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ADAPTABILITY OF BOVINE CALVES UNDER SUBTROPICAL ENVIRONMENT

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ABSTRACT

The present study was conducted in the Department of Animal Production, Faculty of Agriculture, Zagazig University. The experimental work was carried out in Bovine Farm, Experiment Farms Project, Biological Application Department, Radioisotopes Applications Division, Nuclear Research Centre, Atomic Energy Authority, Inshas, Cairo, Egypt. Twelve healthy growing calves including 6 Baladi and 6 cross-bred (50% Brown Swiss x 50% Baladi) calves, were used in this study. The experimental calves were exposed to two climatic conditions. The first was during winter season as mild climate for 3 months. Averages of ambient temperature and relative humidity were 21.8± 0.87°C and 63.7±2.5%, respectively. The second was during summer season as hot climate for 3 months, averages of ambient temperature and relative humidity were 35.25±0.72°C and 55.6±1.03%, respectively. The THI values were 20.9 and 32.33 during winter and summer, respectively, indicating absence of heat stress during winter season and exposure of the experimental animals to very severe heat stress during summer season. The results showed that the Baladi x Brown Swiss crossbreds surpassed the Baladi local cattle in growth and adaptability to heat stress conditions. The estimated heat tolerance index (HTI) values averaged 68.8% in the crossbreds. The accuracy of the actual tolerance level of the animal was found to increase with the increase of number of traits included in the estimation.

Key words: Crossing, growth, glucose, heat stress, purebred, summer, T_3, urea.

INTRODUCTION

In hot climates, high ambient temperatures and high direct and indirect solar radiation, wind speed and humidity, are the main environmental stressing factors that impose strain on animals (Finch, 1984). Marai (2010) defined heat stress as the state at which the animals body physiological mechanisms activate to maintain the body's thermal balance, when exposure to elevated temperature. Exposure of farm animals to high environmental temperature stimulates the peripheral and core receptors to transmit the nerve impulses to the specific centres in the hypothalamus (the defensive evaporative and non-evaporative cooling systems, appetite centre and the adaptive mechanisms that cause such reactions) to help in preventing the rise in body temperature. Prolonged heat exposure suppresses the production of hormone releasing factors from the hypothalamic centres causing reductions in pituitary prolactin, somatotropin, thyrotropin and leutinizing hormone, insulin and possibly parathomone. The decrease in the substrate and hormones and the rise in body temperature inhibit the enzymatic activities, which decrease the metabolism and consequently impair milk production, growth and reproduction (Marai, 2012). Hormonal secretions are known to be of major importance in body thermoregulation. The hormones connected with thermoregulation are thyroxin, cortisol, insulin and aldosterone. Thyroid hormones, either T_4 or T_3 play an important role

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in animals adaptation to environment changes (Marai and Habeeb, 1998).

From another point of view, the use of exotic breeds for crossbreeding purposes, to take advantage of potential heterotic effects, has long been popular. A properly designed crossbreeding system allows the cattle producer to take advantage of appropriate combinations of the superior traits of several different breeds (complementarity) and it also yields heterosis (Olson, 2011). Particularly, the aim of crossbreeding is to transmit the superior genetic and phenotypic characteristics of a breed or breeds to the F_1 offspring. Some breeds pose many of these outstanding phenotypic characteristics which can be clearly seen in its crossbred offspring (Barry and Godke, 2001 and 2005).

However, very little information was available on performance of such introduced breeds and their crosses, in Egypt.

The objective of the present study was to estimate the heat induced changes (%) in some traits which are related to growth during winter and summer seasons to evaluate adaptability of bovine Baladi purebreds and Baladi x Brown crossbred calves under the sub-tropical environmental conditions of Egypt.

MATERIALS AND METHODS

The present study was conducted in the Department of Animal Production, Faculty of Agriculture, Zagazig University. The experimental work was carried out in Bovine Farm Project, Experimental Farms Project, Biological Application Department, Radioisotopes Applications Division, Nuclear Research Centre, Atomic Energy Authority, Inshas, Cairo, Egypt.

Animals and Feeding

The study was carried out on the Bovine calves from bovine Farm Project at Inshas area. A number of 12 bovine calves after weaning with nearly 120 ± 10 kg average live body weight, were used in this research. Animals were fed the ration consisted of concentrate feed mixture (CFM) and rice straw (RS). The ingredients of the CFM and chemical composition of the feedstuffs used in the feeding of the calves, are shown in Table 1.

Experimental Design

Twelve healthy bovine calves including 6 Baladi and 6 cross-bred (50% Baladi x 50% Brown Swiss) were used in the experiment. The experimental calves were exposed to two environmental conditions. The first was during winter climate (90 days from the first of January to the end of March). Averages of ambient temperature (AT) and relative humidity were 21.8 ± 0.87°C and 63.7 ± 2.5%, respectively. The second was conducted during summer climate (90 days from the first of June to the end of August). Averages of ambient temperature (AT) and relative humidity were 35.25± 0.72°C and 55.6 ± 1.03%, respectively (Table 2).

Animal housing and management

The experimental calves were left loose day and night during both mild and hot periods in one separate soil-floored yard (20 x 40 metres) surrounded with wire fence (1.5 metre height). One-third of the surface area of the yard was covered with concrete shading roof in the middle (3.5 metres height) with natural ventilation. The yard was provided also with troughs and source of tab fresh drinking water to be available automatically at all time.

Methods

Thermoregulatory Parameters and Blood Samples

Thermoregulatory parameters (rectal temperature and respiration rate) were estimated weekly. Blood samples were collected monthly from the jugular vein to estimate T_3, glucose and urea-N during the two periods of the experiment. Radioimmunoassay technique was used for estimating T_3 hormone by commercial kits provided by diagnostic product corporation, Los Angeles, USA. The unknown samples or standards are incubated with ^{125}I-labeled hormone in antibody-coated tubes. After incubation, the liquid contents of the tube were aspirated and the radioactivity was determined in a gamma counter. Glucose and urea-N were determined by quantitative enzymatic colorimetric methods using biochemical regent kits according to Biodiagnostic company.

Table 1. Ingredients and chemical composition of the experimental feedstuffs

Items	Concentrate feed mixture	Rice straw
Ingredients of the concentrate (%):		
Crushed yellow maize	40.00	
Wheat bran	25.00	
Soybean meal	7.00	
Undecorticated cotton seed meal	25.00	
Dicalcium phosphate	1.00	
Sodium chloride	1.00	
Mineral mixture *	0.50	
Vitamin AD_3E	0.50	
Chemical composition of the feedstuffs (on DM basis)(%)**		
Dry matter	89.81	92.30
Organic matter	94.00	83.52
Crude protein	15.68	3.20
Crude fibre	8.50	32.70
Ether extract	2.67	1.80
Nitrogen-free extract	67.15	44.60
Ash	6.00	17.70
Calculated Nutritive values of the feed stuffs:		
Net energy (MJ/kg DM)	4.00	1.60
Total digestible nutrients (%)	60.82	30.00
Digestible crude protein (g/kg DM)	115.0	0.00
Starch equivalent	0.50	0.20

*Each 100 kg concentrates was supplemented with 50 g minerals mixture (Each kg contains 20g Mn, 1.5g Cu, 0.15g I, 0.05g Se and 15g Fe from Pfizer-Co., Egypt), 50g vitamins mixture (AD3 E), AliphosDical 18 (Dicalcium phosphate) 1kg and coarse refined iodized kitchen salt 1kg (El-Nasr saline Co., Egypt).

** According to AOAC (1990).

Table 2. Ambient temperature (AT,°C), relative humidity (RH%) and temperature humidity index (THI) during the two experimental periods ($\bar{x}$ ± SE).

Climate	Months	*Ambient temperature (AT, °C)	*Relative humidity (RH %)	Temperature humidity index (THI)
Mild climate	January	20.50 ± 0.29	67.2±2.2	19.88
	February	22.00 ±0.41	62.7±2.2	21.12
	March	23.00±0.29	61.3±1.8	21.80
	Overall	**21.8 ± 0.87**	**63.7±2.5**	**20.9(Absence of heat stress)**
Hot climate	June	34.00 ± 0.41	57.5±1.44	30.51
	July	35.25±0.25	54.0± 0.58	31.27
	August	36.50±0.29	55.25±0.48	33.43
	Overall	**35.25±0.72**	**55.6 ±1.03**	**32.33(Very severe heat stress)**

*Each value for air temperature and relative humidity was the average of 4 times, recorded weekly at 13.00 hrs.

Calculations

Live body weight and daily body weight gain

Live body weight of the experimental calves was weighed monthly during winter and summer seasons. Daily body weight gain values were estimated as follows:

Total live body weight gain (kg) per month /days of month.

Superiority of crossbreds

It is calculated using the average trait values as follows: [(C-P) / P] x 100,

where: C= the average of crossbreds and P = the value of the male parent.

Severity of heat stress

Severity of heat stress was estimated by Temperature-humidity Index (THI) according to Marai *et al.* (2000) as follows:

THI = db°C – [(0.31-0.31 RH) (db°C -14.4)],

where: db°C= Dry bulb in Celsius (Table 2).

The values obtained were then classified as follows: <22.2=absence of heat stress, 22.2 - <23.3 = moderate heat stress, 23.3-<25.6=severe heat stress and 25.6 and more =very severe heat stress (Marai *et al.*, 2000).

Heat tolerance index (HTI)

Heat tolerance index (HTI) was calculated by using the heat induced change due to heat stress in all measured traits according to Marai *et al.* (2005) as follows:

100% - Average of heat induced changes %,

where average of heat induced changes %=

[(HS-MC) / MC] x 100,

where HS is the average of traits under heat stress and MC = the average of the same traits under mild conditions.

Statistical Analysis

Covariance was carried out due to the significant differences found in the initial live body weights of the experimental calf groups, and all factors except those studied were considered constant.

Data were statistically analyzed covariance (lest square means) using procedure of SAS (1991) according to the following model:

$$Y_{ijk} = \mu + B_i + S_j + BS_{ij} + b\,(X - \overline{X}) + e_{ijk},$$

where: μ = the overall mean, B_i = the fixed effect of breed type (1...2), S_j = the fixed effect of season (1...2), BS_{ij} = the interaction between the breed type and season of the year, b = regression coefficient of Y on live body weight, $\overline{X}$ = the arithmetic means of live body weight and e_{ijk}= random error.

RESULTS

Temperature-Humidity Index (THI)

The estimated THI values were 20.9 and 32.33 during winter and summer, respectively (Table 2), indicating absence of heat stress during winter season and exposure of the experimental animals to very severe heat stress during summer season.

Effect of Breed Type (B) and Season of the Year (S) on Thermoregulatory Parameters

Respiration rate (RR)

The RR values were insignificantly affected by breed type. Concerning the effect of season, the RR was significantly (P<0.01) higher in summer than in winter during the three months of the study. The increase values were 26.7, 45 and 48.5% in the first, second and third months respectively. The interaction effect between B and S on RR values indicated that the change rate values were +20.8, +43.8 and 49.4% in purebred and were +33.2, +47.2 and +48.0% in crossbred calves in the first, second and third months respectively (Table 3).

Rectal temperature (RT)

The RT values were insignificantly affected by breed type. Concerning the effect of season, the RT values were significantly (P<0.001) higher in summer than in winter during the three months. The increase values were 3.6, 3.6 and 3.8% in the first, second and third months, respectively. The interaction effect between B and S on RT indicated that the change rate values were +3.6%, +3.3% and +3.9% in purebred and +3.6%, +3.8% and +3.6% in crossbred calves in the first, second and third months, respectively (Table 3).

Table 3. Least squares means of respiration rate and rectal temperature as affected by breed type, season of the year and their interactions in young calves

Items	Respiration rate, rpm			Rectal temperature °C		
	1st month	2nd month	3rd month	1st month	2nd month	3rd month
			Breed type effect (B)			
Purebreds	35.30±0.61	34.29±1.25	32.42±1.11	39.50±0.02	39.52±0.03	39.56±0.03
Crossbreds	33.39±0.71	32.70±1.78	32.14±1.34	39.50±0.03	39.55±0.04	39.51±0.03
Change (%)	-5.4	-4.6	-0.8	-	+0.07	-0.1
			Season effect (S)			
Winter	30.30±0.92	27.29±2.30	25.96±2.04	38.80±0.04	38.83±0.05	38.80±0.05
Summer	38.39±1.07	39.70±2.68	38.60±2.35	40.20±0.04	40.23±0.05	40.27±0.06
Change (%)	+26.7**	+45.0**	+48.5**	+3.6***	+3.6***	+3.8***
			Interaction between breed and season effect (B x S)			
Purebreds						
Winter	31.97±1.31	28.12±3.29	26.00±3.47	38.80±0.05	38.87±0.06	38.80±0.09
Summer	38.64±1.19	40.45±2.98	38.84±2.80	40.20±0.05	40.17±0.05	40.32±0.07
Change (%)	+20.8	+43.8	+49.4	+3.6	+3.3	+3.9
Crossbreds						
Winter	28.64±0.94	26.45±2.36	25.92±1.52	38.80±0.04	38.80±0.05	38.80±0.04
Summer	38.14±1.33	38.95±3.39	38.36±2.47	40.20±0.05	40.30±0.07	40.22±0.06
Change (%)	+33.2	+47.2	+48.0	+3.6	+3.8	+3.6

***P<0.001 and **P<0.01.

Effect of Breed Type (B) and Season of the Year (S) on Daily Body Weight Gain

The DBWG values were significantly (P<0.001) higher in crossbred than in purebred calves during the three months. The increase values were 44.9, 31.8 and 55.2% in the first, second and third months, respectively.

Concerning the effect of season of the year, the DBWG values were significantly (P0.001) lower in summer than in winter during the three months. The decrease values were 55.2, 60.2 and 57.4% in the first, second and third months, respectively. The interaction effect between B and S on DBWG indicated that the change rate values were -62.2, -69.0 and -70.0% in purebreds and -49.9, -52.6 and -47.1%, in crossbred values, during the first, second and third months, respectively (Table 4).

Triiodothyronin hormone (T_3)

The T_3 values were insignificantly affected by breed type. Concerning the effect of season, the T_3 values were significantly (P<0.01) lower in summer than in winter during the three months. The decrease values were 31.2, 29.4 and 21.4% in the first, second and third months, respectively. The interaction effect between B and S on T_3 values indicated that the T_3 values were -36.8, -36.1 and -23.7% in purebreds and were -24.6, -21.6 and -19.0 in crossbred calves during the first, second and third months respectively.

Effect of Breed Type (B) and Season (S) of the Year on Glucose

The glucose values were insignificantly affected by breed type. Concerning the effect of season, the glucose values were significantly lower in summer than in winter in the second (P<0.05) and third (P<0.01) months, but without significance due to season in the first month. The decrease values were 21.6, 24.4 and 43.1% in the first, second and third months, respectively. The interaction effect between B and S on glucose values indicated that the glucose values were -14.2, -17.4 and -39.6% in purebreds and-28.2, -30.8 and -46.8% in crossbred calves in the first, second and third months, respectively (Table 5).

Table 4. Least squares means of daily body weight gain and T_3 hormone as affected by breed type, season of the year and their interactions at month intervals in young bovine calves

Items	Daily body weight gain (g/d) 1st month	2nd month	3rd month	T_3 (nmol/L) 1st month	2nd month	3rd month
	Breed type effect (B)					
Purebreds	477.7±14	506.3±16	430.6±19	5.62±0.19	5.45±0.16	5.62±0.10
Crossbreds	692.1±14	667.4±16	668.4±19	5.16±0.22	5.16±0.18	5.25±0.12
Change (%)	+44.9***	+31.8***	+55.2***	-8.2	-5.3	-6.6
	Season effect (S)					
Winter	807.6±22	839.5±23	770.8±23	6.38±0.28	6.22±0.24	6.08±0.18
Summer	362.2±22	334.2±23	328.2±23	4.39±0.32	4.39±0.27	4.78±0.21
Change (%)	-55.2***	-60.2***	-57.4***	-31.2**	-29.4**	-21.4**
	Interaction between breed and season effect (B x S)					
Purebreds						
Winter	693.1±27	773.1±32	667.4±35	6.88±0.40	6.65±0.34	6.37±0.31
Summer	262.2±24	239.5±25	193.9±26	4.35±0.36	4.25±0.31	4.86±0.25
Change (%)	-62.2	-69.0	-70.9	-36.8	-36.1	-23.7
Crossbreds						
Winter	992.1±23	905.9±24	874.3±25	5.88±0.28	5.78±0.24	5.80±0.13
Summer	462.1±27	428.9±30	462.4±33	4.43±0.40	4.53±0.34	4.70±0.22
Change (%)	-49.9	-52.6	-47.1	-24.6	-21.6	-19.0

***P<0.001 and **P<0.01.

Table 5. Least squares means of glucose and urea-N as affected by breed type, season of the year and their interactions in young calves

Items	Glucose (mg/dl) 1st month	2nd month	3rd month	Urea-N (mg/dl) 1st month	2nd month	3rd month
	Breed type effect (B)					
Purebreds	80.32±3.56	81.19±3.36	85.47±3.00	29.90±0.67	29.92±0.49	31.45±0.57
Crossbreds	82.32±4.14	81.02±3.91	76.17±3.63	27.32±0.78	29.09±0.58	27.87±0.69
Change (%)	+2.5	-0.2	-10.9	-8.6*	-2.8	-11.4**
	Season effect(S)					
Winter	91.15±5.33	92.36±5.04	103.03±5.54	25.23±1.00	26.59±0.741	24.5±1.06
Summer	71.48±6.21	69.86±5.86	58.61±6.37	31.98±1.17	32.42±0.86	34.82±1.22
Change (%)	-21.6	-24.4*	-43.1**	+26.7**	+21.9**	+42.1**
	Interaction between breed and season effect (B x S)					
Purebreds						
Winter	86.48±7.62	88.94±7.19	106.58±9.41	27.15±1.43	27.09±1.06	26.22±1.80
Summer	74.15±6.92	73.44±6.53	64.36±7.62	32.65±1.30	32.76±0.96	36.69±1.46
Change (%)	-14.2	-17.4	-39.6	+20.2	+20.9	+39.9
Crossbreds						
Winter	95.82±5.47	95.77±5.16	99.48±4.13	23.32±1.03	26.09±0.76	22.79±0.79
Summer	68.82±7.78	66.27±7.33	52.85±6.71	31.32±1.46	32.09±1.08	32.96±1.28
Change (%)	-28.2	-30.8	-46.8	+34.3	+23.0	+44.6

**P<0.01 and *P<0.05.

Urea-N

Concerning the effect of breed type, the urea-N values were significantly lower in crossbred than in purebred calves in the first ($P<0.05$) and third ($P<0.01$) months, respectively, but without significance between the two breed types in the second month. The decrease values were 8.6, 2.8 and 11.4% in the first, second and third months respectively. Concerning the effect of season, the urea-N values were significantly ($P<0.01$) higher in summer than in winter during the three months. The increase in urea values were 26.7, 21.9 and 42.1% in the first, second and third months respectively. The interaction effect between B and S on urea-N values indicated that the urea –N values were +20.2, +20.9 and +39.9% in purebreds and +34.3, +23.0 and +44.6% in crossbred claves in the first, second and third months, respectively (Table 5).

Heat Tolerance Index (HTI)

In this respect, HTI was estimated by using the heat induced changes due to heat stress in some traits, as shown in Table 6 (according to Marai *et al.*, 2005).

Table 6 shows that the estimated HTI values differed according to sensitivity of each trait to heat stress. This means that animal trait response to heat stress differs from one trait to another. The less affected trait by heat stress, the more high value of HTI is shown. Rectal temperature and glucose level seemed to be of this type of traits, while DBWG showed the more affected trait by heat stress. Accordingly, the HTI estimated for one trait at one time can be used for comparison between groups or individuals. Postulately, it could be stated that the accuracy of the actual tolerance level of the animal increases with the increase of number of traits included. In Table 6, the HTI averages obtained were 68.0 and 68.8%, respectively.

DISCUSSION

The growth traits of the crossbred calves were higher than those of the Baladi purebred parent. These results were in agreement with Nigm *et al.* (1982); Nasr *et al.* (1997); El-Fouly *et al.* (1998) and Habeeb *et al.* (2002) who explained that the increase of growth performance in crossbreds may be due to heterosis.

The adverse effects of the elevated ambient temperature on the traits studied in the present investigation were similar to those reported by Johnson (1980); Bernabucci *et al.* (1999); Kamal and Habeeb (1999); Habeeb *et al.* (2001); Marai *et al.* (2007); Shwartz *et al.* (2009), Marai and Habeeb (2010) and Habeeb *et al.* (2011).

The decrease in DBWG in heat stressed animals may be due to increase in glucocorticoids and catecholamines and decrease in each of insulin and thyroid hormones (Kamal and Johnson, 1971). In addition, exposure of animals to hot environment can affect feed intake, digestibility and feed utilization (Bernabucci *et al.*, 1999).

The increase in RR in heat stressed animals is an attempt to increase respiratory evaporation (Habeeb *et al.*, 1992).

The body temperature expressed as RT rises if the calves fail to achieve thermal balance between body heat production and body heat loss (Habeeb *et al.*, 1992). The RT values are considered a good indicator of the thermal stress (Al-Haidary, 2004).

Exposure of the animals to severe heat stress conditions suppresses the production of hormone releasing factors from the hypothalamic centres causing decrease in secretion of pituitary hormonal secretion and in thyroid stimulating hormone that lowers the secretion of thyroid hormones (Habeeb *et al.*, 1992). In addition, the interaction between the thyroid and the adrenaline and noreadrenaline released in response to high temperature may contribute in thyroid depression in cattle (Christopherson *et al.*, 1978). Particularly, the reduction in thyroid activity under heat stress is a process of adaptation to the environment (Silanikove, 2000).

The decrease of glucose level in heat stressed animals may be probably a result of the heat–induced increase in circulating basal insulin concentration (Shwartz *et al.*, 2009 and Brien *et al.*, 2010).

The increase in plasma urea nitrogen during heat stress may be due to an improved rumen nitrogen balance (Erasmus *et al.*, 1992), increase

Table 6. Heat tolerance Index (HTI) values in the measured traits, in the present study

The trait used	Baladi				Brown Swiss x Baladi			
	1st month	2nd month	3rd month	Average	1st month	2nd month	3rd Month	Average
Rectal temperature	96.4%	96.7%	96.1%	96.4%	96.4 %	96.2%	96.4%	96.3%
Respiration rate	79.2%	56.2%	50.6%	62.0%	66.8%	52.8%	52.0%	57.2%
DBWG*	37.8%	31.0%	29.1%	32.6%	50.1%	47.4%	52.9%	50.1%
T_3 level	63.2%	63.9%	76.2%	67.8%	75.4%	78.4%	81.0%	78.3%
Glucose level	85.8%	82.6%	60.4%	76.3%	71.8%	69.2%	53.8%	64.9%
Urea-N level	79.8%	79.1%	60.1%	73.0%	65.7%	77.0%	55.4%	66.0%
General average				68.02%				68.8%

*Daily body weight gain.

in muscle breakdown (Kamiya *et al.,* 2006), low energy /protein ratio and to glucongogenesis by protein degradation in conditions of insufficient energy for growth (Momtmurro *et al.*, 1995).

Conclusion

It can be concluded that the crossbreds performed better than in purebred local bovine calves and were also more resistant to heat stress of summer season in Egypt. The HTI estimated from one trait at one time, can be used for comparison between groups or individuals. The accuracy of the heat tolerance level of the animal (measured as HTI) increases with the increase of the number of traits included in the estimation.

REFERENCES

AOAC (1990). Association of Official Analysis Chemist. Official Methods of Analysis. 5th Edition, s, Washington, D.C., USA.

Al-Haidary, A. (2004). Physiological responses of Naimey Sheep to heat stress challenge under semi-arid Environments. Inter. J. Agric. and Biology, 2:307-309.

Barry, D.M. and R.A. Godke (2001). The Boer Goat. The potential for crossbreeding. Sci. Dept., LSU Agric. Cent., Louisiana State Univ., Baton Rouge, USA.

Barry, D.M. and R.A. Godke (2005). The Boer goat, the potential for crossbreeding. Anim. Sci. Dept., LSU Agric. Cent., Louisiana State Univ., Boton Rouge. Louisiana.

Bernabucci, U., P. Bani, B. Ronchi, N. Lacetera and A. Nardone (1999). Influence of short- and long-term exposure to a hot environment on rumen passage rate and diet digestibility by Friesian heifers. J. Dairy Sci., 82: 967-973.

Brien, M.D.O., R.P. Rhoads, S.R. Sanders, G.C. Duff and L.H. Baumgard (2010). Metabolic adaptation to heat stress in growing cattle. J. Domestic Anim. Endocrinol., 38: 68-94.

Christopherson, R.J., J.R. Thompson, V.A. Hammond and G.A. Hills (1978). Effect of thyroid on plasma adrenaline and nor-adrenaline concentrations in sheep during acute and chronic cold exposure. Candian J. Pharmacol., 59:490-494.

El-Fouly, H.A., K.A. El-Masry and M.H. Gamal (1998). Physiological studies related to some reproductive traits in Baladi cows. 2.Effect of calves sex on some reproductive traits of Baladi cows and growth performance of their Baladi and crossbred (Brown Swiss x Baladi) calves. Zagazig Vet. J., 26 (3):69-78.

Erasmus, L.J., P.M. Botha and A. Kistner (1992). Effect of yeast culture supplement on production, rumen fermentation, and duodenal nitrogen flow in dairy cows. J. Dairy Sci., 75: 3056-3065.

Finch, V.A. (1984). Heat as a stress factor in herbivores under tropical conditions, edited by F.M.C. Gilchrist and R.I. Mackie. The Science Press, Graighall, South Africa, 89-105.

Habeeb, A.A.M., A.E. Gad and A.A. El-Tarabany (2011). Effect of two climatic conditions and types of feeding on body weight gain and some physiological and biochemical parameters in crossing calves. Zagazig Veterinary J., 39 (3): 34-48.

Habeeb, A.A.M., A.I. Aboulnaga and T.H. Kamal (2001). Heat induced changes in body water concentration, T_3, cortisol, glucose and cholesterol levels and their relationships with thermoneutral body weight gain in Friesian calves. Proceedings of the Second International Conference and Animal Production and Health in Semi-Arid Areas, Fac. Environ. Agric. Sci., Suez Canal Univ., El-Arish, North Sinai, Egypt, 97-108.

Habeeb, A.A.M., A.I. Aboulnaga, K.A. El-Masry and S.F. Osman (2002). Changes in blood biochemical and hormonal levels during pregnancy stages in native purebred and crossbred cattle reared in desert of Inshas area. Egyptian J. Appl. Sci., 17 (10): 463-581.

Habeeb, A.A.M., I.F.M. Marai and T.H. Kamal (1992). Heat stress edited by Phillips, C., Pigginns, D., Farm Animals and the Environment. CAB Inter., Wallingford, UK, 27-47.

Johnson, H.D. (1980). Environmental management of cattle to minimize the stress of climate change. Inter. J. Biometeral., 24 (Supplement 7): 65-78.

Kamal, T.H. and A.A. Habeeb (1999). The effect of sex difference in Friesian calves on heat tolerance using the heat-induced changes in total body water, total body solids and some blood components. Egyptian J. Appl. Sci., 14 (12): 1-15.

Kamal, T.H. and H.D. Johnson (1971). Total body solids as measure of a short-term heat stress in cattle. J. Anim. Sci., 32: 306-311.

Kamiya, M., Y. Kamiya, M. Tanaka, T. Oki, Y. Nishiba and S. Shioya (2006). Effect of high ambient temperature and restricted feed intake on urinary and plasma 3-methyl-histidine in lactating Holstein cows. Anim. Sci. J., 77: 201-207.

Marai, I.F.M. (2010). Buffaloes reproductive and productive traits. Its biological functions as affected by heat stress. Lap Lumbert Academic Publishing GmbH and Kg. Germany.

Marai, I.F.M. (2012). Sheep production in the tropics. Published by Lap Lumbert Academic Publishing GmbH and Kg Germany.

Marai, I.F.M., A.A. El-Darawany, A. Fadiel and M.A.M. Abdel-Hafez (2007). Physiological traits as affected by heat stress in sheep–A review. J. Small Ruminant Res., 71: 1-12.

Marai, I.F.M. and A.A.M. Habeeb (1998). Adaptability of *Bos Taurus* cattle under hot arid conditions. J. Arid zone, 37 (3): 253-281.

Marai, I.F.M. and A.A.M. Habeeb (2010). Review: Buffaloes reproductive and productive traits as affected by heat stress. Tropical and Subtropical Agroecosystems, 12: 193 – 217.

Marai, I.F.M., A.A.M. Habeeb and A.E. Gad (2005). Tolerance of imported rabbits grown as meat animals to hot climate and saline drinking water in the subtropical environment of Egypt. J. Anim. Sci. (British Society), 81: 115-123.

Marai, I.F.M., L.B. Bahgat, T.H. Shalaby and M.A. Abdel-Hafez (2000). Fattening performance, some behavioral traits and physiological reactions of male lambs fed concentrates mixture alone with or without natural clay under hot summer of Egypt. Annals of Arid Zone, 30:449-460.

Momtmurro, N., C. Pacelli and Borghese (1995). Metabolic profiles in buffalo heifers bred in two farms with different feeding and climatic conditions. Egyptian J. Anim. Prod., 32: 1-12.

Nasr, A.S., E.L. Abou-Fandoud and L.F.M. Marai (1997). Evaluation of grading up native cattle with Friesian or Brown Swiss under Egyptian desert conditions. International Conference on Animal, Poultry and Rabbit Production and Health. Organized by Institute of Efficient Productivity, Zagazig Univ., Egypt, 213-226.

Nigm, A.A., M.A. Morsy, A. Mostageer and F. Pirchner (1982). The performance of the Baladi cattle and its crosses with five European breeds. 1- Growth performance from birth to six months of age. In: 6^{th} Inter. Conference on Anim. and Poult. Prod., Zagazig, Egypt, 285-303.

Olson, T.A. (2011). Crossbreeding programs for beef cattle in Florida, Publication. University of Florida, IFAS Extension, BUL, 326-356.

SAS (1991). Statistical Analysis System, SAS User's Guide Statistics, SAS Institute Inc., Editors Cary' NC.

Shwartz, G., M.L. Rhoads, M.J. Van Baale, P.P. Rhoads and L.H. Baumgard (2009). Effects of a supplemental yeast culture on heat-stressed lactating Holstein cows. J. Dairy Sci., 92 (3): 935-942.

Silanikove, N. (2000). Effect of heat stress on the welfare of extensively managed domestic ruminants. J. Livestock Prod. Sci., 67: 1-18.

تأقلم عجول الأبقار تحت البيئة شبه الحارة

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أجريت هذه الدراسة تحت إشراف قسم الإنتاج الحيوانى بكلية الزراعة جامعة الزقازيق ، وتم أجراء التجارب العملية فى مزرعة الأبقار التابعة لمشروع المزارع التجريبية بمركز البحوث النووية ، هيئة الطاقة الذرية بإنشاص، وقد أجريت هذه الدراسة لبحث تأثير كلا من نوع السلالة (بلدى أصيل وبلدى خليط٥٠% مع البراون سويس) والمناخ الحار أثناء الصيف فى مصر على معدل النمو الشهرى وقيمة النمو اليومى فى عجول الأبقار حديثة الفطام وتمت الدراسة على ١٢ عجل بقرى حديثة الفطام منها ٦ عجول بلدى أصيل و٦ عجول خليط (٥٠% بلدى + ٥٠% براون سويس) وأجريت الدراسة على كل العجول خلال فترتين كل فترة إستمرت ٩٠ يوماً كما يلى: الفترة الأولى خلال فصل الشتاء (يناير – فبراير – مارس) وكانت متوسط درجة الحرارة ٢١,٨°م ومتوسط نسبة الرطوبة ٦٣,٧%، أما الفترة الثانية خلال فصل الصيف من نفس العام (يونيو – يوليو– أغسطس) وكانت متوسط درجة الحرارة ٣٥,٢٥°م ومتوسط نسبة الرطوبة ٥٥,٦% وكانت قيمتى THI لفترتى الشتاء والصيف هما ٢٠,٩ و ٣٢,٣٣ على التوالى، وكانت أهم النتائج مايلى: الجو الحار يسبب ارتفاع معنوى فى درجة حرارة الشرج ومعدل التنفس سواء فى العجول الأصيلة أو الخليطة خلال شهور التجربة الثلاثة ولا يوجد فرق معنوى بين العجول الأصيلة والعجول الخليطة فى درجة حرارة الشرج أو معدل التنفس، ومن حيث المقارنة بين نوعى العجول فان النتائج توضح أن قيمة العائد اليومى لوزن الجسم فى العجول الأصيلة هى ٤٧٧,٧ و ٥٠٦,٣ و ٤٣٠,٦ جم بينما كانت فى العجول الخليطة ٦٩٢,١ و ٦٦٧,٤ و ٦٦٨,٤ جم وأن العائد اليومي فى العجول الخليط أعلى من العائد اليومى للعجول الأصيلة بمقدار ٤٤,٩ و٨,٣١ و ٥٥,٢% خلال الشهور الثلاثة على التوالى، ومن حيث تأثير الظروف الجوية فان النتائج تشير إلى أن العائد اليومى لوزن الجسم فى فصل الشتاء تقدر ٨٠٧,٦ و٨٣٩,٥ و ٧٧٠,٨ جم بينما كانت فى فترة الصيف على التوالى٣٦٢,٢ و ٣٣٤,٢ و ٣٢٨,٢ جم أى بنسبة نقص فى فصل الصيف عن الشتاء خلال الشهور الثلاثة قدرها ٥٥,٢ و ٦٠,٢ و ٥٧,٤ %على التوالى، وثبت أن العجول الخليطة أعطت أعلى عائد يومى من وزن الجسم سواء فى فصل الشتاء أو فى فصل الصيف وبالتالى يمكن القول أن الحيوانات الخليطة أفضل من الحيوانات الأصيلة خاصة أثناء الصيف، ويسبب الجو الحار انخفاض معنوى فى تركيز كل من هرمون الثراى ايودوثيرونين والجلوكوز فى دم العجول سواء الأصيلة أو الخليطة خلال شهور التجربة الثلاثة ولا يوجد فرق معنوى فى تركيز الهرمون أو الجلوكوز بين العجول الأصيلة والعجول الخليطة بينما الجو الحار يسبب زيادة تركيز اليوريا فى دم العجول سواء الأصيلة أو الخليطة خلال الشهور الثلاثة.

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