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EFFECT OF REARING TYPE ON PHYSIOLOGICAL RESPONSE OF LOCAL GOATS IN THE SULAYMANIYAH REGION

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Abstract

This study was conducted in two different areas in the Sulaymaniyah Governorate / Kurdistan Region of Iraq, in spring 2021. Thirty-six adult local goats (18 does + 18 bucks) and different colors of goats (black, brown and white), aged 1.5-2 years by using two types of rearing, OG: Open grazing (for this system Qaiwan area was used, Mountainous logic), the animal in the group open grazing deepening on natural grazing for all days. IS: Intensive system (for this system Arbat area was used, not a mountain logic), the animal in the group intensive system depending on traditional feeding regime. The purpose of this study was to see how different husbandries affected some blood and hormone parameters. Moreover, blackbuck goat's, (WBCs), L%, MCHC, and MCV were significant differences ($p<0.05$) for OG, and MO%, N%, N/L, Hb and HCT for IS, brown goat's, L% and MO% for OG, and (WBCs), N/L and MCHC for IS, white goat's, (WBCs), L%, Hb and HCT for IS and MCHC for OG. Black doe goat's, N%, E%, B%, N/L, RBC, Hb, and MCV were significant differences ($p<0.05$) for OG, and (WBCs), L%, MO%, MCHC and MCH for IS, brown goat's, N%, E%, N/L and MCV for OG, and L%, RBC, MCHC and MCH for IS, white goat's, (WBCs), L%, N%, Hb and MCHC for OG and N/L and RBC for IS, whereas other parameters were not significant. Cholesterol level in both sexes of (black and white) and brown doe goats were significant differences ($p<0.05$) for IS, brown buck goats was not significant. The total protein level in both sexes of black goats and brown doe goats were significantly different ($p<0.05$) for IS, while brown buck and white doe for OG. Glucose concentration was

significantly different ($p<0.05$) in both sexes of three-color in OG, except brown doe, was for IS. Cortisol levels, in both sexes, were significant differences ($p<0.05$), (black and white buck) and (brown and white doe) goats for IS, whereas brown buck and white doe for OG. Adrenocorticotropic (ACTH) levels in buck goats were not significant, while white and brown doe were significant differences ($p<0.05$) for OG, black doe for IS.

Keywords: Goat, Rearing, Hematological, Biochemical, Hormones parameters.

تأثير نوع التربية على الاستجابة الفسيولوجية للماعز المحلي في محافظة السليمانية

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الملخص

أجريت الدراسة في منطقتين مختلفتين في محافظة السليمانية / إقليم كردستان العراق (منطقة قيوان وأربت) في ربيع 2021. ستة وثلاثون ماعزًا محليًا بالغًا (18 ذكر + 18 اناث) وألوانًا مختلفة من الماعز (أسود، بني وأبيض)، تتراوح أعمارهم بين 1.5 و2 سنة لذكور واناث، وكانت اوزان التي استخدمت 40 ± 2 كغم بدرجة حالة الجسم جيدة، ومن خلال استخدام نوعين من التربية، OG الرعي المفتوح (لهذا النظام تم استخدام منطقة قيوان، المنطق الجبلية)، والحيوان في مجموعة الرعي المفتوح تعتمد على الرعي الطبيعي لجميع الأيام. IS ن نظام مكثف (لهذا النظام تم استخدام منطقة أربت، ليس منطقًا جبلية)، يعتمد الحيوان في نظام المجموعة المكثف على نظام التغذية التقليدي.

علاوة على ذلك، ذكور ماعز اسود، نسبة WBCs، L، MCHC وMCV مختلف معنويا OG، وMO، N، N/L وHCT ل IS، ماعز البني، OG نسبة L وN، IS نسبة WBCs، N/L وMCHC، ماعز ابيض، كل من نسبة، L، Hb وHCT ل IS، وMCHC ل .OG اناث ماعز اسود، ($p<0.05$) مختلف معنويا في كل من نسبة N، E، N/L، RBC، Hb وMCV ل OG، وL، RBC، MCHC وMCH ل .IS ماعز ابيض، في نسبة كل من WBCs، L، N، Hb وMCH ل OG، N/L وRBC ل IS، بينما لم توجد اختلافات معنوية في القياسات الاخرى. مستوى الكوليسترول في كلا الجنسين من ماعز (الأسود والأبيض) واناث البني مختلف معنويا ($p<0.05$) IS، لم توجد اختلافات معنوية في ذكور ماعز البني. البروتين الكلي في كلا الجنسين من الماعز اسود واناث البني مختلف معنويا ($p<0.05$) IS، بينما ذكور البني واناث ابيض ل .OG تركيز كلوكوز، في كل ألوان الماعز في كلا الجنسين مختلف معنويا ($p<0.05$) ل OG ماعدا اناث البني ل .IS

مستوى الكورتيزول، في كلا الجنسين من (ذكور ماعز اسود وابيض) و(اناث ماعز بني وابيض) مختلف معنويا (p<0.05) IS، بينما ذكور البني واناث الابيض OG لمستوى (ACTH) Adrenocorticotropic لم توجد اختلافات معنوية في ذكور ماعز، بينما مختلف معنويا (p<0.05) لإناث ابيض والبني ل OG، واناث اسود ل IS.

كلمات مفتاحية: الماعز، التربية، قياسات الدم، البايوكيميائية والهورمونات.

Introduction

Goats were the first domesticated farm animals. This historic event occurred 10,000 years ago in Gaji Dara [Genj Dara] in southern Kurdistan. In terms of growth, management, and husbandry, livestock production in Iraq lags far behind crop production. Crop farming and livestock production have never been combined in the past. Goats and sheep, in general, graze widely on natural grass, stubble, and crop residues for more than six months per year. The amount of forage generated is extremely limited (25). The native goat, which had a population of around 1.3 million in 1999 (19), is found throughout the country, with 12.5, 44.2, and 43.3 o/o in the southern, central, and northern parts of the country, respectively (5). This valuable genetic resource is mainly raised for meat and milk, with hair coming in second. Despite this, unlike dairy cattle and sheep, there has been very little research into the different venues and economic characteristics of the local goat in Iraq. Livestock production is reliant on the growth and survival of a population of animals that can be exploited for human profit. As a result, reproductive characteristics have often piqued the interest of livestock producers (10). Several factors, including the physical climate, diet, management, and genetics, influence the season in tropical regions (48). Many clinical studies on local female and male goats in Iraq indicated that they are not exclusively seasonal animals, and that their reproduction is identical throughout the year, but that their reproductive performance is highest in the autumn and spring (4). Hematochemical tests are valuable tools for assessing the physiological and health status of farm animals, and they're practically required in organic farming, where veterinary interventions are strictly controlled and restricted. Several factors, including breed, age, reproductive status, accommodation, malnutrition, environmental factors, stress, and transportation, are known to affect physiological and hematochemical parameters (7). These variations point to the need for acceptable physiological baseline values for livestock, which could be used in the practical assessment of management practices, diet, and health condition diagnosis, as well as assessing animal physiological status (53). Cortisol is a glucocorticoid, a class of steroid hormone. Cortisol levels in goats that are elevated are a sign of stress, regardless of the cause or stressor. This cortisol is helpful to the animal in terms of allowing it to avoid the stressor, but it also has serious negative effects (27). It has the potential to obstruct efficient reproduction (16) and production (54) and makes you more susceptible to diseases due to a weakened immune system (22). The goal of this

experiment was to recognize the effect of various husbandries on some blood parameters and hormones such as Adrenocorticotropic (ACTH) and cortisol.

Materials and Methods

This investigation took place in the two different areas in the Sulaymaniyah Governorate / Kurdistan Region of Iraq, (Qaiwan and Arbat area) in spring 2021. In this research, a total of 36 local goats (18 does + 18 bucks) and different colors of goats (black, brown, and white), by using two types of rearing (Open grazing and Intensive system). Aged 1.5-2 years for does and bucks, weighed 40 ± 2 kg were use and good body condition scores. The experimental design was shown in table 1.

Table 1 shows the experimental design.

Rearing Type			
Open grazing		**Intensive system**	
18 local goats		18 local goats	
9 local does	9 local bucks	9 local does	9 local bucks
3 black	3 black	3 black	3 black
3 brown	3 brown	3 brown	3 brown
3 white	3 white	3 white	3 white

T1: Open grazing (for this system Qaiwan area was used, Mountainous logic), the animal in the group open grazing deepening on natural grazing for all days.

T2: Intensive system (for this system Arbat area was used, not a mountain logic), the animal in the group intensive system depending on the traditional feeding regime.

Data collection, Haematological Blood Parameters, blood samples were taken by vacuum puncture of the jugular vein. Tubes containing EDTA, 2ml, a hematological anticoagulant. Hämatological parameters including total number of white blood cells (WBC) count, hematocrit (HCT), hemoglobin (Hb), number of red blood cells (RBC), Total concentration of corpuscular hemoglobin (MCHC), the total concentration of the corpuscular Measured volume (MCV) and mean cell hemoglobin (MCH). By Automated Analyzer for veterinary were calculated (Hemato Analyzer). Biochemical Blood Parameters, Sample collect 7 ml was deposited into anticoagulant-free plastic tubes and then blood samples were put in a centrifuge type TRIUP 80-2 at a speed of 3000 r / min for 5 minutes to separate blood serum. The serum samples were later stored at a temperature of -20oC for biochemical analysis. The concentration of glucose, total protein, and cholesterol was estimated photometrically in an automatic blood analyzer (Microlab 200, E-Merck, Germany) using specific analytical kits (in vitro diagnostic kits manufactured by Erba Diagnostics, Manheim, Germany). Hormones Parameters, Cortisol, and Adrenocorticotropic (ACTH) hormones were measured by immunoassay analysis using an automatic blood analyzer kit (Monobind, Lake Forest, CA) according to the manufacturer's instructions.

Statistical analysis was performed using a completely randomized design through XLSTAT software (55). Differences between means of care were tested using the Duncan Test (14). The model used for analysis was $Yij= \mu+Si +Eij$ where Yij was the

observation of the dependent variable; μ was the population mean for the variable; Si was the effect of rearing and Eij was the random error associated with observation.

Results and Discussion

The results of the rearing type effect on the hematological parameters of bucks are demonstrated in the table 2. There were significant differences (P<0.05) recorded in WBC count between the two-rearing type (Open Grazing and Intensive System, OG and IS), which recorded significant difference (P<0.05) in blackbucks of OG 15.5±2.32 compared to IS, on the other hand, the differences recorded in IS of brown and white bucks. This difference due to the ratio of lymphocyte (L%) in OG of black and brown bucks, which were recorded 59.30±4.29 and 66.60±0.32 respectively. Also, the significant differences (P<0.05) were recorded in monocytes (MO%), Neutrophiles (N%) and N/L ratio of IS rearing type of blackbucks was 0.86±0.11, and differences in MO% of OG rearing for brown bucks 5.60±0.14. However, there was no significant difference between the mean values of RBC for all buck's species of the rearing systems, Nevertheless, there were significant differences (P<0.05) in Hb (g/L), HCT (%), MCH, MCV, and MCHC in all bucks Species in both rearing types.

Table 2 Effect of rearing type on hematological parameters of black, brown and white bucks' goats (Mean ± S.E.).

Parameters	Black		Brown		White		Range
	OG	IS	OG	IS	OG	IS	
WBC ($\times10^9$/μL)	15.5 ± 2.32^a	7.30 ± 0.11^b	9.13 ± 0.18^b	15.47 ± 0.12^a	09.90 ± 0.06^b	13.10 ± 0.11^a	5.0-14.0
L %	59.30 ± 4.29^a	47.70 ± 6.23^b	66.60 ± 0.32^a	50.63 ± 0.23^b	43.53 ± 0.26^b	45.03 ± 0.54^a	55.8-90.6
MO %	4.23 ± 0.09^b	4.70 ± 1.11^a	5.60 ± 0.11^a	5.07 ± 0.14^b	04.13 ± 0.09^a	4.30 ± 0.12^a	1.8-6.0
N %	41.23 ± 5.61^b	40.97 ± 7.14^a	37.87 ± 2.11^a	38.43 ±1.74^a	41.90 ± 4.27^a	43.41 ± 5.14^a	30-48
E%	2.61 ± 0.09^a	2.15 ± 0.14^a	2.63 ± 0.61^a	2.61 ± 0.32^a	3.44 ± 1.27^a	2.97 ± 1.13^a	1-8
B%	0.67 ± 0.05^a	0.80 ± 0.09^a	0.71 ± 0.08^a	0.66 ± 0.14^a	0.69 ± 0.09^a	0.75 ± 0.11^a	0-1
N/L Ratio	0.69 ± 0.03^b	0.86 ± 0.11^a	0.57 ± 0.12^b	0.76 ± 0.07^a	0.96 ± 0.10^a	0.96 ± 0.24^b	
RBC ($\times10^{12}$/μL)	10.45 ± 1.21^a	10.68 ± 1.^{33a}	11.48 ± 1.23^a	10.60 ± 2.14^a	11.42 ± 2.10^a	10.66 ± 1.23^a	8.30-17.9
Hb (g/L)	9.77 ± 0.88^b	11.33 ± 2.97^a	10.77 ± 1.24^a	10.43 ± 2.18^a	10.67 ± 2.13^b	11.57 ± 0.94^a	8.0-11.5
MCHC (g/dL)	51.47 ± 6.32^a	33.29 ± 2.17^b	36.37 ± 3.21^b	40.87 ± 2.15^a	48.53 ± 5.11^a	39.53 ± 2.13^b	30-36
HCT (%)	26.03 ± 1.78^b	27.70 ± 3.14^a	27.13 ± 1.25^a	27.30 ± 2.09^a	25.60 ± 2.12^b	27.60 ± 0.61^a	23.0-35.0
MCH (Pg)	7.67 ± 1.24^a	6.70 ± 0.67^b	6.10 ± 0.62^b	9.37 ± 0.74^a	7.33 ± 1.31^b	9.53 ± 2.17^a	5.2-8.0
MCV (fL)	28.53 ± 3.17^a	23.50 ± 1.14^b	25.63 ± 2.12^a	25.50 ± 1.97^a	25.57 ± 2.16^a	25.63 ± 1.95^a	16-25

Means with different letters within each column are differed significantly (p<0.05)
OG: Open grazing, IS: Intensive system.

The results of table 3 showed that there are significant differences (P<0.05) in hematological parameters of three-color species does for OG and IS rearing systems. WBC count recorded significant differences (P<0.05) in black doe of IS rearing system and OG of white does, also the (L%) and (MO%) ratio were significant

differences (P<0.05) in IS system of black does and (L%) ratio of brown does, with differences in OG system for white does. Otherwise, the N/L ratio recorded a significant difference (P<0.05) in the OG system of black and brown doe were 0.84±0.09 and 0.96±0.04, but in white does record significantly in IS system was 0.72±0.67. The results of RBC count (table 3) were recorded significantly (P<0.05) in the OG system of black doe, likewise the differences recorded in IS system of brown and white doe. The Hb concentration significant differences (P<0.05) recorded in the OG system of black and white doe. With differences in HCT for all species in the two rearing systems. Observations made on the hematological parameters of the bucks used for this study fell within the normal range for goats for the pre-treatment stage of the work. This, therefore, suggests that the bucks used for the study were in a good state of health. Hematological markers are good indications of physiological health state, and evaluating them is crucial for evaluating an animal's response to various stressful situations. Because blood parameter levels represent metabolic processes during stressful situations. Blood cells are useful parameters of small ruminant physiological or pathophysiological responses to stress (56), and leucocytes, in particular, demonstrate long-term stress consequences (26). Hematological parameters are a reflection of the effects of dietary treatments on the animal in terms of the type, quality, and amount of the feed ingested and are available for the animal to meet its physiological, biochemical, and metabolic necessities (15). These factors inform why several biological types of research engage hematological parameters to assess physiological changes in response to drugs and nutrition. Normal physiological processes are affected long before the death of an animal, there is, therefore, the need to check physiological and biochemical indicators of health and sub-lethal toxicant effects on livestock (13). The hematological blood parameters, such as RBCs, Hb, WBCs, can reflect physical changes occurring in an animal's body. These changes could be due to diseases or normal physiological changes. Hemoglobin is the substance responsible for transporting oxygen to body tissues and removing waste carbon dioxide. It also plays an important role in maintaining the pH of the blood.

Table 3 Effect of rearing type on hematological parameters of black, brown and white doe goats (Mean ± S.E.).

Parameters	Black		Brown		White		Range
	OG	IS	OG	IS	OG	IS	
WBC ($\times10^9$/µL)	10.75 ± 3.14^b	12.67 ± 1.18^a	12.63 ± 0.15^a	12.17 ± 0.17^a	15.47 ± 0.30^a	10.17 ± 0.14^b	5.0-14.0
L %	48.63 ± 5.27^b	50.46 ± 8.35^a	44.10 ± 0.11^b	50.50 ± 0.15^a	56.03 ± 1.32^a	52.00 ± 0.36^b	55.8-90.6
MO %	4.97 ± 1.09^b	6.23 ± 2.22^a	5.60 ± 0.17^a	6.10 ± 0.17^a	4.47 ± 0.12^a	4.80 ± 0.11^a	1.8-6.0
N %	41.17 ± 2.54^a	42.06 ± 6.13^b	42.60 ± 5.48^a	39.06 ± 2.31^b	40.27 ± 5.21^a	37.17 ± 1.28^b	30-48
E%	3.13 ± 0.11^a	2.83 ± 0.21^b	2.93 ± 0.14^a	2.73 ± 0.25^b	2.67 ± 2.06^a	2.55 ± 1.02^a	1-8
B%	0.79 ± 0.02^a	0.71 ± 0.09^b	0.72 ± 0.09^a	0.66 ± 0.11^a	0.67 ± 0.26^a	0.643 ± 0.17^a	0-1
N/L Ratio	0.84 ± 0.09^a	0.83 ± 0.12^b	0.96 ± 0.04^a	0.77 ± 0.47^b	0.71 ± 0.08^b	0.72 ± 0.67^a	
RBC ($\times10^{12}$/µL)	10.47 ± 0.95^a	9.17 ± 1.75^b	10.55 ± 2.17^b	11.32 ± 3.12^a	9.44 ± 1.24^b	10.51 ± 3.13^a	8.30-17.9

Hb (g/L)	9.93 ± 1.24[a]	8.67 ± 0.74[b]	9.73 ± 1.62[a]	10.90 ±1.31[a]	12.37 ± 0.91[a]	10.60 ± 2.17[b]	8.0-11.5
MCHC (g/dL)	47.60 ± 7.16[b]	56.69 ± 4.87[a]	48.39 ± 4.57[b]	56.69 ± 1.14[a]	56.06 ± 1.15[a]	44.68 ± 5.31[b]	30-36
HCT (%)	26.43 ± 1.24[a]	25.53 ± 0.98[a]	26.43 ± 1.15[a]	26.13 ± 1.02[a]	25.57 ± 2.17[a]	25.97 ± 1.94[a]	23.0-35.0
MCH (Pg)	9.50 ± 1.09[b]	10.57 ± 2.11[a]	7.60 ± 0.91[b]	8.73 ± 1.17[a]	9.40 ± 1.02[a]	10.50 ± 1.35[a]	5.2-8.0
MCV (fL)	26.67 ± 1.26[a]	24.43 ± 3.41[b]	26.63 ± 4.21[a]	25.30 ± 0.93[b]	26.07 ± 0.94[a]	26.77 ± 1.47[a]	16-25

Means with different letters within each column are differed significantly ($p<0.05$)

OG: Open grazing, IS: Intensive system.

Observations made on the hematological parameters of the bucks used for this study fell within the normal range for goats for the pre-treatment stage of the work. This, therefore, suggests that the bucks used for the study were in a good state of health. Hematological markers are good indications of physiological health state, and evaluating them is crucial for evaluating an animal's response to various stressful situations. Because blood parameter levels represent metabolic processes during stressful situations. Blood cells are useful parameters of small ruminant physiological or pathophysiological responses to stress (56), and leucocytes, in particular, demonstrate long-term stress consequences (26). Hematological parameters are a reflection of the effects of dietary treatments on the animal in terms of the type, quality, and amount of the feed ingested and are available for the animal to meet its physiological, biochemical, and metabolic necessities (15). These factors inform why several biological types of research engage hematological parameters to assess physiological changes in response to drugs and nutrition. Normal physiological processes are affected long before the death of an animal, there is, therefore, the need to check physiological and biochemical indicators of health and sub-lethal toxicant effects on livestock (13). The hematological blood parameters, such as RBCs, Hb, WBCs, can reflect physical changes occurring in an animal's body. These changes could be due to diseases or normal physiological changes. Hemoglobin is the substance responsible for transporting oxygen to body tissues and removing waste carbon dioxide. It also plays an important role in maintaining the pH of the blood. RBCs transport Hb. Reduction of Hb or RBCs results in low O2 in tissues, causing short breath, a symptom of anemia. WBCs, or leukocytes, defend the body against invasions of foreign particles. Their number can be used to detect the presence of pathogens in the blood of sick animals. The differences between values obtained in the current study and other reports can be attributed to many factors including differences in climate (1), diet (52), management system (23, 24 and 32) and breed. The latter cause is confirmed in the current study, as goats of all breeds were raised under the same conditions. According to the obtained results, the blackbuck in the OG system had higher WBCs and lymphocytes percentage than that at IS rearing and However, the WBCs in the IS rearing of a brown and white buck was also higher than that rearing at OG system. In contrast, lymphocytes percentage was lower in the blackbuck of IS system than that recorded in the other species and sex, which could be due to the extremely high percentage of neutrophils in the blackbuck breed of IS rearing system. The values of RBC, HGB, and HCT in our study were within the normal range that is reported by (17). Hemoglobin is the iron-containing oxygen

transport metalloprotein in the red blood cells of all vertebrates (28). The deficiency of hemoglobin in the red blood cells decreases blood oxygen-carrying capacity leading to symptoms of anemia (12). In ruminants, respiration is the most sensitive physiological measure to changes in the temperature and physical environment (40). When the skin's warm receptors are activated by a greater ambient temperature, the rate of respiration increases. When these receptors are activated, brain signals are sent to the hypothalamus, which enhances respiratory activity to expedite heat departure from the body by respiratory evaporation (2). In contrast, the values of RBCs, HGB, and HCT were higher than those reported in the Damascus breed (33). Erythrocyte values were observed differences in the present study than those previously reported (32, 34 and 39). Age and sex have been reported to influence the hematological values of goats in the arid zone (59 and 57). The disease could also influence the hematological parameters in goats (49). The mean concentration value of glucose for bucks of two rearing systems (OG, IS) was showed in table 4. The Glu. concentrations were significantly different (P<0.05) in the Open grazing OG system for the three-color species, which recorded 52.67, 60.37, and 56.03 mg/dL for black, brown, and white bucks respectively. The TP concentration of black buck in IS system recorded significant differences (P<0.05), but TP concentration significantly differences (P<0.05) in the OG system of brown buck (7.57±0.41 g/dL), while TP concentration not significantly differences in the white buck. The levels of Cholesterol (mg/dL) were significantly high (P<0.05) at IS system of black bucks and white black (58.47 and 57.47 mg/dL) respectively, whereas Cholesterol concentration not significantly differences in the brown buck (Table. 4).

Table 4 Effect of rearing type on biochemical parameters of black, brown, and white bucks' goats (Mean ± S.E.)

Parameters	Black buck		Brown buck		White buck	
	OG	IS	OG	IS	T1	T2
Glucose (mg/dL)	52.67 ± 4.27[a]	47.4 ± 2.45[b]	60.37 ± 2.45[a]	46.47 ± 3.11[b]	56.03 ± 4.28[a]	42.47 ± 5.16[b]
Total Proteins (g/dL)	6.80 ± 0.62b	7.17 ± 1.42a	7.57 ± 0.41a	6.27 ±0.90b	7.48 ± 2.11a	7.37 ± 1.37a
Cholesterol (mg/dL)	50.87 ± 3.19b	58.47 ± 1.16a	59.43 ± 3.21a	58.53 ±2.47a	51.83 ± 5.17b	57.47 ±3.29a

Means with different letters within each column are differed significantly (p<0.05)
OG: Open grazing, IS: Intensive system.

In the study, the biochemical parameters of three species color doe were shown in table 5, which were the significant differences (P<0.05) of glucose concentration recorded for three-colors doe at OG rearing system were (49.27, 43.57 and 56.63 mg/dL). Moreover, the significant differences of TP recorded in IS rearing system of black and brown doe, and OG system of white doe. The cholesterol levels significantly different in IS rearing system for all species when they compared to those does that rearing in the Open Grazing system.

Table 5 Effect of rearing type on biochemical parameters of black, brown and white doe goats (Mean ± S.E.).

Parameters	Black		Brown		White	
	OG	**IS**	**OG**	**IS**	**T1**	**T2**
Glucose (mg/dL)	49.27 ± 5.13[a]	42.57 ± 2.32[b]	43.57 ± 5.41[a]	42.23 ± 2.62[b]	56.63 ± 4.58[a]	46.23 ± 2.11[b]
Total Proteins (g/dL)	7.07 ± 1.35[b]	7.46 ± 0.92[a]	6.26 ± 0.76[b]	7.35 ± 1.03[a]	6.76 ± 0.94[a]	6.33 ± 1.16[b]
Cholesterol (mg/dL)	34.7 ± 0.97[b]	52.33 ± 4.10[a]	48.9 ±1.17[b]	61.8 ±3.46b[a]	53.4 ± 3.84[b]	70.27 ± 6.12[a]

Means with different letters within each column are differed significantly ($p<0.05$)
OG: Open grazing, IS: Intensive system

The animals' general blood biochemical condition is considerably altered when they are exposed to heat stress situations (9 and 46). Biochemical blood factors must be understood to describe the biochemical profile, energy metabolism, metabolism disorders, liver function, and bone abnormalities, as well as to assess the level of adaptability of animals to climatic adversities (50). The mechanisms that control the blood level of various metabolites, as well as the significant variance in these levels caused by a variety of variables, make biochemical profiles difficult to understand. Among these, we can mention the animal's breed, age, physiological stage, feeding, and management, as well as the climate (21). The concentration of glucose in the blood serum is regulated by the nutritional regime and hormones; however, it could be influenced by many other factors, such as age, sex, breed, and environment (41). The high glucose levels could be a result of the stressful situation, or the administration of some drugs like steroids (6). Some studies have found that in a high-temperature setting, blood glucose levels drop, which is evidence of homeostasis failure (31, 36 and 38). The liver, extrahepatic tissues, and hormones such as insulin, glucagon, adrenaline, cortisol, and thyroid hormones all play a role in keeping blood glucose levels steady (50). Glucose concentrations decreased markedly, along with high ambient temperature, which is consistent with previous reports, and this may be due to greater blood insulin activity (11) or could be due to reduced feed intake. The results obtained in the study were in accordance with a previous experiment conducted by (30). Generally, concentrations of total protein and albumin are used as indices for nutritional status in goats (8). Serum total proteins concentration decreased during thermal stress in goats and our results were similarly to those of (44). Earlier studies in goats (43) have also reported a significant decrease in total proteins concentration under heat stress. High serum protein levels may result from a high intake of grains, dehydration, and high temperature (42). (58) reported that the total protein value in goat serum could be increased to 7.5 g/dl in extensively raised animals. (41) also reported a normal value of 7.0 g/dl; however, they also found significant differences between sexes. Moreover, considering that cholesterol is the basic material for cortisol synthesis, the elevated cholesterol level in Open grazing goats could be ascribed to the need for greater cortisol levels to counteract the heat stress level (20). The higher cholesterol level in Intensive system goats could be an effort by this breed to support hepatic gluconeogenesis by

mobilizing the fat reserves to maintain the additional glucose supply for the adaptation processes (44). In heat-stressed indigenous Malpura sheep backed up these theories for cholesterol levels. Nevertheless, there have been reports of ruminant cholesterol concentrations dropping over the summer season (31 and 46). The enzyme concentration is required to assess animal welfare. The levels of aspartate aminotransferase, gamma-glutamyl transferase, and alanine aminotransferase represent metabolic processes during heat stress. Due to decreased thyroid activity, a drop in the levels of these enzymes may occur in animals subjected to heat stress (36 and 38). The data obtained in the present study are the first reference values obtained from Karadi goats raised under Opening grazing and intensive production system in Kurdistan region-Sulaymaniyah. It may be concluded that the biochemical and hematological parameters were mostly within the physiological range for goats as reported from previous studies. These data can contribute to our knowledge for monitoring health status, diagnosis of diseases, and management in these four breeds in KRG. Effect of rearing type on plasma cortisol level of black, brown, and white bucks' goats was shown in Figure 1, plasma cortisol level was significantly different ($p<0.05$) in three-color of buck goats, black and white bucks goats in intensive system 30.91 and 40.08 nmol/l were the largest level than open grazing were 29.18 and 26.26 nmol/l respectively, whereas brown buck goats in open grazing 30.34 nmol/l was the largest level than intensive system was 27.19 nmol/l. Figure 2 show the effect of rearing type on plasma cortisol level of black, brown, and white doe goats, plasma cortisol level in three-color of doe goats was significant differences ($p<0.05$), black doe goats the highest level was in open grazing 37.53 nmol/l, while brown and white doe goats in intensive system 37.63 and 43.40 nmol/l were highest level than open grazing 21.69 and 32.05 nmol/l respectively.

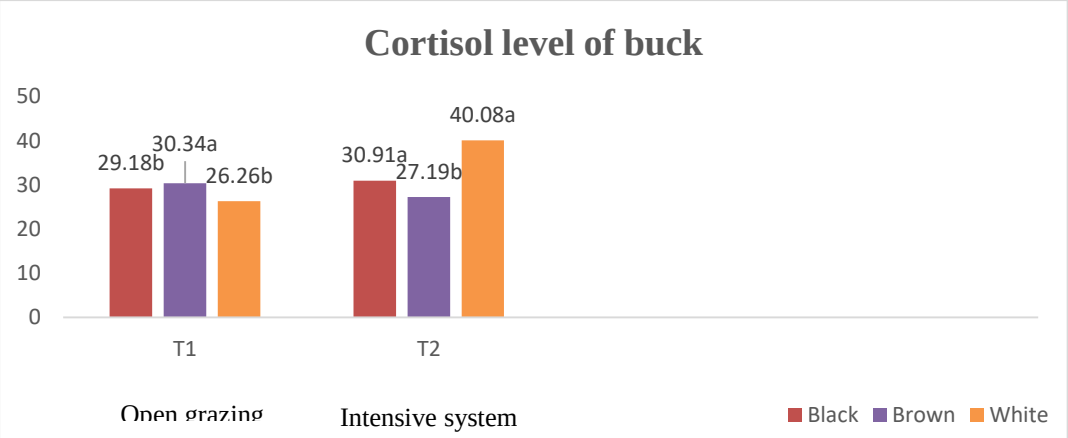

Figure 1 Effect of rearing type on plasma cortisol level of black, brown, and white bucks' goats.

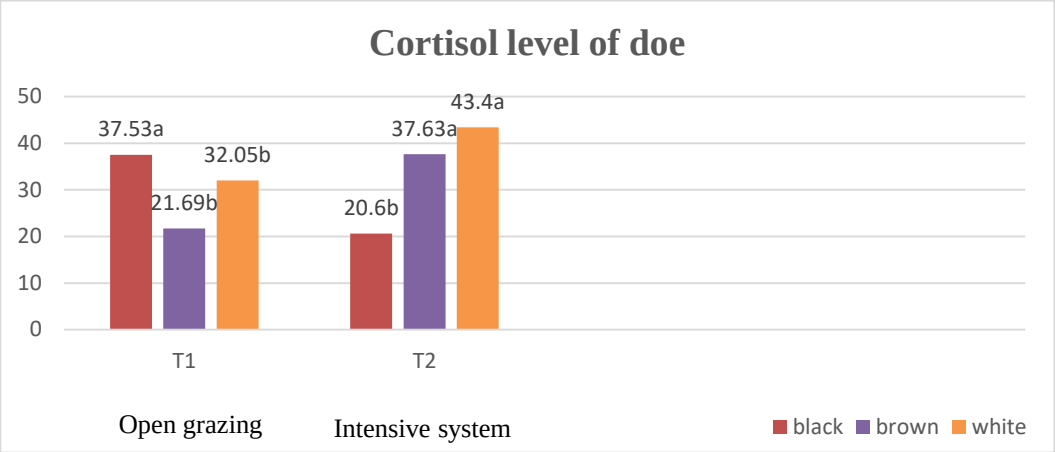

Figure 2 Effect of rearing type on plasma cortisol level of black, brown, and white doe goats.

Figure 3 show the effect of rearing type on plasma ACTH (Adrenocorticotropic) level of black, brown, and white bucks goats, plasma ACTH (Adrenocorticotropic) level was not significantly different in three-color of bucks' goats, the highest level in open grazing was blackbuck goats 0.97 pg/ml and the lowest was 0.90 pg/ml for white buck goats, also in intensive system blackbuck goats was the largest level 1.01 pg/ml and white buck goats was the smallest level 0.88 pg/ml. Effect of rearing type on plasma ACTH (Adrenocorticotropic) level of black, brown, and white doe goats showed in Figure 4, plasma ACTH (Adrenocorticotropic) level was significant differences ($p<0.05$) in three-color of doe goats, black doe goats in intensive system 1.47 pg/ml was the highest level than open grazing was 0.88 pg/ml, while brown and white doe goats in open grazing 2.07 and 1.17 were the largest level than intensive system were 0.83 and 0.97 pg/ml respectively.

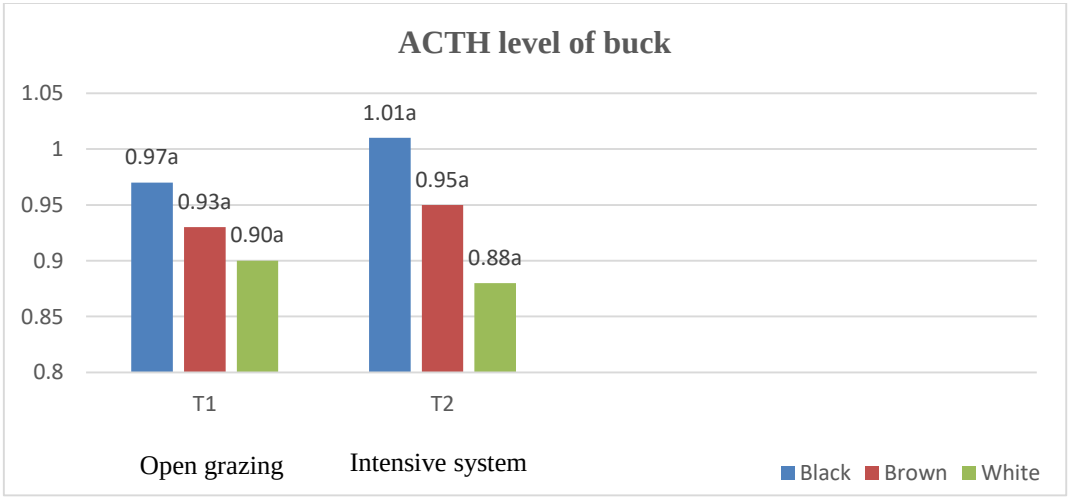

Figure 3 Effect of rearing type on plasma ACTH of black, brown, and white bucks' goats.

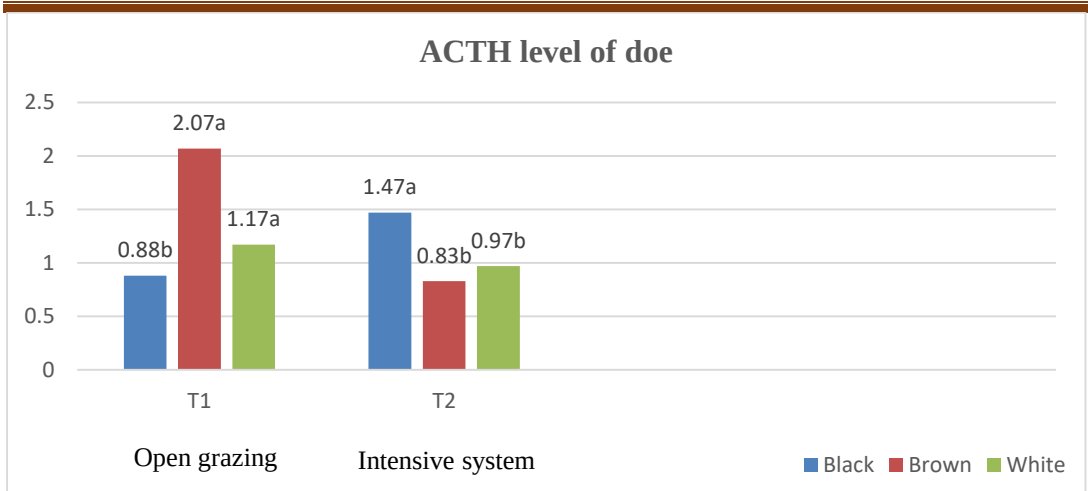

Figure 4 Effect of rearing type on plasma ACTH of black, brown, and white doe goats.

Blood metabolites, hormones, and enzymes (such as cortisol, catecholamines, and CK) have been frequently employed as stress indicators in small ruminants, among the procedures available to assess stress in farmanimals (26 and 51). Cortisol is one of the main stress hormones, and its main role is to promote protein metabolism by converting protein into amino acids and so aiding gluconeogenesis. The adrenal cortex produces cortisol, which increases the breakdown and release of glucose, amino acids, and fat in the liver, muscle, and adipose tissue (43). Cortisol levels can fluctuate depending on several factors, including the circadian rhythm, season, photoperiod, and diet composition. Cortisol levels rise during the first phase of an animal's activity cycle, according to the circadian rhythm, and also during times of stress. One of cortisol's key activities during heat stress is to enhance protein catabolism, which converts protein into amino acids to enable gluconeogenesis (43). Despite its unpredictability and limited lifespan, cortisol secretion is beneficial. Cortisol causes physiological changes in the animal that allow it to cope with stress produced by heated conditions. Physical and endocrine reactions to stress are catabolic because threatening situations necessitate quick action. That is, they aid in the mobilization of the organism's energy reserves through altering carbohydrate, lipid, electrolyte, and water metabolism (45). The hypothalamic-pituitary-adrenal axis secretes hormones that have a broad and long-lasting effect on the organism. Cortisol controls nearly every biological function influenced by stress, including immunological capacity, reproduction, metabolism, and behavior. The goal of these endocrine reactions is to improve the individual's ability to handle stress. Cortisol is important to live and is responsible for a variety of functions, thus it cannot be viewed solely as a negative response to the body. The purpose of releasing the least amount of cortisol possible is to maintain homeostasis, or the body's internal equilibrium, which differs from person to person (29 and 37). The hypothalamus releases corticotropin (CRH), which controls the release of adrenocorticotropic hormone (ACTH) by the hypophysis, when the hypothalamic-pituitary-adrenal axis is activated. The ACTH regulates the release of glucocorticoids, including cortisol

and catecholamines, adrenalin and noradrenalin by the adrenal, promoting interference in the hypothalamicpituitary-gonadal center (18). The study found that regardless of breed, the breeding habitat and its climatic variables might cause physiological, biochemical, hematological, and hormonal changes, resulting in a decrease in heat production to sustain homeothermy. Although goats are regarded to be harder than other ruminants, little is known about their adaptation abilities. Unlike exotic varieties, Creole goat breeds have a stronger ability to keep the rectal temperature within the optimal range, with little volatility in respiration rate and heart rate. In different physiological periods, the environmental temperature has a significant impact on the activity of biochemical blood variables. During heat stress, the metabolism slows down and is regulated by hormones. Hormones make it easy to comprehend the physiological elements involved in the adaptation process.

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