

Characterization of Kasargod Cattle of Kerala

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Abstract: Kasargod cattle were found in Kasargod, Kozhikode and Kannur, Kerala India. A study was carried out for breed characterization with information on 351 cattle. The Kasargod cattle are maintained mainly on a grazing system with an average herd size of 2.5. The coat colour is black, brown, white or chocolate. Spotted animals were also seen. Ears were medium in length with horizontal orientation. Horns were short 8.3 ± 2.2 cm for males and 11.2 ± 0.4 cm for females. Tail is long and almost touching the ground, switch is mostly black in colour but brown and white colours were also noticed. The average body length, chest girth and height at withers of adult male were 106.0 ± 5.8 , 133.1 ± 6.7 and 103.3 ± 4.1 cm whereas for female it was 96.0 ± 1.2 , 124.4 ± 1.6 and 90.0 ± 1.1 cm, respectively. The average body weight of adult male and female was 182.5 ± 22.7 and 146.4 ± 3.3 Kg, respectively. The calves showed high growth rate even under low input conditions. The average age at first oestrous was 24.9 ± 0.5 months. The average inter-calving period was 466.6 ± 13.5 days. Gestation period and service period were 281.4 ± 1.1 days and 197.6 ± 10.9 days, respectively. Average daily milk yield, peak milk yield and lactation length were 1.4 ± 0.04 Kg, 2.0 ± 0.06 Kg and 239.5 ± 8.6 days, respectively. The cows reached peak yield in 24.2 ± 2.2 days of lactation. The adaptability studies from physiological parameters of body temperature, respiration and pulse rates, heat tolerance, showed very positive results towards the adaptability of these cattle to hot humid climate. The small size of the animals is believed to be due to the hot humid climate of the area. Low milk production of this breed is probably due to the small size of the cows and lack of any kind of selection for this trait. The resistance of these cattle to foot and mouth was obvious in several occasions

Keywords: Body Weight, Characterisation, Conservation, Kasargod cattle, Milk production

I. Introduction

Malabar previously a part of Madras Presidency got integrated to Kerala at the time of formation of States on the basis of language. Malabar Manual written by William Logan (1887) gives a reference about the cows of Malabar. They were non-descript (ND) cattle and never considered as a breed. This is natural when 82% of the Indian cattle population belong to ND category and just 18% belong to definite breeds. No scientific study was undertaken on these cattle until a project was taken up for conservation of local cattle [1]. After this project these cattle in Kasargod and nearby areas were called Kasargod cattle. The home tract of Kasargod cattle is at the latitude ranging from $11.15'$ to $12.48'$ N and longitude $75.10'$ to $76.26'$ E. Kerala is a strip of land in North-South direction, situated between the Arabian Sea and the Western Ghats. The climate is hot and humid. Agriculture is mainly dominated by small, marginal and homestead farmers. The average land holding was 54.36 cents and per-capita cultivated land is 14 cents during 2013-14. Agriculture and allied sectors provide livelihood to approximately two-third of the population and contribute 25% of the SDP, of which 40% is contributed by livestock sector. The state is blessed with unique domestic animal genetic resources like diminutive Vechur cattle, prolific Malabari goats and sturdy Attapaddy black goats, motherly Ankamalli pigs and distinct Kuttanad ducks and a lot more of other local unidentified genetic groups of animals and birds. The Kasargod cattle are small in size and are relatively poor in milk production. The contribution of these animals has often been overlooked. The crossbreeding programmes adopted in the State in 1960s reached Northern Kerala also transforming the native cattle to crossbreds. The high input and output crossbreds appeared superior especially in the first filial generation. However, indigenous breeds carry genes that enable them to tolerate harsh environments, cope with limited feed resources and repel attacks by diseases/pests. They provide the necessary genetic diversity and ensure stability for future livestock breeding programmes. As such, conserving them is necessary, not only for the farming communities who keep the animals but also for the future of agriculture. Random Amplified Polymorphic DNA (RAPD) by Polymerase Chain Reaction (PCR) on Vechur and Kasargod as a single step analysis, band sharing values to find out the genetic variation, showed significant difference between both the breeds [2]. Hence, a survey is undertaken to characterize the Kasargod cattle of North Kerala state of India.

II. Materials and Methods

Data were collected from the Conservation unit of Kerala Agricultural University (KAU) and also from the Vechur Conservation Trust project area in Kozhikode. The questionnaire provided by the National Bureau of Animal Genetics Resources was used for survey and characterisation. In addition, data on reproduction traits were also collected. All together 351 animals, 305 of the farmers and 46 animals from the conservation unit of Kerala Agricultural University were included in the study. Insemination records were also collected from farmers' herds. Data collected were on morphological characteristics like coat colour, muzzle colour, eyelid colour, tail switch colour, hoof colour, horn (size, colour and shape), ear size, udder (shape, size), and teat (shape, colour and size). Body weights and measurements; at birth, 3 months, 6 months, 9 months, 12 months and adult animals. Reproduction traits like age at first ejaculation, age at first mating, age at first oestrus, oestrous cycle duration, oestrus duration, age at first calving, gestation period, service period, service per conception, and calving interval. Milk production traits like daily milk yield, peak milk yield, days to attain peak yield, lactation length and percentages of fat, protein, lactose, ash, solids not fat (SNF), total solids in milk. Physiological parameters like rectal temperature, pulse and respiration rate. Hematological parameters like haemoglobin content, erythrocyte sedimentation rate (ESR), packed cell volume (PCV), total erythrocyte count and leucocyte count.

III. Results and Discussion

3.1 Herd size

The herd size had an average of 2.5 in this study. The herd size used to be larger earlier. The cattle were reared mostly for manure. The management of the herd used to be different in northern Kerala where a kind of deep litter system was practiced. Change in the cultivation system resulted in smaller herd size.

3.2 Breed Characteristics

3.2.1 Physical Characteristics

The coat colour of animal is Black, Tan, White, Chocolate or Spotted. The Skin colour is pink. Horns were short length 8.3 ± 2.2 cm for males and 11.2 ± 0.4 cm for females. Ears were of medium length 16.0 ± 0.6 cm for adult male where as 15.4 ± 0.3 cm for adult female and horizontal in orientation. The hair was glossy and straight. The tail was straight and almost touching the ground. Cows have bowl shaped and small size udder. Teat colour is black in 25.4% animals. Black colour teats are only present in black coat colour animal. Details of the morphological characters were presented in Table 1.

Table 1 - Morphological characters of Kasargod cattle

Parameter		Male	Female	
Coat Colour	Black	45.6% (68)	46.8% (237)	
	Brown	39.7% (68)	44.7% (237)	
	Chocolate	-	2.1% (237)	
	Spotted	4.4% (68)	3.0% (237)	
	White	10.3% (68)	3.4% (237)	
Muzzle Colour	Black	92.6% (68)	87.3% (237)	
	Flesh	7.3% (68)	12.7% (237)	
Eyelids Colour	Black	64.7% (68)	58.2% (237)	
	Brown	35.3% (68)	41.8% (237)	
Tail Switch Colour	Black	92.6% (68)	80.6% (237)	
	Brown	4.4% (68)	12.6% (237)	
	White	3.0% (68)	6.8% (237)	
Hooves Colour	Black	89.7% (68)	85.6% (237)	
	Brown	10.3% (68)	14.4% (237)	
Forehead	Straight	52.9% (68)	86.9% (237)	
	Convex	47.1% (68)	13.1% (237)	
*Horns (Adult)	Size (cm)	8.0 ± 1.9 (14)	11.5 ± 0.5 (134)	
	Colour	Black	60.0% (10)	65.0% (123)
		Brown	40.0% (10)	35.0% (123)
	Shape	Straight	90.0% (10)	41.5% (123)
		Curved	10.0% (10)	58.5% (123)
No Horn	9.0% (11)	2.4% (126)		
*Ear (Adult)	Size (cm)	16.0 ± 0.6 (14)	15.4 ± 0.3 (134)	
Udder	Shape		Bowl	
	Size		Small	
Teat	Shape	Cylindrical	86.5% (126)	
		Funnel	13.5% (126)	
	Tip	Pointed	11% (126)	
		Round	89% (126)	
	Colour	Black	25.4% (126)	
		Pink	74.6% (126)	

- Number of observations are given in parenthesis

3.2.2 Body weight and measurements

The calves born had an average birth weight of 11.1±0.2 Kg for males and 10.0±0.3 Kg for females. Average body weights are displayed in Table 2.

Table 2 – Mean ± SE for Body Weight (Kg) of Kasargod Cattle at different age group

Age group	Body weight (Kg)	
	Male	Female
Birth weight.	11.1±0.2 (27)	10.0±0.3 (19)
3months weight	33.9±1.9 (9)	29.9±1.9 (15)
6months weight	48.3±3.1 (13)	48.8±2.5 (19)
9 months weight	69.1±5.1 (14)	56.7±4.2 (11)
12 months weight	86.8±11.2 (4)	64.8±3.9 (14)
Adult weight	182.5±22.7 (12)	146.4±3.3 (137)

- Number of observations are given in parenthesis

The body weight increase was 3, 4.3, 6.3 and 7.9 times from birth to 3, 6, 9 and 12 months, in males. Similar trend was observed in females.

Kasargod cattle have an average body weight of 182.5±22.7 and 146.4±3.3 kg for adult male and female, respectively. A lower average weight of 173.5 ± 6.8 and 133.6 ± 3.7 kg for adult male and female, respectively was reported in Vechur cattle of Kerala [3]. The adults weighed about one third of the cross-bred.

Though the animals had low body weight, the growth rate in relation to birth weight had been high with a daily average gain of 208 g up to twelve months of age in males. Fast growing Sahiwal showed a daily gain of 0.470 g with high concentrate feeding of 3 kg/calf for a period of 21 weeks [4]. A study from National Dairy Research Institute, Karnal reported that from birth to 12 months the weight gain in Sahiwal was 0.490 g [5]. The 208 g daily gain in Kasargod is remarkable considering birth weight of 11 kg and the maintenance with no concentrate. The average body measurement like length, girth and height was 106.0±5.8, 133.1±6.7 and 103.3±4.1 cm for bulls whereas 96.0±1.2, 124.4±1.6 and 90.0±1.1 cm for the cows, respectively. The measurements were in general slightly less for Vechur cattle [3]. The average body measurements are presented in Table 3.

Table 3 – Mean ± SE for Body measurements (cm) of Kasargod cattle at different age group

Age group	Male			Female		
	Length	Girth	Height	Length	Girth	Height
At Birth	41.0±0.6 (27)	53.4±0.4 (27)	53.3±0.5 (27)	42.2±0.7 (19)	51.0±0.5 (19)	51.1±0.8 (19)
3 months	59.0±1.8 (9)	76.1±2.2 (9)	70.0±1.2 (9)	59.2±1.1 (15)	72.0±2.0 (15)	66.1±0.9 (15)
6 months	69.0±1.8 (13)	88.0±2.0 (13)	78.0±1.3 (13)	70.3±1.4 (19)	87.2±1.4 (19)	76.0±0.9 (19)
9 months	75.0±2.0 (14)	98.0±2.0 (14)	83.0±2.2 (14)	78.0±2.2 (13)	94±1.6 (13)	82.0±1.4 (13)
12 months	84.5±1.5 (4)	103.2±4.8 (4)	91.0±2.7 (4)	82.1±9.2 (10)	97.6±1.6 (10)	82.8±1.4 (10)
Adult	106.0±5.8 (8)	133.1±6.7 (8)	103.3±4.1 (8)	96.0±1.2 (128)	124.4±1.6 (128)	90.0±1.1 (128)

- Number of observations are given in parenthesis

3.2.3 Reproduction traits

The average age at first oestrous was 24.9±0.5 months. Age at first calving was 36.4±0.8 months. The average inter-calving period was 466.6±13.5 days. The average of reproductive performance traits are depicted in Table 4.

Table 4 - Mean ± SE for Reproductive parameters of Kasargode Cattle

Reproductive parameters	Male	Female
Age at first ejaculation (months)	28.0±4.1 (8)	
Age at first oestrus (months)		24.9±0.5 (110)
Oestrous cycle duration (days)		21.5±0.2 (116)
Oestrus duration (hrs)		*39.5±1.3 (154)
Age at first mating (months)	28.0±4.1 (8)	26.4±0.6 (91)
Age at first calving (months)		36.4±0.8 (69)
Gestation period (days)		281.4 ±1.1 (117)
Service period (days)		197.6±10.9 (118)
Service per conception (no's)		1.5±0.2 (416)
Calving interval (days)		466.6±13.5 (100)

- Number of observations are given in parenthesis

* Up to 24 hrs: 35.7%, 24-36 hrs: 15.1%, 36-48 hrs: 35.7%, 48-72 hrs: 12.5%, more than 72 hrs: 0.8%

Both natural service and artificial insemination were practiced though natural service was to lesser extent. Maintaining bulls was a problem to most of the farmers as bulls were aggressive. Artificial inseminations with liquid and frozen semen were also done. All females in the farm and field units have a definite mating plan to avoid inbreeding. Total 416 inseminations were done in two AI units of the Vechur Conservation Trust, one each in Kozhikode (314 numbers) and Palakkad (102 numbers) district. The reproductive performance of Kasargod cattle was similar to Vechur cattle [3]. Service rewire for one pregnancy was 1.5.

3.2.4. Milk Production

Milk production performance is presented in Table 5. Calves were not weaned at birth and were allowed to suckle. Let down of milk was possible only with the stimulus of suckling. The lactation length had an average of 239.5±8.6 days. The peak yield was attained by the 24th day of lactation as per KAU farm records.

Table 5 – Mean ± SE Average milk production traits of Kasargod cows

Parameter	Kasargod
Daily milk yield (kg)	1.4±0.04 (137)
Peak milk yield (kg)	2.0±0.06 (131)
Days to attain peak yield (days)	24.2±2.2 (13)
Lactation length (days)	239.5±8.6 (133)

- Number of observations are given in parenthesis

The average daily milk yield was 1.4±0.04 kg on milk records pooled from KAU farm and field. The average daily yield was higher for Vechur -2.5 kg per day [6]. With a peak yield of 2.0 kg the lactation milk yield is to be assumed below 400 kg considering a lactation length much lower than 305 days. Peak milk production of Vechur recorded was 3.7 kg/day [7].

3.2.4.1 Milk composition

The mean percentage of different milk constituents during second month of lactation is presented in the Table 7. The results are based on cows in KAU farm. Fat percent was found to be most variable with an average of 3.9±0.3. This percentage is lower than expected, but it is due to holding of last milk by the cows for their calves.

Table 6 – Mean ± SE for milk composition of Kasargod cow

Milk Constituents (%)	Kasargod
Fat	3.9±0.3
Protein	3.79±0.06
Lactose	4.81±0.01
Ash	0.62±0.01
Solids Not Fat	8.56±0.17
Total solids	12.36±0.18

3.2.5 Physiological parameters

Physiological parameters such as body temperature, respiration and pulse rate have been observed in both sexes of Kasargod cattle at 0800 hrs and 1400 hrs. No significant differences were noted among genetic groups, seasons and timings [3]. The averages of various physiological parameters observed during the different times for two seasons of the year are presented in Table 7 to 9.

3.2.5.1 Rectal temperature

The overall average forenoon and afternoon rectal temperatures recorded were 100.82 °C ± 0.04 and 101.79 °C ± 0.04 with ranges of 98 to 103 °C and 99.8 to 103.8 °C, respectively. Afternoon temperature was uniformly higher than forenoon rectal temperature but was not significant. Coefficient of variation for the trait was very low (0.3 to 1.1%).

3.2.5.2 Pulse rate / minute

The overall mean pulse per minute in the forenoon and afternoon 62.9 ± 0.4 and 68.78 ± 0.4 with ranges of 46 to 85 and 48 to 90, respectively. Pulse rate per minute recorded in the afternoon was uniformly higher than forenoon in all categories. The coefficient of variation of the trait ranged from 4.5 per cent to 14.5 per cent. Significant difference was noticed between afternoon and forenoon pulse rate in bulls.

3.2.5.3 Respiration rate/ minute

All categories showed an increase in respiration rate per minute in the afternoons compared to forenoons. The overall average forenoon and afternoon respiration rate recorded were 20.93 ± 0.2 and 23.89 ± 0.2 with ranges of 12 to 32 and 16 to 36 respectively. No significant differences were noticed between seasons, time of recording or genetic groups.

Table 7 – Mean ± SE for body temperature of Kasargod cattle for different seasons

Category	May to July		August to October	
	Temperature (°F)		Temperature (°F)	
	Forenoon	Afternoon	Forenoon	Afternoon
Cows (8)	100.88±0.09	100.58±0.07	101.1±0.20	101.8±0.10
Heifers (3)	101.41±0.16	101.13±0.11	100.9±0.14	101.6±0.08
Bulls (3)	100.1±0.13	100.64±0.13	100.4±0.15	101.6±0.11

- Number of observations are given in the parentheses

Table 8 - Mean ± SE for pulse rate of Kasargod cattle for different seasons

Category	May to July		August to October	
	Pulse (per minute)		Pulse (per minute)	
	Forenoon	Afternoon	Forenoon	Afternoon
Cows (8)	65±0.62	62.77±0.39	61.8±0.57	65.0±0.57
heifers (3)	64.63±0.79	63.92±0.73	65.2±0.89	69.1±1.13
Bulls (3)	63.88±0.58	64.92±0.56	63.0±1.25	69.3±1.09

- Number of observations are given in the parentheses

Table 9 - Mean ± SE for respiration rate of Kasargod cattle for different seasons

Category	May to July		August to October	
	Respiration rate (per minute)		Respiration rate (per minute)	
	Forenoon	Afternoon	Forenoon	Afternoon
Cows (8)	21.59±0.2	22.75±0.2	19.5±0.3	21.3±0.5
heifers (3)	21.04±0.3	21.79±0.3	21.0±0.5	24.0±0.5
Bulls (3)	21.46±0.6	20.5±0.36	20.2±0.6	22.7±0.5

- Number of observations are given in the parentheses

It was observed that Kasargod cattle had no frothing, no leg in-coordination, no excitement, no tongue protrusion and no inhibition of progressive movement before and after work.

3.2.6 Haematological studies

Blood samples for analysis were collected in the morning before feeding and watering by jugular puncture. Blood constituents of different categories of Kasargod cattle were determined by standard methods. The mean haematological values of different categories Kasargod cattle are presented in the Table 11.

3.2.6.1 Haemoglobin

The haemoglobin content in the blood ranged from 9.32-14.0 g %. Cows and calves had significantly lower values than bulls. The lower values in calves/ young animals may be due to lower iron intake during nursing period or due to active growth.

3.2.6.2 Total erythrocyte count (TEC)

It was observed that the blood of calves with a TEC varying from 5.6 to 8.02 million per mm³ is richer than the blood of mature animals in which the count ranges from 5.34 to 5.98 million per mm³. These differences are highly significant.

3.2.6.3 Total leucocyte count (TLC)

A trend similar to that observed in TEC is noticed for TLC also. It ranged from 6.23 to 6.85 thousands per mm³ in adults and 4.9 to 9.73 thousands per mm³ in calves.

3.2.6.4 Differential leucocyte count

Calves have less polymorphs and eosinophils but about 3.8per cent more lymphocytes than adults. The average lymphocyte for the breed observed in this study (70%) was higher than the estimates for other breeds. The higher number of lymphocytes was associated with higher levels of plasma immunoglobulins in tropical cattle. This appears to have developed as a physiological mechanism for adaptation to tropical climate. Monocytes are few in all classes of animals.

3.2.6.5 Packed cell volume (PCV)

PCV was significantly higher in calves than adults. The breed average observed in this study was higher than those reported for other Indian breeds.

3.2.6.6 Erythrocyte sedimentation rate (ESR)

ESR estimates in calves was significantly lower than in adults.

Table 11 - Mean \pm SE for Hematological constituents of Kasargod cattle

Category	Hb (g%)	TEC ($\times 10^6$ /cmm)	TLC ($\times 10^3$ /cmm)	Differential Leucocyte Count (%)				PCV (mm)	ESR mm/24hr
				Lymphocytes	Neutrophils	Eosinophils	Monocytes		
Bulls (5)	12.7 \pm 0.72	5.34 \pm 1.29	6.57 \pm 1.12	70.33 \pm 2.89	25.38 \pm 0.89	2.43 \pm 0.83	0.6 \pm 0.30	40.4 \pm 3.41	30.6 \pm 10.93
Cows (6)	10.83 \pm 0.34	5.69 \pm 0.8	6.85 \pm 1.33	73.85 \pm 0.62	23.82 \pm 1.21	2.27 \pm 1.04	0.16 \pm 0.05	37.0 \pm 1.97	26.0 \pm 9.47
Female calves (6)	12.5 \pm 0.92	5.6 \pm 0.65	9.73 \pm 1.15	71.87 \pm 1.26	24.58 \pm 0.74	2.93 \pm 0.77	2.4 \pm 0.69	43.67 \pm 2.24	19.5 \pm 2.4
Male calves (5)	11.4 \pm 0.78	7.12 \pm 0.51	4.9 \pm 1.11	69.32 \pm 0.89	27.34 \pm 1.6	2.4 \pm 0.88	1.56 \pm 0.60	47.4 \pm 4.98	18.0 \pm 2.79
Mean	11.85 \pm 0.37	5.77 \pm 0.42	7.13 \pm 0.67	71.53 \pm 0.75	25.17 \pm 0.62	2.48 \pm 0.44	1.30 \pm 0.34	41.95 \pm 1.69	23.45 \pm 3.59

- Number of observations are given in the parentheses

It was reported that Sahiwal cow had higher Haemoglobin content, erythrocyte count, leucocyte count, neutrophil (%), eosinophils (%), monocytes (%) whereas lower lymphocyte (%) and PCV (%) [8].

3.3 Disease prevalence

The incidences of diseases were rare in Kasargod cattle. An important observation during 2011-15 was that Foot and Mouth outbreak did not affect the Kasargod cattle while there was high incidence of the disease among crossbred cattle. This was true for the University farm with crossbred cattle and also Kasargod. In 1991 there was a severe outbreak of the disease in the University farm among crossbreds, but there was no incidence in Kasargod cattle.

IV. Conclusion

Kasargod cattle are small sized animals with black, brown, white, chocolate or spotted. Muzzle colour is black for majority and flesh for the rest. Eyelids, tail switch, hoofs, horns are mostly black. Forehead is straight. Horns mostly medium sized and curved upward and outward but variations are there in horn length and shape. Udder is bowl shaped and small. Teat colour is mostly pink. Black teats are seen only in black cows, though pink is seen with all body colours. The weights and measurements indicated the small size. Lot of variation is seen in the population but the growth rate is excellent. The importance is that these animals gain weight in a very low input system. No selection for any particular trait was done by farmers. The low milk production with high variation indicates lack of selection but at the same time scope for improvement. They are resistant to diseases like Foot and Mouth disease. They have good adaptability to the hot and humid climate of Kerala. The reproduction and production indicates any animal's fitness to survive in the environment. These animals had no frothing, panting, excitement, tongue protrusion, leg incoordination or any sign of heat stress during day. Haematological studies showed normal values.

Acknowledgements

We acknowledge Indian Council of Agricultural Research (ICAR), KAU and United Nations Development Programme (UNDP) for the facilities and financial assistance for the studies. The help from Abraham Varkey, Joby George, Jayan Joseph, K. C. Jayan and farmers and friends of Vechur Conservation Trust (VCT) especially Unnigopalan K. P. and N. Chandran Nair during the work is also acknowledged.

References

- [1] S. Iype, *Conservation of Vechur cattle of coastal area and other dwarf cattle of high ranges of Kerala*, Annual Report, ICAR – ADHOC Project, 1993.
- [2] P. Suprabha, K. Anilkumar, T. V. Aravindakshan, and K. V. Raghunandan, Assessment of bandsharing values in RAPD-PCR analysis of dwarf cattle of Kerala. *Asian-Aust. J. Anim. Sci*, 18(9), 2005, 1217-1220.
- [3] S. Iype, and R.T. Venkatachalapathy, *Vechur cattle of Kerala* (Mannuthy, Kerala: Kerala Agricultural University, 2001).
- [4] R. Khan, S. Ahmad, K. Kaleem, M. Shahid, M. Irshad, M. Rizwan, and B. D. Khan, Growth rate of various indigenous breed fed on Shandar Wanda at livestock research and development station Surezai Peshawar, *Journal of Agricultural and Biological Science*, 5(6), 2010, 35-38.
- [5] M. Manoj, R. S. Gandhi, T. V. Raja, A. Verma, A. Singh, G. K. Sachdeva, and A. Kumar, Genetic parameters of body weights at different ages in Sahiwal heifers, *Indian Journal of Animal Research*, 48(3), 2014, 217-220.

- [6] Iype, S, *Developing entrepreneur skills in rural women through rearing of Vechur cows*, Annual Report, Vechur Conservation Trust to the Ministry of Science and Technology project, 2009.
- [7] S. Iype, The Vechur cattle of Kerala. *AGRI*, 18, 1996, 59–63.

M. S. Parmar, A. K. Madan, S. K. Rastogi, and R. Huozha, Comparative Study of Seasonal Variations on Hematological Profile in Sahiwal Cows (*Bos Indicus*) and Murrah Buffalo (*Bubalus Bubalis*). *Journal of Animal Research*, 3(2), 2013, 167.