Quest Journals
Journal of Research in Pharmaceutical Science
Volume 7 ~ Issue 3 (2021) pp: 13-18
ISSN(Online) : 2347-2995
www.questjournals.org

Research Paper

Changes in rectal temperature, pulse and respiration rate of Sudan Nubian Goat's kids Fed Different Levels of Natron and Minerals Block

Babeker E.A.[1,2*] and Elfatih Abdallah A.E.[2]
1Department of Biology (Basic Science), College of Science and Arts in Uglat Asugour, Qassim University, Buraydah, Kingdom of Saudi Arabia .
2Department of Biology, Faculty of Science, University of Bakht Elruda, Sudan.
** Corresponding Author Babeker E.A*

ABSTRACT
This study was carried out to determine changes in some physiological parameters of male Nubian goat's kids male fed diet supplemented with Natron salts and Minerals block,where a total of 40 Nubian goat's kids male (5-7 month old) were used. They were divided into four equal groups and each randomly allocated to diet animal block containing different levels of Natron and Mineral block (0%, 1%, 2%; and 1%, respectively). The experimental period covered twelve weeks. The physiological data (rectal temperature, pulse and respiration rate) were recorded every three weeks until the end of the experiment in the morning (08.00-09.00) before feeding, after feeding at midday (01.00-02.00) and in the evening (06.00-07.00). Eight hours after feeding (06.00-07.00) Most physiological parameters (rectal temperature and respiratory rate) have shown no variations in control and treatment groups, while the pulse rate was higher significantly (P<0.05) in Natron (2%) 78.83±0.21 and Minerals block (1%) 79.16±0.19 than that in Control 77.56±0.30 and Natron (1%) 77.86±0.2per/min respectively. Rectal temperature decrease significantly (P<0.05) 8hrs after feeding in Natron 1%, where increase in overall and respiration rate in this decrease significantly (P<0.05) 8hrs feeding in Natron 1%, while increase significantly (P<0.05) in Natron 2%, control and overall, where the pulse rate increase significantly (P<0.05) 8hrs feeding in Natron 1%, Natron 2% and overall. The pulse rate of Natron1% was higher in the evening (06.00-07.00) than in morning (08.00-09.00) and at midday (01.00-02.00) and the pulse rate of Natron2% was increase at midday and in the evening compared to morning. While Minerals block level had high value of pulse rate in the evening than in morning and midday.

KEYWORDS: *Natron salt, Minerals block supplementation, Nubian goat's kids, Some physiological parameters*

Received 29 Mar, 2021; Revised: 10 Apr, 2021; Accepted 12 Apr, 2021 © The author(s) 2021.
Published with open access at www.questjournals.org

I. INTRODUCTION

Body condition scoring describes the systematic process of assessing the degree of fatness of an animal (Gatenby, R. M. (2002), Todd, R. B. (2008). and Addass, P. A. (2011).). The score reflects the plane of nutrition on which an animal has been exposed over a reasonable length of time (Stuth, W., et al. 1998). The loin, ribs, tail head, brisket, flank, vulva and/or rectum and udder are the important parts of the body used in determining the score. Physiologically, the proportion of protein and water of the animal's bodyweight decrease as it gains body condition (NRC. 1996). An animal's body temperature is the result of the balance between heat produced by the basal metabolism and muscular activity of the body the heat lost from the body (Jeffrey, M. B. and Michael, M. S. 2010). Rectal, temperatures, Respiration pulse and heart rates, have been used as reliable indicators of short time physical stress in animals (Plyaschenko, S. I. and Sidorov, V. T. (1987)., Verstegen, M. V. A. (1987), Oladimeji, O.et at1996, and Ayo, J.O, et al.1998).

The thermal environment is a major factor that can negatively affect goat performance. Increased body temperature and respiration rate are the most important signs for heat stress in goat. The increase in body temperature is associated with marked reduction in feed intake, redistribution in blood flow and changes in endocrine functions that will affect negatively the productive and reproductive performance of the sheep (Eltawill and Narendran, 1990).

II. MATERIALS AND METHODS

Experimental Conditions: The present Experiment was carried out under the semi-arid condition of White Nile State-Sudan, at the Faculty of Science, University of Bakht Alruda, in Edduiem locality (Latitudes 130 and 290 North, Longitudes 200 and 320 East) 200 km from Khartoum.

Animals and Management: Forty male of Sudan Nubian Kids goats at age of 5 -7 months, their average body weight was from (6.5 to 12.5kg) were used in this study. Mature animals body weight ranged from 18- 35kg and body size 70-75cm at wither height. The animals were housed in shaded goat's pen; for 14 days on adapt in period. They were vaccinated with Ivermectin against endoparasite Ectoparasite 0.2ml per/kg body weight; with drawal period. The animals were divided randomly into four groups each of ten animals according to their live weight. First groups with average weight 9.70 kg; used as control (zero Natron salt fed). The second group was 10.10 kg, the third group10.01 kg and the fourth group 10.58 kg they fed different levels of Natron and Mineral block (0%, 1%Natron,2%Natron; and 1%Mineral block, respectively).. Feed and water were offered approximately at the same time in the morning (08.00-09.00) hr. The food offered was weighed in a single pan balance - to the nearest 100g. The food and water were offered in the fodder basins and the remaining amounts from the previous day were measured, so that the amounts of food and water consumed were determined. The period of this study was eleven or twelve -weeks.

Physiological Parameters: - Rectal temperature, pulse and respiration rate were recorded every three weeks until the end of the experiment in the morning (08.00-09.00) before feeding, and after feeding at midday (01.00-02.00) and in the evening (06.00-07.00). Rectal temperature was recorded by using digital temperature indicator (clinical thermometer) inserted into the rectum for 1 min. The respiration rate was noted down when animal was in standing position by observing the movement of flank, ribs and sternum. Pulse rate was measured by hand femoral vein for 1 min.

III. RESULTS

Table (1): Overall some physiological of goat's kids as affected by fed different levels of Natron salts and Minerals block supplementation in the morning at 0hr.

Parameter	Control (0%)	Natron (1%)	Natron (2%)	Mineral Block (1%)
Rectal temperature (Tr) ^{o}c	39.08± 0.06^{a}	39.43± 0.07^{b}	39.21± 0.06^{a}	39.10± 0.04^{a}
Respiratoryrate(RR)beats/minutes	18.20± 0.22^{a}	18.46± 0.27^{a}	17.43± 0.31^{b}	17.9± 0.26^{ab}
Pulse rate (Pr) beats/minutes	77.16± 0.31^{a}	76.33± 0.31^{ab}	77.13± 0.31^{a}	77.30± 0.31^{ac}

^{a,b,c} means in the same row with different superscripts are significantly different from each other (P<0.05).

Table (1) show some physiological of goat's kids as affected by fed different levels of Natron salts and Minerals block supplementation (08.00-09.00) at 0hr after feeding. There was significant (P>0.05) variation has been observed on rectal temperature, where there was little or no significant (P>0.05) variation has been observed on respiratory rate, pulse rate. The mean value of rectal temperature was higher in Natron (1%)than that in control and other treatment groups.

The rectal temperature: Control had rectal temperature ranged from 38.53-39.82 ^{o}c with a mean value of 39.08± 0.06 ^{o}c, Natron 1% had rectal temperature ranged from 38.83-39.9 ^{o}c with a mean value of 39.43±0.07 ^{o}c Natron 2% had rectal temperature ranged from 37.89-39.5 ^{o}c with a mean value of 39.21± 0.06^{o}c and Mineral block 1% had rectal temperature ranged from 38.10-39.7 ^{o}c with a mean value of 39.10±0.04^{o}c.

The respiratory rate: Control had respiratory rate ranged from 16.50-19.53 with a mean value of 18.20± 0.22, Natron 1% had respiratory rate ranged from 15.83-19.91 with a mean value of 18.46± 0.27, Natron 2% had respiratory rate ranged from 16.09-18.95 with a mean value of 17.43± 0.31 and Mineral block 1% had respiratory rate ranged from 16.91-19.7 with a mean value of 17.9± 0.26.

The pulse rate: Control goats had respiratory rate ranged from 75.50-78.53 with a mean value of 77.16± 0.31, Natron 1% had respiratory rate ranged from 73.83-79.51 with a mean value of 76.33± 0.31, Natron 2% had respiratory rate ranged from 71.59-78.55 with a mean value of 77.13± 0.31 and Mineral block 1% had respiratory rate ranged from 76.49-78.7 6 with a mean value of 77.30± 0.31.

Table (2): Overall some physiological of goat's kids as affected by fed different levels of Natron salts and Minerals block supplementation at midday after 4hrs.

Parameter	Control (0%)	Natron (1%)	Natron (2%)	Mineral Block (1%)
Rectaltemperature (Tr) ^{o}c	39.29±0.06^{a}	39.59±0.05^{b}	39.28±0.06^{a}	39.09±0.06^{c}
Respiratory rate(RR) beats/minutes	18.30±0.24^{a}	18.87±0.22^{a}	17.17±0.36^{b}	18.20±0.22^{a}
Pulse rate(Pr) beats/minutes	77.40±0.26	77.27±0.36	78.00±0.26	77.80±0.25

^{a,b,c} means in the same row with different superscripts are significantly different from each other (P<0.05).

The physiological parameters of goat's kids as affected by fed different levels of Natron salts and Minerals block supplementation at 4hr (01.00-02.00) after feeding are shown in Table (2). There was significant (P>0.05) variation has been observed on rectal temperature and respiratory rate, where there was no significant (P>0.05) variation has been observed on pulse rate. The mean value of rectal temperature shows that Natron (1%) had higher values than the control and other treatment groups. The respiratory rate was highest in Natron (2%), followed by treatment groups (including control) having the least value.

The rectal temperature: Control goats had rectal temperature ranged from 38.30-39.80 ^{o}c with a mean value of 39.29±0.06 ^{o}c, Natron 1% had rectal temperature ranged from 38.36-39.98 ^{o}c with a mean value 39.59±0.05^{o}c Natron 2% had rectal temperature ranged from 37.98-39.75 ^{o}c with a mean value of 39.28±0.06^{o}c and Mineral block 1% had rectal temperature ranged from 38.40-39.35^{o}c with a mean value of 39.09±0.06^{o}c.

The respiratory rate: Control goats had respiratory rate ranged from 17.050-19.34 with a mean value of 18.30± 0.24, Natron 1% had respiratory rate ranged from 16.03-19.98 with a mean value of 18.87±0.22, Natron 2% had respiratory rate ranged from 16.39-18.59 with a mean value of 17.17±0.36 and Mineral block 1% had respiratory rate ranged from 17.19-19.07 with a mean value of 18.20±0.22. The pulse rate: Control goats had respiratory rate ranged from 76.25-78.43 with a mean value of 77.40±0.26, Natron 1% had respiratory rate ranged from 75.39-79.01 with a mean value of 77.27±0.36, Natron 2% had respiratory rate ranged from 73.94-79.55 with a mean value of 78.00±0.26 and Mineral block 1% had respiratory rate ranged from 76.39-78.96 with a mean value of 77.80±0.25.

Table (3): Overall some physiological of goat's kids as affected by fed different levels of Natron salts and Minerals block supplementation in the evening after 8hrs.

Parameter	Control (0%)	Natron (1%)	Natron (2%)	Mineral Block (1%)
Rectal temperature (Tr) ^{o}c	38.96± 0.10^{a}	39.31± 0.11^{b}	39.17± 0.08^{ab}	39.18± 0.07^{ab}
Respiratory rate(RR) beats/minutes	18.00± 0.27^{a}	18.76± 0.26^{b}	17.66± 0.30^{a}	18.40± 0.20^{ab}
Pulse rate (Pr) beats/minutes	77.56± 0.30^{a}	77.86± 0.27^{a}	78.83± 0.21^{b}	79.16± 0.19^{b}

^{a,b,c} means in the same row with different superscripts are significantly different from each other (P<0.05).

Table (3) show some physiological of goat's kids as affected by fed different levels of Natron salts and Minerals block supplementation (06.00-07.00) 8hrs after feeding. There was little or no significant (P>0.05) variation has been observed on rectal temperature and respiratory rate, where there was significant (P>0.05) variation has been observed on pulse rate. The mean value of pulse rate was higher in Natron (2%) and Mineral block 1% than those in Control and Natron (2%).

The rectal temperature: Control goats had rectal temperature ranged from 36.97-39.85 ^{o}c with a mean value of 38.96± 0.10 ^{o}c, Natron 1% had rectal temperature ranged from 38.62-39.88 ^{o}c with a mean value39.31± 0.11^{o}c Natron 2% had rectal temperature ranged from 38.08-39.55 ^{o}c with a mean value of 39.17± 0.08^{o}c and Mineral block 1% had rectal temperature ranged from 38.10-39.52^{o}c with a mean value of 39.18± 0.07^{o}c.

The respiratory rate: Control goats had respiratory rate ranged from 17.65-19.04 with a mean value of 18.00± 0.27, Natron 1% had respiratory rate ranged from 16.93-19.48 with a mean value of 18.76±0.26, Natron 2% had respiratory rate ranged from 17.09-18.29 with a mean value of 17.66± 0.30 and Mineral block 1% had respiratory rate ranged from 17.58-19.21 with a mean value of 18.40± 0.20.

The pulse rate: Control goats had respiratory rate ranged from 76.56-78.64 with a mean value of 77.56± 0.30, Natron 1% had respiratory rate ranged from 76.39-79.61 with a mean value of 77.86±0.27, Natron 2% had respiratory rate ranged from 75.49-79.3with a mean value of 78.83± 0.21 and Mineral block 1% had respiratory rate ranged from 77.29-79.76 with a mean value of 79.16± 0.19.

Table (4): Overall some physiological of goat's kids of Control (0%), Natron (1%), Natron (2%) and Mineral Block (1%), pre and post feeding.

Parameter	Treatment	Control(0%)	Natron (1%)	Natron (2%)	Mineral Block (1%)
Rectal temperature (Tr)^{o}c	Pre. feeding	39.08± 0.06	39.43±0.07^{A}	39.21±0.06	39.10± 0.04
	Post. Feeding	39.29±0.90	39.28±0.09^{B}	39.23±0.07	39.14±0.06
	Overall	39.29± 0.11^{a}	38.96± 0.10^{b}	39.17± 0.08^{a}	39.18± 0.07^{a}
Respiratory rate(RR) beats/minutes	Pre. feeding	18.20± 0.22^{A}	18.46± 0.27^{A}	17.43± 0.31^{A}	17.93± 0.26
	Post. Feeding	18.51±0.26^{B}	18.28±0.26^{B}	17.78± 0.28^{B}	17.10± 0.25
	Overall	18.72± 0.27^{a}	17.66± 0.30^{b}	18.40± 0.20^{b}	18.00± 0.27^{b}
Pulse rate (Pr) beats/minutes	Pre. feeding	77.16± 0.31	76.33± 0.31^{A}	77.13± 0.31^{A}	77.30± 0.31
	Post. Feeding	77.48± 0.28	78.06± 0.28^{B}	77.93± 0.29^{B}	78.48± 0.48
	Overall	77.56± 0.30^{a}	78.83± 0.21^{b}	77.86± 0.28^{a}	79.16± 0.19^{b}

$^{A, B}$ means in the same column with different superscripts are significantly different from each other (P<0.05).
^{a,b,c,d} means in the same row with different superscripts are significantly different from each other (P<0.05).

The Overall some physiological of goat's kids of Control (0%), Natron (1%), Natron (2%) and Mineral Block (1%), pre and post feeding are shown table (4), showed variation in control and treatment groups except Mineral Block. Rectal temperature decrease significantly (P<0.05) 8hrs after feeding in Natron 1% and overall. Respiratory rate increase significantly (P<0.05) 8hrs feeding in control and Natron 2%, where decrease in Natron 1%. The pulse rate increase significantly (P<0.05) 6hrs feeding in Natron 1%, Natron 2% and overall.

Table (5): Overall some physiological of goat's kids as affected by fed different levels of Natron salts and Minerals block supplementation in the morning, at midday and in the evening.

Parameter		morning	midday	evening
Rectal temperature (Tr)^{o}c	**0%**	39.08± 0.06^{a}	39.29± 0.06^{ab}	39.29± 0.11^{b}
	1%	39.43± 0.07^{a}	39.59± 0.05^{ab}	38.96± 0.10^{b}
	2%	39.21± 0.06	39.28± 0.06	39.17±0.08
	1%	39.10± 0.04	39.09± 0.06	39.18± 0.07
Respiratoryrate(RR beats/minutes	**0%**	18.20± 0.22	18.30± 0.24	18.72±0.27
	1%	18.46± 0.27	18.90± 0.21	17.66±0.30
	2%	17.43± 0.31	17.16± 0.36	18.40±0.20
	1%	17.93± 0.26	18.20± 0.22	18.00± 0.27
Pulse rate (Pr) beats/minutes	**0%**	77.16± 0.31	77.40± 0.26	77.56± 0.30
	1%	76.33± 0.31^{a}	77.29± 0.35^{b}	78.83± 0.21^{c}
	2%	77.13± 0.31^{a}	78.00± 0.26^{b}	77.86± 0.28^{b}
	1%	77.30± 0.31^{a}	77.80± 0.25^{a}	79.16± 0.19^{b}

^{a,b,c} means in the same row with different superscripts are significantly different from each other (P<0.05).

Table (5) showed some physiological of goat's kids as affected by fed different levels of Natron salts and Minerals block supplementation after 0hr, 4hrs and 8hrs. The mean values of little Parameters of treatment groups (including control) increased significantly (P<0.05) during the morning 0hrs, midday 4hrs and the evening 8hrs, where most of them showed no significantly (P<0.05) during the day. The pulse rate of treatment supplementation levels increased significantly at midday and in the evening, while the rectal temperature and the respiratory rate showed no significantly at all day.

IV. DISCUSSION

The result in table (1) show some physiological of goat's kids as affected by fed different levels of Natron salts and Minerals block supplementation pre feeding at 0hr (08.00-09). These results have shown that there are variations in some physiological parameter of goat's kids in control and treatment groups, while there are no variations in other physiological parameter of goat's kids. The rectal temperature was higher significantly (P<0.05) in Natron (1%) 39.43±0.07than that in Control 39.08±0.06, Natron (2%)39.21±0.06 and Minerals block (1%)39.10±0.04 respectively. There was no significant (P<0.05) variation has been observed in respiratory rate and pulse rate for Control and treatment groups. The values of rectal temperature, respiratory rate and pulse rate fall within normal range reported as (39-40.50 ,15-30 and 70-100) of goats (Peter G. and Peter D.2002).

table (2) show some physiological of goat's kids as affected by fed different levels of Natron salts and Minerals block supplementation 4hr after feeding (01.00-02.00). The rectal temperature and respiratory rate have shown variations in control and treatment groups. The pulse rate showed no variations in control goats and treatment groups. The rectal temperature was higher significantly (P<0.05) in Natron (1%) 39.59±0.05 and Minerals block (1%) 39.09±0.06 than that in Control 39.29±0.06 and Natron (2%) 39.28±0.06 respectively, the rectal temperature was constant and fell within the normal range for sheep and goats 3260 **^{o}c** to 39.60 **^{o}c**(Aye,2007). the respiratory rate of Natron (2%) had significantly lower (P<0.05) values than those of Control and other treatment groups. But mean values of respiratory rate for Control and other treatment were lower than

that of 17.70-20.10 per /min as reported by HALA. (2015).

table (3) show some physiological of goat's kids as affected by fed different levels of Natron salts and Minerals block supplementation 8hr after feeding (06.00-07.00). Most physiological parameter (rectal temperature and respiratory rate) have shown no variations in control and treatment groups, while the pulse rate showed variations in control goats and treatment groups. The pulse rate was higher significantly ($P<0.05$) in Natron (2%) 78.83±0.21 and Minerals block (1%) 79.16±0.19 than that in Control 77.56±0.30 and Natron (1%) 77.86±0.2per/min respectively. Bianca and Kunz (1978) found that Saanen goats exposed to high environmental temperature increased their respiration rate tenfold from 26 to 261 breaths/min. Normal body temperature, respiration and pulse rates of Saanen goats in their comfort zone were recorded as 38.8°C, 25.3 breaths/min and 94 beats/min, respectively. The Saanen is particularly sensitive to strong sunlight and for this reason it is often continuously stall-fed in the tropics (Devendra.1987). Rectal temperature, pulse and respiration rates are important indicators of thermal balance and might be used to evaluate the impact of heat stress (Spiers et al., 2004). In all farm animals, only goats can maintain their rectal temperatures below 38.5°C, which is considered normal (Devendra, 1987; Avendano-Reyes et al., 2006). Their basal respiration rate is about 25-30 breaths per min (Silanikove, 2000) and basal pulse rate is about 65-80 beats per min (Devendra, 1987).

table (4) shows Rectal temperature, Respiratory rate and pulse rate of goat's kids in Control (0%), Natron (1%), Natron (2%) and Mineral Block (1%), pre and post feeding. They were variation in control group and treatment groups. Rectal temperature decrease significantly

($P<0.05$) 8hrs after feeding in Natron 1%, where increase in overall. Ogebe et al. (1996) reported that, as temperature increased; less time was spent consuming food, probably to minimize or curtail body heat production and to keep the body cool. Marai et al., (1997) and Fahmy (1994) reported that heat stress increased both skin and rectal temperatures in goats. Hirayama and Katoh (2004), reported that, time spent eating in the heat treatment was the highest, while ruminating time was the lowest.

The respiration rate in this study decrease significantly ($P<0.05$) 8hrs feeding in Natron 1%, while increase significantly ($P<0.05$) in Natron 2%, control and overall. The present respiration rates were in agreement with the range (17.17-20.10 beat/min) of goats, which reported by(HALA2015).Habeeb et al, (1992) reported that respiration rate can be elevated through heat stress in goats.

The pulse rate in this study increase significantly ($P<0.05$) 8hrs feeding in Natron 1%, Natron 2% and overall. Many earlier workers reported that there are variations dueto water restriction in rectal temperature, respiration and pulse rate in small ruminants (Purohit et al.,1972, Singh et al.,1976; Kaushish et al.,1976 and Rajkhowa and Hazarika, 2000).

Table (5) showed some physiological of goat's kids as affected by fed different levels of Natron salts and Minerals block supplementation in the morning at 0hr (08.00-09.00), in the midday at 4hrs (01.00-02.00) and in the evening at 8hrs (06.00-07.00). The mean values of little Parameters of treatment groups (including control) increased significantly ($P<0.05$) during the day, where most of them showed no significantly ($P<0.05$) during the day. the rectal temperature and the respiratory rate showed no significantly at all day. The pulse rate of Natron1% was higher in the evening (06.00-07.00) compared to morning (08.00-09.00) and at midday (01.00-02.00). While the pulse rate of Natron2% was higher at midday and in the evening compared to morning. Minerals block had high value of pulse rate in the evening compared to morning and midday. M. M. Alam et al (2011) reported that the respiration rate tended to increase with 4hour heat stress, was increased with 8hour heat stress compared to the control group. During summer, respiration rate is higher than in winter for goat(Fahmy,1994). Ismail et al., (1995) reported that the pulse rate of goat was significantly higher during summer than in winter.

Summary: -

1- Different levels of Natron salt and Minerals block supplementation fed to goat's kids had significant changes on rectal temperature, respiratory rate and pulse rate.

2- The pulse rate was higher in Natron (2%) and Mineral block 1% than in Control and Natron (2%) 8hours after feeding.

3-The pulse rate was increase significantly ($P<0.05$) 8hours after feeding in Natron 1%, Natron 2% and overall compared to 0hours before feeding.

4- After feeding the respiratory rate increase significantly ($P<0.05$) in control and Natron 2% and overall compared to before feeding.

5- The pulse rate of Natron1% was higher in the evening (06.00-07.00) than in morning (08.00-09.00) and at midday (01.00-02.00).

6-While the pulse rate of Natron2% was increase at midday and in the evening compared to morning.

7- Minerals block level had high value of pulse rate in the evening than in morning and midday.

REFERENCES:

[1]. Addass, P. A. (2011). Effect of age and body condition score on sperm production potential among some indigenous bull cattle inMubi Adamawa state, Nigeria. *Journal of North America,* 2 (2): 203

[2]. Avendano-Reyes, L., F.D.Alvarez-Valenzuela,A.Correa-Clederon,J.S,Saucedo-Quintero, P. H. Robinson and J.G.Fadel.(2006).Effect of cooling Holstein cows during The dry period on postpartum performance under heat stress conditions.Livest.Sci. 105:198-206.

[3]. Aye, P. A. (2007). Production of multinutrient blocks for ruminants and alcohol from waste products of Leucaena and Gliricidia leaves using local technologies. Ph.D Thesis, Federal University of Technology Akure.

[4]. Ayo, J.O, Oladele, S. B. Fayomi, A., Jumbo, S. D. and Hambolu, J. O. (1998). Body temperature, respiration and heart rates in the Red Sokoto goat during harmattan season. Bull. Anim. Health Prod. Africa, 46: 161-166.

[5]. Devendra, C. (1987). Goats. In: Bioclimatology and the adaptation of livestock (Ed. H. D. Johnson). Elsevier, Amsterdam, 15:157-167.

[6]. Eltawill, A., and Narendran, R. (1990). Ewe productivity in four breed of sheep in Saudi Arabia. World Rev. Anim. Prod., 25: 93.

[7]. Fahmy, S. (1994). Effect of crossing Romanov with Rahmani sheep on some physiological and productive performance. M. Sc. thesis. Faculty of Agriculture, Al-Azhar University, Cairo, Egypt.

[8]. Gatenby, R. M. (2002). Sheep. The tropical agricultulist 2Edn. MacMillan publishers CTA. A. J. Wageningen, the Netherlands, Pp.10 – 45.

[9]. Habeeb, A. A., Marai, I. F. M. and Kamal, T. H. (1992). Heat stress. In: Philips, C., Piggens, D. (Eds.), Farm Animals and the Environment. C.A.B. International, pp. 27–47.

[10]. Hala,K.A.A. (2015). Effect of Different Levels of Natron salts of supplementation on Performance, Haematological, Biochemical and Some Physioological Parameters of Sudan Nubian Goats Male. M.Sc Thesis, Department of Biology, University of Bakht Alruda.

[11]. Hirayama, T. and K. Katoh. 2004. Effects of heat exposure and restricted feeding on behavior, digestibility and growth hormone secretion in goats. Asian-Aust. J. Anim. Sci. 17(5): 655-658.

[12]. Ismail, E., Abd-El-Latif, H., Hassan, G.A. and Salem, M.H. (1995). Water metabolism and requirements of sheep as affected by breed and season. World Review of Animal Production (30): 95-105.

[13]. Jeffrey, M. B. and Michael, M. S. (2010). Recent studies using a reticular bolus system for monitoring dairy cattle core body temperature.The First North American Conference on PrecisionDair Management held at the University of Kentucky, Kentucky and Purdue University, Indiana.

[14]. Kaushish, S.K., Bhatia, D.C. and Arora, K.L. (1976). Studies onadaptability of sheep to subtropicalclimate and seasonal changes in rectal temperature, Cardiorespiratory and haematological attributes of Nali sheep. Indian Vet. J., 53, 760 – 765.

[15]. M. M. Alam, M. A. Hashem, M. M. Rahman, M. M. Hossain, M.R.Haque, Z. Sobhan and M. S. Islam(2011). effect of heat stress on behavior, physiological and blood parameters of goat progress. agric. 22(1 & 2): 37 – 45, 2011. issn 1017-8139.

[16]. Marai, I. F. M., Daader, A. M., Abdel-Samee, A. M. and Ibrahim, H. (1997). Winter and summer effects and their ameleoration on lactating Friesian and Holstein cows maintained under Egyptian conditions. In: Proceedings of International Conference on Animal, Poultry, Rabbits and Fish Production and Health, Cairo, Egypt.

[17]. NRC (1996). Nutrient requirements of beef cattle, 7th revised Edition. National Research Council Update 2000. National Academic, Press, Washington, DC, USA. Pp. 36 - 97.

[18]. Ogebe, P. O., B. K. Ogunmodede and L. R. McDowell. (1996). Behavioral and physiological responses of Nigerian dwarf goats to seasonal changes of the humid tropics. Small Rumin. Res. 22:213-217.

[19]. Plyaschenko, S. I. and Sidorov, V. T. (1987). Stresses in farm animal. Agropromizdat. Moscow, Russia. Pp. 192.

[20]. Peter G. G. Jackson, Peter D (2002). Clinical Examination of Farm Animals. Cockcroft Copyright © 2002 by Blackwell Science Ltd.

[21]. Purohit, G.R., Ghosh, P.K. and Ganeja, G.C. (1972). Water metabolism in desert sheep. Effect of various degrees of water restriction on the distribution of body water in Marwari sheep. Aust. J. Agric. Res23, 685 – 691.

[22]. Rajkhowa, S. and Hazarika, G.C. (2000). Clinico-biochemical studies on the effect of water deprivation of goats under hot climatic conditions. Indian Vet. J., 77, 856 – 858.

[23]. Silanikove, N., (2000). The physiological basis of adaptation in goats to harsh environment. Small Ruminant Res., 35(): 181-193.

[24]. Singh, N.P., More, T. and Sahni, K.L. (1976). Effect of water deprivation in feed intake nutrient digestibility and nitrogen retention in sheep. J. Agric. Camb. 86, 431 – 433.

[25]. Spiers, D. E., J. N. Spain, R. P. Sampson and R. P. Rhoads. (2004). Use of physiological parameters to predict milk yield and feed intake in heat-stressed dairy cows. J. Therm. Biol. 29:759-764.

[26]. Stuth, W., Dyke, P., Jama, A. and Corbett, J. (1998). The use of NIR/NUBTAL, PHYGROW, and APEX in a meta-modelling environment for an early warning system to monitor livestock nutrition and health. National Workshop on Early Warning System for Monitoring Livestock Nutrition and Health, Addis Ababa, Ethiopia. Pp. 59 – 107.

[27]. Todd, R. B. (2008). Getting those repeat breeders bred. Western dairy news, Agrilife extention and research, University of Texas, 8 : 7.

[28]. Oladimeji, O., Osinowo, A., Alawa, J. P. and Hambolu, J. O. (1996). Seasonal and diurnal changes in respiration rate, pulse rate and rectal transportation in Yankassa sheep ofdifferent agegroups and sexes in the sub- humid Tropic. Journal Animal Prod. Res., 16: 45-48.

[29]. Verstegen, M. V. A. (1987). Swine. In: H.D. Johnson (ed) Bioclimatology and adaptation ofL/S Elsevier Science Publishers. Amsterdam. The Netherlands. Pp. 245.