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PHYSIOLOGICAL RESPONSES TO CLIMATIC CHANGES IN RAHMANI, IMPORTED FINN RAMS AND THEIR HALF SIBS BORN TO RAAHMANI RECIPIENT IN EGYPT

T.H. Shalaby, O.Salama and G. Solouma

Animal Production Research Institute, Ministry of Agriculture and Land Reclimation, Dokki, Cairo, Egypt.

SUMMARY

Ten imported Finnish Landrace (FF) ram lambs, their half sibs (n=9) born to local Rahmani recipient ewes (FE) and a group of Rahmani (R) ram lambs (n=9) were utilized to study the physiological responses to the prevailing subtropical environmental conditions. For most traits the results indicated that both seasonal and breed differences were significant (P<0.01). Both Finn breed groups, FF and FE ram lambs, seemed to be less tolerant to the subtropical environmental conditions than R as evident by marked increases in body temperature, respiration rate and a marked decrease in T3 and T4 levels. No marked differences were found between FF and FE groups, implying no differences in physiological responses due to recipient breed. It is recommended that proper and careful attention should be paid to the housing physical parameter when raising exotic temperate sheep breeds.

Keywords: Sheep, exotic breeds, physiological responses

INTRODUCTION

Finnish landrace sheep has been used in intensive breeding (crossing) program in Egypt to increase lamb production from subtropical local breeds. Through this program, embryo transfer technique has been used to supported and accelerate the number of pure Finn sheep production needed for such program. In order to assess the adaptability of Finn sheep to the prevailing environmental condition, an erlier study showed that Finn ewes imported to Egypt were less tolerant to suptropical environmental conditions compared to their half sibs raised in their home land, Finland (Aboul-Ela *et al.*, 1987). The purpose of the present study was to examine the physiological responses of the imported Finn ram-lambs to the prevailing subtropical climatic conditions compared with their half sibs born in Egypt through an embryo transfer and to know if there would be any immunological ground for these physiological responses.

MATERIALS AND METHODS

A group of 10 Finnish landrace ram-lambs (FF) were imported from Finland to Egypt , about 4 months prior to the start of this study, while another group (9 ram-

lambs) of their half sibs (FE) were born in Egypt through embryo transfer (ET) program. Embryos were produced in Finland and transplanted in recipient Rahmani, local breed of sheep, synchronized to match the embryo's stage. In addition, a group of 9 Rhahmani ram-lambs (R) of the same age were included in the study for comparison.

The three groups were raised at El-Karada experimental farm, located at latitude 30° 24' N and longitude 30° 18' E. The animals were housed indoors in a semi-shaded open pen (roofed with asbestos slabs with six meters high in the middle) and were fed on dry feed composed of concentrate mixture plus clover hay during summer to cover their requirements. During winter, green fodder (clover) was available ad libitum.

Rectal temperature (RT), skin temperature (ST), wool surface temperature (WT) and respiration rate (RR) were measured at 0800 and 1400h by-weekly on two successive days during January and February in winter and August and September in Summer.

Blood samples were taken by vacutainer from the Jugular vein on the days of measurements. Whole blood was centrifiuged at 3000 rpm for 25 minutes and plasma stored frozen. Thiiodothyronine (T_3) and thyroxine (T_4) were measured in plasma by solid phase radioimmunoassay (RIA) using Coat - A-Count kits produced by Diagnostic Products Corporation (LA, CA, USA). Micro-meteorological data were recorded at the times of measurements.

Ambient air temperature (AT) at 08 00 and 14 00h averaged 26.4 and 31.8°C in summer and 13.3 and 16.3°C in winter, respectively. The corresponding values of relative humidity (RH) averaged 76.5 and 58.5% in summer, 84.5 and 71.5% in winter, respectively. The maximum and minimum AT averaged 32.5 and 16.5°C in summer and 20.2 and 8.3°C in winter, respectively.

Data obtained were analyzed using SAS program (SAS, 1982), General Linear Model procedure (GLM) as repeated measurements analysis of variance.

RESULTS AND DISCUSSION

Effect of season and time of day

In almost all studied traits, there was common trend of larger differences between measurements recorded during winter and those recorded during summer (Table 1). In general these changes were consistently followed the seasonal changes in AT.

In order to compare the various physiological criteria in their magnitude of changes during summer in proportion to those of winter, these changes were expressed in terms of percentage (Table 2). The lowest magnitude of changes was that of RT which did not exceed 0.8%. This is expected as the animal acts by various means to keep its core temperature stable. To achieve such stability, dissipation of surplus heat increases along with a decrease in heat production. The increase in heat loss via body surface is reflected by the increase in ST particularly during summer. The magnitude of changes during summer compared with that during winter (9.3-15.3%) was, however less than that of RR (24.4-71.1%) indicating that RR were more sensitive to the seasonal changes in AT. The present findings are in agreement with previous findings reported by Hafez *et al.* (1956) ; Shalaby (1985); Ibrahim (1994) and Abdalla *et al.* (1993).

Table 1. physiological responses of Rhmani (R), imported Finn (FF) and their half-sibs born in Egypt (FE) breeds of sheep during summer(S) and winter (W) seasons.

Physiological traits	Rahmani(R)				Finn (FF)				Finn (FE)			
	S		W		S		W		S		W	
	0800h	1400h	0800h	1400h	0800h	1400h	0800h	1400h	0800h	1400h	0800h	1400h
RT °C	38.2± 0.06	38.3± 0.06	38.3±.0.06	38.8± 0.06	38.7± 0.07	39.0± 0.07	38.6± 0.07	38.7±0.07	38.7± 0.05	39.0± 0.05	38.7± 0.06	38.7± 0.06
ST °C	36.1± 0.15	37.4± 0.15	33.9± 0.15	34.5± 0.15	37.1± 0.16	38.0± 0.16	33.7± 0.16	34.1± 0.16	36.9± 0.14	37.7± 0.14	33.7± 0.16	34.5± 0.16
WT °C	32.8± 0.24	35.5± 0.24	19.8± 0.24	21.5± 0.24	33.6± 0.26	36.0± 0.26	17 6± 0.26	21.3± 0.26	33.4± 0.23	35.9± 0.23	17.3± 0.25	20.7± 0.25
R.R., births/min	31.2 ± 1.2	45.4± 1.20	25.0± 1.20	26.8± 1.20	57.7± 1.30	74.4± 1.30	34.9± 1.30	34.4± 1.30	57.7± 1.20	74.0± 1.20	34.1± 1.20	44.3± 1.30
T3 (ng/ml)	99.0± 6.20	85.5± 5.30	93.4± 5.10	96.3± 5.50	97.2± 5.90	70.8± 6.10	96.9± 6.20	115± 5.90	86.9± 5.60	81.8± 5.00	89.1± 5.40	110± 5.30
T4 (µg/ml)	5 8 ± 0.3	5.7 ± 0.2	4.5 ± 0.2	5.8± 0.3	4.5 ± 0.3	4.1± 0.3	5.5 ± 0.3	5.9± 0.3	4.6 ± 0.2	4.6± 0.2.	5.1± 0.3	6.2 ± 0.3
AT °C	26.4	31.8	13.3	16.3								
RH (%)	76.5	58.5	84.5	71.5								

Table 2. The differences in various physiological traits between summer and winter seasons (S-W) expressed as % of values measured in winter .

Traits	Rahmani (R)		Finn. (F)		Finn. (E)	
	dif.	%	dif.	%	dif.	%
0.800 h						
RT	- 0.1	- 0.3	0.1	0.3	0.0	0.0
ST	5.2	15.3	3.4	10.1	3.2	9.5
WT	13.0	65.7	16.0	90.9	16.1	93.1
RR	6.1	24.4	22.8	65.3	23.6	69.2
T_3	5.6	6.0	0.3	0.3	- 2.2	- 2.5
T_4	1.3	28.9	- 1.0	- 18.2	- 0.5	- 9.8
1400 h						
RT	0.1	0.3	0.3	0.8	0.3	0.8
ST	2.9	8.4	3.9	11.4	3.2	9.3
WT	14.0	65.1	14.7	69.0	15.2	73.4
RR	18.6	69.4	31.0	71.1	29.6	67.0
T_3	- 10.4	- 10.4	- 45.0	- 38.9	- 28.7	- 26.0
T_4	- 0.1	- 1.7	- 1.8	- 30.5	- 6.1	- 25.8

The larger magnitude of changes in WT compared with that of ST (Table 2) may be attributed to exposure to the adjacent ambient air, which seems to be a result of the direct effect of air temperature. Kibler *et al.* (1970) reported that, although deep body temperature may remain constant, peripheral temperature will rise or fall with varying environmental temperature.

Thyroid hormones are known to play an important role in adjustment of mammals to environmental changes. Tri-iodothyronine is concerning more with thermogenesis where thyroxine is concerned more with general metabolic activity (Nathanielsz, 1975). The high ambient temperature has a direct effect on plasma T4 and this effect is initiated at the hypothalamus level (Valtoata *et al.*, 1982). On the other hand, exposure to cold increased T3 level (Kennedy *et al.*, 1977 and El-Nouty *et al.*, 1978). The results presented in Tables (2 and 3) indicated that T_3 level was about 11-39% lower in the hottest periods (at 1400h in summer) while it was increased to about 3-24% at the coolest period (08 00h in winter). On the other hand, the corresponding degree of changes in T_4 was lower (1.7-30.5 %). The same trend was observed in a previous studies carried out in Egypt on Ossimi and Rahmani subtropical sheep breeds (Shalaby, 1985) and on Finnish landrace ewes imported to Egypt (Abou-Ela *et al.*, 1987). The results of Yousef and Johnson (1966) indicated that both lower and higher environmental temperature have significant effect on the various parameters of thyroid activities. They suggested that the hypothalamus is thermo-sensitive in its regulation of TSH secretion and based on the analysis of topographical localization of body temperature controlling and thyroid controlling regions in hypothalamus.

The larger differences in AT between 0800 and 1400h in summer (23.5%) than in winter (15.4%) was reflected in the changes observed in all the physiological traits studied (Table 3). Among the three measurements of body temperature, WT was the most affected by time of day, thus showing its protective function for sheep body temperature. The present findings are in agreement with those found by Khalil (1980). Furthermore, Shalaby (1985) found that the correlation between AT and the measurements of body temperature was strongest with WT followed by ST and RT.

In the present study, during the hot season RR was the trait most affected by time of day and RT was the least affected. It has been reported that during the hot season, RR was the most affected trait by time of the day and this may be due to that the peripheral sensory receptors are stimulated by heat to cause panting in sheep (Bligh, 1959). Moreover, Symington (1960) reported that the respiratory evaporation was the principle thermolytic process and the rate of respiration was sensitive indicator of thermal stress in sheep.

Table 3. The differences in various physiological traits between the two times (1400 - 0800h) expressed as percentage to values measured at 0800h.

Traits	Rahmani (R)		Finn. (F)		Finn. (E)	
	dif.	%	dif.	%	dif.	%
Summer						
RT	0.7	1.8	0.3	0.8	0.3	0.8
ST	1.3	3.6	0.9	2.4	0.8	2.2
WT	2.7	8.2	2.4	7.1	2.5	7.5
RR	14.3	46.0	16.7	28.9	16.3	28.2
T_3	-13.1	- 13.2	-26.4	- 27.2	- 5.1	- 5.9
T_4	- 0.1	- 17.2	- 0.4	- 8.9	- 0.0	0.0
AT	5.4	20.5				
RH	18.0	23.5				
Winter						
RT	0.5	1.3	0.1	0.3	0.0	0.0
ST	0.6	1.8	0.4	1.2	0.8	2.4
WT	1.7	8.5	3.7	21.0	3.4	19.7
RR	1.8	7.2	8.5	24.3	10.2	29.9
T_3	2.9	3.1	18.9	19.5	21.4	24.0
T_4	0.3	6.7	0.4	7.3	1.1	21.6
AT	3.0	22.6				
RH	13.0	15.4				

Breed differences

The results of the present study revealed that Finn rams seems to be less tolerant to heat than Rahmani ram lambs. This was evident from the larger increase in RT and RR in Finn rams with the rise in AT. The increase in these two traits may be explained on the basis that heat dissipation rate from the body surface was less than the rate of heat production, particularly under hot conditions, which resulted in an increase in core body temperature. Elevation of core body temperature stimulates the mechanism of heat dissipation by increasing heat transfer from core to surface by vasodilatation in skin and increase of blood flow to surface (Shalaby, 1985). This was reflected by an increase in ST. Furthermore since the water vaporization from the respiratory tract is the main avenue for cooling the body in sheep (Symington, 1960; Hales and Brown,1974; Johnson, 1976 and Shalaby, 1985) thus the higher heat load in FF and FE, indicated by higher RT, resulted in increase in its RR compared to R.

In the present study, Finnsheep showed slightly higher concentration of T3 and T4 during winter. The breed differences in thyroid hormones were more pronounced at 14 00h than at 08 00h. This was indicated by larger decline in T3 level at 1400h in summer (38.7% in FF and 26.0% in FE compared to 10.4% in R). The

corresponding magnitude of changes in T4 were 30.5, 26.8 and 1.7% in the three breed groups, respectively. Marked breed variation in different physiological responses have been reported between temperate and subtropical breeds of sheep (Diwivedi, 1976; Degen, 1977; El-Sheikh *et al.*, 1981; Shalaby, 1985;Fawzy, 1986; Aboul-Ela *et al.*, 1987 and Ibrahim, 1994).

The result obtained showed that Finn rams produced in Egypt by the means of embryo transplants did not differ significantly in their physiological responses than their half sibs born in their homeland (Finland).

It could be concluded from the results of the study that animals produced through embryo transfer did not differ significantly in their physiological responses to subtropical environment when compared with those imported alive. The maternal effect due to the breed of the recipient ewes did not show marked effect on the subsequence born lambs. However, in view of the magnitude of changes in physiological responses to the subtropical climatic condition it would be highly recommended that proper and careful attention should paid to the housing physical parameters for exotic temperate breeds, to bring the climatic burden to minimal values and maintain a longer life time productivity.

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الاستجابة الفسيولوجيه للتغييرات المناخية فى حملان الرحمانى والفنلندى المستوردة واخواتهاالانصاف اشقة المولودة من نعاج رحماني فى مصر

توفيق حسن شلبى- عمر سلامه - جمال سلومه

معهد بحوث الانتاج الحيوانى -وزارة الزراعه واستصلاح الاراضى - مصر

استخدم فى هذة الدراسه عشرة حملان ذكور من سلالة الفنيش لاندريس وتسعه من اخواتها الانصاف اشقه المولودة من نعاج محلية من سلالة الرحمانى عن طريق تكنولوجيا نقل الاجنه بالاضافة الى تسعه حملان ذكور من سلالة الرحمانى بهدف دراسة الاستجابة الفسيولوجيه للظروف البيئية التحت استوائية السائدة فى مصر .

وقد اظهرت النتائج ان فى معظم المقاييس الفسيولوجيه المستخدمه فى الدراسه كان هناك اختلافات معنويه بين موسمى الصيف والشتاء وبين السلالات . وتشير النتائج ان كلاً من مجموعتى الحملان الفنلندى اقل تحملا لهذه الظروف من الرحمانى. وقد ظهر هذا واضحا فى الاختلافات المعنويه فى درجة حرارة الجسم ومعدل تنفس والانخفاض في مستوى هرمونات الغدة الدرقيه . بينما لم تظهر اى فروق معنويه فى المقاييس الفسيولوجيه بين مجموعة الفنلندى المستوردة وتلك المولودة من نعاج رحمانى .

وعلى ضوء هذه النتائج يمكن التوجيه بأعطاء الاهتمام بتوفير الاسكان المناسب عند تربية الاغنام المستوردة من المناطق الباردة تحت الظروف البيئية السائدة فى مصر .