the blood redistribution to the more peripheral body regions (Al-Tamimi, 2007) [2].

c. Haematological parameters (Complete blood count)

Haematological profile of Malabari and Attappady goats are presented in table 2.

Table 2: Complete blood count of Malabari and Attappady Black goats

Blood components	Malabari	Attapaddy Black	Reference value*
WBC total (×10^3/µl)	18.18±1.10	16.28±0.96	4.00-13.00
L (%)	11.68±1.22	8.75±0.66	50-70
M (%)	0.91±0.06	0.98±0.08	0-4
Granulocytes (%)	5.11±0.37	6.56±0.70	
RBC (× 10^6/µl)	18.21±0.46[a]	15.72±0.56[b]	8.00-18.00
Hb (g/dl)	10.96±0.24[a]	9.78±0.36[b]	8.00-12.00
HCT/PCV (%)	31.93±0.62[a]	28.32±1.03[b]	22.00-38.00
MCV (fL)	17.58±0.21	17.99±0.22	16.00-25.00

Mean value of the same parameters with superscripts [a,b] (between breeds) are significantly different (P<0.05). WBC, white blood cell; L, lymphocytes; M, monocytes; Hb, hemoglobin; HCT, hematocrit; RBC, red blood cells; MCV, mean corpuscular volume.*Radostits *et al*., 2000. veterinary medicine. 9th (Edn). W. B. Saunders, London, pp. 1819-1822.

The white blood cells count was higher than the normal range reported for goats in both Malabari and Attappady Black goats. Lymhocyte count was very low in both the breeds but monocytes, red blood cells, Hb, HCT and MCV were in the normal range. Poor nutrition and long term heat stress could reduce RBC count and Hb levels resulting in anaemia (Swenson and Reece, 2006). Though in normal range, the red blood cell count, hemoglobin and HCT were significantly higher (P<0.05) in Malabari goats when compared to Attappady Black. However, MCV was higher in Attappady goats. In normal animals, the process of erythropoiesis as well as the size and number of red blood cells are regulated by cellular oxygen level (Olver, 2010) [7]. Erythropoiesis converts the larger pro-erythroblast to the small sized erythrocytes (Manwani and Bieker, 2008; Olver, 2010) [5, 7]. Hypoxia leads to reduced duration of erythropoiesis, bypassing some stages of RBC maturation to give larger erythrocytes (Adili and Melizi, 2013) [1]. Thus, the increased RBC diameter as indicated by an elevated MCV in our study could be interpreted by hypoxia experienced in higher altitudes. This may be an adaptative response of these goats for living in higher altitudes where the oxygen concentration is comparatively less. Dehydration, prolonged physical exertion, hemodilution, could lead to depression in hematocrit (Nouty

et al., 1990) [3]. Thus, the present findings indicated that the experimental animals were non anaemic and apparently healthy. But the hematology profile of these breeds was different from other goat breeds such as Barbari, Black Aaradi, Damascus goats (Mohammed *et al*., 2016) [6].

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