

Factors Affecting Some Hematology and Serum Biochemical Parameters in Three Indigenous Sheep Breeds

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Abstract

This study was aimed to investigate the effect of some factors such as breed, age and sex on some hematological and biochemical parameters at Duhok province; Kurdistan region of Iraq. Blood samples from 120 healthy sheep (60 males and 60 females) from three flocks around Duhok city were used. The overall mean for Packed Cell Volume (PCV), Hemoglobin (HB), Erythrocyte Sedimentation Rate (ESR), Neutrophils to Lymphocyte ratio (N/L), Total Protein (TP), Albumin (ALB), Globulin (GLO), Glucose (GLU), Cholesterol (CHO) and Blood Urea (BU) were 27.35 ± 3.16 %, 8.93 ± 1.07 g/dl, 8.88 ± 2.76 mm/7hrs, 1.32 ± 0.37 %, 6.00 ± 0.34 g/dl, 2.10 ± 0.26 g/dl, 3.61 ± 0.42 g/dl, 60.36 ± 15.04 mg/dl, 46.69 ± 11.81 mg/dl and 41.75 ± 9.84 mg/dl, respectively.

There were a highly significant PCV, HB, ESR, N/L and BU with the lowest Albumin ($p < 0.05$) in Karadi breed when you compared to others. While Naimy sheep were recorded significantly the highest GLU ($p < 0.001$) than both breeds, but TP and GLO in the last breed were the lower than Karadi breed significantly ($p < 0.01$) and ($p < 0.001$), respectively. Cholesterol was lower significantly ($p < 0.001$) in Awassi breed when compared with Karadi. Also there were significantly higher ESR, N/L ($p < 0.001$) and GLU ($p < 0.05$) with the lowest PCV, HB ($p < 0.01$) in Adults sheep. In this study there is a non-significant differences of sex of animal for all studied traits with exception of N/L ratio, (female > Male) ($p < 0.01$), But these parameters were remained within the normal ranges for healthy sheep.

Key words: Hematological, Biochemical Parameters, Breed, Age, Sex, Sheep.

Introduction

Sheep are and will always be the most important farm animals in Kurdistan region of Iraq. Base on the FAO report, sheep population of Iraq in 1999 was about six-million head (FAO, 2000), and is distributed all over the country. Karadi, Awassi and Naimy are the main native breeds of sheep in Iraq are; which all belong to the fat tailed carpet wool sheep (Majid *et al*, 2003). Karadi (Kurdi) sheep, which live in the Kurdistan region of Iraq, are considered to be the largest size of local breeds. They represent about 20% of the total sheep population of the country (Juma & Alkass, 2000). The Awassi and Naimy sheep are the main indigenous breeds and it's raised primarily for lamb and mutton production, these sheep are represents an important contribution of sheep breeds in Iraq (about 60% of total sheep population, Juma & Alkass, 2000). The traits which are most important for genetic improvement whose associated with reproduction and wool production of the ewe, survival, growth and carcass characteristics of the lamb (Alkass and Juma, 2005). The productivity and reproductive efficiency of animal was correlated with the blood parameters (Abdel-Fattah *et al*, 2013) and these values were affected by the internal and external environment (Awah and Nottidge, 1998 and Ariyibi *et al*, 2002). Fat-tailed sheep are more adaptable to the harsh environmental conditions and also resistance to common diseases, while their

production of milk and meat are low. They are also characterized by low seasonality and low prolificacy rate of the native ewes (Gootwine and Goot, 1996 and Galal *et al.*, 2008).

Blood is an important and reliable medium for estimate the health status of individual animals (Oduye, 1976). Blood parameters of animals are differing due to several factors such as breed, age, sex, health status, altitude, management, feeding level, hematological techniques used, seasonal variation, temperature, and physiological status of the animal (Sherman and Mary, 1994 and Mbassa and Poulsen, 2003). As a limited information are available regards to the hematological and biochemical parameters of local breed of sheep; therefore, This study was aimed to evaluate the effect of some factors like breed, age and sex of animals on some hematological and biochemical parameters of healthy male, non-pregnant and non-lactating ewes for different native breeds of sheep in Dohuk province. In addition to establish mean values of hematological and biochemical parameters as reference values for these breeds.

Materials and Methods:

In this study, a total one hundred and twenty healthy sheep (Forty sheep from each breed namely Karadi, Awassi and Naimy) at the same physiological status (ewes were non-pregnant, and non-lactating) for both sexes (male and female) with two ages {Adults (2.5-4.5 years) and Young (8-10 months)} were used.

All animals were selected randomly from three flocks (Karadi, Awassi and Naimy sheep) which reared on three different regions around Duhok city, all of them are so far about 10 km from Duhok center: Sumail region (at latitude N 36.8590°, longitude E 42.8690° and altitude 492 m), Beribihar region (at latitude N 36.8736°, longitude E 43.0944° and altitude 720 m) and Koradeer region, (at latitude N 36.8706°, longitude E 43.1825° and altitude 853 m). The study was conducted from June to July 2011. Sheep were fed free grazing with addition of hay and barely-based concentrate ration.

Blood samples were collected from the jugular vein with approximately 10 ml for each sample. Sub sample (3ml) of blood collected was emptied into a test tube contained EDTA as an anticoagulant for analyzing packed cell volume (PCV), which was determined by the microhematocrit method, using a heparinized microhematocrit capillary tube for collecting blood from the samples. Hemoglobin concentration (HB) was determined according to cyanmetha- emoglobin method (Cork and Halliwell, 2002), and erythrocyte sedimentation rate (ESR) was determined by Westergren method and N/L estimated according to Schalm *et al.* (1975). The another sub sample (7ml) was emptied into glass sterile test tube without EDTA, and left for 2 hrs in the room temperature and then centrifuged (3000 RPM) for 15 minutes and the serum was separated by micropipette and emptied into tubes and stored at -20 C° until analysis for total protein was determined by Biuret method using analyzing material (Kit) produced by Biocode Hycel, France. Urea was determined using urea kits from Labkit Company (Spiny), (Young, 2001). Albumin, globulin, glucose and cholesterol were determined by using biochemical kits (Biolabo Maizy, France) by spectrophotometer (JENWAY 6300).

Statistical analysis:

The data obtained was analyzed using the GLM (General Linear Model) within SAS (2005) program as in the following model: $Y_{ijkl} = \mu + B_i + A_j + S_k + e_{ijkl}$

Where: Y_{ijkl} = Observational value of the k^{th} animal.

μ = Overall mean.

B_i = Effect of i^{th} breed (B = Karadi, Awassi and Naimy).

A_j = Effect of j^{th} Age (A = Adult and young).

S_k = Effect of k^{th} Sex (S = male and female).

e_{ijkl} = Experimental error assumed to be NID with $(0, \sigma^2 e)$.

Also Duncan multiple range test (Duncan, 1995) was used to found the significant differences between means.

Results and discussion

The overall mean (\pm SE) of HB, PCV, ESR and N/L are 8.93 ± 1.07 g/dl, 27.35 ± 3.16 %, 8.88 ± 2.76 mm/7hrs and 1.32 ± 0.37 %, respectively (Table1). However, the hematological parameters are within the normal range of ovine species (Jain, 1993; Forhead *et al.*, 2002; Jawasreh *et al.*, 2010 and NseAbasi *et al.*, 2014). While HB and PCV were lower and N/L was higher than reported by (Borjesson *et al.*, 2000) for free-ranging Desert Bighorn sheep. The present results revealed that breed had a significant ($P \leq 0.01$) effect on HB and PCV. Karadi sheep had higher value of HB (9.36 g/dl) and PCV (28.73%) than Awassi and Naimy sheep. Moreover, Karadi sheep had significantly ($P \leq 0.001$) the highest value of ESR (11.53mm/7hrs) and N/L (1.51%) than other breeds. The breed differences for these profiles were also reported earlier by (Forhead *et al.*, 2002 and Jawasreh *et al.*, 2010). In contrast, Schalm *et al.* (1975) reported that breed had no significant effect on hematological parameters of farm animals. The breed differences in haematology parameters may be due to that blood profiles are essentially affected by the genetic potential and parameters of homeostasis in the body (Alonso, 1997). The results also indicated that a significant age difference ($P \leq 0.01$) for HB and PCV, and ($P \leq 0.001$) for ESR and N/L (Table1). The values of HB (9.20g/dl) and PCV (28.10%) were significantly higher in young than adult sheep. While significantly higher value of ESR (9.93mm/7hrs) and N/L (1.45%) were recorded in adult than young sheep. The higher ESR and N/L in adult might reflect of immunity system. These results are in agreement with the finding of other worker had been reported that age effect on hematological profile in sheep (Hawkey *et al.*, 1983; Tafesse, 1987; Alonso *et al.*, 1997 and Egbe-Nwiyi *et al.*, 2000). Age related hematological parameter changes were reported earlier by several investigators (Schalm *et al.*, 1975; Coles, 1986; Jain, 1993 and Sherman and Mary, 1994). While, Tibbo *et al.*, (2004) and Piccione *et al.*, (2010) reported no significant age effect on hematological variables of goats. On the other hand, there were no significant sex differences in HB, PCV and ESR. These results were in agreement with Tibbo *et al.*, (2004) and Shumaila *et al.*, (2012). While, Egbe-Nwiyi *et al.*, (2000) was reported the sex differences in HB and PCV of Nigeria sheep. However, the effect of sex on N/L was significantly ($P \leq 0.01$) higher in female (1.40%) than in male (1.24%) (Table1). This result was in agreement with Tibbo *et al.*, (2004). In contrast, Egbe-Nwiyi *et al.*, (2000) showed a higher value in male than female. Higher N/L value in female might be attributed to stress and immune response the environment (Coles, 1980).

Table(1). Effect of breed, age and sex of animal on some hematological parameters (Mean \pm S.E).

Factors	No.	HB (g/dl)	PCV (%)	ESR (mm/7hrs)	N/L (%)
Overall mean	120	8.93 \pm 1.07	27.35 \pm 3.16	8.88 \pm 2.76	1.32 \pm 0.37
Breed		**	**	***	***
Karadi	40	9.36 \pm 0.16a	28.73 \pm 0.46 a	11.53 \pm 0.27 a	1.51 \pm 0.05 a
Awassi	40	8.85 \pm 0.16b	27.00 \pm 0.46 b	8.00 \pm 0.27 b	1.29 \pm 0.05b
Naimy	40	8.59 \pm 0.16 b	26.33 \pm 0.46 b	7.13 \pm 0.27 c	1.16 \pm 0.05 b
Age		**	**	***	***
Adult	60	8.67 \pm 0.13 b	26.60 \pm 0.38 b	9.93 \pm 0.22 a	1.45 \pm 0.04 a
Young	60	9.20 \pm 0.13 a	28.10 \pm 0.38 a	7.83 \pm 0.22 b	1.19 \pm 0.04 b
Sex		N.S.	N.S.	N.S.	**
Male	60	8.80 \pm 0.13 a	27.02 \pm 0.38 a	8.67 \pm 0.22 a	1.24 \pm 0.04 b
Female	60	9.07 \pm 0.13 a	27.68 \pm 0.38 a	9.10 \pm 0.22 a	1.40 \pm 0.04 a

** = P<0.01 *** = P<0.001 N.S. = Not Significant

Means having different letters within each factor/column differ significantly (P<0.05) according to Duncan's Multiple Range Test.

The overall mean of total protein, albumin and globulin are 6.00 g/dl, 2.10 g/dl and 3.61 g/dl, respectively (Table 2). These results are within reference interval investigated by (Borjesson *et al.*, 2000) and lower than overall mean values reported by Gundogan (2005). The effect of breed on serum biochemical parameters shows in table 2 seems to be had different significantly (P \leq 0.01) for TP, (P \leq 0.05) for ALB and (P \leq 0.001) for GLO. The result resembles those reported by Jawasreh *et al.* (2010) for TP, but disagrees with his result for ALB who indicated that the breed had no significant effect on ALB. Also, these results were disagree with those found by Gundogan (2005), whose reported that the effect of breed on total protein, albumin and globulin was not significant. The Naimy sheep had significantly (P \leq 0.01) lowest TP (5.66 g/dl) and significantly (P \leq 0.001) lowest GLO (3.42 g/dl) values than Karadi and Awassi sheep. While Karadi breed had significantly (P \leq 0.05) lowest ALB (2.01 g/dl) than Awassi and Naimy sheep. The biochemical parameters are usually influenced by nutrition level and closely associated with metabolic activity of individual animals (Shumaila *et al.*, 2012). The results revealed no significant age and sex on TP, ALB and GLO (Table 2). Also, Abdel-Fattah *et al.*, (2013) investigated that sex had no significant effect on TP.

Table (2). Effect of breed, age and sex of animal on some serum biochemical parameters (Mean \pm S.E).

Factors	No.	Total protein (g/dl)	Albumin (g/dl)	Globulin (g/dl)
Overall mean	120	6.00 \pm 0.34	2.10 \pm 0.26	3.61 \pm 0.42
Breed		**	*	***
Karadi	40	6.20 \pm 0.05 a	2.01 \pm 0.04b	3.62 \pm 0.06a
Awassi	40	6.15 \pm 0.05a	2.13 \pm 0.04a	3.78 \pm 0.06a
Naimy	40	5.66 \pm 0.05b	2.14 \pm 0.04a	3.42 \pm 0.06 b
Age		N.S.	N.S.	N.S.
Adult	60	5.74 \pm 0.04a	2.12 \pm 0.03a	3.63 \pm 0.05a
Young	60	5.66 \pm 0.04a	2.08 \pm 0.03a	3.59 \pm 0.05a
Sex		N.S.	N.S.	N.S.
Male	60	5.68 \pm 0.04a	2.08 \pm 0.03a	3.59 \pm 0.05a
Female	60	5.73 \pm 0.04a	2.11 \pm 0.03a	3.62 \pm 0.05a

* = P<0.05 ** = P<0.01 *** = P<0.001 N.S. = Not Significant

Means having different letters within each factor/column differ significantly (P<0.05) according to Duncan's Multiple Range Test.

The overall mean values of glucose, cholesterol and blood urea are 60.36 mg/dl, 46.69 mg/dl and 41.75 mg/dl, respectively (Table3). These results obtained herein are within the normal range reported for the ovine species (Forhead *et al.*, 2002). The result showed significantly ($P \leq 0.001$) breed differences for GLU, Cho and BU. Shumaila *et al.*, (2012) was reported that the breed had significant effect on glucose. Moreover, Gundogan (2005) concluded that the breed had a significant effect on serum cholesterol. The Naimy sheep had significantly ($P \leq 0.001$) the highest GLU value (74.19 mg/dl) compared to Karadi and Awassi breeds, while Awassi breed had significantly ($P \leq 0.001$) lowest CHO (38.82 mg/dl) when compared to Karadi and Naimy sheep. Moreover, Karadi breed had significantly ($P \leq 0.001$) the higher BU value (47.90 mg/dl) compared to Awassi and Naimy sheep (Table3). The differences in biochemical parameters were due to the metabolic activity and level for nutrition on individual animals (Jawasreh *et al.*, 2010). There was significantly ($P \leq 0.05$) age effect on GLU. The value of GLU (62.51 mg/dl) was significantly ($P \leq 0.05$) higher in adult than young sheep. While there was no significant difference of age on CHO and BU. Also the results indicated there were no significant differences for sex on GLU, CHO and BU (Table3). The last effects were in agreement with values reported by Shumaila *et al.*, (2012) whose shows that the age and gender had no significant effects on serum glucose and cholesterol of sheep.

Table(3). Effect of breed, age and sex of animal on some serum biochemical parameters (Mean \pm S.E).

Factors	No.	Glucose (mg/dl)	Cholesterol (mg/dl)	Blood Urea (mg/dl)
Overall mean	120	60.36 \pm 15.04	46.69 \pm 11.81	41.75 \pm 9.84
Breed		***	***	***
Karadi	40	48.80 \pm 1.70c	52.18 \pm 1.64a	47.90 \pm 1.32a
Awassi	40	58.08 \pm 1.70b	38.82 \pm 1.64b	42.19 \pm 1.32b
Naimy	40	74.19 \pm 1.70a	49.07 \pm 1.64a	35.16 \pm 1.32c
Age		*	N.S.	N.S.
Adult	60	62.51 \pm 1.37a	47.77 \pm 1.34a	43.13 \pm 1.08a
Young	60	58.20 \pm 1.37b	45.62 \pm 1.34a	40.38 \pm 1.08a
Sex		N.S.	N.S.	N.S.
Male	60	59.03 \pm 1.37a	45.37 \pm 1.34a	42.33 \pm 1.08a
Female	60	61.68 \pm 1.37a	48.01 \pm 1.34a	41.18 \pm 1.08a

* = $P < 0.05$ *** = $P < 0.001$ N.S. = Not Significant

Means having different letters within each factor/column differ significantly ($P < 0.05$) according to Duncan's Multiple Range Test.

The correlation coefficients among hematological and serum biochemical parameters of different sheep breeds in this study were investigated and they are given in Table (4). PCV was positively and highly significantly correlated with HB and negatively and highly significantly correlated with GLU. Also, HB negatively and highly significantly correlated with GLU. ESR was positively and highly significantly correlated with each of N/L, CHO and BU, and negatively and highly significantly correlated with GLU. N/L was positively and significantly associated with each TP and GLO. TP was positively and highly significantly correlated with GLO. While ALB value was negatively and highly significantly correlated with the GLO. Moreover, GLO was positively and significantly correlated with GLU. In addition, GLU was positively and highly significantly correlated with BU.

Table(4). Simple correlation coefficients among hematological and serum biochemical parameters of different sheep breeds.

Para-metrs	HB	ESR	N/L	TP	ALB	GLO	GLU	CHO	BU
PCV	0.94**	0.05 N.S	0.17 N.S	0.09 N.S	0.05 N.S	0.03 N.S	-0.28**	0.06 N.S	-0.13 N.S
HB		0.04N.S	0.17N.S	-0.08N.S	-0.06 N.S	0.04 N.S	-0.26**	0.08 N.S	-0.11 N.S
ESR			0.29**	0.12 N.S	-0.07 N.S	0.13 N.S	-0.42***	0.25**	0.45***
N/L				0.22*	-0.08 N.S	0.22*	-0.16 N.S	0.10 N.S	0.03N.S
TP					0.01 N.S	0.79***	-0.15 N.S	0.03 N.S	0.10N.S
ALB						-0.60 ***	0.14 N.S	-0.02 N.S	-0.07 N.S
GLO							0.20*	0.04 N.S	0.13N.S
GLU								-0.11 N.S	-0.33***
CHO									0.06 N.S

* = P<0.05 ** = P<0.01 *** = P<0.001 N.S = Not Significant

It is evident from above, that all correlation coefficients among different hematological and serum biochemical which were calculated are expected. Such results are in agreement with those reported earlier by Bungardt *et al.*, 1963; Goodrich *et al.*, 1968; Kitchenham *et al.*, 1977 and Sikka *et al.*, 1994. Hence, the hematological and biochemical parameter values from this research can be used as normal reference to assess the health status of the Karadi, Awassi and Naimy sheep breeds in Kurdistan region of Iraq. In conclusion, according on this findings, breed showed remarkable effect on most hematological and serum biochemical parameters, while age had significant effect on most hematological parameters and glucose. However, sex had no significant effect on both hematological and serum biochemical profiles.

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