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Influence of Age and Gender on Haematological Parameters of Apparently Healthy Barbary Sheep in Aljabal Alakhdar, Libya

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Abstract: ***Objective: To report and assess the effect of age and gender on the haematological parameters of Barbary Sheep from the southern region of Aljabal Alakhdar in Libya. Methods: Blood samples were collected from forty nine apparently healthy Barbary sheep consisting of sixteen adult females, aged between 1.5 to 4 years, and thirty three young sheep, less than 12 months (17 males and 16 females). Packed cell volume (PCV), white blood Cell (WBC) count, red blood cell (RBC) count, haemoglobin (Hb) concentration, mean corpuscular volume (MCV), mean corpuscular haemoglobin (MCH), mean corpuscular haemoglobin concentration (MCHC), differential white blood cells, and platelets counts were determined. The studied parameters were compared between males and females and between young and adult sheep. Results: The PCV values were highly influenced (P=0.001) by both sex and age. Sex highly influenced (P<0.01) the MCV, and MCHC values. There were significantly (P<0.05) higher WBC, MCV, and MCH in adult females than the young ones. MCHC was not influenced by age (P>0.05). WBC, RBC, Hb, and MCH values were not significantly influenced (P>0.05) by sex. The percentage of lymphocytes was higher in male Barbary sheep, while that for granulocytes was higher in female sheep, but the difference was not statistically significant. Age significantly influenced (P<0.05) the lymphocytes values of Barbary Sheep. Age and sex did not influence (P>0.05) the monocytes values. Age greatly influenced (P=0.001) RBC, and Hb values of sheep. Age and sex had no significantly influence (P>0.05) on Platelets counts in Barbary sheep. Conclusions: It can be concluded from the present study that there were significant differences in some of the hematological values between male and female and between young and adult Barbary sheep. The haematological values reported in this study could serve as a baseline information for comparison in conditions of nutrient deficiency, physiological and health status of Barbary sheep in northeastern Libya.***

Keywords: Blood parameters, Barbary Sheep, age, gender.

1. Introduction

Small ruminant animals are economically important livestock play an important socioeconomic role for small and large farmers In Libya [1].Sheep production in Libya plays a major role both as income to farmers and as an important source of meat which come first before cattle meat [2].Libya hosts about 4.500.000 heads of sheep, and About 95% of sheep belong to the fat-tailed, coarse-wooled Barbary breed, which characterized by multi-coloured, large framed with pendulous fat-tail [3], [4].Natural grasses, cereal straws, crop residues, and stubbles are the main sources of roughage for small ruminant animals in Libya. In general, the feeding calendar and the practice applied to almost 100% of small ruminant animals is to graze the annual pasture during the spring and autumn. Sheep owners are always keeping grains and cereal stubbles for season's shortage in native pasture, barley grain and wheat bran are the most common feed supplements used for feeding sheep when shortage in grazing pasture, especially in the drought seasons [1].Blood is an important index of physiological and pathological changes in an organism [5]. The primary function of the blood is to transport oxygen from respiratory organs to body cells, distributing nutrients and enzymes to cells and carrying away waste products, thereby maintaining homeostasis of the internal environment. The various functions of the blood are carried out by the collective actions of its constituents, the haemotological and biochemical components [6], [7]. Haematological tests have been widely used for the diagnosis of various diseases and nutritional status of animal [8]. The significance of determining haematological indices of domestic animals has been well documented [9]. In addition to their role in providing insight into the health status of animal, some of blood parameters have been reported to be related to some clinical traits. For example, [10] suggested that carriers of haemoglobin type A have demonstrated resistance against helminth infection and this could be due to the better functional properties such as higher haemoglobin concentration and packed cell volume. haematological measurements may vary depending on factors such as sex, age, altitude, weather, stress, season, and physical exercise [11]. There is a dearth of literature on the heamatological values of the Barbary sheep in Libya. This study was therefore an attempt to come up with normal haematological reference values in indigenous Barbary sheep breed found in the north eastern of Libya raised under free ranged system as influenced by sex and age.

2. Materials and Methods

The study was conducted in Omer Al Mukhtar district, AlJabal Al Akhdar (green mountain), northeastern of Libya, in the spring season. Forty nine Barbary sheep comprising of 17 males and 16 females (aged from 5 to 12 months), and 16 females (aged from 1.5 to 4 years) were randomly selected from 70 sheep reared in the area. The sheep grazed mostly on natural pasture with supplementation of barley grain once a day.

3 ml of blood was collected from each animal from the external jugular vein following proper restraint by the owners and with minimal excitement**.** The blood was collected in ethylene diaminetetracetate (EDTA) vacutainer

tubes and transported to the laboratory for analysis. The samples were analyzed within two hours from sampling**.** The red blood cell (RBC), white blood cell (WBC), packed cell volume (PCV), haemoglobin concentration (Hb), differential leucocyte counts, mean corpuscular volume (MCV), mean corpuscular haemoglobin (MCH), and mean corpuscular haemoglbin concentration (MCHC), and platelets count were measured by automatic analyzer (Nihon Kohden, MEK 6410 K, Japan).

The data obtained was expressed as mean and standard deviation (mean ±SD) and statistically analyzed using Student's t-test. SPSS version 21 was used. P values less than or equal to 0.05 were considered significant.

3. Results

3.1 Effect of gender on haematological parameters

Total WBC count was slightly higher in male Barbary sheep than female but the difference was not statistically significant (P>0.05). RBC, Hb, and MCH values were comparable in female and male Barbary sheep (P>0.05). PCV and MCV values were significantly higher in female compared to male (P<0.01). The difference between female and male Barbary sheep in MCHC was highly significant with male having values higher than female (P=0.001). sex had no significant influence on the PLT values of Barbary sheep. These values were higher in female than male. Lymphocytes count was higher in male Barbary sheep than female, while the count for granulocytes was higher in female than male, but the differences were not statistically significant. Monocytes count compared well between male and female of Barbary sheep (P>0.05). **Table 1**

Table 1: Means (±SD) for haematological values in male and female Barbary sheep

parameters	Male (n=17)		Female (n=16)	
	Mean ± SD	Range	Mean ± SD	Range
WBC (X10^3/µl)	9.1±3.8	3.1–17.7	8.9±3.3	3.9–14.9
RBCs (X 10^6/µl)	11.8±0.8	10.6–13.4	12.1±0.8	10.1–13.3
Hb(g/dl)	10±0.9	8–11.5	10.3±0.9	8.5–12.3
PCV (%)	29.9±2.7	24.3–33.3	33±2.3	28.1–36.4
MCV (fl)	25.4±2	22.2–29.9	27.4±1.7	24.9–31.6
MCH (pg)	8.5±0.6	7.3–9.9	8.5±0.5	7.4–9.4
MCHC (g/dl)	33.5±1.7	29.3–36.3	31.3±1.6	28.9–34.3
Platelets (X 10^3/µl)	193.4±57.7	109–305	206.4±105.8	102-461
Lymphocytes (%)	45.9±19.7	19.3–73.3	34.5±13.6	13.9–73.9
Monocytes (%)	5.5±2.8	2.4–10	5.9±2.3	2.4–9.2
Granulocytes (%)	38.9±17.2	22.5–64.8	43.9±15.8	18.3–77.3

3.2 Effect of age on haamatological parameters

RBC, Hb, and PCV values highly significantly (P=0.001) varied between adult and young female Barbary sheep with young having higher values than adult sheep. WBC, MCV, and MCH values were significantly higher in adult sheep compared to young sheep (P<0.05). MCHC compared well between young and adult sheep (P>0.05).

Platelets count was higher in young than adult sheep but the difference did not reach the statistical significance (P>0.05).

Comparison of leukocytes count revealed no significant difference between young and adult sheep in monocytes and granulocytes values, however lymphocytes were significantly higher in adult female (P<0.05). Monocytes varied slightly between young and adult female sheep but the difference did not reach the statistical significance. **Table 2**

Table 2: Effect of age on blood parameters of Barbary sheep

parameters	Up 12 months (n=16)		More than 12 months (n=16)	
	Mean ± SD	Range	Mean ± SD	Range
WBC (x 10^3/µl)	8.9±3.3	3.9–14.9	11.7±2.4	8.2–16.7
RBC (x 10^6/µl)	12.1±0.8	10.1–13.3	9±2	4.7–14
Hb(g/dl)	10.3±0.9	8.5–12.3	8.2±2.1	4.2–13.4
PCV (%)	33±2.3	28.1–36.4	26.2±6	12.8–41.2
MCV (fl)	27.4±1.7	24.9–31.6	29±2.2	25.9–32.8
MCH (pg)	8.5±0.5	7.4–9.4	9±0.6	7.9–10.3
MCHC (g/dl)	31.3±1.6	28.9–34.3	31.2±1.8	28.6–34.4
Platelets (x 10^3/µl)	206.4±105.8	102–461	177.8±58.9	108–276
Lymphocytes (%)	34.5±13.6	13.9–73.9	50.1±16.4	17.5–71.4
Monocytes (%)	5.9±2.3	2.4–9.2	6.3±3	2.4–10.3
Granulocytes (%)	43.9±15.8	18.3–77.3	41.4±14.7	20.5–63.8

4. Discussion

The PCV in young female sheep was higher than in adult females, young females also had higher PCV values than young males. age and sex exhibited remarkable influence on the PCV values. Similar observations were reported by Njidda et al in Balami and Yankasa sheep [12]. In contrast, EGBE-NWIYI et al reported PCV values that gradually increased with age [13]. However, in their study it was observed fluctuated PCV values with female showed higher PCV values than male at some stages of age. The packed cell volume obtained in the present study (26.2 to 33.0%) was lower than (42±0.01 %) reported for Captive wild sheep, (49.5±7 %) reported for west African sheep, and (64 %) reported for Ouda sheep [14], [13], [12]. on the other hand Devendran et al reported PCV value of 28.7±1 for Coimbatore sheep and Jawasreh et al reported PCV value of 31±0.7 for Awassi sheep which are in the range of PCV values reported in the present study [15]-[16]. Rusoff et al, Bianca, and Patterson et al attributed an increase in PCV values to the increase in environmental temperature [17]-[19]. Dargie and Allonby suggested the presence of association between high PCV values and the exposure of animal to infection [20]. It has been suggested an association between high PCV concentration and the resistance of the animal carrying Hb type A to infestation with helminth parasites [10].

Haemoglobin is the iron- containing oxygen-transporting protein in the red blood cells of vertebrates. The deficiency of haemoglobin decreases blood oxygen- carrying capacity leading to symptoms of anemia [6]. The result of the blood haemoglobin showed that young sheep had higher values than the adult ones. Njidda et al and EGBE-NWIYI et al reported similar observations in Balami and West African sheep respectively [12]-[13]. Njidda et al, EGBE-NWIYI et al, Mostaghni et al, and Taiwo and Ogunsanmi reported Hb values higher than the values in this study [12]-[14], [21]. However, the Hb values obtained in present study (8.2 to 10.3) fall within the range reported for other sheep Breeds

[15]-[16], [22]. High Haemoglobin concentration is associated with greater ability to resist disease infection and low level is an indication of disease infection and poor nutrition [23]– [24]. No gender influence was observed on Hb concentration of Barbary sheep which is in agreement with the finding reported by Mostaghni et al [14].

Similarly, young female sheep had higher RBC values than adult sheep, while the values were almost the same for males and females. This finding is in contrast to the results of Njidda et al and addass et al [12], [25]. EGBE-NWIYI et al also reported significantly influence of sex on RBC counts in West African sheep [13]. On the other hand Mostaghni et al found no influence of sex and age on haematological parameters of captive wild sheep [14]. RBC counts reported in this study (9±2 to 12.1±0.8) were higher than values reported in earlier studies [12], [14], [16]. Carlos et al obtained RBC values that did not differ from the values reported in this study [27]. The high RBC counts may be associated with conditions that cause the body to make too many red blood cells (Polycythemia), while low RBC counts may be associated with iron deficiency, some types of anemia or some vitamin deficiency [12]. Libyan Barbary sheep seem to possess relatively high RBC values and this is an advantage in terms of the oxygen carrying capacity of the blood. This study was achieved in a region that is located in a mountain elevated about 900m above sea level. It has been shown that the altitude is an important factor that affects the haematological parameters of an organism [11].Thus this could be the cause for the high RBC values reported in the present study. Taiwo and Ogunsanmi attributed high RBC values to genetically-induced more efficient haematopoietic capacity of the bone marrow [21].

MCV, MCH, and MCHC values are dependent upon RBC, Hb and PCV values. These parameters are very important in the diagnosis of anemia and also serve a useful index of the capacity of the bone marrow to produce red blood cells [28]. Sex significantly influenced MCV and MCHC but had no influence on MCH values. Njidda et al reported an influence of sex on these parameters, while Egbe–Nwiyi et al found a gender influence on MCHC but not on MCV values [12]-[13]. The adult females had a significantly higher MCH and MCV values than young females, While MCHC values were almost the same between adult and young females. Njidda et al, Egbe–Nwiyi et al , and Carlos et al reported age influence on these parameters [12]-[13], [27]. On the other hand Mostaghni et al found no influence of sex and age on MCV, MCH, and MCHC of captive wild sheep [14]. MCHC reported in this study (31.3±1.6 to 33.5±1.7) was within the range reported by Njidda et al, Egbe–Nwiyi et al, and Taiwo and Ogunsanmi [12]-[13], [21]. On the other hand Mostaghni et al and Jawasreh et al reported MCHC higher than the values obtained by the present study [14], [16]. MCV values reported by Njidda et al, Egbe–Nwiyi et al, Taiwo Ogunsanmi, and Carlos et al were higher than values (25.4±2 to 29±2.2) obtained by this study [12]-[13], [21], [27]. MCH values reported for Barbary sheep (8.5±0.5 to 9±0.6) were lower than values reported by Njidda et al, Mostaghni et al, and Jawasreh et al [12], [14], [16].

WBC values were slightly higher in male than female and significantly higher in adult female than in the young female. Njidda et al reported similar observations in Balami sheep breed regarding the influence of sex and in Ouda, Yankasa, and Balami breeds regarding age influence [12]. The findings of Egbe–Nwiyi et al and Addass et al were in contrast to the results of the present study who reported that age had no significant influence but sex had an influence on the total WBC count [13], [25]. The leucocyte count (8.9±3.3 to 11.7±2.4) reported in this study was within the range reported by earlier studies [15]-[16]. Mostaghni et al, Baumgartner and Pernthaner reported total WBC lower than the obtained values in present study [14], [29]. The high values of WBC observed may be attributed to the extensively managed sheep which makes them face challenges from microbes when on free range and may be suggestive of well-developed immune system of the Barbary sheep [9], [12]. There was a significant influence of age on lymphocyte count, the value for lymphocytes was higher for male sheep than female ones but the value for granulocytes was higher for female sheep. Although the difference was not significant, these observations were in agreement with the result of Njidda et al and in contrast to observation made by Egbe-Nwiyi et al [12]-[13]. As related species, it has been reported this trend of ratio between lymphocytes and granulocytes in goats [24], [30]. The high lymphocyte counts in the animals in this study are favored by the findings of Milson et al, and Wilkins and Hodges [31]-[32]. Cole attributed high lymphocytes count in animal's blood to stress and immune response to the environment [33]. The counts for lymphocytes (34.5±13.6 to 50.1±16.4) and for granulocytes (38.9±17.2 to 43.9±15.8) reported in this study were within the ranges reported by Njidda et al and Baumgartner and Pernthaner [12], [29]. The value for monocytes in the present study was observed to be comparable among age and sex groups. Perhaps the most outstanding feature was the high monocytes count (5.5±2.8 to 6.3±3) obtained in this study compared with other breeds of sheep. In this regard Tambuwal et al reported monocytes value of 7.4 + 1.7 for Red Sokoto goat [24]. There was no significant influence of both age and sex on Platelets counts and this result was in agreement with the finding reported by Mostaghni et el [14]. The values reported in the present study (177.8±58.9 to 206.4±105.8) were lower than values reported for other Breeds of sheep [14], [16].

5. Conclusion

The haematological parameters in Barbary sheep in this study seem to point out some differences from those obtained for other sheep breeds. The observed differences further support the fact that the physiological parameters reported for other ruminant animals may not be applied on the Barbary sheep kept in native husbandry system in the northeastern region of Libya.

The findings of this study may serve as references in which alterations due to nutrient deficiency, Physiological and health status can be compared both for diagnostic and therapeutic purposes in Barbary sheep.

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