

EFFECT OF VITAMIN C ADMINISTRATION ON HEAT TOLERANCE OF LOCAL AND TURKISH AWASSI SHEEP IN DIYALA PROVINCE OF IRAQ

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ABSTRACT

The object of this study was done to evaluate the effect of increased environmental temperature on physiological traits of local Awassi (LA) and Turkish Awassi (TA) sheep ewe (of age 2-3 years) in Diyala Province of Iraq. Two groups (12 LA and 12 TA each) were divided into two subgroups (6 ewes each) and treated with two levels of vitamin C (ascorbic acid) (500 and 0 mg/kg of the ration respectively). Data were monthly recorded include; body weight (BW), pulse rate (PR), respiration rate (RR) and rectal temperature (RT). All traits were taken at monthly intervals (cold season) viz.; December, January and February, and in hot season viz.; June, July and August at 9am. The results revealed that the RT 40.1 and 39.6 C; RR 84 and 70.6 (rate/min); PR: 117 and 108 (rate/min) were for Turkish and Local Awassi sheep for hot season in control groups while they were RT; 39.1 and 38.8° C; RR 74.6 and 64 (rate/min); PR: 101 and 96.0 (rate/min) respectively. in treated groups with 500 mg /kg vit c / kg of diet The difference between the two breeds were significant, also it was found that there was a differences in individuality. There for, it is possible to identify those animals with in breed is more or less resistant to the climatic conditions. This information may be used in program of selection to heat tolerance.



INTRODUCTION

Livestock performance is affected by heat stress because an animal having difficulty in dissipating excess body heat to its in environment. This heat if not dissipated will decrease animal production by lowering feed intake, lactation, growth, gestation and conception. Environmental heat stress affects the maintenance energy, because the body may be at higher temperature result in greater metabolic rate and also energy is used to increase heat dissipation(1). It has been an interest in a possible that nutritional rule of ascorbic acid (AA) on the basis of the fact that endogenous synthesis may not be adequate to meet the needs of the animals at all times. These requirements of ascorbic acid (AA) may be increased under stressful condition. It has documented that the biological functions of ascorbic acid are based on their ability for reducing the equivalents for variety of biochemical reactions. For this reason most physiologically relevant reactive oxygen species were reduced by vitamin C (2). The primary function of vitamin as a cofactor in reactions requiring a reduced copper or iron metal coenzyme, on other hand as a protective anti-oxidant in the aqueous phase both extra and intra cellular(3). Increasing air temperature above the critical threshold is related with reduced feed intake(4,5) and a deleterious effect on the physiological parameters via, skin temperature, body temperature, heart pulse rate and respiration rate gives an immediate response to the climatic stress which lead to discomfort/comfort. These responses used as a measure to adaptability to an adverse environment. The aim of this work was to study the effect of environment temperature and the response of two breeds of sheep to dietary ascorbic acid (AA) supplementation.

MATERIAL AND METHODS

The study was conducted at Animal Production Farm, Department of Animal Production College of Agriculture, University of Diayla, during the period of cold season December, January, February and in summer hot season June, July and August, 2013. Where total of 24 ewes 2-3 years old 12 of them local Awassi ewes(LA) and the others Turkish Awassi ewes (TA) all the ewes were weighted and divided randomly into 2 equal



treatment groups (12 ewes each) and received (0 and 500 mg/kg feed daily) of vitamin C for duration of experiment.

Rectal temperature was carried out with aid of a digital clinical, thermometer and respiration rate by counting flank movement and recorded as frequency for minute, while pulse rate (PR) were measured using a stethoscope, Collection the measurement at morning (9 H). We used the temperature-humidity index (THI) was estimated according to the following equation(6) $THI = db\ C^{\circ} - \{(0.31 - 0.31\ RH)\ (db\ C^{\circ} - 14.4)\}$ where $db\ C^{\circ}$ = dry blub temperature in Celsius and $RH\%$ = relative humidity%, Then the obtain values of THI were classified as follows; 25.6 and more = very severe heat stress, 23.3 - < 25.6 = severe heat stress, 22.2 - < 23.3 = moderate heat stress and < 22.2 = Absence of heat stress.

Analysis of variance (ANOVA) was used to analyze of data(7). Breed (local Awassi versus Turkish Awassi) were the main effects in the model. Breed X treatment and Treatment (vitamin C versus Control) interaction.

Table 1: Average of maximum and minimum daily ambient temperatures (°C) and relative humidity (%) during the complete experimental period.

Variable	December	January	February	June	July	August	significant level
Maximum temperature	19 ± 3.2	13.5 ± 2.3	10 ± 0.6	39.3 ± 1	45.4 ± 4.2	44.9 ± 3.1	*
minimum temperature	11.3 ± 3.1	5.5 ± 0.3	7 ± 0.8	26 ± 4.2	25 ± 0.7	24.5 ± 0.2	*
Maximum humidity	75 ± 3.7	74 ± 9.1	78 ± 4.1	46 ± 3.2	53.3 ± 4.1	55.4 ± 3.4	*
minimum humidity	60 ± 4.6	63 ± 4.8	68 ± 1.3	28.5 ± 3.1	20 ± 0.2	26.1 ± 3.2	*
THI at Maximum temperature	18.4	13.6	10.4	33.8	37.3	43.4	*
THI at minimum temperature	10.7	6.2	14.9	28.2	24	26	*



RESULTS AND DISCUSSION

RECTAL TEMPERATURE

As shown in Table, 2 in cold season below the upper normal limits were agreement with those found by(8), whom referred to rise Rectal temperature rates in sheep above normal when environment temperature reaches 32° C. while in this study the temperature was not reaches in cold months. An increase in the ambient air temperature from 10.4° C in February up to 45.41° C in July is accompanied by significant increase in critical temperature and is in agreement with(6).

Rectal temperature was increased in hot season may be attributed to store body heat in these animals during the periods of heat stress especially in TA “As shown in table 2” this result in accordance with(9). Ewes expose to elevate temperature (hot months) directly stimulate the peripheral thermal receptors which transmit nerves impulse that stimulate directly the peripheral thermal receptors causing an increase in heart activity due to pumping more blood to the peripheral circulation to regulate the temperature increase in RT with an expose to heat stress which supported by those obtain by(10).From table (2) RT was significantly ($P < 0.05$) declined from (39.6° C) in LA and (40.8° C) in TA for control groups in June to (38.9 and 39.6° C respectively) at the end of summer for treated groups with vitamin C.

Ascorbic acid in the diet prevent the negative impact of corticosteroid hormones by reducing their synthesis and improves the performance of animal heat stress. It was reported that regulation of body temperature by vitamin C helps to maintain homeostasis in homoeothermic animals(11) Similarity (12) reported that RT of lambs was not affected by using ascorbic acid at level 500, 750 and 1000 mg/kg diet.



Table 2: Effect of vitamin C administration on RT of two breeds of ewes (C°)

Breed ²	Vit C level	Cold season			Hot season		
		December	January	February	June	July	August
LA	Control	38.5±0.5	38.6±0.7	38.7±0.4	39.6±0.5	39.4±0.2	39.8±0.2
	mg 500	38.7±0.3	38.8±0.6	38.7±0.4	38.9±0.3	38.7±0.7	39.1±0.2
TA	Control	38.8±0.7	38.7±0.4	38.6±0.5	40.8±0.6	40.1±0.5	39.5±0.3
	mg 500	38.9±0.4	38.8±0.3	38.7±0.9	39.6±0.6	38.8±0.7	38.5±0.6
Source of variation		Significance					
breeds		NS	NS	NS	0.05	0.05	0.05
Vit C levels		NS	NS	NS	0.05	0.05	0.05
Breeds X Vit C levels		NS	NS	NS	0.05	0.05	0.05

¹Mean in the same column with no common superscripts differ significantly ($p < 0.05$). LA = local Awassi; TA = Turkish Awassi

RESPIRATORY RATE (RR)

The results revealed that season; breeds and vitamin C administration have highly significant influenced on RR "As shown in table, 3". RR in winter months recorded lower values than those reported in the summer months; therefore RR can be used as indicator of heat stress(13).In mammals respiration get rid of CO₂ from the body's tissues and support O₂ in thermo-neutral conditions and evaporation of moisture from respiratory system also prevention of hypothermia under high ambient temperature. According to(14), the protective coat offered by Fleece was reduces evaporation by sweating therefore thermoregulation in these animals depend on evaporation through respiration.. In winter months there are insignificant differences among groups of sheep, also vitamin C had not any effect on RR, but in summer months, when ambient temperature exceed than 40° C, The animals start to open their mouths and RR is reached above 80 mov./min and this indicated the founding of(15).Supplementation of vitamin C have relived the severity of heat stress. Similar reduction in RR was reported (16) in goats under heat stress condition.



Table 3: Effect of vit. C administration on RR of two breeds of ewes (breath/min)¹

Breed ²	Vit C level	Cold season			Hot season		
		December	January	February	June	July	August
LA	control	28±1.5	29±2.1	35±2.4	72±6.5	70±4.9	69±5.2
	mg500	29±5.5	30±5.1	32±2.1	66±4.1	65±3.4	61±4.6
TA	control	33±7.5	34±5.4	29±2.3	86±2.3	84±6.7	81±2.3
	mg500	29±7.2	31±6.4	30±1.5	79±2.2	76±3.1	69±5.2
Source of variation		Significance					
breeds		0.05	0.05	0.05	0.05	0.05	0.05
Vit C levels		NS	NS	NS	0.05	0.05	0.05
Breeds X Vit C levels		NS	NS	NS	0.05	0.05	0.05

¹ Mean ± SEM² LA = local Awassi; TA = Turkish Awassi

PULSE RATE

highly significant differences “As shown in table 4” between seasons in both breeding groups of their PR were conducted, it is clear that the animals in summer temperature showed higher values in their PR compared in winter, this is due to the high temperature above thermal zone of the animals, so the thermo regulation mechanism has impact on PR. The same trend was observed in Barki sheep in Egypt(17). The PR is primarily reflected of the homeostasis of animals. The increase in PR of animals when exposes to high environmental temperature “As shown in table 4”. That caused the blood flow an increase from the core to the surface of the body and give a chance for more heat to be lost(18). LA showed significantly PR lower than TA, which agreed with the finding of(14), In the present study vit C supplementation improved the ability to overcome the detrimental effect of reflected on PR.



Table 4 : Effect of vit. C administration on pulse rate of two breeds of ewes (pulse/min)¹

Breed ²	Vit C level	Cold season			Hot season		
		December	January	February	June	July	August
LA	control	78 ± 3.1	74 ± 5.6	75 ± 3.4	111 ± 7.1	110 ± 3.9	106 ± 5.2
	500 mg	80 ± 5.4	89 ± 3.2	74 ± 2.6	99 ± 7.3	96 ± 8.4	94 ± 3.1
TA	control	83 ± 5.1	77 ± 3.4	79 ± 6.1	123 ± 9.8	119 ± 6.2	110 ± 6.1
	500 mg	81 ± 4.2	76 ± 1.6	80 ± 5.2	105 ± 10	100 ± 9.6	98 ± 7.1
Source of variation		Significance					
breeds		NS	NS	NS	0.05	0.05	0.05
Vit c levels		NS	NS	NS	0.05	0.05	0.05
Breeds X vit c levels		NS	NS	NS	0.05	0.05	0.05

¹ Mean ± SEM

² LA = local Awassi; TA = Turkish Awassi

CORRELATION BETWEEN PHYSIOLOGICAL CHARACTERS:

Table 5 shows that high significant positive correlation coefficients among physiological characters viz.; RT, RR and PR. These results are in agreement with those found by(14). When rectal temperature increases due to the action of heat stress, the RR and PR being activated control mechanism of the animals to restore the balance of vital function .while body weight is not follow this trend.



Table 5: correlation between physiological traits and live weight of LA and TA in Iraq

	PR	RR	live weight
TR	0.59	0.76	-0.200
PR		0.64	0.39
RR			-0.16

CONCLUSIONS

Therefore, it could be concluded that adding vit.C in the diet reduce the negative impact of heat stress on physiological traits of sheep particularly the imported sheep (Turkish breed) which is in less accommodate to the environmental conditions compared with the local breed (Awassi sheep) particularly in summer season, which it takes long period in Iraq and recorded high average degrees reached some time more than 50°C.

تأثير فيتامين C في تحمل الحرارة للأغنام العواسية المحلية والتركية في محافظة ديالى من العراق

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الخلاصة

استهدفت الدراسة الحالية تقييم درجة حرارة المحيط على الصفات الفسلجية لنعاج العواسي المحلي والتركي بعمر (2-3 سنة) في محافظة ديالى /العراق وبواقع (12) نعجة لكل سلالة ، حيث أن نعاج كل سلالة قسمت بصورة عشوائية إلى مجموعتين بواقع (6) حيوانات لكل مجموعة اعتبرت المجموعة الأولى من كل سلالة مجموعة سيطرة والمجموعة الثانية أعطيت فيتامين C بجرعة 500 ملغم /كغم علف مركز . سجلت البيانات شهريا والتي تضمنت وزن الجسم (كغم) ، ودرجة حرارة المستقيم (م°) ومعدل النبض وعدد مرات التنفس .تم الاستدلال على حدوث



الإجهاد من خلال حساب دليل الحرارة والرطوبة (THI) بالاعتماد على معدلات الحرارة والرطوبة المقاسة يوميا في حقل التجربة . أظهرت النتائج للصفات المدروسة لأشهر الصيف للعواسي التركي والمحلي هي 40,1 و 39,6 م° لدرجة حرارة المستقيم و 84 و 70,6 معدل شهيق وزفير/ دقيقة و 117 و 108 ضربة /دقيقة لمعدل النبض على التوالي ، أما المعدلات للمعاملة بفيتامين C فكانت للعواسي التركي والمحلي 39,1 و 38,6 م° لدرجة حرارة المستقيم و 74,6 و 64 شهيق وزفير/دقيقة لمعدل مرات التنفس و 101 و 96 ضربة /دقيقة لمعدل النبض على التوالي . ولوحظ أن الاختلاف بين السلالتين معنويا وكذلك تأثير إضافة الفيتامين مهم في تخفيف الإجهاد الحراري على الصفات المدروسة صيفا ، ومن الملاحظ أيضا هنالك تباين بين الأفراد داخل السلالة يمكن استثماره في عمل برنامج لانتخاب النعاج الأكثر مقاومة للإجهاد الحراري .

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