# BLOOD PARAMETERS OF YOUNG GOATS IN SEMI-ARID REGION OF THE NORTHEAST OF BRAZIL[1]

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ABSTRACT - Red and white blood characteristics were studied at three, six, nine and twelve months of age of goats of both the sexes belonging to Anglo-Nubian grade, Bhuj, Canindé, Moxotó and SRD (Sem Raça Definida) breeds in the Northeast of Brazil. Highly significant breed differences were observed but no sex differences were encountered.

Index terms: hematology, significant breed differences.

## PARÂMETROS SANGÜÍNEOS EM CAPRINOS JOVENS DA REGIÃO SEMI-ÁRIDA DO NORDESTE DO BRASIL

RESUMO - Foram estudados os parâmetros sangüíneos das séries eritrocitária e branca, de ambos os sexos, aos três, seis, nove e doze meses de idade, pertencentes às raças mestiças Anglo-Nubiana, Bhuj, Canindé e Moxotó, bem como de animais SRD (Sem Raça Definida) no Nordeste do Brasil. Da análise dos dados obtidos resultou uma diferença significante entre as raças, porém nenhuma diferença quanto ao sexo.

Termos para indexação: hematologia, diferenças significativas entre raças.

## INTRODUCTION

A sound knowledege of blood parameters is necessary in clinical diagnosis. In the recent years, much attention has been paid to selection of animals based on certain blood parameters, like hemoglobin (Lindström 1982) and number of red blood cells may be related to the adaptability of animals in adverse climatic conditions (Sarkar et al. 1978).

There is scarcity of literature on blood characteristics of goats in general, and in Brazil in particular. Although Birgel (1973) in more systematic studies has presented some information, but this information pertains more to imported European breeds in the Central-East region of Brazil. In the Northeast of Brazil exist almost all goats of the country (93 percent), and a majority of these goats are called native as these are well adapted to local conditions of climate and management. Very scanty information on their blood characteristics is available (Matos et al. 1982). This study was undertaken with a view to analyse data on blood characteristics of several breeds in greater detail, the breeds being the ones maintained and bred in the region over several years.

## MATERIALS AND METHODS

For the determination of blood parameters, a total of 80 goats, 42 males and 38 females, were utilized, and blood collections were made at three, six, nine and twelve months of age. The initial number of goats suffered a reduction during this period but no substitution was made. The work was carried out in the semi-arid region of Ceará state in the Northeast of Brazil. The mean annual temperature was 34.7°C and annual precipitation 691.5 mm. The initial distribution of animals in breeds was as follows: Anglo-Nubian (AN) grades, 16; Bhuj (Bj), 16; Canindé (CA), 12; Moxotó (MO), 18; SRD (Sem Raça Definida, undefined breed), 12. At three months of age, the kids were mantained on a mixed feed offered in the corrals, in addition to mother's milk and pastures. The kids were weaned at 112 days of age and thereafter all goats were maintained on native caatinga pastures only. During the daytime, animals remained in the pasture area and in the evening they were brought to the corrals where they had *ad libitum* access to water. The housing was small and crowded and hence offered very little hygiene and protection.

The blood was obtained through jugular vein by vacutainer system, with EDTA, and a 25 x 12 needls, always in the morning before animals had any chance of feeding.

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At each blood collection, every animal was examined for any visible symptoms of disease. In addition, faeces were collected for EPG (eggs/g) examination to evaluate intestinal worm infestation, and 400 to 1000 eggs/gramme of faeces was considered a normal basal worm load for this type of habitat and management.

The blood samples after homogenization in Kahn's agitator were examined for the following blood parameters:

Hematocrit (PCV), micro-hematocrit method (Lamberg & Rothstein 1981).

Hemoglobin (Hb), cyanmethemoglobin method, where readings were taken on spectrophotometer (Coleman Junior II, mod. 6/20), using green filters, 540 millimicrons (Lamberg & Rothstein 1981).

Red blood cell number (RBC), using the red cell pipette, the Gower's solution and the Neubauer counting chamber (Birgel 1979).

White blood cell number (WBC), using the white cell pipette, the Thoma's solution and the Neubauer counting chamber (Birgel 1979).

Mean corpuscular values (MCV), mean corpuscular hemoglobin (MCH) and mean corpuscular hemoglobin concentration (MCHC) were calculated from the red cell count and, hemoglobin and hematocrit values (Lamberg & Rothstein 1981).

Differential white blood cell count was determined by counting 100 cells per slids on blood smears made of fresh blood and stained with Rosenfeld's stain (Birgel 1979), for the following: lymphocytes (Ly), neutrophils (Ne), eosinophils (Eo), basophils (Ba), monocytes (Mo), and stab cells (immature neutrophils).

## RESULTS

The mean blood characteristics are presented in Tables 1 to 4 and Fig. 1 and 2. Means are presented separately for each breed and also for males and females over breeds. Significant differences between breeds in their blood characteristics were found and hence mean comparison have been presented. However, no mean comparisons were made for ages.

The maximum number of RBC was found in MO breed at three months of age. In subsequent collections, the number was more or less similar in MO, SRD, AN grades, and Bj, and significantly lower in CA. Hb was also maximum in MO breed at three months, but at six months both SRD and MO had maximum values. At nine months, all breeds had similar values with no significant differences between them. At twelve months, only CA had lower values than the other four breeds. The maximum PCV value was encountered in SRD and MO breeds at three and six months of age, but at nine and twelve months the values were higher only in MO breed.

Breed differences also existed in the mean corpuscular values (VCM, MCH, MCHC). The first two (VCM and MCH) were higher in SRD at three months of age, in CA at six and nine months of age, and at twelve months there were no significant breed differences in these two characteristics. The MCHC was higher in AN grades, MO and SRD at three months of age. At six months, this index was higher in CA and SRD, at nine months in Bj, and at twelve months in AN grades.

The mean total number of WBC also showed significant difference between breeds but not between sexes. At all ages, the MO and SRD presented highest values. In the differential count of WBC, numbers of Ly predominated at three and six months of age, but thereafter the number of Ne was maximum. Largest percentage of Ly was observed in MO breed at three, nine, twelve months of age; at six months the breed differences were not significant.

During the whole period of experiment, twelve animals died as follows: Bj, six; AN grades, two; SRD, two; MO and CA, one each. A large number (eight) of these animals died between three and six months of age, which corresponded to the leanest dry period of the region. The main causes of death were malnutrition and secondary causes such as bronchopneumonia and heavy worm infestation; the latter was diagnosed by parasitological egg examination in the faeces (more than 1000 eggs per gram of faeces).

## DISCUSSION AND CONCLUSION

In these hematological studies, comparison was made only of breeds and sexes. Age effects were not analysed. Age variation is known to occur in blood parameters (Holman & Dew 1965, Edjtehadi 1978). Migliano (1967) reported differences between young and adult goats, and Boss & Wanner (1977) and Edjtehadi (1978) encountered differences between recently-born and young (three and six - months old) kids. In this experiment, the

different ages were reached in different months and seasons and hence such age differences, if calculated, may have been due to any of the following factors: age itself, nutritional factors, direct seasonal effects, health of the animals. Hence, age effects were not calculated as the principal objective was to obtain typical values of blood parameters of different breeds maintained under traditional system of management in northeast Brazil.

The breed differences in the values of blood parameters, at three, six and nine months of age were highly significant ($P < 0.01$), which is contrary to observations of Amakiri (1981) in adult animals.

In the number of RBC, after six months of age, a certain stability occurred; the differences between the four breeds, namely, MO, SRD, AN grades and Bj, were not significant and their mean values were higher than those of CA.

The values in Hb behaved in a different manner in their variation between three and six months of age, being more in SRD and MO breeds, and for these after nine months there did not exist any significant breed difference. At twelve months, the values were lower only in CA breed.

Such large differences between breeds made it difficult to obtain a common value in this experiment for comparison with values reported elsewhere on goats. Still, if general means are calcu-

**TABLE 1. Mean blood values of goats at three months.**

| Blood parameters | Breed | | | | | Sex | |
|---|---|---|---|---|---|---|---|
| | AN grade | Bj | MO | CA | SRD | Male | Female |
| | (16) | (16) | (18) | (12) | (18) | (42) | (38) |
| PCV (%) | $24.95^{b}$ | $21.40^{a}$ | $30.50^{c}$ | $24.86^{b}$ | $28.72^{c}$ | 25.90 | 26.27 |
| | (1.05) | (1.05) | (0.99) | (1.22) | (0.98) | (0.65) | (0.69) |
| RBC x $10^6$/mm$^3$ | $13.92^{b}$ | $11.88^{a}$ | $16.80^{c}$ | $12.21^{ab}$ | $13.55^{ab}$ | 13.98 | 13.37 |
| | (0.79) | (0.79) | (0.74) | (0.91) | (0.73) | (0.49) | (0.52) |
| Hb g/100 ml | $8.41^{bc}$ | $6.48^{a}$ | $9.88^{d}$ | $8.09^{b}$ | $9.25^{cd}$ | 8.31 | 8.54 |
| | (0.42) | (0.42) | (0.40) | (0.49) | (0.39) | (0.26) | (0.28) |
| MCV $\mu^3$ | $18.30^{a}$ | $18.68^{a}$ | $18.33^{a}$ | $20.93^{ab}$ | $22.53^{b}$ | 19.17 | 20.33 |
| | (1.08) | (1.08) | (1.02) | (1.26) | (1.01) | (0.67) | (0.71) |
| MCH pg | $6.12^{ab}$ | $5.49^{a}$ | $5.95^{ab}$ | $6.77^{bc}$ | $7.29^{c}$ | 6.09 | 6.55 |
| | (0.36) | (0.36) | (0.34) | (0.42) | (0.33) | (0.22) | (0.24) |
| MCHC g/dl | $33.59^{b}$ | $29.77^{a}$ | $32.41^{b}$ | $32.45^{b}$ | $32.24^{b}$ | 31.90 | 32.28 |
| | (0.82) | (0.82) | (0.77) | (0.95) | (0.77) | (0.51) | (0.54) |
| Total WBC/mm$^3$ | $12.213^{ab}$ | $11.039^{a}$ | $15.831^{c}$ | $11.251^{ab}$ | $14.053^{bc}$ | 13.734 | 12.020 |
| | (1.173) | (1.173) | (1.104) | (1.363) | (1.097) | (726) | (773) |
| Ne (%) | $32.38^{a}$ | $35.16^{a}$ | $29.45^{a}$ | $30.36^{a}$ | $34.61^{a}$ | 32.46 | 32.32 |
| | (2.96) | (2.96) | (2.79) | (3.44) | (2.77) | (1.83) | (1.95) |
| Ly (%) | $64.74^{ab}$ | $59.11^{a}$ | $68.70^{b}$ | $66.10^{ab}$ | $63.78^{ab}$ | 62.85 | 66.12 |
| | (3.41) | (3.41) | (3.21) | (3.96) | (3.19) | (2.11) | (2.25) |
| Stab cell (%) | 0.11 | 0.45 | 0.24 | 0.60 | 0.28 | 0.40 | 0.27 |
| | (0.19) | (0.19) | (0.18) | (0.22) | (0.18) | (0.12) | (0.12) |
| Eo (%) | 1.71 | 1.27 | 0.92 | 2.08 | 1.28 | 1.76 | 1.14 |
| | (0.45) | (0.45) | (0.42) | (0.52) | (0.42) | (0.28) | (0.29) |
| Mo (%) | 0.87 | 0.72 | 0.74 | 0.78 | 0.78 | 0.93 | 0.62 |
| | (0.22) | (0.22) | (0.21) | (0.26) | (0.21) | (0.14) | (0.14) |
| Ba (%) | 0.07 | 0 | 0.10 | 0.14 | 0.11 | 0.14 | 0.03 |
| | (0.09) | (0.09) | (0.09) | (0.11) | (0.09) | (0.06) | (0.06) |

Mean comparisons were made within rows.
Mean differences are exposed by superscripted letters; the significance was considered at $P < 0,0705$.

**TABLE 2. Mean blood values of goats at six months.**

| Blood parameters | Breed | | | | | Sex | |
|---|---|---|---|---|---|---|---|
| | AN grade | Bj | MO | CA | SRD | Male | Female |
| | (16) | (12) | (17) | (11) | (16) | (38) | (34) |
| PCV (%) | 22.77$^{b}$ | 23.76$^{bc}$ | 25.10$^{c}$ | 19.98$^{a}$ | 24.85$^{c}$ | 22.95 | 23.63 |
| | (0.74) | (0.87) | (0.73) | (0.90) | (0.76) | (0.51) | (0.50) |
| RBC x $10^6$/mm$^3$ | 14.53$^{b}$ | 14.66$^{b}$ | 14.36$^{b}$ | 11.27$^{a}$ | 14.02$^{b}$ | 13.62 | 13.91 |
| | (0.63) | (0.73) | (0.61) | (0.75) | (0.64) | (0.43) | (0.43) |
| Hb g/100 ml | 6.72$^{ab}$ | 6.81$^{ab}$ | 7.25$^{bc}$ | 6.38$^{a}$ | 7.85$^{c}$ | 6.77 | 7.23 |
| | (0.28) | (0.32) | (0.27) | (0.34) | (0.29) | (1.19) | (0.19) |
| MCV $\mu^3$ | 15.85$^{a}$ | 16.25$^{ab}$ | 17.79$^{bc}$ | 18.66$^{c}$ | 17.92$^{bc}$ | 17.43 | 17.17 |
| | (0.61) | (0.71) | (0.60) | (0.73) | (0.62) | (0.42) | (0.41) |
| MCH pg | 4.67$^{a}$ | 4.77$^{a}$ | 5.13$^{ab}$ | 5.93$^{c}$ | 5.70$^{bc}$ | 5.23 | 5.24 |
| | (0.23) | (0.27) | (0.23) | (0.28) | (0.24) | (0.16) | (0.16) |
| MCHC g/dl | 29.54$^{a}$ | 29.48$^{a}$ | 28.86$^{a}$ | 31.77$^{b}$ | 31.54$^{b}$ | 29.90 | 30.57 |
| | (0.58) | (0.70) | (0.57) | (0.70) | (0.60) | (0.40) | (0.40) |
| Total WBC/mm$^3$ | 8.742$^{a}$ | 7.197$^{a}$ | 11.212$^{c}$ | 8.964$^{ab}$ | 10.480$^{bc}$ | 9.119 | 9.519 |
| | (724) | (841) | (708) | (870) | (742) | (496) | (490) |
| Ne (%) | 38.06$^{a}$ | 44.08$^{a}$ | 36.73$^{a}$ | 43.58$^{a}$ | 41.65$^{a}$ | 42.08 | 39.56 |
| | (2.99) | (3.47) | (2.92) | (3.59) | (3.06) | (2.05) | (2.03) |
| Ly (%) | 59.63$^{a}$ | 53.20$^{a}$ | 61.92$^{a}$ | 54.83$^{a}$ | 57.18$^{a}$ | 55.36 | 58.95 |
| | (3.00) | (3.49) | (2.93) | (3.61) | (3.08) | (2.06) | (2.03) |
| Stab cell (%) | 0.24 | 0 | 0.15 | 0.45 | 0.08 | 0.26 | 0.11 |
| | (0.09) | (0.11) | (0.09) | (0.11) | (0.09) | (0.06) | (0.06) |
| Eo (%) | 0.87 | 1.16 | 0.63 | 0.67 | 0.65 | 1.00 | 0.59 |
| | (0.32) | (0.38) | (0.32) | (0.39) | (0.33) | (0.22) | (0.22) |
| Mo (%) | 0.99 | 1.41 | 1.08 | 1.03 | 1.12 | 1.05 | 1.20 |
| | (0.32) | (0.37) | (0.31) | (0.38) | (0.32) | (0.23) | (0.21) |
| Ba (%) | 0.20 | 0.14 | 0.05 | 0.33 | 0.32 | 0.24 | 0.17 |
| | (0.12) | (0.14) | (0.12) | (0.15) | (0.13) | (0.09) | (0.08) |

Mean comparisons were made within rows.
Mean differences are exposed by superscripted letters; the significance was considered at $P < 0,0559$

lated over breeds and ages, these fall within the ranges obtained by Greenwood (1977) where the extreme values may pertain to animals in diverse physiological conditions. Determination of blood parameters in young animals have been made by Birgel (1973), Edjtehadi (1978) and Oduye (1976) an of these values, only PCV, RBC and Hb were close to MO and SRD breeds in the present study. In other three breeds, the remaining parameters were not only lower to MO and SRD but also close to the lower limits reported by Greenwood (1977). In any case, a correlation between these three blood characteristics, as observed by Swenson (1977), is possible in such a way that animals with high PCV also have higher number of RBC and higer Hb content.

In the data presented here, there was no constant trend in breed variations so that one particular breed did not present maximum values at all ages. After six months of age, when blood values approached adult levels, there was no apparent difference between breeds in number of RBC and Hb content with the exception of CA breed. At twelve months, when animals practically reached the blood parameter values of adult animals, only CA presented lower RBC (13.36 x $10^6$) and Hb content (8.07 g/100 ml). The marked breed differences were observed only at three months of

age. Considering that at three months of age the blood undergoes physiological transformation from neonatal to young phase (Boss & Wanner 1977), transformation that continues upto six months of age, the variation observed in the red blood cell series permits to conclude that the MO breed, closely followed by SRD, gave the best response to local environmental conditions, thus being most adaptable. The values of RBC (16.8 and 13.55 x $10^6$) and Hb (9.88 and 9.25 g/100 ml) were also higher in these two breeds.

Among all ruminant species, the quantity of RBC is highest among goats perhaps because of their adaptability to climatic regions of constantly low atmospheric pressures. To overcome the difficulty of oxygen transport, a function of RBC through Hb, the number of RBC increased which also permitted a reduction of MCV which is related to oxygenation at the level of lungs (Breazile 1971). This characteristic of goats demonstrates its versatility and advantage over other species, the advantage that perhaps exists in goats of vaious genotypes. The capacity of synthesising a large quantity of blood cells and Hb, even under the limitations of nutritional stress, makes this species a more adapted one among domestic livestock (Swenson 1977). The fact that the breeds studied here, which were maintained under adverse conditions of nutritional management, did not suffer any diminution in their RBC or Hb content, shows

**TABLE 3. Mean blood values of goats at nine months.**

| Blood parameters | Breed | | | | | Sex | |
|---|---|---|---|---|---|---|---|
| | AN grade | Bj | MO | CA | SRD | Male | Female |
| | (16) | (12) | (17) | (11) | (16) | (38) | (34) |
| PCV (%) | 22.90[a] | 24.03[ab] | 25.10[b] | 21.58[a] | 23.44[ab] | 21.35 | 25.47 |
| | (0.82) | (0.96) | (0.78) | (0.96) | (0.79) | (0.54) | (0.56) |
| RBC x $10^6$/mm$^3$ | 11.57[b] | 13.37[b] | 13.03[b] | 9,59[a] | 12.66[b] | 11.07 | 13.01 |
| | (0.70) | (0.81) | (0.66) | (0.81) | (0.67) | (0.45) | (0.47) |
| Hb g/100 ml | 7.63[a] | 7.76[a] | 8.44[a] | 7.51[a] | 8.02[a] | 7.28 | 8.47 |
| | (0.36) | (0.42) | (0.34) | (0.42) | (0.35) | (0.23) | (0.24) |
| MCV $\mu^3$ | 19.97[a] | 17.69[a] | 20.34[a] | 23.90[b] | 18.97[a] | 20.20 | 20.16 |
| | (1.09) | (1.28) | (1.04) | (1.28) | (1.05) | (0.71) | (0,74) |
| MCH pg | 6.67[a] | 6.32[a] | 6.84[a] | 8.27[b] | 6.47[a] | 6.94 | 6.89 |
| | (0.35) | (0.41) | (0.33) | (0.41) | (0.33) | (0.23) | (0.24) |
| MCHC g/dl | 33.54[a] | 34.71[a] | 33.59[a] | 34.82[a] | 34.16[a] | 34.16 | 34.17 |
| | (0.45) | (0.52) | (0.42) | (0.52) | (0.43) | (0.29) | (0.30) |
| Total WBC/mm$^3$ | 8.720[a] | 7.651[a] | 12.035[b] | 8.358[a] | 10.822[ab] | 8.862 | 11.173 |
| | (835) | (977) | (795) | (977) | (807) | (546) | (569) |
| Ne (%) | 48.75[a] | 53.95[ab] | 48.46[a] | 58.52[b] | 53.94[ab] | 51.34 | 54.11 |
| | (2.75) | (3.22) | (2.62) | (3.22) | (2.66) | (1.80) | (1.88) |
| Ly (%) | 49.90[b] | 44.38[ab] | 48.04[b] | 39.42[a] | 43.44[ab] | 46.57 | 43.50 |
| | (2.52) | (2.95) | (2.40) | (2.95) | (2.44) | (1.65) | (1.72) |
| Stab cell (%) | 0 | 0.17 | 0 | 0.18 | 0.12 | 0.08 | 0.11 |
| | (0.10) | (0.11) | (0.09) | (0.11) | (0.09) | (0.06) | (0.07) |
| Eo (%) | 2.12 | 0.27 | 1.68 | 0.38 | 1.12 | 0.82 | 1.40 |
| | (0.48) | (0.56) | (0.45) | (0.56) | (0.46) | (0.31) | (0.32) |
| Mo (%) | 0.95 | 1.05 | 1.53 | 0.83 | 1.12 | 0.82 | 1.38 |
| | (0.28) | (0.32) | (0.26) | (0.32) | (0.27) | (0.18) | (0.19) |
| Ba (%) | 0.40 | 0.27 | 0.29 | 0.77 | 0.25 | 0.44 | 0.35 |
| | (0.16) | (0.19) | (0.15) | (0.19) | (0.16) | (0.10) | (0.11) |

Mean comparisons were made within rows.
Mean differences are exposed by superscripted letters; the significance was considered at $P < 0,0698$

**TABELA. 4. Mean blood values of goats at twelve months.**

| Blood parameters | Breed | | | | | Sex | |
|---|---|---|---|---|---|---|---|
| | AN grade | Bj | MO | CA | SRD | Male | Female |
| | (14) | (10) | (17) | (11) | (16) | (35) | (33) |
| PCV (%) | 27.28[b] | 27.42[b] | 29.38[c] | 24.82[a] | 27.87[b] | 27.58 | 27.13 |
| | (0.51) | (0.62) | (0.47) | (0.58) | (0.48) | (0.34) | (0.34) |
| RBC x $10^6$/mm$^3$ | 15.28[b] | 14.84[b] | 15.83[b] | 13.36[a] | 14.95[b] | 15.03 | 14.68 |
| | (0.41) | (0.50) | (0.38) | (0.47) | (0.39) | (0.27) | (0.27) |
| Hb g/100 ml | 9.15[b] | 9.09[b] | 9.34[b] | 8.07[a] | 9.27[b] | 9.10 | 8.87 |
| | (0.21) | (0.25) | (0.19) | (0.24) | (0.20) | (0.14) | (0.14) |
| MCV $\mu^3$ | 18.09[a] | 17.29[a] | 18.64[a] | 18.68[a] | 18.68[a] | 18.47 | 18.08 |
| | (0.69) | (0.83) | (0.64) | (0.78) | (0.64) | (0.46) | (0.45) |
| MCH pg | 6.02[a] | 6.15[a] | 5.89[a] | 6.04[a] | 6.19[a] | 6.06 | 6.06 |
| | (0.71) | (0.20) | (0.15) | (0.19) | (0.16) | (0.11) | (0.11) |
| MCHC g/dl | 33.51[b] | 33.14[b] | 31.73[a] | 32.53[ab] | 33.16[b] | 32.97 | 32.66 |
| | (0.46) | (0.55) | (0.42) | (0.52) | (0.43) | (0.30) | (0.30) |
| Total WBC/mm$^3$ | 10.528[ab] | 10.054[ab] | 12.423[b] | 9.093[a] | 11.750[ab] | 12.090 | 9.449 |
| | (1.076) | (1.299) | (992) | (1.218) | (1.006) | (713) | (710) |
| Ne (%) | 54.78[b] | 53.87[ab] | 46.34[a] | 53.62[ab] | 53.19[ab] | 54.78 | 49.94 |
| | (2,98) | (3.60) | (2.75) | (3.38) | (2.79) | (1.97) | (1.97) |
| Ly (%) | 43.28[a] | 43.79[a] | 52.00[b] | 43.95[a] | 43.62[a] | 43.02 | 47.64 |
| | (2.87) | (3.46) | (2.65) | (3.25) | (2.68) | (1.90) | (1.89) |
| Stab cell (%) | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) | (0.00) |
| Eo (%) | 1.28 | 0.83 | 1.57 | 1.90 | 1.37 | 1.33 | 1.46 |
| | (0.43) | (0.52) | (0.40) | (0.49) | (0.41) | (0.29) | (0.29) |
| Mo (%) | 0.57 | 1.17 | 0.51 | 0.10 | 1.00 | 0.58 | 0.76 |
| | (0.21) | (0.26) | (0.19) | (0.24) | (0.20) | (0.14) | (0.14) |
| Ba (%) | 0.07 | 0.33 | 0.31 | 0.43 | 0.31 | 0.32 | 0.26 |
| | (0.16) | (0.20) | (0.15) | (0.18) | (0.15) | (0.11) | (0.11) |

Mean comparisons were made within rows.
Mean differences are exposed by superscripted letters; the significance was considered at $P < 0,05$.

that the breeds are, in general, well adapted to local conditions (Swenson 1977).

If mortality of these goats during perinatal period is also considered as an aspect related to adaptability, it was observed that the large number of animals that died belonged to Bj breed which had comparatively lower values of RBC and Hb. In the near adult phase growth at twelve months, when there were no more significant breed differences in blood values of MO, SRD, AN grades and Bj, the first two breeds continued to have marginally higher values of RBC series, demonstrating that these breeds had some advantage. This permits one to conclude that MO and SRD are more adapted breeds in the local climatic conditions when young as well as when adult.

With regard to the WBC, the analysis of numbers of WBC gave, in general, lower values than have been reported in literature pertaining to tropical regions (Oduye 1976, Edjtehadi 1978). These values are only comparable to those of Boss & Wanner (1977) in Saanen breed. In the first three collections, pertaining to three, six and nine months of age, the Ly were most predominant in the differential count. At twelve months, it was Ne that predominated. Similar observations have been recorded by Holman & Dew (1965) and Boss & Wanner (1977).

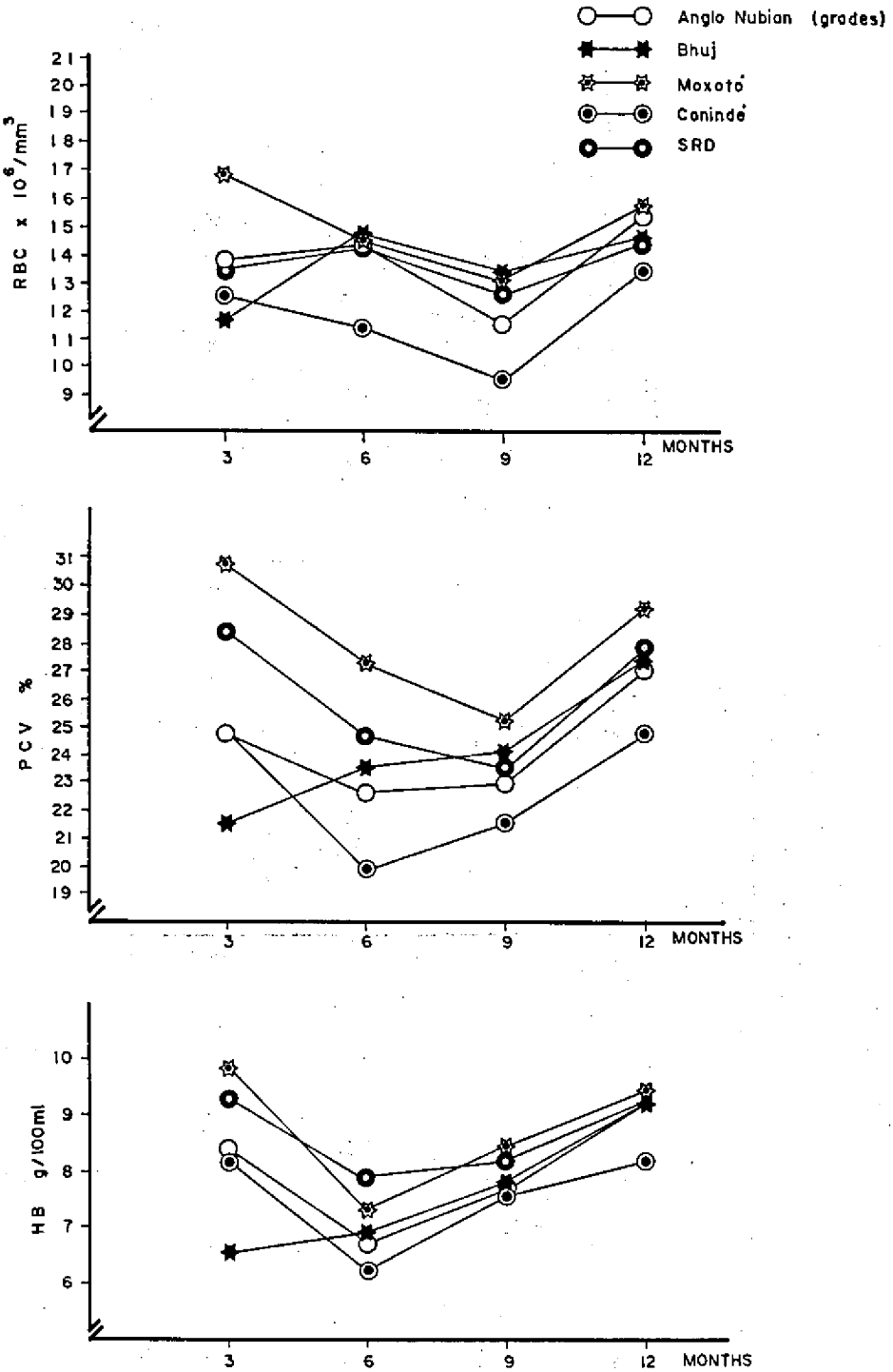


FIG. 1. Erytrocyte number, packed cell volume and hemoglobin of goats of several breeds according to ages and sex.

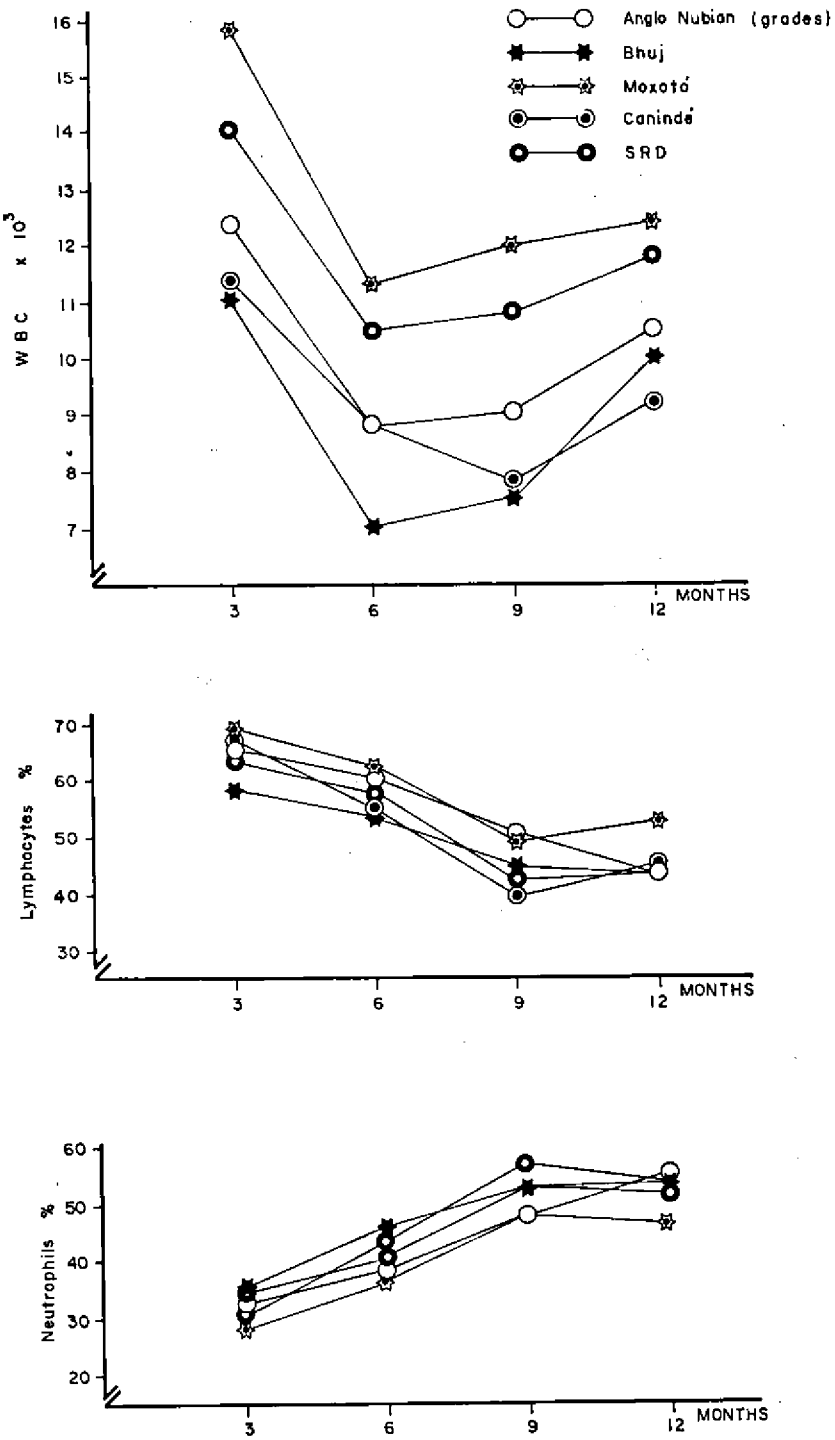


FIG. 2. WBC, lymphocyte and neutrophil numbers of goats of several breeds according to ages and sex.

In all the ages studied, significant ($P < 0.01$) between breed differences were observed in the number of WBC, being higher in MO than in other breeds. This increased number was mainly due to a higher number of Ly in the blood. Any conclusion from the study of the behaviour of WBC must take into account its properties and functions, especialy those related to the capacity of Ly to produce antibodies as their extract contains gamma-globulin (Swenson 1977). The same animals that had higher RBC series values, also had higher counts of Ly is the WBC series, and this increased number of Ly may mean increased production of antibodies and thereby better body defense against infections. This observation further strengthens the conclusion that the better adaptability of MO and SRD breeds may also be, at least in part, due to better body defense mechanism.

The absence of any sex effects in any blood values support the observations of Oduye (1976).

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