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# Effects heat stress in summer on some physiological characters in Iraqi indigenous goets

**Ola Hussen Ali**
**Salih Hassan Al- Azzawi**
**Raaed Ibrahim Khalil**
Department of Animal Production - College of Agriculture – University of Diyala
**agrianimh14a@uodiyala.edu.iq**

**Abstract:** This study was conducted in the animal field of the Department of Animal Production - College of Agriculture - University of Diyala.. The study included 47 local female goats in the Baquba region of Diyala Governorate, located between two latitudes (3, 33¯ and 35.6¯) north and (44.22¯ and 45.56¯) east longitudes. This study was carried out in the summer(through Auguast mounth), i.e., during the presence of heat stress to know the effect of hair color, presence of horns ,Watals , and pregnancy on hematological characteristics PCV, volume of compacted blood cells, Hb, hemoglobin concentration and RBC calculation Red blood cell count and WBC count white blood cell count and each of the ALT enzyme, the amino group transporter enzyme, and the ALP enzyme, the alkaline phosphatase enzyme, heat stress has a significant impact on the homatogical traits of goats and that this effect is negative and the goats can adapt physiologically, including blood traits and enzymes, which are considered as an indicator of their range The animal was subjected to stress and there was no study stating the effect of ratchets or horns on blood characteristics, where the results of the analysis of variance showed a significant effect of these factors on WBC, RBC and ALT. As for HP, there was an effect of black and white color in casting In the evening, this may be due to the high humidity in the morning. In addition to this, there was a significant effect of black and white color, and when the horns were present on the ALP enzyme, it was higher in the morning than in the evening

**Keyword:** Heat Stress, Physiological , Raqi Goet

## Introduction

Ruminant animals, including goats, are a main source of livelihood for farmers, and there are many factors, including heat stress, which affects the productivity, reproduction and natural immunity of goats (Yasha et al., 2017), and mainly the effect of air temperature and relative humidity on the possibility of ruminant production (Seixas et al., 2017). Goats adapt to stressful environmental conditions largely through behavioral, physiological, and genetic behaviors (Seixas et al., 2017, José et al., 2016). Animals possess a variety of physiological mechanisms that help reduce heat stress (Yasha et al., 2017) when physiological mechanisms fail to relieve stress. The effect of heat stress The animal's temperature may rise to a degree that affects the animal's well-being, causing a change in heart rate, respiratory rate and rectal temperature. These rates are considered key indicators of the physiological adaptation mechanism of ruminants (Kaushik, 2016, Sejian et al., 2017) and that the respiratory system is the first mechanism Thermal regulation used by the animal (Nejad, 2017) and heat stress affects hematological, physiological and biochemical parameters. For goats (Ocak and Guney 2010, Sharma and Kataria 2011) heat stress increases the oxygen consumption of animals by increasing the respiratory rate and the high oxygen intake increases the partial pressure of oxygen in the blood, reduces erythropoiesis, which in turn reduces the number of circulating red blood cells Thus PCV packed cell volume and hemoglobin (Hb) values (Temizel et al., 2009, Sivakumar et al., 2010, Alam et al., 2011, Kumar et al., 2011). Enzymes are important determinants of physiological mechanisms during stressful conditions and are assessed by determining the level of These enzymes are in plasma, where acid phosphatase and alkaline phosphatase (ALP) are the main enzymes associated with the metabolic activities of animals and the levels of these enzymes are generally low in heat stressed animals (Chaidanya, 2015). Morphologically, hair color in goats is an important characteristic for determining heat load. (Daramola, 2009) light-coloured animals absorb less heat than dark-coloured animals (Asres, 2014)

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Date of Publication: 18-07-2022

## Materials and methods

This study was conducted in the Department of Animal Production at the College of Agriculture / University of Diyala to know the effect of heat stress on the physiological characteristics of Iraqi goats. Using electronic thermometers, the number of red blood cells (RBC), the number of white blood cells (WBC), the concentration of hemoglobin (Hb) according to Schalm's method (1986) and the volume of the PCV-compounded blood cells according to the Sood method 1986) and the measurement of the amino group transporter enzyme (ALT) according to the method of Tietz (1995). The alkaline phosphatase enzyme (AlP) was measured according to the method of Varly et al. (1980). The morphological characteristics of goats were taken, including color, presence or absence of horns, presence or absence of Watals , presence or absence of pregnancy. Data analysis was carried out by SAS program and using the mathematical model to study heat stress. on physiological traits

$$Yijk = \mu + Ai + Bj + Pk + CL + eijkL$$

Yijk = watch value

μ = the general average of the studied trait.

Ai = color (1 black, 2 brown, 3 white, 4 black and white, 5 white and brown)

Bj = pregnancy (0 no pregnancy, 1 pregnancy)

Pk = Watals (0 no Watals, 1 Watals)

CL = horns (0 no horns, 1 horns)

eijkL = The random error is supposed to be distributed randomly with a mean equal to zero and a variance ofϴ2σ

Table (2) Temperature and relative humidity (morning and evening) during the three days of August.

| Temperature and humidity guide | | % relative humidity | | temperature | | the days |
|---|---|---|---|---|---|---|
| evening | A.m | evening | A.m | evening | A.m | |
| 40.16 | 31.95 | 17 | 21 | 49.2 | 37.8 | 14 /8 |
| 36.38 | 31.35 | 18 | 24 | 43.9 | 36.8 | 15 / 8 |
| 37.64 | 31.28 | 18 | 23 | 45.8 | 36.6 | 16 / 8 |

According to the temperature and humidity index according to the Marai equation (and others, 2001) shown below

$$THI = Tdp - [(0.31 - 0.31\ RH)\ (Tdp - 14.4)]$$

Where Tdp is the ambient temperature and RH is the relative humidity

## Results and Discussion

Table (1) shows that there are no significant differences for PCV between morning and evening reading traits, while Hb, a significant decrease was observed in the evening reading of black and white goats, and this agreed with Alam et al. (2011) in their study on a group of goats in Bangladesh, where a comparison was made between goats Exposed to stress and not exposed to stress, the Hb of goats exposed to stress was high, and there is no previous study on the effect of hair color on Hb values during stress, and that the general average of hemoglobin corresponds to the normal range determined by Abdulkareem et al. (2020, AL-Dujaily, AL-Hadithy, Saleh and others). (2010) As for WBC, a significant increase in all traits was observed in the evening reading, and that the general average of the number of white blood cells was identical to the normal level determined by Abdulkareem et al. (2020), AL-Dujaily and AL-Hadithy (2015), and there was no study stating the effect of color. And the markers or horns on the blood characteristics and that the number of WBC is higher in the evening reading and this is identical to what was found (Alam et al., 2011 and Okoruwa, 2014), where it was found that the number of white blood cells increases during heat stress, and we note that the average In the case of a pregnancy that is less than average when there is no pregnancy, as Abdul-Rahaman

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Date of Publication: 18-07-2022

et al. (2019) found, when studying local pregnant and non-pregnant goats, that the number of white blood cells was low in pregnant women.

Tabel(2) The mean of least squares ± standard error of some blood characteristics of local goats during the summer

| WBC | | Hb | | PCv | | the number | |
|---|---|---|---|---|---|---|---|
| evening | A.m | evening | A.m | evening | A.m | | |
| 12.95 A | 9.13 B | 6.56 | 6.67 | 21.80 | 22.34 | 47 | overall average |
| | | | | | | | the color |
| 12.62 a ±0.65 | 9.38 b ± 0.49 | 6.42 ± 0.44 | 6.50 ± 0.68 | 21.200 ± 1.39 | 22.00 ±2.21 | 5 | black |
| 12.87 a ± 0.28 | 9.17 b ±0.50 | 6.55 ± 0.19 | 6.68 ± 0.22 | 21.77 ±0.58 | 22.27 ± 0.68 | 18 | brouwn |
| 12.42 a ± 0.75 | 8.85 b ± 0.23 | 6.62 ± 0.14 | 6.05 ±0.20 | 22.00 ± 0.40 | 20.50 ± 0.86 | 4 | white |
| 13.11 a ±0.36 | 9.40 b ± 0.44 | 6.59 b ± 0.22 | 6.89 a ± 0.39 | 22.00 ± 0.68 | 23.00 ± 1.16 | 12 | black and white |
| 13.33 a ±0.21 | 8.65 b ± 0.62 | 6.58 ± 0.24 | 6.72 ± 0.28 | 21.87 ± 0.74 | 22.62 ±0.90 | 8 | white and brown |
| | | | | | | | the horns |
| 12.99 a ± 0.18 | 9.06 b ± 0.26 | 6.50 ± 0.11 | 6.68 ± 0.16 | 21.62 ± 0.34 | 22.37 ±0.51 | 43 | Presence |
| 12.50 a ± 0.38 | 9.90 b ± 0.40 | 7.20 ±0.21 | 6.55 ± 0.47 | 23.75 ± 0.62 | 22.00 ±1.41 | 4 | lack of |
| | | | | | | | Watals |
| 12.85 a ± 0.23 | 9.51 b ± 0.25 | 6.61 ± 0.13 | 6.60 ± 0.15 | 21.93 ± 0.39 | 22.16 ± 0.47 | 30 | Presence |
| 13.11 a ± 0.24 | 8.47 b ± 0.48 | 6.47 ±0.20 | 6.78 ± 0.34 | 21.58 ±0.61 | 22.64 ± 1.05 | 17 | lack of |
| | | | | | | | pregnancy |
| 12.81 a ± 0.17 | 9.42 b ±0.51 | 6.47 ± 0.16 | 6.51 ± 0.18 | 21.57 ±0.51 | 21.71 ±0.56 | 14 | Presence |
| 13.00 a ± 0.23 | 9.01 b ± 0.28 | 6.59 ± 0.13 | 6.73 ±0.20 | 21.90 ± 0.42 | 22.60 ± 0.63 | 33 | lack of |

It was noted in Table (3) that the general average of red blood cells is within the normal range according to what Abdulkareem et al. (2020) where the normal range is (8-18 106/ µL) and there was a significant effect of the brown color on the number of red blood cells, where the RBC is in the evening It was higher than RBC

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in the morning, as well as black and white, and white and brown. There was a significant effect, and RBC in the evening was higher than in the morning, and there was a significant effect in the case of horns on the number of red blood cells, where in the morning it was higher than in the evening, and this is due to the percentage of porosity In the horns of 0% goats, and this is according to what was stated (Zhang et al., 2018), meaning that there is no thermal evaporation through the horns as in sheep, and there is also a significant effect of the absence of drooping, where the number of red blood cells RBC in the evening was higher than in the morning, but there is no Previous studies on the effect of rattlesnakes on blood characteristics, as well as a significant effect for both cases of pregnancy and the absence of pregnancy on the number of red blood cells RBC, where in the evening is higher than in the morning, and through the study of Abdul-Rahaman et al. (2019) on local pregnant and non-pregnant goats, it was found The number of red blood cells It is lower in pregnant goats, and its higher in the evening than in the morning is due to heat stress and is identical to what was found (Alam et al., 2011 and Okoruwa, 2014). AL-Thuwaini et al. (2019) also found a high-rise study on a group of Awassi and Orabi sheep. Significance in (RBC) in summer compared with winter and in another study on local sheep and goats, it was found that RBC is lower in summer compared to winter (Salem et al., 2013). As for the biochemical characteristics, where it was higher in the morning than in the evening, and this is contrary to what was found (Helal et al., 2010), where it was found that these enzymes are low during stress and that this decrease is due to a decrease in the activity of the thyroid gland, or the reason for its rise in the morning than the evening is due to an increase in the activity of the thyroid gland. Relative humidity in the morning, where Motar and Al-Samee (2018) found that the higher the humidity and the lower the temperature the more stress on the animal, as for the rest of the color gradients, there was no significant effect, as Chaidanya (2015) mentioned that ALP is one of the main enzymes associated with On the metabolic activities in animals, where the level of this enzyme is generally low in heat-stressed animals, and there was a significant effect of the presence of horns, as it was higher in the morning than in the evening, this may be due to the high humidity in the morning or according to what was stated (Zhang et al. (2018), where the lack of porosity was found in the horns of goats, i.e. no thermal evaporation occurs through the horns, but in the absence of horns there was no significant effect, as well as the and Watals regnancy there was no significant effect as well. As for the ALT enzyme, a significant increase was observed in There is a significant increase in the level of ALT in pregnant goats, and the average of the ALT transporter enzyme is identical to the normal range determined by (Abdulkareem et al, 2020). This increase is due to the basic requirements of amino acids for milk production, especially at the end of pregnancy, or due to an increase in metabolism in the liver, according to Kaneko (1997). The rise in the level of ALT in the afternoon is due to the presence of heat stress, and this was identical to what was reached by Banerjee et al. (2015). Where it was found that the level of ALT is high when exposed to heat stress, as well as Sharma (2011) found that the percentage of ALT increases in goats during heat stress, the cause of high ALT may be when the animal is exposed to a state of stress, it loses its appetite for food and therefore the animal body needs sugar after the carbohydrates run out. To non-carbohydrate (protein) sources, and this leads to an increase in enzyme ALT .

Tabel(3) The mean of least squares ± standard error of some blood characteristics of local goats during the summer

| ALT | | ALP | | RBC | | the number | |
|---|---|---|---|---|---|---|---|
| evening | A.m | evening | A.m | evening | A.m | | |
| **17.13 A** | **12.32 B** | **39.29** | **40.07** | **11.24 A** | **10.32 B** | **47** | **overall average** |
| | | | | | | | **the color** |
| 18.36 a ±0.33 | 12.10 b ±0.60 | 39.20 ± 2.85 | 40.14 ± 0.83 | 11.62 ±0.60 | 11.46 ±0.95 | 5 | **black** |
| 16.64 a ± 0.38 | 12.52 b ± 0.40 | 39.42 ±0.93 | 40.05 ± 0.47 | 11.07 a ± 0.26 | 10.34 b ±0.33 | 18 | **brouwn** |

ISSN NO: 2771-8840
Date of Publication: 18-07-2022

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 17.40 ± 0.88 | 12.74 ± 1.37 | 41.00 ±1.58 | 39.06 ± 0.47 | 9.70 ± 0.14 | 10.60 ± 0.84 | 4 | **white** |
| 17.58 a ±0.66 | 12.05 b ±0.30 | 37.00 b ±1.12 | 39.99 a ±0.53 | 11.59 a ±0.31 | 10.18 b ± 0.34 | 12 | **black and white** |
| 16.65 a ±0.65 | 12.21 b ±0.55 | 41.62 ±1.13 | 40.70 ± 0.69 | 11.63 a ± 0.41 | 9.62 b ±0.55 | 8 | **white and brown** |
| | | | | | | | **the horns** |
| 17.06 a ± 0.25 | 12.34 b ± 0.24 | 39.36 b ± 0.62 | 40.05 a ± 0.28 | 11.25 a ± 0.18 | 10.30 b ± 0.23 | 43 | **having horns** |
| 17.85 a ±1.76 | 12.12 b ± 0.37 | 38.50 ±2.95 | 40.25 ± 1.03 | 11.10 ± 0.70 | 10.52 ±0.29 | 4 | **lack of horns** |
| **Watals** | | | | | | | |
| 17.48 a ± 0.34 | 12.03 b ± 0.25 | 39.05 ± 0.77 | 39.88 ±0.32 | 11.35 ± 0.23 | 10.42 ± 0.28 | 30 | **The presence of charms** |
| 16.51 a ± 0.39 | 12.83 b ± 0.43 | 39.70 ± 1.02 | 40.41 ± 0.47 | 11.05 a ± 0.23 | 10.14 b ± 0.35 | 17 | **No charms** |
| | | | | | | | **pregnancy** |
| 16.65 a ± 0.49 | 12.42 b ± 0.38 | 40.14 ± 1.03 | 40.17 ±0.55 | 11.13 a ±0.31 | 10.16 b ± 0.38 | 14 | **Pregnancy** |
| 17.33 a ±0.31 | 12.28 b ± 0.28 | 38.93 ± 0.75 | 40.03 ±0.31 | 11.29 a ±0.211 | 10.38 b ± 0.26 | 33 | **no pregnancy** |

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