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Profiling of haematological indices in changra goats reared under trans-himalayan pastoral system and under intensive management in Ladakh

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Abstract
Blood samples for haematological were collected from representative number of goats of both sexes and different age groups. The haematological parameters studied included Hb concentration, PCV, TEC, MCV, MCH, MCHC TLC, and DLC. The overall mean Hb, PCV, TEC, MCV, MCH, and MCHC values were 9.383 ± 0.074 gm/dL, $40.146 \pm 0.285\%$, 13.421 ± 0.101 m/dL, 30.206 ± 0.264fL, 7.050 ± 0.063pg and $23.428 \pm 0.122\%$, respectively. Significant differences were observed between young and adult, but not between sexes. The overall mean TLC, and percent neutrophil, lymphocyte, monocyte, eosinophil and basophil counts, observed were 7.841 ± 0.050 Th/dL, $32.605 \pm 0.256\%$, $61.837 \pm 0.253\%$, $1.808 \pm 0.050\%$, $3.004 \pm 0.090\%$, and $0.743 \pm 0.044\%$, respectively. The age wise comparison of the leukocytic indices revealed a variable trend in different areas. Sex did not reveal any significant effect on the leukocytic indices. The study established baseline data with respect to haematological indices in Changra goats in their native belt.

Keywords: haematological, changra goats, trans-himalayan, Ladakh

Introduction
Hematological indices provide important information for pathophysiological assessment (Carlos *et al*., 2015) [5]. They serve as biological markers for pre-clinical and para-clinical evaluations. Haematological parameters change during normal development and maturation. Besides, qualitative and quantitative changes in various parameters may be associated with physiological status, nutritional status, stress, disease conditions as well as ambient influences (Arfuso *et al*., 2016) [2]. Although the pattern of changes under a given influence is relatively same across the species, the baseline values show marked variation across the species, breeds and strains, as well as between the individual. Ambient influences instill further variation warranting establishment of reference values for populations in given target areas. Understanding sources of individual variation, including differences between species, sexes, and age groups is important because it can provide a meaningful context for interpreting data and a range of expected values for healthy animals. The extent to which hematological measures are useful for either clinical or research use depends on the availability of standard reference ranges against which a test sample can be compared and evaluated.
Goats, being small-sized ruminants, are capable of integrating themselves into dissimilar socio-economic situations prevailing in countries like India. Changra is a well-recognized goat breed, native to Changthang region in the Indian Trans-Himalayan area of Ladakh. This western extension of the Tibetan Plateau, located 3000 m to 6000 m above sea level, is an important highland grazing ecosystem (Goldstein and Beall, 1990) [8]. The area has harsh climatic conditions with very low rainfall and temperature ranging between -40 to +40 ºC, and sparse vegetation (Wani *et al.,* 2009) [16]. The breed is well adapted to the local cold arid agro-climatic conditions of the region and is reared mainly by a nomadic tribe known as 'Changpa' who move continuously from dawn to dusk with their flocks in the grazing areas (LAHDC, 2006) [9]. Thus, Changra goats are an important source of economy and food security in their natural belt. Almost 90% of the population of the Changthang area survives on the income from goats and sheep, which is nearly $8.4 million annually (Bhattacharya *et al.,* 2004) [4]. Health constitutes an important concern compromising production and productivity of this

highly prised breed as well as affecting the quality of highly valued undercoat, pashmina, the prince fibre. Clinical haematology being the fundamental assessment tools in both clinical and research setups, the present study aimed at profiling of haematological indices of Changra goats vis-à-vis effect of age, sex, and area, in their native tract

Materials and Methods

The study was conducted in Changthang area of Ladakh in Jammu and Kashmir representing Trans-Himalayan high Altitude Cold arid desert. Its elevations range from 3500-4500 m above the MSL. It experiences harsh dry climate with temperature ranging from -40 to +40ºC, has undulated land topography, and sparse vegetation. Blood samples for haematological studies were collected from representative number of goats of both sexes and different age groups from Kharnak, Sumdho, Chushul, Mughlib and Kargyam in the traditional Changra rearing belt, and Digger, Turtuk and Stakna in non-traditional belt. The GIS position of these areas was done using GPSMAP 76CSx (Garmin, Taiwan) (Table-1). Sample size varied depending upon the flock strength. Age of the animals was determined based on dentition, horn rings and owners information.

Table 1: GIS position of different sampling/surveillance areas of traditional and non-traditional Changra goat rearing regions in Ladakh

Position\ Area	Altitude (m)	Longitude (ºEast)	Latitude (ºNorth)
Kharnak	4634-4722	77.802-77.840	33.409-33.446
Sumdho	4187-4580	78.358-78.499	33.190 -33.260
Chushul	4286-4519	78.634-78.820	33.387-33.752
Mughlib	NA	NA	NA
Kargyam	NA	NA	NA
Digger	3901	77.816	34.294
Turtuk	2879	76.823	34.844
Stakna	3301	77.687	34.015

Collection of blood and serum

Blood sampling was performed during early morning before animals were let out for grazing. Goats were restrained for venipuncture and site cleansed with tincture of iodine. Approximately 3 mL of blood samples were collected from the jugular vein using standard techniques and immediately transferred to sterile vials containing K-EDTA.

Haematology

A total of 246 blood samples from male (M) and female (F) Changra goats of different ages, were analysed for haematological indices. The animals were categorized into age groups of 2-tooth, 4-tooth, 6-tooth and full mouth, and number of male and female samples collected from respective age groups were 16 & 18, 11 & 6, 6 & 15, and 13 & 5 from Kharnak, 14 & 22, 4 & 14, 13 & 13, and 9 & 10 from Sumdho, 5 & 6, 3 & 3, 3 & 3, and 6 & 6 from Chushul and 3 & 3, 4 & 5, 5 & 5, and 3 & 3 from Stakna. The haematological parameters studied included haemoglobin (Hb) concentration by Sahli's acid haematin method, packed cell volume (PCV) by microhaematocrit method, total erythrocyte count (TEC) and total leukocyte count (TLC) by Neubaur haemocytometer method. For differential leucocyte count (DLC), freshly prepared blood smears were stained

with Wrights-Giemsa stain. Besides, mean corpuscular volume (MCV), mean corpuscular haemoglobin (MCH), and mean corpuscular haemoglobin concentration (MCHC) were calculated.

Statistical Analysis

Results are expressed as Mean ± S.E. with n equal to number of animals. Data were analyzed by t-test, one-way ANOVA followed by Dunnet's test and two-way ANOVA followed with Bonferroni's multiple comparison tests using SPSS software.

Results

The haematological indices were studied in 2-tooth, 4-tooth, 6-tooth and full mouth, male and female Changra goats reared in traditional areas of Kharnak, Sumdho, and Chuschul, and at Stakna farm.

Erythrocytic attributes

Haemoglobin (Hb): The mean hemoglobin concentration for Changra goats reared in different areas of Ladakh was 9.383 ± 0.074 gm/dL. The overall mean Hb values observed in Kharnak (9.635 ± 0.131 gm/dL) and Sumdho (9.517 ± 0.119 gm/dL) were significantly (P≤0.05) higher than Chushul (9.082 ± 0.171 gm/dL) and Stakna (8.645 ± 0.142 gm/dL) which did not differ significantly among themselves.

Age wise comparison of different areas revealed that the Hb levels of the goats at Stakna were significantly (P≤0.05) lower in all age groups except 4 tooth goats among which the differences were statistically non-significant (Table 2). The overall mean Hb values observed in 2 tooth (9.329 ± 0.139 gm/dL), 4 tooth (9.719 ± 0.116 gm/dL) and full mouth (9.483 ± 0.164 gm/dL) Changra goats were comparable. However the overall mean value observed in 6 tooth (9.090 ± 0.119 gm/dL) goats was significantly (P≤0.05) low when compared with 2 and 4 tooth goats but was comparable with full mouth goats. In general the mean Hb levels of different age groups within an area were comparable except for significantly (P≤0.05) higher mean value in full mouth goats at Sumdho and significantly (P≤0.05) lower value in 6 tooth goats reared at Stakna.

Sex wise evaluation revealed that the overall mean Hb concentration in male and female Changra goats was 9.298 ± 0.103 gm/dL and female 9.463 ± 0.105 gm/dL, respectively. The overall mean Hb values in male and female goats reared at Kharnak, Sumdho, Chushul and Stakna were 9.639 ±.170 gm/dL and 9.629 ± 0.209 gm/dL, 9.443 ± 0.176 gm/dL and 9.567 ± 0.161 gm/dL, 8.800 ± 0.172 gm/dL and 9.350 ± 0.281 gm/dL, and 8.420 ± 0.201 gm/dL and 8.856 ± 0.193 gm/dL, respectively. No significant differences were observed in male and female goats within an area. The mean Hb values in male and female goats of 2 tooth, 4 tooth, 6 tooth and full mouth age groups were 9.289 ± 0.196 gm/dL and 9.369 ± 0.201 gm/dL, 9.343 ± 0.207 gm/dL and10.028 ± 0.232 gm/dL, 9.003 ± 0.194 gm/dL and 9.155 ± 0.151 gm/dL, and 9.532 ± 0.216 gm/dL and 9.420 ± 0.258 gm/dL, respectively. The differences in the mean values between the sexes within an age group and within the sexes between the age groups, in general, were non-significant except for significantly (P≤0.05) higher mean values in 4-tooth females at Kharnak and full mouth females at Sumdho (Table 3).

Table 2: Effect of age and area on haemoglobin (gm/dl) profile of Changra goats reared in different areas of Ladakh (Mean±SE)

Area Age	Kharnak	Sumdho	Chuschul	Stakna	Overall
2 tooth	9.716 ±0.264[aA]	9.316 ±0.201[aA]	9.127 ±0.334[abA]	8.233 ±0.181[bAB]	9.329 ±0.139[AB]
4 tooth	9.964 ±0.315[aA]	9.694 ±0.293[aAB]	9.700 ±0.533[aA]	9.322 ±0.263[aA]	9.719 ±0.116[A]
6 tooth	9.414 ±0.208[aA]	9.296 ±0.271[aA]	8.533 ±0.252[abA]	8.210 ±0.192[bB]	9.090 ±0.119[B]
Full mouth	9.472 ±0.267[abA]	10.021 ±0.309[aB]	9.008 ±0.303[bA]	8.766 ±0.289[bAB]	9.483 ±0.164[AB]
Overall	9.635 ±0.131[a]	9.517 ±0.119[a]	9.082 ±0.171[b]	8.645 ±0.142[b]	9.383 ±0.074

Mean within an age group (along rows) bearing at least one common lowercase superscript, and between the age groups (along columns) bearing at least one common uppercase superscript, does not differ significantly

Table 3: Effect of sex and age on haemoglobin (gm/dl) profile of Changra goats reared in different areas of Ladakh (Mean ± SE)

Area	Kharnak		Sumdho		Chushul		Stakna		Overall	
Sex/Age	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female
2 tooth	9.862 ± 0.331[aA]	9.425 ± 0.447[aAB]	9.171 ± 0.273[aA]	9.409 ± 0.283[aAB]	8.560 ± 0.237[aA]	9.600 ± 0.524[aA]	8.000 ± 0.000[aA]	8.466 ± 0.333[aA]	9.289 ± 0.196[aA]	9.369 ± 0.201[aA]
4 tooth	9.536 ± 0.381[aA]	10.750 ± 0.423[bB]	9.100 ± 0.479[aA]	9.907 ± 0.374[aAB]	9.166 ± 0.440[aA]	10.233 ± 0.504[aA]	9.250 ± 0.433[aA]	9.380 ± 0.369[aA]	9.343 ± 0.207[aA]	10.028 ± 0.232[bB]
6 tooth	9.150 ± 0.199[aA]	9.520 ± 0.280[aAB]	9.523 ± 0.284[aA]	9.069 ± 0.182[aA]	8.233 ± 0.233[aA]	8.833 ± 0.417[aA]	7.940 ± 0.252[aA]	8.480 ± 0.257[aA]	9.003 ± 0.194[aA]	9.155 ± 0.151[aA]
Full mouth	9.676 ± 0.304[aA]	8.940 ± 0.523[aA]	9.944 ± 0.517[aA]	10.090 ± 0.385[aB]	9.100 ± 0.332[aA]	8.916 ± 0.538[aA]	8.533 ± 0.290[aA]	9.000 ± 0.529[aA]	9.532 ± 0.216[aA]	9.420 ± 0.258[aAB]
Overall	9.639 ± 0.170 [a]	9.629 ± 0.209 [a]	9.443 ± 0.176[a]	9.567 ± 0.161[a]	8.800 ± 0.172[a]	9.350 ± 0.281[a]	8.420 ± 0.201[a]	8.856 ± 0.193[a]	9.298 ± 0.103[a]	9.463 ± 0.105[a]

Mean of different sexes within an age group and from a particular area (along rows) bearing common lowercase superscript, and between the age groups within a particular sex (along columns) bearing at least one common uppercase superscript, does not differ significantly

Haematocrit or Packed cell volume (PCV): The mean hematocrit value of Changra goats reared in different areas of Ladakh was 40.146 ± 0.285%. The overall mean hematocrit values at Stakna (38.032 ± 0.865%) were significantly (P≤0.05) lower than at Kharnak (40.812 ± 0.475%), Sumdho (39.820 ± 0.439%) and Chushul (41.428 ± 0.724%) which did not differ significantly among themselves. The overall mean hematocrit values observed in 2 tooth (39.324 ± 0.539%) and 6 tooth goats (39.127 ± 0.477%) was significantly lower (P≤0.05) when compared with 4 tooth (41.254 ± 0.605%) and full mouth goats (41.436 ± 0.610%). Although, the mean haematocrit values did not differ significantly between the age groups within an area or within the age groups between the areas, comparatively lower haematocrit was observed in 2 tooth and 6 tooth animals at Stakna (Table 4).

Sex wise evaluation revealed that overall mean hematocrit values in male and female Changra goats was 40.134 ± 0.402% and 40.157 ± 0.405%. The overall mean hematocrit values in male and female goats reared in Kharnak (41.565 ± 0.594% and 39.794 ± 0.752%), Sumdho (39.292 ± 0.701% and 40.186 ± 0.564%), Chushul (40.764 ± 0.933% and 42.055 ± 1.103%) and Stakna (37.333 ± 1.094% and 38.687 ± 1.340%) were comparable. The overall mean hematocrit values of 4 tooth and 6 tooth females (42.857 ± 0.700% and 39.277 ± 0.645%) was significantly (P≤0.05) higher than their respectively males (39.304 ± 0.894 and, 38.925 ± 0.717). No significant difference was observed in the mean haematocrit values of male and female goats within an age group in an area, except for significantly (P≤0.05) higher mean values in 2 tooth and full mouth males (42.687 ± 0.929% vs 38.500 ± 1.239%; & 42.153 ±.918% vs 37.600 ± 2.694%) at Kharnak, and 4 tooth females (39.000 ± 0.000% vs 46.000 ± 1.154%) in Chushul. With few exceptions significantly higher mean values observed in 4 tooth females at Kharnak and Stakna, full mouth females at Sumdho, and males at Chushul, no significant differences were observed in the mean haematocrit values between the age groups, within sexes in an area (Table 5).

Table 4: Effect of age and area on haematocrit (%) profile of Changra goats reared in different areas of Ladakh (Mean ± SE)

Area Age	Kharnak	Sumdho	Chuschul	Stakna	Overall
2 Tooth	41.291 ± 0.837[aA]	38.527 ± 0.811[bcA]	40.090 ± 1.048[abA]	34.833 ± 2.023[cA]	39.324 ± 0.539[A]
4 Tooth	41.588 ± 1.233[aA]	40.684 ± .834[aAB]	42.500 ± 1.707[aA]	41.000 ± 1.572[aB]	41.254 ± 0.605[B]
6 Tooth	39.571 ± 0.735[aA]	39.500 ± 0.754[aAB]	40.333 ± 1.173[aA]	36.500 ± 1.351[aA]	39.127 ± 0.477[A]
Full mouth	40.888 ± 1.072[aA]	41.842 ± 0.971[aB]	42.666 ± 1.563[aA]	39.333 ± 1.382[aAB]	41.436 ± 0.610[B]
Overall	40.812 ± 0.475[a]	39.820 ± 0.439[a]	41.428 ± 0.724[a]	38.032 ± 0.865[b]	40.146 ± 0.285

Mean within an age group (along rows) bearing at least one common lowercase superscript, and between the age groups (along columns) bearing at least one common uppercase superscript, does not differ significantly

Table 5: Effect of age and sex on haematocrit (%) profile of Changra goats reared in different areas of Ladakh (Mean ± SE)

Area	Kharnak		Sumdho		Chushul		Stakna		Overall	
Sex/Age	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female
2 Tooth	42.687 ± 0.929[aA]	38.500 ± 1.239[bA]	38.071 ± 1.242[aA]	38.818 ± 1.084[aA]	38.200 ± 1.019[aA]	41.666 ± 1.498[aA]	36.000 ± 4.163[aA]	33.666 ± 1.333[aA]	39.868 ± 0.774[aA]	38.794 ± 0.751[aA]
4 Tooth	40.545 ± 1.631[aA]	43.500 ± 1.707[aB]	37.800 ± 0.860[aA]	41.714 ± 0.957[aB]	39.000 ± 1.000[aA]	46.000 ± 1.154[bA]	38.000 ± 2.160[aA]	43.400 ± 1.691[aB]	39.304 ± 0.894[aA]	42.857 ± 0.700[bB]
6 Tooth	39.166 ± 0.980[aA]	39.733 ± 0.968[aAB]	39.692 ± 1.189[aA]	39.307 ± 0.976[aAB]	38.333 ± 0.881[aA]	42.333 ± 1.452[aA]	37.000 ± 2.000[aA]	36.000 ± 2.024[aA]	38.925 ± 0.717[aA]	39.277 ± 0.645[bA]

Full Mouth	42.153 ± 0.918aA	37.600 ± 2.694bA	41.444 ± 1.724aA	42.200 ± 1.083aB	45.000 ± 1.125aB	40.333 ± 2.70aA	38.333 ± 0.333aA	40.333 ± 2.905aAB	42.129 ± 0.719aB	40.541 ± 1.035aAB
Overall	41.565 ± 0.594a	39.794 ± 0.752a	39.292 ± 0.701a	40.186 ± 0.564a	40.764 ± 0.933a	42.055 ± 1.103a	37.333 ± 1.094a	38.687 ± 1.340a	40.134 ± 0.402a	40.157 ± 0.405a

Mean of different sexes within an age group and from a particular area (along rows) bearing common lowercase superscript, and between the age groups within a particular sex (along columns) bearing at least one common uppercase superscript, does not differ significantly

Total erythrocyte count (TEC): The overall mean TEC of Changra goats reared in different areas of Ladakh was 13.421 ± 0.101 m/dL. The mean TEC of goats at Stakna (12.801 ± 0.219 m/dL) was significantly lower (P≤0.05) than those at Kharnak (13.375 ± 0.184 m/dL), Sumdho (13.559 ± 0.160 m/dL) and Chushul (13.681 ± 0.268 m/dL) which did not differ significantly among themselves. The overall mean TEC values in 2 tooth goats (15.347 ± 0.164 m/dL) was significantly (P≤0.05) higher than 4 tooth (12.567 ± 0.067 m/dL), 6 tooth (12.466 ± 0.067 m/dL) and full mouth goats (12.608 ± 0.060 m/dL). Similar trend was observed in all the areas between the age groups. Area-wise comparison within the age groups did not reveal any significant differences (Table 6).

The overall mean TEC value of male (13.392 ± 0.151 m/dL) and female (13.448 ± 0.135 m/dL) Changra goats was comparable. The overall mean TEC values and within age group values of male and female goats within an area, in general were comparable except for the higher mean TEC value in 2 tooth females (16.266 ± 0.176 m/dL) than males

(15.090 ± 0.743 m/dL) (Table 7).

Table 6: Effect of age and area on Total Erythrocyte Count (10^6/dL) profile of Changra goats reared in different areas of Ladakh (Mean ± SE)

Area/Age	Kharnak	Sumdho	Chushul	Stakna	Overall
2 tooth	15.345 ± 0.366aA	15.309 ± 0.224aA	15.731 ± 0.378aA	14.885 ± 0.263aA	15.347 ± 0.164A
4 tooth	12.561 ± 0.105aB	12.520 ± 0.140aB	12.808 ± 0.096aB	12.516 ± 0.127aB	12.567 ± 0.067B
6 tooth	12.503 ± 0.069aB	12.522 ± 0.110aB	12.628 ± 0.123aB	12.147 ± 0.257aB	12.466 ± 0.067B
Full mouth	12.533 ± .084aB	12.700 ± 0.084aB	12.765 ± 0.121aB	12.233 ± 0.303aB	12.608 ± 0.060B
Overall	13.375 ± 0.184ab	13.559 ± 0.160a	13.681 ± 0.268a	12.801 ± 0.219b	13.421 ± 0.101

Mean within an age group (along rows) bearing at least one common lowercase superscript, and between the age groups (along columns) bearing at least one common uppercase superscript, does not differ significantly

Table 7: Effect of age and sex on Total Erythrocyte Count (10^6/dL) profile of Changra goats reared in different areas of Ladakh (Mean ± SE)

Area	Kharnak		Sumdho		Chushul		Stakna		Overall	
Sex/Age	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female
2 Tooth	15.374 ± 0.485aA	15.288 ± 0.562aA	15.481 ± 0.328aA	15.199 ± 0.306aA	15.090 ± 0.743aA	16.266 ± 0.176bA	14.720 ± 0.498aA	15.050 ± 0.270aA	15.324 ± 0.253aA	15.370 ± 0.214aA
4 Tooth	12.521 ± 0.137aB	12.633 ± 0.176aB	12.334 ± 0.126aB	12.587 ± 0.184aB	12.766 ± 0.178aB	12.850 ± 0.112aB	12.415 ± 0.115aB	12.598 ± 0.215aB	12.494 ± 0.078aB	12.627 ± 0.105aB
6 Tooth	12.476 ± 0.104aB	12.514 ± 0.089aB	12.546 ± 0.191aB	12.498 ± 0.117aB	12.376 ± 0.110aB	12.880 ± 0.020aB	11.850 ± 0.452aB	12.444 ± 0.224aB	12.383 ± 0.130aB	12.529 ± 0.064aB
Full Mouth	12.600 ± 0.082aB	12.358 ± 0.216aB	12.562 ± 0.155aB	12.824 ± 0.065aB	12.921 ± 0.078aB	12.610 ± 0.220aB	11.750 ± 0.225aB	12.716 ± 0.420aB	12.569 ± 0.080aB	12.660 ± 0.091aB
Overall	13.530 ± 0.263a	13.165 ± 0.247a	13.526 ± 0.257a	13.581 ± 0.205a	13.435 ± 0.340a	13.913 ± 0.414a	12.554 ± 0.342a	13.031 ± 0.278a	13.392 ± 0.151	13.448 ± 0.135

Mean of different sexes within an age group and from a particular area (along rows) bearing common lowercase superscript, and between the age groups within a particular sex (along columns) bearing at least one common uppercase superscript, does not differ significantly

Mean Corpuscular Volume (MCV): The overall mean MCV of Changra goats reared in different areas of Ladakh was 30.206 ± 0.264fL. The overall mean MCV values observed in Kharnak (30.797 ± 0.434 fL), Sumdho (29.676 ± 0.418 fL), Chushul (30.616 ± 0.741 fL) and Stakna (29.924 ± 0.779 fL) were comparable. Also, the differences between mean MCV values in goats from different areas within age groups were not statistically significant, except for 2 tooth goats at Kharnak (27.157 ± 0.701 fL) having significantly high mean value when compared with other areas. Comparision between age groups revealed significantly lower mean MCV values in 2 tooth goats in all the areas (Table 8).

The overall MCV values in male (30.261 ± 0.366fL) and female (30.154 ± 0.380 fL) goats were comparable. In

general, the mean MCV values in male and female goats within an area did not differ significantly. Comparison between sexes within age groups revealed significantly higher overall mean MCV values in 4 tooth females (31.410 ± 0.597 fL vs 33.906 ± 0.398 fL) and full mouth males (33.482 ± 0.461 fL vs 31.949 ± 0.666). Similarly, area wise comparison between sexes in different age groups revealed significantly values in 2 tooth and full mouth males at Kharnak; and 4 tooth females at Chushul and Stakna. Evaluation within sexes and between different age groups showed significantly (P≤0.05) lower overall mean values in 2 tooth male and female goats. Similar trend was also observed in males and females of different areas (Table 9).

Table 8: Effect of age and area on Mean Corpuscular Volume (fL) profile of Changra goats reared in different areas of Ladakh (Mean ± SE)

Area/ Age	Kharnak	Sumdho	Chushul	Stakna	Overall
2 tooth	27.157 ± 0.701aA	25.203 ±0.468bA	25.561 ±0.671abA	23.335 ±1.012bA	25.717 ±0.351A
4 tooth	33.035 ±0.799aB	32.452 ±0.412aB	33.168 ±1.266aB	32.733 ±1.153aB	32.780 ±0.385B
6 tooth	31.617 ±0.481aB	31.480 ±0.399aB	31.906 ±0.671aB	30.002 ±0.740aC	31.332 ±0.270C
Full mouth	32.582 ±0.751aB	32.908 ±0.648aB	33.328 ±0.973aB	32.171 ±0.939aBC	32.813 ±0.399B
Overall	30.797 ±0.434a	29.676 ±0.418a	30.616 ±0.741a	29.924 ±0.779a	30.206 ±0.264

Table 9: Effect of age and sex on Mean Corpuscular Volume (fL) profile of Changra goats reared in different areas of Ladakh (Mean ± SE)

Area	Kharnak		Sumdho		Chushul		Stakna		Overall	
Sex/Age	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female
2 Tooth	28.096 ± 0.924^aA	25.277 ± 0.659^bA	24.539 ± 0.446^aA	25.625 ± 0.706^aA	25.522 ± 1.220^aA	25.595 ± 0.810^aA	24.323 ± 1.975^aA	22.346 ± 0.493^aA	26.149 ± 0.535^aA	25.297 ± 0.453^aA
4 Tooth	32.308 ± 1.091^aB	34.368 ± 0.935^aB	30.628 ± 0.405^aB	33.104 ± 0.420^aB	30.540 ± 0.568^aB	35.796 ± 0.885^bB	30.570 ± 1.516^aB	34.464 ± 1.314^bB	31.410 ± 0.597^aB	33.906 ± 0.398^bB
6 Tooth	31.381 ± 0705^aB	31.712 ± 0.624^aC	31.548 ± 0.573^aB	31.413 ± 0.580^aB	30.956 ± 0.435^aB	32.856 ± 1.078^aBC	31.154 ± 0.697^aB	28.850 ± 1.149^aC	31.372 ± 0.333^aB	31.301 ± 0.406^aC
Full Mouth	33.443 ± 0.668^aB	30.346 ± 1.850^bC	32.937 ± 1.146^aB	32.883 ± 0.740^aB	34.803 ± 0.723^aC	31.853 ± 1.665^aC	32.643 ± 0.688^aB	31.700 ± 1.928^aBC	33.482 ± 0.461^aC	31.949 ± 0.666^bC
Overall	31.043 ± 0.561^a	30.465 ± 0.688^a	29.347 ± 0.651^a	29.905 ± 0.548^a	30.642 ± 1.021^a	30.591 ± 1.100^a	29.930 ± 0.948^a	29.919 ± 1.250^a	30.261 ± 0.366	30.154 ± 0.380

Mean of different sexes within an age group and from a particular area (along rows) bearing common lowercase superscript, and between the age groups within a particular sex (along columns) bearing at least one common uppercase superscript, does not differ significantly

Mean Corpuscular Haemoglobin (MCH): The mean MCH of Changra goats was 7.050 ± 0.063 pg. The overall MCH value observed was highest in goats at Kharnak (7.261 ± 0.109 pg) followed by Sumdho (7.084 ± 0.105 pg), Chushul (6.692 ± 0.148 pg) and Stakna (6.797 ± 0.144 pg), and the mean values differed significantly (P≤0.05). The overall MCH MCH value was significantly (P≤0.05) higher in 4 tooth goats (7.714 ± 0.104 pg). The values in 6 tooth (7.281 ± 0.077 pg) and full mouth (7.508 ± 0.116 pg) goats were comparable, where as significantly lower values were observed in 2 tooth goats (6.093 ± 0.084 pg). Similar trend was observed in goats at Chushul and Stakna. At Sumdhu MCH was highest in full mouth goats, while at Kharnak, MCH values in 4 tooth, 6 tooth and full mouth goats were comparable (Table 10).

The overall MCH values of male and female Changra goats (7.003 ± 0.088 pg vs 7.093 ± 0.090 pg) were comparable. Also the MCH values of male and female goats within area as well as within age groups did not differ significantly except in 4 tooth goats at Kharnak where the vale was significantly (P≤0.05) higher in females. Within sex evaluation revealed significantly (P≤0.05) lower values in 2 tooth males and females at all the areas (Table 11).

Table 10: Effect of age and area on Mean Corpuscular Haemoglobin (pg) profile of Changra goats reared in different areas of Ladakh (Mean ± SE)

Area→ Age↓	Kharnak	Sumdho	Chushul	Stakna	Overall
2 tooth	6.363 ± 0.163^aA	6.093 ± 0.118^abA	5.810 ± 0.196^bA	5.530 ± 0.104^bA	6.093 ± 0.084^A
4 tooth	7.912 ± 0.209^aB	7.714 ± 0.164^aBC	7.560 ± 0.254^aB	7.444 ± 0.209^aB	7.714 ± 0.104^B
6 tooth	7.519 ± 0.146^aB	7.413 ± 0.105^aB	6.750 ± 0.162^bC	6.754 ± 0.072^bC	7.281 ± 0.077^C
Full mouth	7.542 ± 0.183^abB	7.881 ± 0.229^aC	7.037 ± 0.186^bBC	7.168 ± 0.203^bBC	7.508 ± 0.116^BC
Overall	7.261 ± 0.109^a	7.084 ± 0.105^ac	6.692 ± 0.148^b	6.797 ± 0.144^bc	7.050 ± 0.063

Mean within an age group (along rows) bearing at least one common lowercase superscript, and between the age groups (along columns) bearing at least one common uppercase superscript, does not differ significantly

Table 11: Effect of age and sex on Mean Corpuscular Haemoglobin (pg) profile of Changra goats reared in different areas of Ladakh (Mean ± SE)

Area	Kharnak		Sumdho		Chushul		Stakna		Overall	
Sex/Age	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female
2 Tooth	6.454 ± 0.209^aA	6.182 ± 0.259^aA	5.917 ± 0.123^aA	6.205 ± 0.175^aA	5.716 ± 0.276^aA	5.890 ± 0.296^aA	5.443 ± 0.178^aA	5.616 ± 0.123^aA	6.079 ± 0.117^aA	6.106 ± 0.121^aA
4 Tooth	7.597 ± 0.250^aB	8.491 ± 0.253^bB	7.368 ± 0.171^aB	7.837 ± 0.206^aB	7.166 ± 0.242^aB	7.953 ± 0.333^aB	7.440 ± 0.290^aB	7.448 ± 0.326^aB	7.463 ± 0.136^aB	7.920 ± 0.144^bB
6 Tooth	7.328 ± 0.139^aB	7.595 ± 0.196^aC	7.575 ± 0.161^aB	7.252 ± 0.125^aC	6.643 ± 0.135^aAB	6.856 ± 0.319^aAB	6.704 ± 0.102^aB	6.804 ± 0.108^aB	7.255 ± 0.113^aB	7.300 ± 0.107^aC
Full Mouth	7.666 ± 0.211^aB	7.220 ± 0.363^aC	7.905 ± 0.382^aB	7.860 ± 0.287^aB	7.035 ± 0.244^aB	7.040 ± 0.306^aB	7.270 ± 0.346^aB	7.066 ± 0.275^aB	7.575 ± 0.157^aB	7.422 ± 0.173^aC
Overall	7.184 ± 0.136^a	7.365 ± 0.179^a	7.056 ± 0.168^a	7.103 ± 0.135^a	6.601 ± 0.189^a	6.778 ± 0.228^a	6.761 ± 0.218^a	6.831 ± 0.198^a	7.003 ± 0.088^a	7.093 ± 0.090^a

Mean of different sexes within an age group and from a particular area (along rows) bearing common lowercase superscript, and between the age groups within a particular sex (along columns) bearing at least one common uppercase superscript, does not differ significantly

Mean Corpuscular Haemoglobin Concentration (MCHC): The overall MCHC of Changra goats was 23.428 ± 0.122%. Highest MCHC value was observed in goats at Sumdho (23.940 ± 0.185) which differed significantly (P≤0.05) from the values observed in goats at Stakna (22.910 ± 0.374%) and Chushul (21.966 ± 0.267%). The mean MCHC value observed in goats at Kharnak (23.628 ±.192) was comparable with those at Sumdho and Stakna. Comparison within age groups between different areas revealed lower MCHC values in goats at Chushul. Comparison between age groups revealed highest MCHC in 2 tooth goats (23.780 ± 0.213%) and the

value differed significantly from that of full mouth goats (22.943 ± 0.288%). The MCHC values observed in 4 tooth (23.599 ± 0.266%) and 6 tooth (23.283 ± 0.216%) goats did not differ significantly among themselves or with other groups. No significant differences were observed among the age groups in different areas except for significantly lower levels in full mouth goats at Chushul (Table 12).

Sex wise evaluation revealed that MCHC value of male (23.229 ± 0.181%) and female (23.614 ± 0.163%) were comparable. The male vs female overall MCHC values in goats reared in Sumdho (24.085 ± 0.265% vs 23.839 ±

0.254%), Chushul (21.665 ± 0.391% vs 22.250 ± 0.364%) and Stakna (22.717 ± 0.600% and 23.091 ± 0.471%) did not differ significantly but significant (P≤0.05) differences were observed in goats reared at Kharnak (23.211 ± 0.273 vs 24.193 ± 0.235%). Comparison between sexes within age groups in different areas, and between age groups within sexes, in general, did not reveal any significant differences (Table 13).

Table 12: Effect of age and area on Mean Corpuscular Haemoglobin Concentration (%) profile of Changra goats reared in different areas of Ladakh (Mean ± SE)

Area/Age	Kharnak	Sumdho	Chushul	Stakna	Overall
2 tooth	23.519 ±0.389[abA]	24.245 ±0.281[bA]	22.725 ±0.381[aA]	23.966 ±1.226[abA]	23.780 ±0.213[A]
4 tooth	24.030 ±0.500[aA]	23.774 ±0.373[aA]	22.861 ±0.572[aA]	22.906 ±0.777[aA]	23.599 ±0.266[AB]
6 tooth	23.788 ±0.269[aA]	23.611 ±0.356[aA]	21.166 ±0.336[bA]	22.641 ±0.556[aA]	23.283 ±0.216[AB]
Full mouth	23.210 ±0.389[acA]	23.977 ±0.547[aA]	21.222 ±0.511[bB]	22.308 ±0.375[bcA]	22.943 ±0.288[B]
Overall	23.628 ±0.192[ac]	23.940 ±0.185[a]	21.966 ±0.267[b]	22.910 ±0.374[c]	23.428 ±0.122

Mean within an age group (along rows) bearing at least one common lowercase superscript, and between the age groups (along columns) bearing at least one common uppercase superscript, does not differ significantly

Table 13: Effect of age and sex on Mean Corpuscular Haemoglobin Concentration (%) profile of Changra goats reared in different areas of Ladakh (Mean ± SE)

Area	Kharnak		Sumdho		Chushul		Stakna		Overall	
Sex/Age	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female
2 Tooth	23.058 ± 0.462[aA]	24.441 ± 0.629[aA]	24.172 ± 0.436[aA]	24.291 ± 0.374[aA]	22.418 ± 0.410[aA]	22.981 ± 0.627[aA]	22.786 ± 2.475[aAB]	25.146 ± 0.006[aA]	23.362 ± 0.318[aAB]	24.186 ± 0.273[aA]
4 Tooth	23.648 ± 0.728[aA]	24.730 ± 0.410[aA]	24.062 ± 0.369[aA]	23.671 ± 0.494[aA]	23.490 ± 0.767[aA]	22.233 ± 0.811[aA]	24.430 ± 0.891[bA]	21.688 ± 0.929[aB]	23.853 ± 0.389[aA]	23.390 ± 0.365[aA]
6 Tooth	23.381 ± 0.335[aA]	23.950 ± 0.349[aA]	24.061 ± 0.482[aA]	23.162 ± 0.512[aA]	21.473 ± 0.214[aAB]	20.860 ± 0.652[aA]	21.586 ± 0.649[aB]	23.696 ± 0.642[aAB]	23.164 ± 0.337[aAB]	23.373 ± 0.285[aA]
Full Mouth	22.950 ± 0.491[aA]	23.884 ± 0.530[aA]	24.000 ± 0.762[aA]	23.958 ± 0.819[aA]	20.221 ± 0.550[aB]	22.223 ± 0.666[aA]	22.250 ± 0.613[aAB]	22.366 ± 0.570[aAB]	22.659 ± 0.394[aB]	23.310 ± 0.419[aA]
Overall	23.211 ± 0.273[a]	24.193 ± 0.235[b]	24.085 ± 0.265[a]	23.839 ± 0.254[a]	21.665 ± 0.391[a]	22.250 ± 0.364[a]	22.717 ± 0.600[a]	23.091 ± 0.471[a]	23.229 ± 0.181	23.614 ± 0.163

Mean of different sexes within an age group and from a particular area (along rows) bearing common lowercase superscript, and between the age groups within a particular sex (along columns) bearing at least one common uppercase superscript, does not differ significantly

Leukocytic Attributes
Total Leukocyte Count (TLC): The mean TLC of Changra goats was 7.841 ± 0.050 Th/dL. The overall mean TLC value observed in Kharnak, Sumdho, Chushul and Stakna was 7.923 ± 0.103 Th/dL, 7.749 ± 0.054 Th/dL, 7.942 ± 0.150 Th/dL, and 7.818 ± 0.161 Th/dL, respectively and in 2 tooth, 4 tooth, 6 tooth and full mouth goats was 7.858 ± 0.090 Th/dL, 7.900 ± 0.099 Th/dL, 7.814 ± 0.102 Th/dL and 7.796 ± 0.110 Th/dL respectively. The differences between the means across the areas and across the age groups were statistically non significant. No significant difference was found within age groups across the areas. Also, the means TLC of different age groups did not differ significantly at Kharnak, Sumdho and Chushul. At Stakna, mean TLC in full mouth goats was significantly (P≤0.05) lower in full mouth goats when compared with 2 tooth and 4 tooth goats but was comparable with mean TLC in 6 tooth goats which in turn did not differ significantly from mean value in 4 tooth goat (Table 14).

The overall mean TLC observed in male and female Changra goats at Kharnak, Sumdho, Chushul and Stakna was 7.993 ± 0.138 Th/dL and 7.827 ± 0.157 Th/dL, 7.724 ± 0.087 Th/dL and 7.766 ± 0.071 Th/dL, 7.864 ± 0.198 Th/dL and 8.016 ± 0.229 Th/dL, 7.567 ± 0.195 Th/dL and 8.053 ± 0.246 Th/dL respectively with an overall mean of 7.828 ± 0.072 Th/dL and 7.854 ± 0.069 Th/dL. The respective mean values were 7.827 ± 0.118 Th/dL and 7.888 ± 0.138 Th/dL in 2 tooth, 7.708 ± 0.152 Th/dL and 8.057 ± 0.125 Th/dL in 4 tooth, 7.967 ± 0.163 Th/dL and 7.699 ± 0.129 Th/dL in 6 tooth, and 7.797 ± 0.155 Th/dL and 7.795 ± 0.159 Th/dL in full mouth goats. In general the means between sexes did not differ significantly at any level except at Kharnak where mean value in 4 tooth females and 6 tooth males was significantly (P≤0.05) higher, when compared either between sexes or between age groups (Table 15).

Table 14: Effect of age and area on Total Leukocyte Count (Th/dL) profile of Changra goats reared in different areas of Ladakh (Mean ± SE)

Area/Age	Kharnak	Sumdho	Chushul	Stakna	Overall
2 tooth	8.010 ±.166[aA]	7.671 ±.106[aA]	7.685 ±.275[aA]	8.688 ±.357[aA]	7.858 ±0.090[A]
4 tooth	7.967 ±.210[aA]	7.764 ±.077[aA]	7.966 ±.373[aA]	8.014 ±.295[aAB]	7.900 ±0.099[A]
6 tooth	7.893 ±.213[aA]	7.783 ±.125[aA]	8.158 ±.418[aA]	7.522 ±.228[aBC]	7.814 ±0.102[A]
Full mouth	7.798 ±.263[aA]	7.834 ±.091[aA]	8.057 ±.247[aA]	7.148 ±.187[aC]	7.796 ±0.110[A]
Overall	7.923 ±.103[a]	7.749 ±.054[a]	7.942 ±.150[a]	7.818 ±.161[a]	7.841 ±0.050

Mean within an age group (along rows) bearing at least one common lowercase superscript, and between the age groups (along columns) bearing at least one common uppercase superscript, does not differ significantly

Table 15: Effect of age and sex on Total Leukocyte Count (Th/dL) profile of Changra goats reared in different areas of Ladakh (Mean ± SE)

Area	Kharnak		Sumdho		Chushul		Stakna		Overall	
Sex/Age	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female
2 Tooth	8.145 ± 0.188aAB	7.741 ± 0.323aA	7.550 ± 0.165aA	7.748 ± 0.140aA	7.422 ± 0.188aA	7.905 ± 0.483aA	8.103 ± 0.545aA	9.273 ± 0.026aA	7.827 ± 0.118aA	7.888 ± 0.138aA
4 Tooth	7.584 ± 0.202aA	8.670 ± 0.311bB	7.668 ± 0.202aA	7.798 ± 0.080aA	8.263 ± 0.663aA	7.670 ± 0.412aA	7.685 ± 0.471aA	8.278 ± 0.375aAB	7.708 ± 0.152aA	8.057 ± 0.125aA
6 Tooth	8.450 ± 0.480aB	7.670 ± 0.213bA	7.927 ± 0.177aA	7.638 ± 0.174aA	8.256 ± 0.557aA	8.060 ± 0.746aA	7.318 ± 0.241aA	7.726 ± 0.395aBC	7.967 ± 0.163aA	7.699 ± 0.129aA
Full Mouth	7.941 ± 0.321aAB	7.426 ± 0.451aA	7.732 ± 0.107aA	7.926 ± 0.143aA	7.836 ± 0.344aA	8.278 ± 0.362aA	7.290 ± 0.389aA	7.006 ± 0.063aC	7.797 ± 0.155aA	7.795 ± 0.159aA
Overall	7.993 ± 0.138a	7.827 ± 0.157a	7.724 ± 0.087a	7.766 ± 0.071a	7.864 ± 0.198a	8.016 ± 0.229a	7.567 ± 0.195a	8.053 ± 0.246a	7.828 ± 0.0723a	7.854 ± 0.069a

Mean of different sexes within an age group and from a particular area (along rows) bearing common lowercase superscript, and between the age groups within a particular sex (along columns) bearing at least one common uppercase superscript, does not differ significantly

Differential leukocyte count (DLC)
Neutrophils: The mean neutrophil count (NC) in Changra goats was observed 32.605 ± 0.256%. The overall mean NC values observed at Kharnak (36.000 ± 0.310%) were found to be significantly (P≤0.05) higher than Sumdho (30.700 ± 0.366%), Chushul (31.600 ± 0.619%) and Stakna (31.129 ± 0.446%) which were comparable among themselves. Similar trend was observed with age groups between the areas. The overall mean NC value in 6 tooth (33.587 ± 0.467%) goats was significantly (P≤0.05) higher than 2 tooth (32.026 ± 0.448%) and 4 tooth (31.862 ± 0.580%) goats but were comparable with full mouth (32.981 ± 0.568%). The mean NC values did not differ significantly between age groups at Kharnak, Chushul and Stakna. At Sumdho mean NC value in 4 tooth goats was significantly (P≤0.05) lower than 6 tooth goats (Table 16).
The overall meant NC value in male and female Changra goats was 33.025 ± 0.361% and 32.212 ± 0.361% respectively. The respective mean NC at Kharnak, Sumdho, Chushul and Stakna were 35.891 ± 0.361% and 36.147 ± 0.547%, 31.170 ± 0.581% and 30.372 ± 0.472%, 31.176 ± 1.015% and 32.000 ± 0.745%, 31.400 ± 0.741% and 30.875 ± 0.531% respectively. The differences between sexes within an area were nonsignificant. The mean NC values of male and females in 2 tooth, 4 tooth, 6 tooth and full mouth were 32.368 ± 0.586% and 31.692 ± 0.679%, 33.608 ± 0.821% and 30.428 ± 0.717%, 32.814 ± 0.677% and 34.166 ± 0.631%,

33.580 ± 0.839% and 32.208 ± 0.712% respectively and the difference was significant (P≤0.05) in 4 tooth goats. The difference in the mean NC values between sexes within an age group were not significant except significantly (P≤0.05) lower values in males of 2 tooth at Chushul. The mean NC values between age groups within sexes were also comparable except significantly (P≤0.05) lower value in 4 tooth females at Sumdho and full mouth males at Stakna, and higher value in full mouth males at Chuschul (Table 17).

Table 16: Effect of age and area on Neutrophil Count (%) of Changra goats reared in different areas of Ladakh (Mean ± SE)

Area/Age	Kharnak	Sumdho	Chushul	Stakna	Overall
2 tooth	35.250 ± 0.692aA	30.500 ± 0.539bAB	30.909 ± 1.115bA	30.333 ± 1.201bA	32.026 ± 0.448A
4 tooth	36.117 ± 0.574aA	29.052 ± 0.781bA	31.000 ± 1.316bA	30.333 ± 0.577bA	31.862 ± 0.580A
6 tooth	36.809 ± 0.546aA	32.038 ± 0.689bB	30.166 ± 0.833bA	32.900 ± 0.690bA	33.587 ± 0.467B
Full mouth	35.944 ± 0.574aA	30.894 ± 1.008bAB	33.250 ± 1.213cA	30.166 ± 0.980bcA	32.981 ± 0.568AB
Overall	36.000 ± 0.310a	30.700 ± 0.366b	31.600 ± 0.619b	31.129 ± 0.446b	32.605 ± 0.256

Mean within an age group (along rows) bearing at least one common lowercase superscript, and between the age groups (along columns) bearing at least one common uppercase superscript, does not differ significantly

Table 17: Effect of age and sex on Neutrophil Count (%) of Changra goats reared in different areas of Ladakh (Mean ± SE)

Area	Kharnak		Sumdho		Chushul		Stakna		Overall	
Sex/Age	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female
2 Tooth	35.000 ± 0.584aA	35.750 ± 1.790aA	30.928 ± 0.892aA	30.227 ± 0.686aAB	28.200 ± 0.374aA	33.166 ± 1.492bA	32.000 ± 2.081aAB	28.666 ± 0.333aA	32.368 ± 0.586aA	31.692 ± 0.679aA
4 Tooth	36.727 ± 0.787aA	35.000 ± 0.577aA	30.600 ± 1.122aA	28.500 ± 0.959aA	31.333 ± 2.333aAB	30.666 ± 1.763aA	30.500 ± 0.866aAB	30.200 ± 0.860aA	33.608 ± 0.821aA	30.428 ± 0.717bA
6 Tooth	35.333 ± 0.881aA	37.400 ± 0.630aA	32.076 ± 1.076aA	32.000 ± 0.905aB	29.666 ± 1.666aA	30.666 ± 0.666aA	33.600 ± 1.077aA	32.200 ± 0.860aA	32.814 ± 0.677aA	34.166 ± 0.631aB
Full Mouth	36.538 ± 0.666aA	34.400 ± 0.871aA	30.555 ± 1.608aA	31.200 ± 1.331aB	34.333 ± 1.977aB	32.166 ± 1.447aA	28.333 ± 0.333aB	32.000 ± 1.154aA	33.580 ± 0.839aA	32.208 ± 0.712aAB
Overall	35.891 ± 0.361a	36.147 ± 0.547a	31.170 ± 0.581a	30.372 ± 0.472a	31.176 ± 1.015a	32.000 ± 0.745a	31.400 ± 0.741a	30.875 ± 0.531a	33.025 ± 0.361	32.212 ± 0.361

Mean of different sexes within an age group and from a particular area (along rows) bearing common lowercase superscript, and between the age groups within a particular sex (along columns) bearing at least one common uppercase superscript, does not differ significantly

Lymphocytes
The overall mean lymphocyte count (LC) of Changra goats was 61.837 ± 0.253%. The mean LC observed in goats at Kharnak (59.400 ± 0.321%) was significantly (P≤0.05) lower

than at Sumdho (63.000 ± 0.426%), Chushul (62.971 ± 0.626%) and Stakna (63.096 ± 0.508%). The mean LC observed in 4 tooth (63.274 ± 0.553) was significantly (P≤0.05) higher than 2 tooth (61.129 ± 0.422%) and 6 tooth

(61.349 ± 0.492%) goats, but the value in full mouth (62.054 ± 0.559%) goats was comparable with other age groups. Comparison within age groups between different areas revealed that LC in goats at Kharnak was significantly (P≤0.05) lower in all age groups when compared with goats at Sumdho, Chuschul and Stakna. The mean LC of goats did not differ significantly between age groups at Kharnak and at Chushul but significantly (P≤0.05) higher value was observed in 4 tooth goats at Sumdho and Stakna (Table 18).

The overall LC in male and female Changra goats was 61.588 ± 0.357% and 62.070 ± 0.358% respectively. The mean LC in male and female goats reared at Kharnak, Sumdho, Chushul and Stakna was 59.521 ± 0.360% and 59.235 ± 0.585%, 62.487 ± 0.688% and 63.355 ± 0.542%, 63.647 ± 1.014% and 62.333 ± 0.749%, 63.133 ± 0.785% and 63.062 ± 0.679% respectively. No significant difference was observed in LC values between sexes within an area. The mean LC in male and females goats of 2 tooth, 4 tooth, 6 tooth and full mouth was 61.026 ± 0.587% and 61.230 ± 0.615%, 61.869 ± 0.827% and 64.428 ± 0.683%, 62.185 ± 0.747% and 60.722 ± 0.644%, 61.548 ± 0.767% and 62.708 ± 0.813% respectively. The differences were significant (P≤0.05) only in 4 tooth goats with higher value in females. The differences between sexes within an age group were non-significant except for

significantly (P≤0.05) lower values in 2 tooth females at Chushul. The difference between age groups within sexes were also non-significant except significantly (P≤0.05) higher values in 4 tooth females at Sumdho and significantly (P≤0.05) lower values in full mouth males at Chushul and 6 tooth males at Stakna (Table 19).

Table 18: Effect of age and area on Lymphocyte Count (%) of Changra goats reared in different areas of Ladakh (Mean ± SE)

Area→ Age↓	Kharnak	Sumdho	Chushul	Stakna	Overall
2 tooth	59.208 ± 0.683[aA]	61.666 ± 0.610[bA]	62.727 ± 1.144[bA]	62.666 ± 1.054[bAB]	61.129 ± 0.422[A]
4 tooth	59.882 ± 0.635[aA]	65.263 ± 0.894[bB]	64.333 ± 1.584[bA]	64.777 ± 0.595[bA]	63.274 ± 0.553[B]
6 tooth	59.000 ± 0.661[aA]	62.538 ± 0.839[bA]	64.500 ± 1.176[bA]	61.300 ± 0.760[abB]	61.349 ± 0.492[A]
Full mouth	59.666 ± 0.554[aA]	63.894 ± 1.105[bB]	61.750 ± 1.108[abA]	64.000 ± 1.483[bAB]	62.054 ± 0.559[AB]
Overall	59.400 ± 0.321[a]	63.000 ± 0.426[b]	62.971 ± 0.626[b]	63.096 ± 0.508[b]	61.837 ± 0.253

Mean within an age group (along rows) bearing at least one common lowercase superscript, and between the age groups (along columns) bearing at least one common uppercase superscript, does not differ significantly

Table 19: Effect of age and sex on Lymphocyte Count (%) of Changra goats reared in different areas of Ladakh (Mean ± SE)

Area	Kharnak		Sumdho		Chushul		Stakna		Overall	
Sex→ Age↓	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female
2 Tooth	59.437 ± 0.584[aA]	58.750 ± 1.760[aA]	61.214 ± 1.115[aA]	61.954 ± 0.719[aA]	65.200 ± 1.067[aA]	60.666 ± 1.475[bA]	61.666 ± 2.027[aAB]	63.666 ± 0.666[aA]	61.026 ± 0.587[aA]	61.230 ± 0.615[aA]
4 Tooth	59.090 ± 0.791[aA]	61.333 ± 0.843[aA]	63.600 ± 1.503[aA]	65.857 ± 1.073[aB]	65.333 ± 3.179[aA]	63.333 ± 1.201[aA]	64.750 ± 0.478[aAB]	64.800 ± 1.067[aA]	61.869 ± 0.827[aA]	64.428 ± 0.683[bB]
6 Tooth	60.833 ± 0.980[aA]	58.266 ± 0.777[aA]	62.384 ± 1.268[aA]	62.692 ± 1.151[aA]	66.333 ± 1.666[aA]	62.666 ± 0.881[aA]	60.800 ± 1.067[aB]	61.800 ± 1.157[aA]	62.185 ± 0.747[aA]	60.722 ± 0.644[aA]
Full Mouth	59.384 ± 0.702[aA]	60.400 ± 0.812[aA]	64.000 ± 1.691[aA]	63.800 ± 1.533[aAB]	60.166 ± 1.470[aB]	63.333 ± 1.498[aA]	66.333 ± 0.881[aA]	61.666 ± 2.185[aA]	61.548 ± 0.767[aA]	62.708 ± 0.813[aAB]
Overall	59.521 ± 0.360[a]	59.235 ± 0.585[a]	62.487 ± 0.688[a]	63.355 ± 0.542[a]	63.647 ± 1.014[a]	62.333 ± 0.749[a]	63.133 ± 0.785[a]	63.062 ± 0.679[a]	61.588 ± 0.357	62.070 ± 0.358

Mean of different sexes within an age group and from a particular area (along rows) bearing common lowercase superscript, and between the age groups within a particular sex (along columns) bearing at least one common uppercase superscript, does not differ significantly

Monocytes

The overall mean monocyte count (MC) of Changra goats was 1.808 ± 0.050%. The mean MC observed in goats at Kharnak (1.500 ±0.068%) was found to be significantly lower (P≤0.05) than at Sumdho (1.900 ± 0.081%), Chushul (1.914 ± 0.149%) and Stakna (2.193 ± 0.134%).The mean MC in 2 tooth (1.753 ± 0.090%), 4 tooth (1.803 ± 0.108%), 6 tooth (1.825 ± 0.105%) and full mouth (1.872 ± 0.100%) were

comparable. Comparison within age group between different areas revealed significantly (P≤0.05) lower in 2 tooth and 4 tooth goats at Kharnak and significantly (P≤0.05) higher values in 6 tooth goats at Stakna. Comparison between age groups within areas revealed non-significant differences in goats at Kharnak, Sumdho and Chushul. Significantly lower (P≤0.05) MC was observed in 4 tooth goats aty Stakna (Table 20).

Table 20: Effect of age and area on Monocyte Count (%) of Changra goats reared in different areas of Ladakh (Mean ± SE)

Area→ Age↓	Kharnak	Sumdho	Chushul	Stakna	Overall
2 tooth	1.375 ± 0.117[aA]	1.861 ± 0.133[bA]	2.000 ± 0.301[bA]	2.166 ± 0.307[bAB]	1.753 ± 0.090[A]
4 tooth	1.411 ± 0.149[aA]	2.052 ± 0.194[bA]	2.000 ± 0.365[abA]	1.888 ± 0.200[abA]	1.803 ± 0.108[A]
6 tooth	1.476 ± 0.131[aA]	1.846 ± 0.163[aA]	1.666 ± 0.421[aA]	2.600 ± 0.221[bB]	1.825 ± 0.105[A]
Full mouth	1.777 ± 0.152[aA]	1.894 ± 0.185[aA]	1.916 ± 0.228[aA]	2.000 ± 0.365[aAB]	1.872 ± 0.100[A]
Overall	1.500 ± 0.068[a]	1.900 ± 0.081[b]	1.914 ± 0.149[b]	2.193 ± 0.134[b]	1.808 ± 0.050

Mean within an age group (along rows) bearing at least one common lowercase superscript, and between the age groups (along columns) bearing at least one common uppercase superscript, does not differ significantly

Sex wise evaluation revealed overall mean MC of 1.857 ± 0.071% and 1.763 ± 0.070% in male and female Changra goats respectively. The mean MC in male and female goats reared at Kharnak, Sumdho, Chushul and Stakna was1.608 ±

0.095% and 1.352 ± 0.093%, 1.975 ± 0.128% and 1.847 ± 0.104%, 1.823 ± 0.214% and 2.000 ± 0.213%, 2.333 ± 0.186% and 2.062 ± 0.192%, respectively and in 2 tooth, 4 tooth, 6 tooth and full mouth goats was 1.842 ± 0.133% and

1.666 ± 0.123%, 1.826 ± 0.162% and 1.785 ± 0.148%, 1.740 ± 0.147% and 1.888 ± 0.147%, 2.000 ± 0.139% and 1.708 ± 0.140%, respectively. The difference between the means MC in males and females was statistically non-significant. Comparison of sexes within age groups revealed significant (P≤0.05) difference in 6 tooth goats at Chushul with higher value in females. The difference in the mean MC between age groups within sexes showed significantly (P≤0.05) higher values in 4 tooth males at Sumdho and 2 tooth males at Chushul. Rest of the means did not differ significantly (Table 21).

Table 21: Effect of age and sex on Monocyte Count (%) of Changra goats reared in different areas of Ladakh (Mean ± SE)

Area	Kharnak		Sumdho		Chushul		Stakna		Overall	
Sex→ Age↓	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female
2 Tooth	1.437 ± 0.157[aA]	1.250 ± 0.163[aA]	2.000 ± 0.234[aAB]	1.772 ± 0.160[aA]	2.200 ± 0.374[aA]	1.833 ± 0.477[aA]	2.666 ± 0.333[aA]	1.666 ± 0.333[aA]	1.842 ± 0.133[aA]	1.666 ± 0.123[aA]
4 Tooth	1.545 ± 0.207[aA]	1.166 ± 0.166[aA]	2.400 ± 0.244[aA]	1.928 ± 0.245[aA]	1.666 ± 0.666[aAB]	2.333 ± 0.333[aA]	2.000 ± 0.408[aA]	1.800 ± 0.200[aA]	1.826 ± 0.162[aA]	1.785 ± 0.148[aA]
6 Tooth	1.666 ± 0.210[aA]	1.400 ± 0.163[aA]	1.615 ± 0.212[aB]	2.076 ± 0.239[aA]	1.000 ± 0.000[aB]	2.333 ± 0.666[bA]	2.600 ± 0.244[aA]	2.600 ± 0.400[aA]	1.740 ± 0.147[aA]	1.888 ± 0.147[aA]
Full Mouth	1.846 ± 0.191[aA]	1.600 ± 0.244[aA]	2.222 ± 0.277[aAB]	1.600 ± 0.221[aA]	2.000 ± 0.365[aAB]	1.833 ± 0.307[aA]	2.000 ± 0.577[aA]	2.000 ± 0.577[aA]	2.000 ± 0.139[aA]	1.708 ± 0.140[aA]
Overall	1.608 ± 0.095[a]	1.352 ± 0.093[a]	1.975 ± 0.128[a]	1.847 ± 0.104[a]	1.823 ± 0.214[a]	2.000 ± 0.213[a]	2.333 ± 0.186[a]	2.062 ± 0.192[a]	1.857 ± 0.071	1.763 ± 0.070

Mean of different sexes within an age group and from a particular area (along rows) bearing common lowercase superscript, and between the age groups within a particular sex (along columns) bearing at least one common uppercase superscript, does not differ significantly

Eosinophils

The overall mean eosinophil count (EC) of Changra goats was 3.004 ± 0.090%.The mean EC observed in goats at Sumdho (3.400 ± 0.158%) was significantly (P≤0.05) higher than at Kharnak (2.600 ± 0.130%), Chushul (2.800 ± 0.238%) and Stakna (3.000 ± 0.212%).The mean EC in 2 tooth (4.415 ± 0.148%) goats was significantly (P≤0.05) higher when compared with 4 tooth (2.254 ± 0.124%), 6 tooth (2.412 ± 0.121%) and full mouth (2.400 ± 0.123%). Age wise comparison revealed significantly higher EC in 2 tooth goats in all the areas. Comparison between areas within age groups significantly (P≤0.05) lower EC in 2tooth goats at Chushul (Table 22).

Table 22: Effect of age and area on Eosionophil Count (%) of Changra goats reared in different areas of Ladakh (Mean ± SE)

Area→ Age↓	Kharnak	Sumdho	Chushul	Stakna	Overall
2 tooth	3.791 ± 0.208[acA]	5.027 ± 0.175[bcA]	3.636 ± 0.472[aA]	4.666 ± 0.614[cA]	4.415 ± 0.148[A]
4 tooth	2.058 ± 0.200[aB]	2.421 ± 0.233[aB]	2.166 ± 0.477[aB]	2.333 ± 0.166[aB]	2.254 ± 0.124[B]
6 tooth	2.047 ± 0.161[aB]	2.538 ± 0.216[aB]	2.833 ± 0.477[aAB]	2.600 ± 0.221[aB]	2.412 ± 0.121[B]
Full mouth	2.166 ± 0.202[aB]	2.473 ± 0.177[aB]	2.333 ± 0.355[aB]	3.000 ± 0.258[aB]	2.400 ± 0.123[B]
Overall	2.600 ± 0.130[a]	3.400 ± 0.158[b]	2.800 ± 0.238[a]	3.000 ± 0.212[a]	3.004 ± 0.090[ab]

Mean within an age group (along rows) bearing at least one common lowercase superscript, and between the age groups (along columns) bearing at least one common uppercase superscript, does not differ significantly

The overall mean ECs of male (2.882 ± 0.124%) and female (3.118 ± 0.131%) goats were comparable. The male vs female mean ECs did not differ significantly in goats at Kharnak (2.587 ± 0.190% vs 2.617 ± 0.168%), Sumdho (3.414 ± 0.220% vs 3.389 ± 0.221%), Chushul (2.588 ± 0.343% vs 3.000 ± 0.333%) and Stakna (2.666 ± 0.232% vs 3.312 ± 0.338%). No significant difference was observed in mean ECs between sexes in 4 tooth(2.087 ± 0.152% vs 2.392 ± 0.187%), 6 tooth (2.481 ± 0.195% vs 2.361 ± 0.155%), and full mouth (2.354 ± 0.176% vs 2.458 ± 0.170%) goats, but difference was significant in 2 tooth goats with higher value in females (4.078 ± 0.217% vs 4.743 ± 0.189%). No significant difference was found between sexes within age groups in different areas, except significantly (P≤0.05) higher values in 2 tooth females at Stakna, 4 and 6 tooth females at Chushul and 6 tooth males at Sumdho. Comparison within sexes between age groups revealed significantly (P≤0.05) higher overall mean values in 2 tooth males and females. In general similar trend was observed in all areas (Table 23).

Table 23: Effect of age and sex on Eosinophil Count (%) of Changra goats reared in different areas of Ladakh (Mean ± SE)

Area	Kharnak		Sumdho		Chushul		Stakna		Overall	
Sex→ Age↓	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female
2 Tooth	3.750 ± 0.309[aA]	3.875 ± 0.125[aA]	4.714 ± 0.304[aA]	5.227 ± 0.207[aA]	3.600 ± 0.812[aA]	3.666 ± 0.614[aA]	3.666 ± 0.881[aA]	5.666 ± 0.333[bA]	4.078 ± 0.217[aA]	4.743 ± 0.189[bA]
4 Tooth	2.090 ± 0.211[aB]	2.000 ± 0.447[aB]	2.400 ± 0.400[aB]	2.428 ± 0.291[aB]	1.333 ± 0.333[aB]	3.000 ± 0.577[bAB]	2.250 ± 0.250[aAB]	2.400 ± 0.244[aB]	2.087 ± 0.152[aB]	2.392 ± 0.187[aB]
6 Tooth	1.666 ± 0.333[aB]	2.200 ± 0.174[aB]	3.076 ± 0.287[aB]	2.000 ± 0.253[bB]	2.000 ± 0.000[aB]	3.666 ± 0.666[bA]	2.200 ± 0.200[aB]	3.000 ± 0.316[aB]	2.481 ± 0.195[aB]	2.361 ± 0.155[aB]
Full Mouth	2.000 ± 0.253[aB]	2.600 ± 0.244[aB]	2.444 ± 0.337[aB]	2.500 ± 0.166[aB]	2.666 ± 0.494[aAB]	2.000 ± 0.516[aB]	3.000 ± 0.000[aAB]	3.000 ± 0.577[aB]	2.354 ± 0.176[aB]	2.458 ± 0.170[aB]
Overall	2.587 ± 0.190[a]	2.617 ± 0.168[a]	3.414 ± 0.220[a]	3.389 ± 0.221[a]	2.588 ± 0.343[a]	3.000 ± 0.333[a]	2.666 ± 0.232[a]	3.312 ± 0.338[a]	2.882 ± 0.124[a]	3.118 ± 0.131[a]

Mean of different sexes within an age group and from a particular area (along rows) bearing common lowercase superscript, and between the age groups within a particular sex (along columns) bearing at least one common uppercase superscript, does not differ significantly

Basophils

The overall mean basophil count (BC) of Changra goats was 0.743 ± 0.044%. The mean BC observed in goats at Sumdho (1.000 ± 0.081%) was significantly (P≤0.05) higher than at Kharnak (0.500 ± 0.056%), Chushul (0.714 ± 0.077%) and Stakna (0.580 ± 0.111%). Similar trend was observed within age groups between different areas. The mean BC observed in 2 tooth (0.675 ± 0.079%), 4 tooth (0.803 ± 0.097%), 6 tooth (0.825 ± 0.089%) and full mouth (0.690 ± 0.089%) were statistically comparable. The mean BC values of different age groups within an area did not differ significantly (Table 24).

Table 24: Effect of age and area on Basophil Count (%) of Changra goats reared in different areas of Ladakh (Mean ± SE)

Area→ Age↓	Kharnak	Sumdho	Chushul	Stakna	Overall
2 tooth	0.375 ± 0.100[aA]	0.944 ± 0.131[bA]	0.727 ± 0.140[abA]	0.166 ± 0.166[aA]	0.675 ± 0.079[A]
4 tooth	0.529 ± 0.124[aA]	1.210 ± 0.180[bA]	0.500 ± 0.223[aA]	0.666 ± 0.166[aA]	0.803 ± 0.097[A]
6 tooth	0.666 ± 0.105[aA]	1.038 ± 0.170[aA]	0.833 ± 0.166[aA]	0.600 ± 0.221[aA]	0.825 ± 0.089[A]
Full mouth	0.444 ± 0.120[aA]	0.842 ± 0.191[aA]	0.750 ± 0.130[aA]	0.833 ± 0.307[aA]	0.690 ± 0.089[A]
Overall	0.500 ± 0.056[a]	1.000 ± 0.081[b]	0.714 ± 0.077[a]	0.580 ± 0.111[a]	0.743 ± 0.044

Mean within an age group (along rows) bearing at least one common lowercase superscript, and between the age groups (along columns) bearing at least one common uppercase superscript, does not differ significantly

The overall BC in male and female Changra goats was 0.647 ± 0.062% and 0.834 ± 0.060% respectively, with the area wise respective means of 0.391 ± 0.072% and 0.647 ± 0.083% at Kharnak, 0.951 ± 0.130% and 1.033 ± 0.105% at Sumdho, 0.764 ± 0.106% and 0.666 ± 0.114% at Chushul and 0 466 ± 0.165% and 0.687 ± 0.150% at Stakna. The respective (male and females) mean BCs in 2 tooth, 4 tooth, 6 tooth and full mouth were 0.684 ± 0.113% and 0.666 ± 0.112%, 0.608 ± 0.136% and 0.964 ± 0.130%, 0.777 ± 0.144% and 0.861 ± 0.113%, 0.516 ± 0.112% and 0.916 ± 0.133% respectively. No significant difference was observed between sexes at any level except for significantly (P≤0.05) higher values in full mouth females. The differences in the mean BC values between age groups within sexes were statistically non-significant except for significantly (P≤0.05) lower values in 2 tooth females at Sumdho (Table 25).

Table 25: Effect of age and sex on Basophil Count (%) of Changra goats reared in different areas of Ladakh (Mean ± SE)

Area	Kharnak		Sumdho		Chushul		Stakna		Overall	
Sex→ Age↓	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female
2 Tooth	0.375 ± 0.125[aA]	0.375 ± 0.182[aA]	1.142 ± 0.205[aA]	0.818 ± 0.169[aA]	0.800 ± 0.200[aA]	0.666 ± 0.210[aA]	0.000 ± 0.000[aA]	0.333 ± 0.333[aA]	0.684 ± 0.113[aA]	0.666 ± 0.112[aA]
4 Tooth	0.545 ± 0.157[aA]	0.500 ± 0.223[aA]	1.000 ± 0.447[aA]	1.285 ± 0.194[aB]	0.333 ± 0.333[aA]	0.666 ± 0.333[aA]	0.500 ± 0.288[aA]	0.800 ± 0.200[aA]	0.608 ± 0.136[aA]	0.964 ± 0.130[aA]
6 Tooth	0.500 ± 0.223[aA]	0.733 ± 0.118[aA]	0.846 ± 0.249[aA]	1.230 ± 0.230[aAB]	1.000 ± 0.000[aA]	0.666 ± 0.333[aA]	0.800 ± 0.374[aA]	0.400 ± 0.244[aA]	0.777 ± 0.144[aA]	0.861 ± 0.113[aA]
Full Mouth	0.230 ± 0.121[aA]	1.000 ± 0.000[aA]	0.777 ± 0.277[aA]	0.900 ± 0.276[aAB]	0.833 ± 0.166[aA]	0.666 ± 0.210[aA]	0.333 ± 0.333[aA]	1.333 ± 0.333[aA]	0.516 ± 0.112[aA]	0.916 ± 0.133[bA]
Overall	0.391 ± 0.072[a]	0.647 ± 0.083[a]	0.951 ± 0.130[a]	1.033 ± 0.105[a]	0.764 ± 0.106[a]	0.666 ± 0.114[a]	0.466 ± 0.165[a]	0.687 ± 0.150[a]	0.647 ± 0./.062[a]	0.834 ± 0.060[a]

Mean of different sexes within an age group and from a particular area (along rows) bearing common lowercase superscript, and between the age groups within a particular sex (along columns) bearing at least one common uppercase superscript, does not differ significantly

Discussion

The overall mean Hb, PCV, TEC, MCV, MCH, and MCHC values were similar to those reported by Pampori and co-workers (2010) [12]. The eryrhrocytic indices were suggestive of hypochromic microcytic anaemia. This may be attributed to nutritional deficiency especially iron and related micronutrients. The PCV and TEC values were on higher side when compared to reference ranges for goats. This could be due to adaption of the breed to high altitude hypoxic conditions. Further, these goats are living in an ambient temperature much below the thermoneutral zone for majority of goat breeds and differences in the haematological indices might reflect adaption to high stress conditions. The ambient temperature, temperature-humidity index and other climatic conditions are known to drastically affect the haematological parameters (Di Grigoli et al., 2009; Arfuso et al., 2016) [6, 2]. In present study higher values of Hb and PCV were observed in adults goats, whereas TEC values were higher in young. Breed and age have been considered critical for haematological evaluations in goats (Addass et al., 2010; Okonkwo et al., 2011; Piccione et al., 2014. Pampori et al. (2010) [1, 11, 12, 15] also reported higher TEC values in young Changthangi goats. However, variable results have been reported by various workers in goats. Somvanshi et al., (1987) [14] reported higher Hb, PCV and MCH values in young Indian Pashmina goats. Other studies in different goat breeds have also reflected higher Hb and TEC values in young (Addass et al., 2010; Weiss and Wardrop, 2010) [1, 17], however, no significant effect of age on erythrocytic indices in goats was reported by Tibbo et al. (2004) [14]. The observations of non-significant differences in erythrocytic indices with respect to sex are in congurance with reports in Indian Pashmina goats (Somvanshi et al., (1987) and other goats (Daramola et al., 2005; Bhat et al., 2014) [7, 3]. Contrary to this, Tibbo et al. (2004) observed significantly higher RBC and PCV were in female and MCH in males goats.

The age wise comparison of the leukocytic indices revealed a variable trend in different areas. No significant age related difference in eosinophil, basophil and monocytes were observed by Daramola et al. (2005) [7] and Pampori et al. (2010) [12]. Contrary to this, lower values of TLC and per cent neutrophil and higher per cent lymphocytes in adults when compared with young goats have been reported (Mbassa and Poulsen, 1993; Pampori et al., 2010) [10, 12]. Swanson et al. (2004) reported no age related significant difference in TLC of young and adult dogs. Sex did not reveal any significant

effect on the leukocytic indices. Contrary to this Tibbo *et al.* (2004) [15] reported significantly higher TLC, and per cent lymphocytes and eosinophils, and significantly lower neutrophils in females than in males. Dramola *et al.* (2005) also reported revealed higher lymphocyte counts in male compared to female goats.

Baseline data with respect to haematological indices were established in Changra goats. The discrepancy in reports of haematological parameters vis-à-vis effects of different breeds, sex, age, and area buttress the requirement for area tailored profiling for the given breeds. The interaction between the multiple factors, known and unknown, seem to play a critical role in determining the health parameters. Area seemed to have significant effect on these parameters warranting area specific profiling vis-à-vis physiological status, and their correlation with demographic factors including mineral profile of the soil, nutrient status of the pastures, health, etc. A generalized observation of hypochromic erythrocytes in a breed native to an area with hypobaric and hypoxic condition, suggest a probable high oxygen carrying capacity of the haemoglobin or some specific biological adaptation. However, it warrants descephering of nature of the haemoglobin and other physiological processes in the breed.

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