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## Effect of some environmental factors on hematological parameters in apparently healthy Iraqi Awassi sheep

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### Abstract

The present study was conducted to determine some hematological parameters of Awassi sheep belonged to five regions (Shula, Abu-Ghraib, Mahmoudia, Yousifia, and Alameel) in the West and South of Baghdad during the period from December to February, 2015-2016. Further, it was also, aimed to investigate the effect of the sex, age, and regions on the studied parameters. A total of 150 apparently healthy Awassi sheep (93 male and 57 female) included in this study. Results showed that the mean of Red blood cell (RBC) packed cell volume (PCV), haemoglobin (Hb), total white blood cell count (WBC), mean corpuscular volume (MCV), mean corpuscular hemoglobin (MCH) and mean corpuscular hemoglobin concentration (MCHC) were  $7.91 \times 10^6/\mu\text{l}$ , 26.52%, 8.24 g/dL,  $8.64 \times 10^6/\mu\text{l}$ , 32.61 fl, 10.63 pg and 32.73 g/dL respectively.

Statistical analysis shows that the effect of region was significant ( $P < 0.05$ ) on all parameters. The effect of sex was significant ( $P < 0.05$ ) on all parameters except the WBC and MCHC. The effect of age was not significant. The results obtained from this study could serve as reference values for Awassi sheep. However, further study is needed to estimate the hematological reference values of healthy Awassi sheep by using Reference Value Advisor method to get more reliable estimations.

**Keywords:** Awassi sheep, hematological parameters, apparently healthy

### 1. Introduction

The local Awassi sheep is the most common breed raised in Iraq. The sheep productions in Iraq expected to be more important in the future because of two reasons: the increasing human population and the increasing demand for meat production, particularly lamb and mutton [19]. The economic usefulness of sheep in meat production correlated with health status that can detect by an important and reliable tool such as hematological parameters for assessing the health status of animals [2-4]. There are several hematological parameters could be used for prognosis and diagnosis of many diseases which can lead to a high economic loss as a result of the reduction in the productive and reproductive performance of animals [5-7].

The hematological parameters are useful tools for the detection of some changes in the health and physiological status of the animal, which could not be detected during physical examination [8]. The determination of the current health status of animal could have low reliability without hematological parameters because these parameters provide the opportunity for more accurate diagnosis [9, 10]. Ahmadi-hamedani *et al.*, [4] reported that the determination of hematological reference values is very important step in order to form a basis for clinical interpretation. Moreover, many researchers [4, 11-13] found that the level of RBC, PCV and Hb in infected animals were significantly lower than healthy animals.

Several studies [10, 14-17] confirmed that the reference values of hematological parameters could be influenced by some factors such as the age, sex, breed, health status and nutrition. In Iraq, however, there are some studies documented the reference values of hematological parameters in Awassi sheep [18, 19], but the studies are scanty about the factors that could affect those parameters. Therefore, this study was conducted to investigate the effect of the sex, age and the region on some hematological parameters in Awassi sheep.

### 2. Material and methods

#### 2.1 Experimental animals

This study included Awassi sheep with different ages (1-4 years) and sex obtained from five regions (Shula, Abu-Ghraib, Mahmoudia, Yousifia, and Alameel) West and South of Baghdad

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/Iraq during the period from December to February 2015-2016.

## 2.2 Blood samples

Blood samples from 150 Awassi sheep (93 males and 57 females) were collected from apparently healthy sheep from jugular vein using a vacutainer tube containing sodium heparin as an anticoagulant. All the blood samples were subjected to analysis in privet laboratory in Baghdad to estimate Red blood cells (RBC), Packed Cell Volume (PCV), haemoglobin (Hb), including total white blood cell count (WBC), mean corpuscular volume (MCV), mean corpuscular hemoglobin (MCH) and mean corpuscular hemoglobin concentration (MCHC). MCV, MCH, and MCHC were calculated according to Patterson *et al.*, [23].

## 2.3 Statistical analysis

Data were analyzed using General Linear Model (GLM) in SAS program [26] to investigate the effect of the age of the animal, sex, and the regions. The Mathematical model used in this analysis is shown below:

$$Y_{ijkl} = \mu + A_i + G_j + R_k + e_{ijkl}$$

### Where:

$Y_{ijkl}$  is the studied trait,  $\mu$  is the overall means,  $A_i$  the effect of  $i^{\text{th}}$  age ( $i = 1 - 3$ ),  $G_j$  the effect of  $j^{\text{th}}$  sex ( $j = \text{male, female}$ ),  $R_k$  the effect of  $k^{\text{th}}$  region ( $1 = \text{Shula, } 2 = \text{Abu-Ghraib, } 3 = \text{Mahmoudia, } 4 = \text{Yousifia and } 5 = \text{Alameel}$ ), and  $e_{ijkl}$  is the random error. Means were compared by using least significant difference (LSD).  $P < 0.05$  considered statistically significant.

## 3. Results and Discussion

Table 1 shows the descriptive statistics of the hematological parameters. The mean values of WBC ( $8.64 \times 10^3 / \mu\text{l}$ ), MCHC (32.73 g/dL), MCH (10.63 pg), MCV (32.61 fl), RBC ( $7.91 \times 10^6$ ), Hb (8.24 g/dL), and PCV (26.26%) of the present study were within Awassi range values of WBC ( $4.80 \times 10^3 - 10.01 \times 10^3 / \mu\text{l}$ ) [18, 8], MCHC (25.08-33.51 g/dL) [18, 8, 5, 28], MCH (9.83-12.00 pg) [18, 8, 5], MCV (29.39-33.00 fl) [18, 8, 5], RBC ( $7.63-10.54 \times 10^6 / \mu\text{l}$ ) [18, 8, 5, 28], Hb (7.27-10.50 g/dL) [18, 22, 28] and PCV (27.00-33.2%) [8, 5, 22]. The difference in estimations of hematological parameters could be attributed to some factors such as age, sex, breed or strain, sampling techniques, and testing methodology [14].

The results revealed that the differences in hematological parameters due to age were not significant (Table 2). These results are in agreement with results obtained by Carlos *et al.*, [11]. In the same context, Piccione *et al.*, [24] reported no

significant effect of age on hematological parameters in goats. However, the results disagreed with the results of Oramari *et al.*, [22] who confirmed the significant differences among hematological parameters due to age. On the other hand, Addass *et al.*, [1] reported that age significantly ( $P < 0.01$ ) affected all hematological parameters except RBC, PCV, and MCHC of the four indigenous breeds of sheep in Nigeria. Statistical analysis showed that the effect of sex was significant ( $P < 0.05$ ) on PCV, Hb, RBC, MCH, and MCV, while the effect was not significant on WBC and MCHC (Table 3). The males have significantly ( $P < 0.05$ ) higher mean values of PCV (27.15%), Hb (8.49 g/dL), and RBC ( $8.46 \times 10^6$ ) as compared with corresponding means of females 24.81%, 7.82 g/dL, and  $7.02 \times 10^6$ . On the contrary, females means were significantly ( $P < 0.05$ ) higher for MCH (11.16 pg), and MCV (33.88 fl) as compared with the means of males (10.30 pg and 31.83 fl). These results were in accordance with the findings obtained by Badawi and AL-Hadithy, [8] who reported that males have significantly ( $P < 0.05$ ) higher mean values of PCV, Hb, and RBC compared with females values. The results were also consistent with previous findings obtained by Addass *et al.*, [1], Fadare *et al.*, [15] and Njidda *et al.*, [20]. The significant differences in some hematological parameters between males and females could be attributed to that the female is more exposed to different physiological changes (pregnancy, lactation, parturition, and milk production) which represent the stress factors that could lead to reducing their hematological parameters. Weiss and Wardrop, [33] indicated that the differences between males and females in some hematological values could be due to the contrary effects of estrogen in females and the androgen in males as estrogen has a negative effect on erythropoiesis whereas, the effect is positive for the androgen. However, the results of the current study disagreed with the results of Oramari *et al.*, [22] who demonstrated that sex has no significant effect on PCV and Hb in three Iraqi local breeds of sheep (Karadi, Awassi, and Naimy). Moreover, Carlos *et al.*, [11] in his study on Morada Nova sheep in Pakistan found that the sex has no significant effect on RBC, RCV, and MCV. Similar results were obtained by Pradhan, [25] in goats. The differences in hematological values due to the region were significant ( $P < 0.05$ ) in all hematological parameters (Table 4). These results confirmed the previous studies about the significant effect of the region on some hematological parameters [14, 21]. The results obtained by Šimpraga *et al.*, [29] revealed that the effect of location (which determines climate and food availability) was more pronounced than that of breed and seasons in organically raised sheep in Croatia.

**Table 1:** Descriptive statistics of the hematological parameters in Awassi sheep

	Mean	SE	STD	Min	Max
WBCx10 <sup>3</sup> /μl	8.64	0.21	2.67	3.13	14.82
MCHC g/dL	32.73	0.46	5.66	25.00	54.10
MCH pg	10.63	0.18	2.28	6.20	17.30
MCV fl	32.61	0.48	5.93	16.80	51.70
RBCx10 <sup>6</sup> /μl	7.91	0.18	2.20	4.10	21.20
Hb g/dL	8.24	0.09	1.20	7.10	14.20
PCV %	26.52	0.31	3.81	22.00	36.00

**Table 2:** Means±SE of some hematological parameters of Awassi sheep according to the age

Age/yr	No	WBC x10 <sup>3</sup> /μl	MCHC g/dL	MCH pg	MCV fl	RBC x10 <sup>6</sup> /μl	Hb g/dL	PCV%
≥1	38	8.30±0.47	33.93±1.19	10.84±0.40	32.53±0.96	7.79±0.29	8.24±0.19	26.16±0.56
1 < - ≥2.5	46	8.51±0.39	33.11±0.73	10.60±0.30	32.27±0.81	8.36±0.40	8.42±0.16	26.77±0.60
2.5 <	66	8.93±0.31	31.78±0.59	10.53±0.28	32.88±0.77	7.67±0.24	8.12±0.15	8.11±0.15

All differences are not significant

**Table 3:** Means±SE of some hematological parameters of Awassi sheep according to the sex

Sex	No	WBC x10 <sup>3</sup> /µl	MCHC g/dL	MCH pg	MCV fl	RBC x10 <sup>6</sup> /µl	Hb g/dL	PCV%
Male	93	8.42±0.28 <sup>a</sup>	32.40±0.62 <sup>a</sup>	10.30±0.23 <sup>b</sup>	31.83±0.55 <sup>b</sup>	8.46±0.23 <sup>a</sup>	8.49±0.13 <sup>a</sup>	27.23±0.42 <sup>a</sup>
Female	57	9.00±0.39 <sup>a</sup>	33.27±0.65 <sup>a</sup>	11.16±0.29 <sup>a</sup>	33.88±0.87 <sup>a</sup>	7.02±0.25 <sup>b</sup>	7.82±0.16 <sup>b</sup>	25.36±0.60 <sup>b</sup>

**Table 4:** Means±SE of some hematological parameters of Awassi sheep according to the region

Sex	No	WBC x10 <sup>3</sup> /µl	MCHC g/dL	MCH pg	MCV fl	RBC x10 <sup>6</sup> /µl	Hb g/dL	PCV%
Shula	30	7.76±0.50 <sup>b</sup>	34.43±1.26 <sup>a</sup>	11.35±0.46 <sup>a</sup>	32.80±0.72 <sup>ab</sup>	7.99±0.36 <sup>ab</sup>	8.72±0.19 <sup>a</sup>	28.35±0.74 <sup>a</sup>
Abu-Ghraib	30	8.38±0.52 <sup>ab</sup>	34.42±1.16 <sup>a</sup>	10.35±0.48 <sup>ab</sup>	30.51±1.31 <sup>b</sup>	8.06±0.39 <sup>ab</sup>	8.23±0.26 <sup>ab</sup>	25.54±0.68 <sup>b</sup>
Mahmoudia	30	9.68±0.46 <sup>a</sup>	31.38±0.81 <sup>bc</sup>	9.75±0.36 <sup>b</sup>	31.27±1.01 <sup>b</sup>	7.87±0.32 <sup>ab</sup>	7.86±0.16 <sup>b</sup>	25.55±0.55 <sup>b</sup>
Yousifia	30	8.74±0.43 <sup>ab</sup>	30.20±0.64 <sup>c</sup>	10.81±0.36 <sup>ab</sup>	35.40±1.13 <sup>a</sup>	7.15±0.31 <sup>b</sup>	7.71±0.11 <sup>b</sup>	25.84±0.61 <sup>b</sup>
Alameel	30	8.76±0.48 <sup>ab</sup>	33.23±0.98 <sup>ab</sup>	10.90±0.34 <sup>a</sup>	33.05±0.98 <sup>ab</sup>	8.51±0.55 <sup>a</sup>	8.68±0.26 <sup>a</sup>	27.31±0.76 <sup>ab</sup>

#### 4. Conclusion

The results obtained from this study could serve as reference values for Awassi sheep in Baghdad, However, further study is needed to estimate the hematological reference values of healthy Awassi sheep by using Reference Value Advisor method.

#### 5. Author contributions

F. R. Al-Samarai has achieved the analyses and wrote the paper; W. A. H. Al-Jbory has collected the data.

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