Study on the influence of age and sex on the blood constituents of Libyan goats.

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Abstract

The study was undertaken to demonstrate the effect of age, and sex on hematological and biochemical parameters of goat in Libya.

A total of 70 healthy animals of diverse age and sex were selected randomly from two different areas in Libya. The blood samples were collected from the jugular vein of animals for blood analysis. Statistical analysis was applied by using SPSS Statistics software version 25 to calculate the minimum and maximum values to determine the mean, standard deviation of the mean, and the p value.

The results revealed that there are no statistically significant differences between the means of hematological parameters for the gender of goats (p –value > 0.10). Regarding the effect of age, the results of blood hematology revealed that the mean values of WBC ($12.46\pm4.90\times10^3$/µL, $14.37\pm4.23\times10^3$/µL), lymphocyte ($6.34\pm2.91\times10^3$/µL, $8.04\pm2.34\times10^3$/µL) counts and lymphocytes percentage ($46.78\pm14.04\%$, $57.89\pm57.89\%$) were significantly different (p –value < 0. 05) in young and adult goats respectively. No significant variations (p –value > 0.10) were observed in the erythrocyte parameters among young and adult goat. There were significant effects (p < 0.01) of age on biochemical parameters of goat. The 10– 16–month–old goats showed significantly lower blood levels of ALT (p < 0.05), total

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protein ($p < 0.01$), albumin ($p < 0.001$), cholesterol ($p < 0.05$), HDL ($p < 0.01$), creatinine ($p < 0.001$), and calcium ($p < 0.01$) than did adult goats, while the other determined enzymes (AST, ALP, LDH), bilirubin, glucose, urea, lipids, and electrolytes did not change statistically.

This work showed that age, and sex affected significantly hematological and biochemical parameters in local goats raised in Libya.

Keywords: age, sex, goat, hematological, biochemical parameters, Libya.

Introduction

Livestock rearing serves as a major economic activity in the lives and livelihoods of millions of poor and marginal farmers, particularly in developing countries (Aleena et al.,2020;Banda and Tanganyika,2021). Goats rearing act as a critical source of income and nutrition for poor and marginal farmers in rural areas (Kumar et al.,2010;Mlambo and Mapiye,2015). They are considered as perfect animals to keep due to their high ability to live under harsh environmental conditions because it is the best in withstanding varying temperatures, drought tolerance, as well as its ability to resist diseases (Serradilla et al.,2018;TF and CA,2020), and due to their ability to produce high-quality meat and milk (Silanikove,2000;Gawat et al.,2023).

Goats are very popular in some countries, because it does not require large capital and complex technology, in addition to the rapid growth, rapid sexual maturity, short reproductive cycle and short gestational age for female goats, high efficiency in converting food to fodder of poor quality, also, the carcass has a high percentage of meat and a low percentage of fat, and is small in size, which facilitates handling at the household level (Haenlein,2004;Al-Yasery et al.,2023). Goats also possess a better feed conversion ratio than other ruminants and can convert low quality feed into quality protein (Silanikove and Koluman,2015). Therefore, these

various unique characteristics of goat species specifically confirm their extreme potential to be considered as the ideal future animal to reduce the impacts of climate change in animal agriculture. According to FAO's "The State of the World's Biodiversity for Food and Agriculture" report, biodiversity is the variety of life at genetic, species, and ecosystem levels. Performance of the livestock is influenced by several factors including the type of production systems, breed, age, sex, nutritional level, hormonal status, and environment (Habibu et al.,2016).

Hematological and biochemical investigations are an essential diagnostic tool widely used in the laboratory diagnosis of various animals' diseases and general evaluations of animal health (Karaşahin et al.,2022), however, a delay usually occurs between sampling and analysis (Megerssa,2022). Earlier study has been investigated the hematological profile without specifying any reference intervals in Italy (Agradi et al.,2022). Aforementioned studies detected the effect of sex on blood parameters in Boer goats, gender had a significant effect on the number of WBC, RBC, HCT and MCV which were found to statistically higher in females than males (ÇElİK et al.,2019) and others conducted on the effect sex of Alkanian goats on some blood parameters, the values of WBCs, RBC, PCV and hemoglobin were significantly higher in males than females (R et al.,2010). Formerly, goats' blood chemistry was analyzed to study the effects of age and dietary Beta-Hydroxybutyric Acid (BHBA) on blood metabolites, immunoglobulins, and hormones in growing goats (Abdelsattar et al.,2021). The latter highlight the influence of age on blood composition in young goats. Thus, this study was aimed to determine the impact of various ages, and sex of goats on the hematological and biochemical parameters.

Material and methods:

Ethical Approval:

Experimental design and procedures were duly approved by the Tripoli University animal ethics committee, Tripoli, Libya which basically comply with the Guidelines of Laboratory Animals of the National Institutes of Animal Health (USA, release no. 86-23, reviewed 1996).

Experimental Animals:

Seventy goats of different ages (14 young animals from 10- 16 months and 56 adults above 19 months old) and sex (12 males and 58 females) were used in this study at the winter season 2022. All of the animals were considered clinically healthy animals at the time of sampling and all of them were fed on the same diet.

Blood sampling:

Blood samples were collected at the winter season from the jugular vein using 18G disposable needles into vacuum tubes either containing anticoagulant (K_3EDTA) or without anticoagulant (Hashem et al.,2018). All samples with anticoagulant were transferred to the laboratory (Esraa's clinical laboratory, Tripoli, Libya) as quickly as possible on ice for hematological analysis. However, the samples into vacuum tubes without anticoagulants were allowed to coagulate and then centrifuged at 3,000 rpm for 10 min (Hashem et al.,2020). Sera were allocated into clean tubes and kept at – 20 °C until further biochemical analysis at Al-shefaa's clinical laboratory, Tripoli, Libya.

Hematological analysis:

The hematological variables were measured using an automated hematology analyzer (Celltac α, Nihon Kohden, Tokyo, Japan). All the samples were analyzed within 45 min after collection for the total red blood cells count (RBC), hemoglobin (HGB), hematocrit (HCT), mean corpuscular volume (MCV), mean corpuscular HGB (MCH), MCH concentration (MCHC), RDW-CV (red cell distribution width - coefficient of variation) and RDW-SD (Red Cell Distribution Width - Standard Deviation), total white blood cells (WBC), and differential leukocytes count including lymphocytes (Lymph), Mid, and granulocytes (Gran).

Biochemical analysis:

The biochemical analyses were conducted on an automatic analyzer (pz Cormay ACCENT M320) and Easylyte plus for electrolytes using Labst Diagnóstica® kits. The serum activity of alanine aminotransferase (ALT), aspartate aminotransferase (AST), alkaline phosphatase (ALP), lactate dehydrogenase (LDH), and concentration of total protein (TP), albumin (Alb), total bilirubin (T BIL), direct bilirubin (D BIL), glucose (GLU), triglycerides (TG), cholesterol (Chol), very low-density lipoprotein (VLDL), high-density lipoprotein (HDL), low-density lipoprotein (LDL), creatinine (Crea), urea, phosphorus (Phos), calcium (Ca), and magnesium (Mg) (UV kinetic method, International Federation of Clinical Chemistry). The serum concentrations of the sodium (Na), potassium (K), and chloride (Cl) electrolytes were determined by the ion-selective electrode method in the EasyLyte® Plus analyzer.

The aforementioned analyses were performed on 15 random blood samples manually by the researchers and observed the same findings as the lab.

Statistical analysis:

The data were analyzed using the SPSS Statistics software version 25, used to analyze the collected data; mean, standard deviation and percentages. A non-parametric test was used, because the data collected did not follow a normal distribution (Kolmogorov- Smirnov Test). To compare means, tests were used Independent two samples (Mann-Whitney test) and one-way analysis of variances (Kruskal-Wallis test). Statistical significance happened when $p < 0.05$.

Results

The descriptive study for the age and sex are presented in figure 1, while the descriptive statistics for the hematological parameters in Libya goat are presented in Table 1.

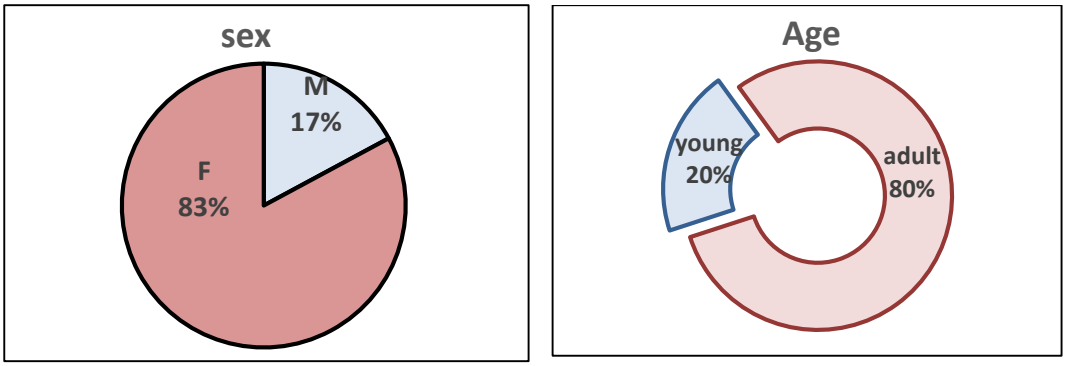

Figure 1. The descriptive study of goats including sex and age.

Table 1. Descriptive statistics for the hematological parameters

Parameter	Minimum	Maximum	Mean		Std.
WBC ($\times 10^3$/µL)	4.70	27.50	13.99	±	4.40
Lymph ($\times 10^3$/µL)	2.20	13.10	7.70	±	2.53
Mid ($\times 10^3$/µL)	0.30	6.80	2.40	±	1.30
Gran ($\times 10^3$/µL)	0.60	8.60	3.60	±	1.94
Lymph (%)	19.80	92.10	55.66	±	16.81
Mid (%)	2.90	45.00	17.41	±	8.60
Gran (%)	5.00	56.10	25.82	±	12.64
HGB (g/dL)	1.60	10.10	6.42	±	2.45
RBC($\times 10^6$/µL)	0.03	2.03	0.52	±	0.40
HCT (%)	0.00	7.30	1.81	±	1.43
MCV(fL)	33.00	107.10	37.93	±	11.09
MCH (pg)	36.40	312.50	136.23	±	52.01
MCHC (%)	12.30	914.20	366.41	±	157.71
RDW-CV (%)	9.80	14.20	11.93	±	0.84
RDW-SD (fL)	11.20	15.90	13.76	±	1.00

WBC = Total leucocyte count; Lymph = lymphocyte; Mid = monocyte and eosinophil count; Gran = granulocytes (neutrophil and basophil); µL= microliter; %= percentage. RBC = red blood cells; HGB = hemoglobin; HCT = hematocrit; MCV = mean corpuscular volume; MCH = mean corpuscular hemoglobin; MCHC = mean corpuscular hemoglobin concentration; RDW = red cell distribution width; CV= coefficient of variation; SD=Standard deviation. g/dL = gram/deciliter; fL= femtoliter; pg= picogram.

Regarding the effect of age on the blood hematology (Table 2), WBC count showed significantly ($p < 0.05$) higher value in adult ($14.37 \pm 4.23 \times 10^3$/µL) than young goats ($12.46 \pm 4.90 \times 10^3$/µL). Moreover, lymphocyte count were statistically ($p < 0.05$) higher in adult's goats ($8.04 \pm 2.34 \times 10^3$/µL) than young one ($6.34 \pm 2.91 \times 10^3$/µL), in addition lymphocyte percentage was significantly ($p < 0.01$) greater in adult ($57.89 \pm 57.89\%$) than young's goats, ($46.78 \pm 14.04\%$).

Table 2. The effect of age on total and differential leukocytes in Libyan goats (means values± SD). n= 14 young and 56 adult.

Parameter	Age	Mean		Std. Deviation	Mann-Whitney test	
					test statistics	*p* -value
WBC ($\times 10^3/\mu L$)	Young	12.46	±	4.90	247.00	0.032*
	Adult	14.37	±	4.23		
Lymph ($\times 10^3/\mu L$)	Young	6.34	±	2.91	240.50	0.023*
	Adult	8.04	±	2.34		
Mid ($\times 10^3/\mu L$)	Young	2.51	±	1.36	379.00	0.845
	Adult	2.38	±	1.30		
Gran ($\times 10^3/\mu L$)	Young	3.56	±	1.85	333.50	0.380
	Adult	3.61	±	1.98		
Lymph (%)	Young	46.78	±	14.04	191.50	0.003*
	Adult	57.89	±	16.81		
Mid (%)	Young	20.91	±	10.34	274.50	0.077
	Adult	16.53	±	7.97		
Gran (%)	Young	28.73	±	10.85	299.50	0.165
	Adult	25.09	±	13.04		

WBC = Total leucocyte count; Lymph = lymphocyte; Mid = monocyte and eosinophil count; Gran = granulocytes (neutrophil and basophil); µL= microliter; %= percentage.

*Significant at $p < 0.05$.

The pattern of changes in RBC, HBG, HCT, and erythrocyte indices (MCV, MCH, MCHC, and RDW) revealed no significant variations ($p > 0.10$) among young and adult goats as shown in Table 3. The lowest mean HBG concentration (g/dl) was observed in in animals aged between 10 and 16 months (6.19±1.96) against 6.48±2.06 in adults (above 16 months) but without significant difference ($p > 0.05$). Adult animals showed higher mean values for HCT (1.84±2.02), MCV (34.95±0.84), MCH (123.84±39.13), MCHC (352.37±133.01) compared with the young one (HCT=1.81±1.27, MCV=34.17±22.05, MCH=119.79±74.56 & MCHC= 341.54±138.93) but without significant difference ($p > 0.05$). Additionally, RDW-CV (12.14±1.16) and RDW-SD (13.94±0.90) were insignificantly higher in young goats than that of adults (11.87±0.74 & 13.71±1.02) respectively.

Table 3. The effect of age on erythrocyte parameters in Libyan goats (means values± SD). n= 14 young and 56 adult.

Parameter	Age	Mean		Std. Deviation	Mann–Whitney test	
					test statistics	*p* –value
HGB (g/dL)	Young	6.19	±	1.96	359.50	0.633
	Adult	6.48	±	2.06		
RBC($\times 10^6$/µL)	Young	0.52	±	0.35	361.00	0.649
	Adult	0.53	±	0.56		
HCT (%)	Young	1.81	±	1.27	361.00	0.649
	Adult	1.84	±	2.02		
MCV (fL)	Young	34. 17	±	22.05	144.50	0.601
	Adult	34. 95	±	0.84		
MCH (pg)	Young	119.79	±	74.56	199.00	0.195
	Adult	123.84	±	39.13		
MCHC (%)	Young	341.54	±	138.93	381.50	0.877
	Adult	352.37	±	133.01		
RDW–CV (%)	Young	12.14	±	1.16	306.00	0.199
	Adult	11.87	±	0.74		
RDW–SD (fL)	Young	13.94	±	0.90	317.50	0.272
	Adult	13.71	±	1.02		

HGB = hemoglobin; RBC = red blood cells; HCT = hematocrit; MCV = mean corpuscular volume; MCH = mean corpuscular hemoglobin; MCHC = mean corpuscular hemoglobin concentration; RDW = red cell distribution width; CV= coefficient of variation; SD=Standard deviation. g/dL = gram/deciliter; fL= femtoliter; pg= pictogram.

As demonstrated in Table 4, the leukocyte parameters revealed none statistically significant discrepancies between the goat's genders ($p > 0.10$). The male goats had non–significant lower WBC (12.74±4.55), lymphocyte (6.57±3.15), Mid (1.99±0.95), and granulocyte counts (3.54±1.63), compared with that of females, 14.25±4.36, 7.93±2.35, 2.49±1.35, and 3.61±2.01 respectively.

Table 4. The effect of gender on total and differential leukocytes in Libyan goats (means values± SD). n= 12 males and 58 females.

Parameter	Gender	Mean		Std. Deviation	Mann–Whitney test	
					test statistics	*p* –value
WBC ($\times 10^3/\mu L$)	M	12.74	±	4.55	270.00	0.221
	F	14.25	±	4.36		
Lymph ($\times 10^3/\mu L$)	M	6.57	±	3.15	249.50	0.118
	F	7.93	±	2.35		
Mid ($\times 10^3/\mu L$)	M	1.99	±	0.95	296.00	0.408
	F	2.49	±	1.35		
Gran ($\times 10^3/\mu L$)	M	3.54	±	1.63	335.00	0.836
	F	3.61	±	2.01		
Lymph (%)	M	51.47	±	15.33	280.50	0.283
	F	56.53	±	17.09		
Mid (%)	M	17.03	±	7.46	341.50	0.917
	F	17.48	±	8.87		
Gran (%)	M	30.83	±	14.17	257.50	0.150
	F	24.78	±	12.18		

WBC = Total leucocyte count; Lymph = lymphocyte; Mid = monocyte and eosinophil count; Gran = granulocytes (neutrophil and basophil); µL= microliter; %= percentage.

Table 5 illustrated that the results of HGB, erythrocytes indices (MCV, MCH & MCH) and RDW–CV were decreased in males comparatively with females but did not show significant differences ($p > 0.115$).

Table 5. The effect of gender on erythrocyte parameters in Libyan goats (means values± SD). n= 12 males and 58 females.

Parameter	Gender	Mean		Std. Deviation	Mann–Whitney test	
					test statistics	*p* –value
HGB (g/dL)	M	5.26	±	2.89	247.00	0.115
	F	6.67	±	2.30		
RBC ($\times 10^6/\mu L$)	M	0.52	±	0.56	286.00	0.334
	F	0.52	±	0.36		
HCT (%)	M	1.83	±	2.03	291.50	0.378
	F	1.81	±	1.30		

MCV (fL)	M	37.03	±	4.21	316.00	0.614
	F	38.11	±	12.05		
MCH (pg)	M	123.29	±	36.04	335.00	0.838
	F	138.91	±	54.61		
MCHC (%)	M	331.66	±	91.26	340.50	0.906
	F	373.59	±	167.92		
RDW-CV (%)	M	11.88	±	0.47	344.50	0.956
	F	11.93	±	0.90		
RDW-SD (fL)	M	14.05	±	0.56	256.00	0.150
	F	13.70	±	1.06		

HGB = hemoglobin; RBC = red blood cells; HCT = hematocrit; MCV = mean corpuscular volume; MCH = mean corpuscular hemoglobin; MCHC = mean corpuscular hemoglobin concentration; RDW = red cell distribution width; CV= coefficient of variation; SD=Standard deviation. µL= microliter; %= percentage; g/dL = gram/deciliter; fL= femtoliter; pg= picogram. M= male; F= female.

With reference to the results of biochemical analysis, Table 6 showed the descriptive Statistics values for selected blood biochemical analysts in goats (Minimum, Maximum, Mean and Std. Deviation).

Table 6. Descriptive Statistics of chemistry in goats

Chemistry	Minimum	Maximum	Mean		Std. Deviation
ALT (U/L)	3.30	34.00	15.07	±	6.58
AST (U/L)	32.90	709.00	94.63	±	87.59
ALP (U/L)	13.70	621.90	92.00	±	118.87
LDH (U/L)	192.30	3168.40	446.37	±	408.78
TP (g/dl)	2.77	8.93	6.47	±	1.04
Alb (g/dl)	1.30	3.98	2.69	±	0.60
T BIL (mg/dl)	0.36	0.21	-0.02	±	0.08
D BIL (mg/dl)	0.36	0.21	-0.02	±	0.08
GLU (mg/dl)	12.00	58.60	36.92	±	12.05

TG (mg/dl)	7.30	75.80	22.56	±	10.50
Chol (mg/dl)	16.80	89.50	57.24	±	19.15
VLDL	2.00	22.00	8.35	±	5.07
HDL (mg/dl)	11.30	53.50	33.07	±	10.37
LDL (mg/dl)	1.60	33.10	16.03	±	8.06
Crea (mg/dl)	0.47	1.22	0.74	±	0.15
Urea (mg/dl)	9.30	61.30	40.23	±	9.64
Phos (mg/dl)	1.41	8.84	4.68	±	1.71
Ca (mg/dl)	5.56	10.06	7.72	±	1.04
Mg (mg/dl)	1.74	3.18	2.34	±	0.28
Na (mEq/l)	133.00	164.10	145.89	±	6.97
K (mEq/l)	3.22	436.00	11.35	±	52.67
Cl (mEq/l)	104.50	130.70	116.07	±	6.12

ALT = alanine aminotransferase; AST = aspartate aminotransferase; ALP = alkaline phosphatase; LDH = lactate dehydrogenase; TP= total protein; Alb= total protein; T BIL = total bilirubin; D BIL = direct bilirubin; GLU = glucose; TG = triglycerides; Chol = cholesterol; VLDL = very low-density lipoprotein; HDL = high-density lipoprotein; LDL= low-density lipoprotein; Crea= creatinine; Phos = phosphorus; Ca= calcium; Mg = magnesium; Na= sodium; K= potassium; Cl= chloride.

The effect of age on the serum enzymes (ALT, AST, ALP, & LDH), TP and albumin of young and adult goats was exhibited in Table 7. Low serum ALT activity ($p < 0.05$), as well as the levels of TP ($p < 0.01$), and Alb ($p < 0.001$) were observed in younger goats compared with adult one. On contrary, the serum AST, ALP, and LDH activity were insignificantly ($p > 0.079$) differed between young and adult goats.

Table 7. The effect of age on serum enzymes, total protein, and albumin in the young (no=14) and adults (no=56) Libyan goats (Mean ± SEM).

Chemistry	Age	Mean		Std. Deviation	Mann-Whitney	
					Test statistics	P- value
ALT (U/L)	young	12.50	±	7.73	215	0.026*
	adult	15.68	±	6.20		
AST (U/L)	young	128.00	±	177.98	334.5	0.720
	adult	86.75	±	46.35		
ALP (U/L)	young	58.66	±	50.63	261	0.132
	adult	99.88	±	128.96		

LDH (U/L)	young	531.58	±	801.57	265	0.149
	adult	426.23	±	249.78		
TP (g/dl)	young	5.84	±	0.94	198.5	0.013
	adult	6.62	±	1.01		
Alb (g/dl)	young	2.22	±	0.67	153	0.001*
	adult	2.79	±	0.53		

ALT = alanine aminotransferase; AST = aspartate aminotransferase; ALP = alkaline phosphatase; LDH = lactate dehydrogenase; TP= total protein; Alb= total protein.

*Significant at $p < 0.05$.

The effect of age on the serum total bilirubin and direct bilirubin, glucose, triglycerides, cholesterol and lipoproteins of young and adult goats was exhibited in Table 8. Low serum Chol ($p < 0.05$), and HDL ($p < 0.01$) were observed in younger goats compared with adult one. On contrary, the other values for measured biochemical parameters (T BIL, D BIL, Glu, TG, VLDL, &LDL) were insignificantly ($p > 0.079$) differed between young and adult goats (Table 8).

Table 8. The effect of age on serum bilirubin, glucose, and lipid profile in the young (no=14) and adults (no=56) Libyan goats (Mean ± SEM).

Chemistry	Age	Mean		Std. Deviation	Mann-Whitney	
					Test statistics	P- value
T BIL (mg/dl)	young	0.01	±	0.11	304	0.402
	adult	-0.03	±	0.07		
D BIL (mg/dl)	young	-0.06	±	0.15	312.5	0.477
	adult	-0.02	±	0.05		
GLU (mg/dl)	young	31.69	±	9.46	234	0.054
	adult	38.16	±	12.34		
TG (mg/dl)	young	23.57	±	11.44	347	0.870
	adult	22.32	±	10.37		
Chol (mg/dl)	young	46.58	±	19.24	208.5	0.020*
	adult	59.76	±	18.41		
VLDL (mg/dl)	young	6.33	±	4.92	214.5	0.079
	adult	8.81	±	5.03		

HDL (mg/dl)	young	25.97	±	10.21	202	0.015*
	adult	34.75	±	9.75		
LDL (mg/dl)	young	14.22	±	7.70	304.5	0.408
	adult	16.46	±	8.16		

T BIL = total bilirubin; D BIL = direct bilirubin; GLU = glucose; TG = triglycerides; Chol = cholesterol; VLDL = very low-density lipoprotein; HDL = high-density lipoprotein; LDL= low-density lipoprotein

*Significant at $p < 0.05$.

Animal gender effects on biochemical parameters are shown in Tables 10-12. All variables showed non-significant ($p > 0.119$) statistically variations between males and females goat, although most variables were higher in males than females but did not significantly different.

Table 9. The effect of age on serum creatinine, urea, and electrolytes in the young (no=14) and adults (no=56) Libyan goats (Mean ± SEM).

Chemistry	Age	Mean		Std. Deviation	Mann-Whitney	
					Test statistics	P- value
Crea (mg/dl)	young	0.64	±	0.08	180.5	0.001*
	adult	0.77	±	0.15		
Urea (mg/dl)	young	43.62	±	12.29	266	0.153
	adult	39.43	±	8.85		
Phos (mg/dl)	young	4.35	±	1.88	323.5	0.596
	adult	4.75	±	1.67		
Ca (mg/dl)	young	7.13	±	0.95	198.5	0.013*
	adult	7.86	±	1.02		
Mg (mg/dl)	young	2.27	±	0.39	259	0.124
	adult	2.36	±	0.25		
Na (mEq/L)	young	144.46	±	5.54	339.5	0.855
	adult	146.23	±	7.27		
	young	5.11	±	0.69		

K (mEq/L)	adult	12.86	±	58.67	281	0.267
Cl (mEq/L)	young	114.73	±	3.89	338.5	0.843
	adult	116.39	±	6.53		

Crea= creatinine; Phos = phosphorus; Ca= calcium; Mg = magnesium; Na= sodium; K= potassium; Cl= chlorine. *Significant at $p < 0.05$.

Table 10. The effect of gender on serum enzymes, total protein and albumin in the males (no=12) and females (no=58) Libyan goats (Mean ± SEM).

Chemistry	Gender	Mean		Std. Deviation	Mann–Whitney	
					Test statistics	P– value
ALT (U/L)	M	14.33	±	7.51	254.5	0.326
	F	15.22	±	6.45		
AST (U/L)	M	82.18	±	22.47	297.5	0.790
	F	97.04	±	95.15		
ALP (U/L)	M	107.85	±	167.14	298.0	0.796
	F	88.94	±	108.89		
LDH (U/L)	M	334.25	±	86.48	271.0	0.479
	F	468.01	±	442.32		
TP (g/dl)	M	6.02	±	1.39	261.0	0.382
	F	6.56	±	0.95		
Alb (g/dl)	M	2.54	±	0.47	252.5	0.309
	F	2.71	±	0.62		

ALT = alanine aminotransferase; AST = aspartate aminotransferase; ALP = alkaline phosphatase; LDH = lactate dehydrogenase; TP= total protein; Alb= total protein

Table 11. The effect of gender on serum bilirubin, glucose and lipids profile in the males (no=12) and females (no=58) Libyan goats (Mean ± SEM).

Chemistry	Gender	Mean		Std. Deviation	Mann–Whitney	
					Test statistics	P– value
T BIL (mg/dl)	M	−0.02	±	0.04	280.5	0.581
	F	−0.02	±	0.09		
D BIL (mg/dl)	M	−0.01	±	0.03	248.5	0.273
	F	−0.03	±	0.09		
GLU (mg/dl)	M	31.43	±	9.73	220.0	0.119
	F	37.98	±	12.24		
TG (mg/dl)	M	19.43	±	6.38	258.0	0.355
	F	23.16	±	11.07		
Chol (mg/dl)	M	55.22	±	21.95	298.0	0.796
	F	57.63	±	18.76		
	M	7.10	±	5.59		

VLDL (mg/dl)	F	8.58	±	4.99	227.0	0.381
HDL (mg/dl)	M	31.47	±	10.72	277.0	0.543
	F	33.38	±	10.37		
LDL (mg/dl)	M	17.07	±	8.91	282.0	0.600
	F	15.83	±	7.96		

T BIL = total bilirubin; D BIL = direct bilirubin; GLU = glucose; TG = triglycerides; Chol = cholesterol; VLDL = very low-density lipoprotein; HDL = high-density lipoprotein; LDL= low-density lipoprotein

Discussion:

Hematological and biochemical qualities are broadly used to decide methodical connections and physiological adjustments, including evaluating the general wellbeing state of a creature (M. T.A et al.,2021) and presents clues for the health status of animals (Karaşahin et al.,2022). In the existing study, we evaluated some parameters in the goat blood that were affected by age, gender or both.

According to the obtained results, adult goats had higher WBC, and lymphocytes counts than that reported in young goats. The higher WBC values in older goats compared to younger goats were in harmony to other studies that reported higher WBC values in adult West African Dwarf goats (Daramola et al.,2005).These results may be attributed to difference in the rate of infection and immune response (Shaikat et al.,2013).

Table 12. The effect of gender on serum creatinine, urea and electrolytes in the males (no=12) and females (no=58) Libyan goats (Mean ± SEM).

Chemistry	Gender	Mean		Std. Deviation	Mann-Whitney	
					Test statistics	P- value
Crea (mg/dl)	M	0.73	±	0.16	296.0	0.770
	F	0.74	±	0.15		
Urea (mg/dl)	M	38.18	±	15.15	294.0	0.745
	F	40.63	±	8.32		
Phos (mg/dl)	M	4.33	±	1.76	262.0	0.391
	F	4.74	±	1.70		
Ca (mg/dl)	M	7.61	±	1.20	299.5	0.816
	F	7.74	±	1.02		
Mg (mg/dl)	M	2.32	±	0.25	298.5	0.803
	F	2.35	±	0.29		

Na (mEq/l)	M	145.21 ± 7.83	266.0	0.477
	F	146.02 ± 6.86		
K (mEq/l)	M	4.99 ± 0.73	290.5	0.767
	F	12.60 ± 57.61		
Cl (mEq/l)	M	115.13 ± 5.33	303.5	0.939
	F	116.25 ± 6.29		

Crea= creatinine; Phos = phosphorus; Ca= calcium; Mg = magnesium; Na= sodium; K= potassium; Cl= chloride.

Similar findings were previously obtained by (Piccione et al.,2007;Zumbo et al.,2011) and confirmed by (Feldman et al.,2002). In contrast to our study, other studies recorded that WBC and lymphocyte fractions decreased with age (Agradi et al.,2022). Also, (Arfuso et al.,2016) found higher WBC values in younger goats compared to older goats. The differences due to age are a signal of the health status of the various age groups among the goat breeds studied, which is in agreement with the findings of other authors (Weiss and Wardrop,2011;Peres et al.,2014;Zvonko et al.,2019). However, the erythrocyte parameters exhibited no significant variations (p-value > 0.10) among young and adult goats and this agree with the results obtained by (Rice and Hall,2007;Shaikat et al.,2013). Dissimilar reports were indicated by several authors (Arfuso et al.,2016;Antunović et al.,2019) who stated that RBC, HGB, HCT, and MCHC were increased with the age. This physiological difference might be due to a greater oxygen-carrying capacity of the younger goats compared with the older ones and, as a consequence, a higher metabolic activity (Daramola et al.,2005). The trend of RDW values was in correlation with previous outcomes showing a decline with age (Zvonko et al.,2019). Indeed, poikilocytosis is very common in goat species, especially in young subjects. On the contrary, MCV increased with age (Agradi et al.,2022).

With reference to compare the hematological parameters between the goat's genders in this study, the results revealed none statistically differences. However, the male goats had non-significant lower mean values in WBC, lymphocyte, and granulocyte than that of females. The lower values of male

category of goats can be attributed to immune response to different environmental factors and physiological status as reported previously in Sudanese desert goats (Babeker and Elmansoury,2013). Our work was partially agree with (Zahira et al.,2019) who stated that the highest value of RBC's count was recorded in males and the lowest value in females, in addition gender had a significant influence on WBC, lymphocytes and monocytes values, while the mean Hb concentration was observed without significant difference in females and males goat. On contrary, the RBC, WBC, neutrophils, eosinophil and monocytes counts as well as the MCV and MCH of male Nigerian coastal goats varied significantly ($p < 0.05$) from those of female goats (Egbe-Nwiyi et al.,2015). Previous investigation showed significantly higher WBC, granulocytes, RBC, HBG, HCT and MCH, with no significant difference in lymphocytes in male Teressa goats as compared with female (Sunder et al.,2016). On contrary, there was no effect of sex on RBC, MCHC, PCV, Hb or WBC, but female kids had significantly higher MCH and MCV values at week 12 (Osman et al.,2016). Several investigation stated that sex did not affect hematological parameters in neonatal Dwarf and Danish Landrace kids (Mbassa and Poulsen,1991), West African Dwarf goats (Daramola et al.,2005) and African goats of Tanzania (Mbassa and Poulsen,1992) and others (So-In and Sunthamala,2023). This was in contrast to the report of others reporters who found significantly higher PCV and RBC values in males than females in Ethiopian native goats (Tibbo et al.,2004).

Biochemical parameters help veterinary practitioners to evaluate the health condition and metabolic activities of the animals. Factors like sex and age may influence the physiologic levels of the blood parameters (Elitok et al.,2004;Cenesiz et al.,2011;ÇElİK et al.,2019;Karaşahin et al.,2022).

Concerning the effect of age on the biochemical analysis in Libyan goats, serum ALT, TP, Alb, Chol, HDL, Crea, and Ca were higher in adult goats compared with younger one. This should

be related to the age growth and physiological maturity of kids (Abdelsattar et al.,2021). ALT is an enzyme found in the highest amount in liver and typically increased with the liver growth (Kaneko et al.,1997;Pratt,2010). The blood TP, Alb, and HDL (mostly protein content) concentrations were increased with age (Abbas et al.,2020) because the enhanced protein intake due to physiological maturity caused extensive degradation of dietary protein and metabolism of absorbed amino acids, which eventually led to the possible increase of blood protein level (Kaneko et al.,1997;Chapman,2013). Furthermore, they also reported that high serum protein levels are an indication of high intake of grains (Sandabe,2000), dehydration or high temperature as a result of kidney failure. The findings of the present study were analogous to those previously recorded by (Sakha et al.,2009). They report that goats' total protein levels vary between sexes and are lower in adult females compared to adult males.

Cholesterol (Chol) plays an important role as an antioxidant and metabolism of cell-soluble hormones, hormone production, cortisone, bile formation, and fat-soluble vitamins. The higher Chol levels in adult goats compared to values from young goats can be attributed to the fact that the metabolite is a precursor to all sex steroid hormones and is, therefore, high in concentrations in adult livestock compared to young animals (Ingraham and Kappel,1988;Mthi et al.,2021).

The high levels of Ca and other electrolytes (Phos, Mg, Na, K & Cl) but did not significantly might also be attributed to the fact that the experimental goats were still growing. Similar results were obtained by (Abbas et al.,2020;Mthi et al.,2021) but differs from the findings of (Kiran et al.,2012)who reported that the level of PHOS decreases as the goats grow older since there is reduced capacity to assimilate Phos from the diet as the goats grow. Similarly, (Abdelkader et al.,2021) reported that age significantly influenced (p <0.05) cholesterol, triglycerides, total protein, calcium and globulin in Algeria goats. They found the lowest total

protein and globulin values were recorded in 9-month-old goats while the lowest values, cholesterol, triglycerides and calcium were recorded in 72- month-old goats. These changes have been discussed in relation to diet and rumen development with age which can be expected from stress especially in young animals (Ashour et al.,2015).

Regarding the influence of animal gender, most biochemical variables in this study were higher in males than females and vice versa but did not significantly different ($p > 0.119$). The results indicated that these parameters could show variations under physiological conditions due to age and gender. Our results were in agreement with (Soul et al.,2019) showed that sex had no significant effects ($p > 0.05$) on serum total proteins, globulins, urea, creatinine, ALT, ALP, and gamma- glutamyl transferase concentrations in goats. However, (ÇElİK et al.,2019) who stated that healthy Boer x hair goat crossbreed had statistically significant ($p < 0.05$) higher levels of K, MG, Crea, TP, Alb, and activities of ALT, and ALP in males than females, while Chol level was statistically higher in females. Also, (Karaşahin et al.,2022) who reported that both the age and sex of the Hair goats had significant effects on blood levels of glucose, phosphorus, urea, cholesterol, creatinine, GGT, CK and total bilirubin. The dissimilarities may be attributed to different season of examination, species or age of goats.

Conclusion:

It could be concluded that there are differences in some hematological and biochemical parameters according to various animals age and sex. Studying the hematological values or proteinogram for the goats provides useful information about the body condition and immunology system.

الملخص:

أجريت هذه الدراسة من أجل تحديد تأثير عاملي الجنس والعمرعلى مكونات الدم وقيم كيمياء الدم في الماعز الذي تمت تنشئته في ليبيا لنقص مثل هذه المعلومات لدينا خاصة بين سلالات مختلفة.

تم اختيار عدد 70 حيوانًا سليمًا من مختلف الأعمار والجنس بشكل عشوائي من مناطقتين مختلفتين (قصر بن غشير والقرابوللي) طرابلس– ليبيا. تم جمع عينات الدم من الوريد الوداجي للحيوانات لتحليل الدم. تم تطبيق التحليل الإحصائي باستخدام برنامج SPSS Statisticsالإصدار 25 لحساب القيم الدنيا والقصوى لتحديد المتوسط والإنحراف المعياري للمتوسط والقيمة.p

أظهرت النتائج عدم وجود فروق ذات دلالة إحصائية بين متوسطات المتغيرات الدموية لجنس الماعز) قيمة .($p > 0.10$ وفيما يتعلق بتأثير العمر، أظهرت نتائج أمراض الدم أن متوسط قيم كريات الدم البيضاء (12.46±4.90×103/ميكرولتر، 14.37±4.23×103/ميكرولتر)، الخلايا الليمفاوية (6.34±2.91×103/ميكرولتر، 8.04±2.34×) كان عدد الخلايا الليمفاوية (103/ميكرولتر) ونسبة الخلايا الليمفاوية (46.78±14.04%، 57.89±57.89%) مختلفين معنوياً) قيمة p ($0.05>$في الماعز الصغيرة والبالغة على التوالي. لم يلاحظ أي اختلافات كبيرة) قيمة ($p > 0.10$ في معاملات كريات الدم الحمراء بين الماعز الصغيرة والبالغة. كانت هناك تأثيرات معنوية ($P <0.01$) للعمر في المعايير الكيموحيوية للماعز. أظهرت الماعز البالغة من العمر 10 إلى 16 شهرًا انخفاضًا ملحوظًا في مستويات ALT في الدم($P <0.05$) ، البروتين الكلي ($P <0.01$)، الألبومين($P <0.001$) ، الكوليسترول($P <0.05$) ، .($P <0.01$) HDLوالكرياتينين($P <0.001$) ، والكالسيوم ($P <0.01$)مقارنة بالماعز البالغ، في حين أن الإنزيمات المحددة الأخرىAST) ، ALP، (LDH، البيليروبين، الجلوكوز، اليوريا، الدهون، والكهارل لم تتغير إحصائيا.

أثبتت هذه الدراسة أن العمر والجنس أثرا بشكل كبير على مؤشرات الدم وكيمياء الدم في الماعز المحلية التي تمت تربيتها في ليبيا.

الكلمات المفتاحية: العمر، الجنس، الماعز، مؤشرات الدم، ، ليبيا.

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