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تأثير الاختلافات الفسيولوجية على مستوى الكورتيزول والبروتينات الكلية والكوليسترول والدهنيات الكلية في دم الابقار في موسم الصيف

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تم فحص ٦٠ حيوان قسمت الى ستة مجاميع حسب الحالة الفسيولوجية . وبالتحليل الدموى لهذه الحالات أظهرت الاتي :

١- قدرت نسبة الكورتيزول في هذه الحالات التي تبدو فسيولوجيا سليمة مابين ٣٢٠٠ ن.مو./ل ، ٤٧٠٠ ن.مو./ل فيما عدا الابقار الجلد التي أظهرت نسبة أقل ١٥٠٠ ن.مو./ل ٣٠١٠ ن.مو./ل . وقد أعزيت الزيادة في نسبة الكورتيزول في بعض الحالات الى الزيادة في نشاط الكظرية.

٢- لم يلاحظ أى تأثير على مستوى البروتينات الكلية في الدم.

٣- كذلك نسبة الكوريدات في السيرم كانت كلها طبيعية.

٤- نقص واضح وملحوظ في نسبة الدهنيات الكلية في الحيوانات عالية الادرار وكذلك زيادة ملحوظة في تلك النسب في اناث الابقار التي تراوح أعمارهن بين ٨ ، ١٢ شهر.

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EFFECT OF DIFFERENT POHYSIOLOGICAL STATES ON LEVELS OF CORTISOL, TOTAL PROTEINS, CHLORIDE AND TOTAL LIPIDS OF CATTLE BLOOD SERUM IN SUMMER TIME

(With 2 Tables & One Fig.)

By
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SUMMARY

Sixty animals (six groups) of the native cattle bred at different physiological status were investigated in summer time. Blood analysis of such cases revealed the following findings

1- Serum cortisol levels in these physiologically normal cattle were between 3200 n mol/L. and 4700 n mol/L. Exception was the non pregnant-nonlactating aged cows 1500 n mol/L. to 3010 n mol/L. p. Raised levels attributed to adrenocortical activity.

2- No distinct difference in the total serum proteins level.

3- No obvious changes were detected in the serum chloride level between the examined groups and most of these values lie within the acceopted physiological limits.

4- Distinct decrease in the totalipid contents in the highly lactating cows, while rise was obvious in heifers (8-12 months of age).

INTRODUCTION

The animal body tries to maintain its internal environment constant by the changes in its various biochemical parameters as a reactions to adverse situation (SAKSENA et al. 1980). Heat stress has been shown to affect adversely the animal production (MC DOWELL, 1972). The metolbolic demands of high producing dairy cow constitute a prfound stress on the animal body (FLATT et al. 1969). Heat stress has also been shown to reduce fertility of dairy and beef cows (STOTT and WILLIAMS, 1962; DUNLAP and VINCENT, 1971; INGRAHAM, et al. 1974; ROSENBERG, et al. 1977).

The aim of the present investigation is to study the variations in the responses of certain blood attributes in cattle, with different physiological status, subjected naturally to summer stress.

MATERIAL and METHODS

Animals:

The study involved 60 animals of the native cattle breed at different physiological status classified into six groups (Table 1 & 2). They were selected from the herd of the experimental farm that belong to the Animal Production Station at Beni Murr Assiut Province. Animals were fully examined clinically.

Blood Samples:

Jugular blood was sampled from each animal between 09.00 and 11.00 hours a.m. and serum samples were separated by allowing clotted blood to settle and centrifuged (2000 g. 15 min.), then were stored at -20°C until required.

Total serum proteins and total lipids level were estimated using test kits supplied by Boehringer Mannheim (W. Germany). Cortisol level was estimated using the enzyme immuno assay kit supplied by Immuno tech. corp. (Cambridge, MA, USA. 02139). Chloride content was estimated using chloride meter analyzer (Corning Model 925). During July and August, 1981 the minimum and maximum ambient temperature were 19°C and 39.5°C and 20°C and 41.7°C respectively according the General Astrological organization.

Statistical Analysis:

Were conducted according to SNEDECOR and COCHRAN (1968).

RESULTS

Concerning the obtained cortisol levels (Table 1, 2 & Fig. 1), the results showed no remarkable difference between the groups with exception of group II (heifers) were the levels rose remarkably in July, than in August, while all the rest groups showed slight rise in August than in July. The cortisol levels in these groups (II) lies between 3200 ± 414.72 n mol/L. and 4700 ± 466.70 n mol/L. Exceptionally was the non pregnant-non lactating group showed cortisol levels range between 1500 n mol/L. and 3010 n mol/L.

No distinct difference in the total serum protein contents was observed in relation to temperature, while the exception of noticeable decrease in the highly lactating cows (Table 1, 2 & Fig. 1).

The concentration of chloride content in the blood serum was registered in tables (1), (2) and Fig. (1) showed no obvious changes between the examined groups.

Regarding total lipids content in the blood serum (Table 1, 2 & Fig. 1) there were a distinct decrease in these values in group V (highly lactating cows) in both months, however an obvious rise in group II (heifers) was observed in comparison with the other groups.

DISCUSSION

Meagre informations are available regarding the cortisol content in our native cattle breed specially its changes in the different physiological processes. Using the more sensitive and advanced enz. immuno-assay technique in replacement for the radio immuno assay (RIA), it was easy to estimate the normal cortisol content (n mol/L.) using 25 ml of serum sample. The obtained results (Tables 1, 2 & Fig. 1) showed slight increase in the cortisol values in August than in July. This could be attributed to the thermal stress upon which the animals were exposed during the summer season, that will stimulate the adrenocortical activity. Also the stress situations induced as the result of high lactation in cows may in part play a role in raising the cortisol content in such cows. Our results come in agreement with FLATT et al. (1969) who stated that the metabolic demands of the high producing dairy cow constitute a great stress to the animal. In cases of group VI (non lactating- non pregnant aged cows) the cortisol levels they exhibited was between 2250 ± 565.69 n mol/L. and 2282 ± 583.52 n mol/L. which is generally the lowest levels registered throughout the whole group. This would confirm our explanation as they were exposed previously

to cold and hot stresses, so they were already acclimatized to such adverse conditions. Furthermore, they were non-pregnant and non-lactating and were away from the physiological stress that contribute in the raise of cortisol levels. The explanation for the remarkably high levels of cortisol in heifers if compared with other groups is a hormonal effect, that these female animals were in a state of growing to adulthood and the high oestrogen levels (catabolic hormones) would constitute a great stress factorl. Howeve, this point needs more investigation as to the inter-relationship between the functional state of the female animal and the adrenocortical activity.

BRODY (1949) in cattle reported no slignificant difference in plasma protein in relation to experimental temperature. Our results except those of the high lactating cows seem to be in consistent with his results. The slight lowered protein levels observed in the latter condition (Table 1, 2 & Fig. 1) could be attributed in the opinion of DIMPOULLOS (1970) who stated that plasma proteins are extremely sensitive to nutritional influences. JOHNSON (1967) reported a depressed appetite in lactating cattle occuring around 25°C, the decline becoming more marked above 30°C. Animals virtually stopped eating at 40°C. So was the case in our study. A similar progressive decrease in cattle plasma proteins content in Holstein Friesian, Brown Swiss and Jersey heifers was observed by KAMAL et al. (1962) when air temperature was raised from 10°C to 35°C.

Normal serum chloride concentration as in all groups were observed (Table 1, 2 & Fig. 1). There results however, seem to disagree with those reported by JOSHI et al. (1968 b), nevertheless, it could be interpreted to the length of time upon which the animals subjected to high temperature in July and August. The reverse were interpreted in the view of JOSHI et al. (1968 a) that cattle sweat contains quite an appreciable amount of chloride 100-300 mg/100 ml. and its discharge in sweat at the rate as high as 600 g of sweat/m^2 of the surface area in cattle per hour or more (MC DOWELL et al. 1961 and JOSHI et al. 1968 b) may constitute a serious threat to life if continued unabetted. A marked reduction in chloride concentration in the sweat may be the most important factor for increase in chloride content of serum. The evidence for it to be part of adrenocortical adjustment was first produced by CONN et al. (1946), who also noted that the change takes place in about to days. HELMAN et al. (1956), ROBINSON et al. (1956), and MC FARLANE and ROBINSON (1957) associated the increased aldosterone secretion with the direct effect of heat exposure. The stimulated aldosterone secretion increases sodium and chloride retention by renal and sweat subules.

The marked and obvious low levels of total lipids detected in the blood serum of highly lactating cows in our study (Table 1, 2 & Fig. 1) could be explained in the view of HASSAN et al. (1981) in sheep that long-chain fatty acids are transported to milk directly from blood lipids. The reverse is true for heifers (Table 1, 2 & Fig. 1).

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CORTISOL LEVEL IN CATTLE BLOOD

Table (1): Serum cortisol, total proteins, chloride and total lipids levels of cattle at different physiological status in summer time.

Animal species	Time	Animal No.	Cortisol (n mol/L.)	Total proteins (g/L.)	Chloride (m mol/L.)	Total lipids (g/l.)
Calves (4-8 months of age) I	July, 20,1981	1	6500	82.00	97	9.60
		2	3000	65.00	95	10.00
		3	3600	60.00	87	8.72
		4	3500	65.00	85	10.16
		5	3000	60.00	89	9.60
	August, 25,1981	6	3000	90.00	90	13.16
		7	7300	70.00	91	16.92
		8	4000	78.00	95	13.16
		9	4200	70.00	98	12.54
		10	3700	67.00	112	12.02
Female adult calves(8-12 months of age) II (Heifers)	July, 20,1981	1	5700	63.00	101	14.80
		2	4900	70.00	95	14.52
		3	7600	59.00	71	17.72
		4	7500	75.00	95	15.20
		5	8000	63.00	100	13.80
	August, 25,1981	6	4000	65.00	97	17.72
		7	2900	65.00	99	25.60
		8	2900	68.00	83	19.40
		9	3200	63.00	99	20.18
		10	3000	57.00	95	17.72
Male adult calves(8-12 months of age) III	July, 20,1981	1	2900	76.00	97	7.20
		2	3700	91.00	99	6.92
		3	3500	72.00	110	8.52
		4	3700	82.00	97	10.42
		5	2500	95.00	100	12.40
	August, 25,1981	6	7600	100.00	104	8.20
		7	3700	79.00	101	14.40
		8	2700	86.00	106	12.40
		9	3500	79.00	104	10.90
		10	3700	95.00	106	8.20
Pregnant cows IV	July, 20,1981	1	5300	65.00	110	13.00
		2	3400	76.00	110	10.80
		3	3800	83.00	97	15.72
		4	3600	83.00	109	16.40
		5	4200	69.00	110	12.80
	August, 20,1981	6	4300	80.00	109	16.20
		7	4200	80.00	109	16.40
		8	5300	90.00	106	15.72
		9	8000	95.00	101	13.80
		10	16000	89.00	105	14.20
Highly lactating cows V	July, 20,1981	1	3800	63.00	110	4.68
		2	3000	63.00	100	5.20
		3	5200	67.00	91	6.18
		4	4700	75.00	100	3.00
		5	3800	63.00	104	3.80
	August, 25,1981	6	5200	84.00	100	4.80
		7	5150	65.00	104	5.40
		8	4700	72.00	101	3.80
		9	3900	63.00	99	3.00
		10	4800	75.00	105	4.80
Non pregnant - non lactating aged cows VI	July, 20,1981	1	2700	86.00	112	7.80
		2	2900	42.00	70	4.80
		3	2500	72.00	78	3.20
		4	1550	75.00	98	6.80
		5	1600	67.00	95	7.90
	August, 25,1981	6	1700	83.00	104	8.12
		7	3010	83.00	96	7.90
		8	2700	91.00	101	6.60
		9	2500	78.00	104	4.80
		10	1500	42.00	99	6.78

Table (2): Serum cortisol, total proteins, chloride and total lipids of cattle in different physiological status in summer time. (Mean±SDM).

Animal species	Time	Animal No.	Cortisol (n mol/L.)	Total proteins (g/L.)	Chloride (m mol/L.)	Total lipids (g/l.)
	July,	1	3900	66.40	90.60	9.62
Calves(4-8 months	20,1981	5	±1313.62	±8.11	± 4.60	±0.50
of age) I	August	6	4400	75.00	97.20	13.56
	25,1981	10	±1486	± 8.34	± 7.93	± 1.73
	July,	1	6740	66.00	92.40	15.21
Female adult calves	20,1981	5	±1214.24	± 5.73	±10.98	± 1.34
(8-/2 months of	August,	6	3200	63.00	94.60	20.12
age) II	25,1981	10	±414.72	± 3.67	± 5.99	± 2.90
	July,	1	3260	83.20	100.50	9.10
Male adult calves	20,1981	5	±480	± 8.70	± 4.43	± 2.07
(8-12 months of						
age) III	August,	6	4240	87.80	105.20	10.82
	25,1981	10	±1720	±8.47	± 2.64	± 2.41
	July,	1	4060	75.20	107.00	13.12
	20,1981	5	±674.09	±7.28	± 5.11	± 2.34
Pregnant cows						
IV	August,	6	4680	88.80	106.00	15.26
	25,1981	10	±2068.43	± 5.91	± 2.97	± 1.06
	July,	1	4100	66.20	101.00	4.57
Highly lactating	20,1981	5	± 989.42	± 4.66	± 6.20	± 1.10
cows V	August,	6	4750	71.80	101.80	4.30
	25,1981	10	± 466.90	± 7.52	± 2.32	±0.86
	July,	1	2250	68.4	90.60	6.10
Nonpregnant -	20,1981	5	± 565.69	±14.60	±14.93	±1.83
nonlacting cows	August,	6	2282	71.90	100.80	6.88
VI	25,1981	10	±583.52	±16.34	± 3.06	±1.18

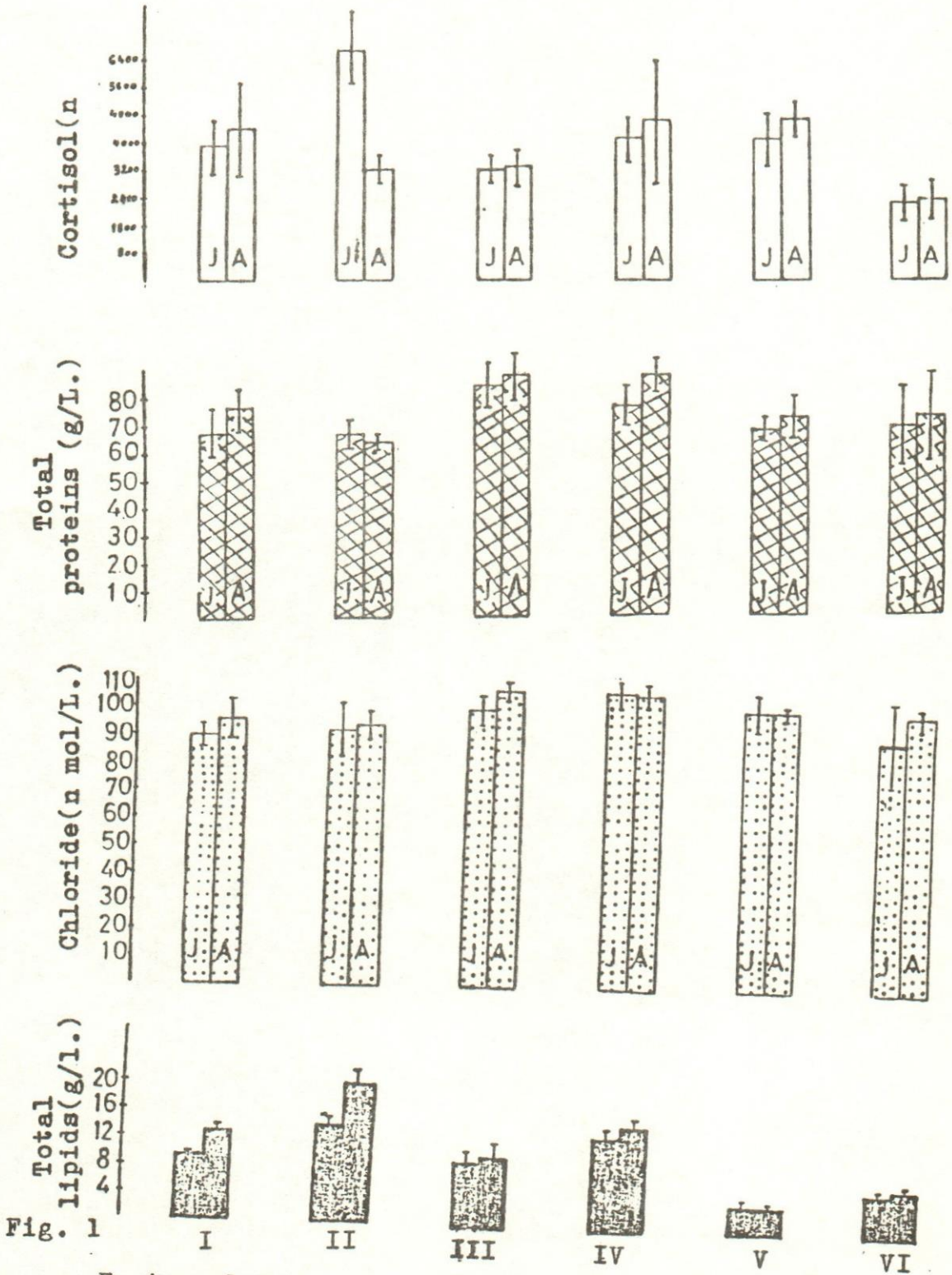

Fig. 1 - Empty columns mean cortisol content in serum (n mol/L.), cross-hatched columns mean total serum proteins (g/L.), Dotted columns mean serum chloride content (n mol/l.), Solid columns mean total lipids (g/L.), (J) mean July, (A) mean August.