Effect Of Two Climatic Conditions And Types Of Feeding On Body Weight Gain And Some Physiological And Biochemical Parameters In Crossing Calves

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ABSTRACT

The present work was planned to study the effects of type of feed stuff under both mild and hot periods of the year on thirty two cross calves (Friesian x Baladi) aged 6-8 months with average body weight 136.8 kg. The study included two periods, each of 3 months. The first period was carried out during mild conditions (from the 1st of January until the end of Marsh) and the second period was during hot conditions (from the 1st of May until the end of July). Averages of air temperature and relative humidity values at mid day inside the farm building were, 23.7±1.1°C and 63.9±2.0% under mild conditions and 34.3±1.1°C and 54.9±2.0%, respectively, during the hot period. Temperature-humidity index values estimated were 22.7 and 31.4 during mild and hot conditions, respectively, indicating absence of heat stress during the first period and exposing the animals to severe heat stress during the second period. In each of the two periods, the animals were divided into two groups according to type of feed stuff. The first group fed the concentrate feed mixture (Traditional ration) while the second group fed the waste products from food industries (untraditional ration). Rice straw was offered to the two groups *ad libitum* and all animals were kept under the same managerial and hygienic conditions in each experimental period.

The results showed that hot period of the year (heat stress) decreased significantly daily body weight gain during 1st, 2nd and 3rd months and concentrations of total proteins, globulin, glucose, total lipids, total cholesterol, triglycerides, sodium, potassium, calcium, inorganic phosphorus and γGT as well as T_4, T_3, parathormone levels. However, significant increase in respiration rate and rectal, skin and ear temperatures as well as cortisol level and activities of SGOT and GPT enzymes and concentrations of urea and creatinine were recorded. Albumin concentration was not affected significantly by the period of the year.

Concerning the effect of feeding type, there was insignificant differences in daily body gain of calves fed traditional or untraditional rations. Similar trend was observed in T_4, T_3, cortisol and parathormone levels. However, untraditional ration as compared to traditional ration decreased significantly each of respiration rate and concentrations of albumin, urea-N, glucose, total lipids, total cholesterol, triglycerides, sodium, calcium and inorganic phosphorus as well as activities of GPT and γGT enzymes. On the other hand globulin concentration increased significantly in calves fed untraditional ration as compared to traditional one.

The period of the year and type of feeding interaction affect each of daily body weight gain and concentrations of most blood components indicating the importance of untraditional feeding during summer period.

INTRODUCTION

The summer in Egypt, is characterized by high ambient temperature, intense solar radiation and high relative humidity. Therefore, farm animals raised in such severe climatic stress for almost 8 months of the year. All farm animals become uncomfortable; they suffer extremely in production, reproduction and resistance to diseases. The productive traits of animals are deleteriously affected by the disturbance in the normal physiological balance ***(1,2)***.

The relatively high prices of concentrates and its ingredients in Egypt are the major problem in animal production. At the same time,

increase wastes products from feed industry at wastes in human, such as citrus pulp, pea pods and tomato pulp, potato wastes obtained from many company feed industry such as, Kaha, Montana and many company in 10th Ramadan, El-Sadat and 6th October Cities. The annually estimated local production of these products was 4.0 million tons containing 1.9 million tons wastes containing 747 megatons and 88 megatons of TDN and CP, respectively *(3)*. This amount and others of the agro-industrial byproducts could participate in covering the nutritional gab found in animal feeds and avoiding the competition between human and animal in edible grains consumption.

Supplementation of heat stressed animals with protein, fat, vitamins and mineral resources is required to correct their negative balances, since heat stress induces a significant decrease in the dry matter intake and live body weight in addition to increase in excretion of urine and sweat containing minerals *(4)*. There are several key areas of nutritional management which should be considered during hot weather. Some studies have been carried out for improving productivity of heat stressed animals using curcumin *(5)* or dries whey milk *(6)*.

The present study was arranged to assess the changes that occur in growth and some physiological traits, especially, in crossing calves as a result of two types of feed under both hot and mild conditions of Egypt.

MATERIALS AND METHODS

The present study was carried out in the El-Khaer and El-Baraka, farm in El-Salhya desert area, El-Sharkia governorate, Egypt.

1-Animal and the experimental procedure: Animals during both mild and hot conditions were housed in doors at day and night and raised under wood roofed shed. The animals on both periods were kept under similar managerial and hygienic conditions. The study was carried out on 32 male growing cross calves (Friesian x Baladi) with average body weight 136.81 kg. The study included two periods, each was 3 months. The first was from the 1st of January until the end of March (90 days) (i.e. under mild conditions) and the second was from the 1st of May until the end of July (i.e. under hot conditions).

In each of the period, the animals were divided into two groups according to type of feed stuff, each group contained 8 calves. The first group fed the concentration feed mixture (CFM) (Traditional ration) as shown in Table 1. CFM ration offered twice daily at morning and evening at the rate of 2.5 kg CFM each 100 kg live body weight and rice straw was offered *ad libitum*. The second group received the mixture by-products from food industries consisted of 20% citrus pulp, 20% potato wastewater pea pods 30% and tomato pulp 30% (untraditional ration). The chemical composition of the untraditional ration is shown in Table 2. The untraditional ration mixture was offered twice daily at morning and evening each animal received 13 kg daily in the beginning and increased to16 kg in the final.

2-Drinking underground water: Drinking underground water was available all time. The chemical composition of drinking water (cations and anions), is shown in Table 3 according to the analysis of Center Laboratory for Elemental and Isotopic analysis, nuclear Research Center, Atomic Energy Authority at Inshas.

3-Thermoregulatory parameters: Rectal, skin and ear temperatures were measured individually at mid day by a digital thermometer and respiration rate was measured visually by counting breaths per minute using a stopwatch, in the two periods.

4-Metrological data of the two experiments: Air temperature (°C) and relative humidity (%) inside the building were measured four times each month at mid day using automatic thermo-hygrometer (Table 4). The temperature-humidity index (THI) was calculated using the equation *(7,8)* as following: THI= db°C-[(0.31-0.31 RH) (db°C-

14.4)], where db°C=dry bulp temperature in Celsius and RH= relative humidity. The THI values obtained were then classified as follows: <27.8= absence of heat stress, 27.8 to < 28.9= moderate heat stress, 28.9 to < 30.0= severe heat stress and 30.0 or more= very severe heat stress.

5-Live body weight gain: The animals were weighed to the nearest 1 kg before the morning feed each two weeks interval and daily body weight gain was calculated monthly.

6-Blood samples and blood biochemical components estimation: In the last week of each experimental period, one blood samples was withdrawn from the Jugular vein of each animal into separate tube before the morning feed and kept in an ice-box. The blood sample was taken without anticoagulant and the blood serum was separated by centrifugation 2000 x g for 30 min.), then stored at -20°C until the biochemical and hormonal determinations were carried out. These determinations were carried out in the tracer bioclimatology Unit, Dept. of Biological Applications, Nuclear research center, Atomic Energy Authority, Inshas, Cairo, Egypt.

Serum total proteins, albumin, globulin, GOT, GPT, γGT, urea, creatinine, glucose, total lipids, total cholesterol, triglyceride, sodium, potassium, calcium and inorganic phosphorus were determined using standard chemical reagent kits purchased from Diagnoestic Company, Egypt. Thyroid hormones, thyroxine (T_4), triiodothyronine (T_3), cortisol and parathormone levels were estimated by RIA using coated tubes kit.

7-Statistical Analysis: Data were statistically analyzed using the General Linear Model Procedure of ***(9)***. ANOVA model 2x2 was used to study the effect of two climatic conditions (C), effect of two feeding types (F) and the interactions between C and F. The model used is: $Y = \mu + C + F + (CF) + e$ where μ= the overall mean; C = the fixed effect of the condition (C, 1= MC and 2= HC); T = the fixed effect of F types (T, 1= traditional and 2=untraditional); the interactions between the two factors(C&F) and e= random error. Significance of the difference in the results was verified by Duncan's new multiple ranges test ***(10)***.

Table1. Ingredients of the concentrate feed mixture and chemical composition of the feed stuffs used in the 1st feeding type during the two experimental periods.

Items	Concentrate feed mixture	Rice straw
Ingredients of the concentrate (%):		
Crushed yellow maize %	40.00	
Wheat bran %	25.50	
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 feed stuffs (on dry matter basis), %:		
Dry matter	89.81	92.30
Organic matter	94.00	83.52
Crude protein	15.68	3.20
Crude fiber	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	050	020

Table 2. Components of untraditional ration (Wastes mixture) and chemical composition of the 2nd feeding type during the two experimental periods.

Components of untraditional ration*	Percentage in ration	Chemical composition of the 2nd feeding type (Untraditional ration)						
		DM	CP	CF	EE	NFE	Ash	OM
Pea pods	30.0	As 100%	20.6	23.5	4.1	45.5	6.3	93.7
		As 30%	6.2	6.1	1.2	13.7	2.2	28.2
Tomato pulp	30.0	As 100%	19.5	30.5	3.2	43.3	3.5	96.5
		As 30%	5.9	9.2	1.0	13.0	1.0	29.0
Potato wastewater	20.0	As 100%	8.0	4.6	9.0	76.0	2.4	97.6
		As 20%	1.6	0.9	1.8	15.2	0.5	19.5
Citrus pulp	20.0	As 100%	5.4	10.8	4.8	73.7	5.3	94.7
		As 20%	1.1	2.2	1.0	14.7	1.1	18.9
Average of chemical as 100% DM composition								
		30	14.8	19.4	5.0	56.6	4.2	95.8

* Lime stone and common salt was added to wastes mixture during mixing at the rate of 1.5 and 1.0%, respectively.

Table 3.Chemical composition of drinking water used during the experimental periods.

Chemical analysis of drinking water*			
Cations	**Concentration (ppm)**	**Anions**	**Concentration(ppm)**
Sodium	233.00	Chloride	190.00
Calcium	200.00	Carbonate	137.00
Potassium	13.00	Bicarbonate	282.00
Magnesium	132.00	Sulphate	640.00
Iron	0.41		
Manganese	0.08		
Lead	0.06		
Total cations	578.55	Total anions	1249.00
Total salinity		1827.55 (ppm)	
pH		8.3	

Drinking water used in the farm is underground water.
'Analysis of water was carried by Center Lab. of minerals analysis in Nuclear Research Center, Atomic Energy Authority at Inshas

Table 4. Monthly averages (X±SE) of air temperature, relative humidity and Temperature humidity index (THI) values at mid-day inside farm building during the two experimental periods.

Months of the two experiments	Ambient temperature (°C)	Relative humidity (%)	Temperature humidity index (THI)
1ST Period (MC)			
January	22.5±0.9	70.3±2.2	21.8
February	24.1±1.0	64.2±2.1	23.0
March	24.6±1.3	57.2±1.8	23.2
Overall mean	23.7±1.1	63.9±2.0	22.7
2nd Period (HC)			
May	32.7±1.5	56.5±2.4	30.1
June	34.9±1.5	52.8 ±1.8	31.8
July	35.3±1.6	55.4 ±1.9	32.4
Overall mean	34.3±1.1	54.9±2.0	31.4(Severe HS)

*Each value from air temperature and relative humidity was the average of four numbers recorded weekly at12.00 hour.

RESULTS AND DISCUSSION

1.Thermoregulatory parameters

Exposure the calves to severe heat stress conditions during hot climate of summer season in Egypt was accompanied by highly significant (P<001) increases in the thermoregulatory parameters (respiration rate and rectal, skin and ear temperatures) (Table 5). An increase in the rate of respiration increases heat dissipation by warming the inspired air and increasing evaporation from the respiratory passages and lungs *(1)*. In this respect, animals loose approximately 20% of total body heat via respiratory moisture in a neutral environmental temperature (12°C) and the moisture loss increases and accounts for approximately 60% of the total heat loss at high ambient temperature (35°C) *(11)*. Similarly, an increase in body temperature also increases the cellular metabolism in the body, which in turn, greatly increases the rate of ventilation *(12)*. Exposure to severe heat stress forced animals to attempt to dissipate as much of excess heat in their bodies as possible *(13)*.

If calves are unable to achieve balance between body heat production and body heat loss and are unable to lose sufficient heat, their body temperature expressed in rectal temperature will rise and they will become heat stressed *(1)*.

The animal skin is an important pathway for heat exchange between the body surface and the environment. Skin temperature is the result of the adjustment of the skin blood flow that ends with regulation of the heat between the body core and skin *(1)*. Skin temperature was recorded to be highest during summer and lowest during winter in sheep and exposure to elevated ambient temperatures coincides with an increase in the dissipation of excess body heat in order to balance the excessive heat load *(14)*.

Results revealed also that calves fed untraditional ration had significant (P<0.001) lower values of respiration rate compared to the calves fed traditional ration regardless environmental conditions. Respiration rate decreased by 18.0 and 26.0% due to untraditional ration feeding during MC and HC, respectively. This decrease in respiration rate in calves fed untraditional ration may be due to that ration increase the appetite of calves as a result to their different contents and high level of water.

2.Daily body weight gain (DBWG)

The heat stress induced a highly significant (P< 0.01) decline in DBWG by 14.0, 29.0 and 22.0% during 1st, 2nd and 3rd months, respectively (Table 6). Friesian calves *(15)* and pregnant ewes*(16)* showed similar effect.

Generally, no significant difference in DBWG during the 3 months of the experiment due to feeding type. However, the interactions between conditions and feeding types showed that under MC, DBWG decreased significantly in calves fed untraditional ratio by 6.0, 21.0 and 12.0 % but under HC, DBWG increased significantly in calves fed untraditional ration by 21.0, 15.0 and 18%, during 1st, 2nd and 3rd months, respectively (Table 6).

The average DBWG throughout the feeding trials were 841, 810 and 741 g for the buffalo calves fed rations, in calves fed on CFM and hay, in calves fed citrus wastes and pea pods and hay and calves fed artichoke wastes and pea pods and hay, respectively *(17)*. From these results, it could be noticed that the average DBWG of buffalo calves fed control ration was higher than those recorded by the other groups of animals in the feeding trial. It has been recorded that replacing 50% of concentrate with agro-industrial byproducts decreased DBWG of calves *(18)*. While replacement of hay by mixture of pea pods and orange wastes (1:1) + 1% urea, increased DBWG of rams *(19)*. The average DBWG improved with replacement of yellow corn by citrus by-product and improved feed efficiency and decreased daily feeding cost, consequently improved relative economical efficiency *(20)*. Lambs fed carob pulp and orange pulp in replacement of cereal grains on diets based on faba bean didn't affect final live weight, average DBWG, dry matter intake and feed conversion *(21)*. In addition, no significant differences was noticed in gain for steers fed

Table 5. Thermoregulatory parameters in crossing calves as affected by climatic conditions, feeding type and their interactions, during experimental period.

Items	Thermoregulatory parameters			
	Respiration rate	Rectal temperature	Skin temperature	Ear temperature
Climatic conditions(C)				
Mild climate	32.79 ±1.3	38.44 ± 0.05	37.25 ± 0.03	38.17 ± 0.09
Hot climate	38.19 ±1.9	39.26 ± 0.04	38.07 ± 0.02	39.07 ± 0.05
Change%	+16.0	+2.0	+2.0	+2.0
Significance (p≤)	0.001	0.001	0.001	0.001
Feeding type(F)				
Traditional	40.0 ±2.1	39.14 ± 0.03	37.65 ±0.04	38.54 ±0.05
Untraditional	30.97±1.8	38.56 ± 0.06	37.67 ±0.03	38.70 ±0.04
Change%	-23.0	-1.0	0.00	0.00
Significance (p≤)	0.001	0.52	--	--
C×F interactions				
Mild climate				
Traditional	36.00^{b} ±1.5	38.83^{b} ± 0.05	37.18^{b} ± 0.05	38.14^{b} ± 0.05
Untraditional	29.57^{c} ±1.4	38.04^{b} ± 0.07	37.32^{b} ± 0.07	38.20^{b} ± 0.07
Change%	-18.0	-2.0	0.00	0.00
Significance (p≤)	0.001	0.43	--	--
Hot climate				
Traditional	44.0^{a} ±1.7	39.45^{a} ± 0.07	38.12^{a} ± 0.05	38.94^{a} ± 0.06
Untraditional	32.37^{bc} ±1.6	39.07^{a} ± 0.05	38.02^{a} ± 0.05	39.20^{a} ± 0.04
Change%	-26.0	-1.0	0.00	+1.0
Significance (p≤)	0.001	0.55	--	0.63

a,b,c:Means with the different superscripts in the same column, within each item differ significantly (P<0.05).

Table 6. Daily body weight gain (g) of crossing calves as affected by climatic conditions, feeding type and their interactions, during experimental period.

Items	Daily body weight gain (DBWG), g		
	DBWG during 1st month	DBWG during 2nd month	DBWG during 3rd month
Climatic conditions(C)			
Mild climate	715 ± 20	858 ± 30	887 ± 30
Hot climate	615 ± 20	608 ± 30	692 ± 30
Change%	-14.0	-29.0	-22.0
Significance (p≤)	0.01	0.001	0.001
Feeding type(F)			
Traditional	648± 20	762 ± 30	790 ± 30
Untraditional	682± 20	704 ± 30	789 ± 30
Change%	+5.0	-8.0	0.00
Significance (p≤)	0.33	0.42	--
C×F interactions			
Mild climate			
Traditional	739 ± 30	957± 40	944 ± 30
Untraditional	691± 30	758 ± 40	830 ± 20
Change%	-6.0	-21.0	-12.0
Significance (p≤)	0.05	0.001	0.01
Hot climate			
Traditional	556 ± 30	566 ± 20	636 ± 30
Untraditional	673 ± 30	650 ± 30	748 ± 40
Change%	+21.0	+15.0	+18.0
Significance (p≤)	0.001	0.01	0.001
Overall mean	665^{B} ± 25	733^{AB} ± 28	790^{A} ± 31

A,B,: Means with the different superscripts in the same row, differ significantly (P<0.05).

citrus pulp, corn feed meal and ground snapped corn when combined with adequate protein and other essential nutrients in a ration for young growing steers *(22)*. Half substitution of corn grain by dried orange pulp concentrates fed to Friesian heifers, from 6 to 18 month, did not negatively affect body weight *(23)*.

3.Serum protein fraction concentrations

Serum total proteins and globulin were significantly (P≤0.01) lower in heat stressed calves than calves exposed to mild conditions and the decreased percentages were 12.0 and 25.0, respectively (Table 7). The decrease in serum protein may be due to decrease in feed nitrogen which occurs under heat stress conditions, dilution of plasma proteins caused by increase of water consumed and/or decrease of protein synthesis as a result of depression of anabolic hormonal secretion *(24)*. Reductions in most of blood components in heat stressed animals may be due to decrease in feed intake or increase in water intake and consequent dilution of the blood components that occur under heat stress conditions *(2,16,25)*.

Serum protein fraction concentrations in cross calves (Friesian x Baladi) traits as affected by type of feed stuffs are shown in Table 7. Fed untraditional ration as compared to traditional ration decreased albumin and increased globulin concentrations while total protein values were not affected due to type of feeding. The interactions between conditions and feeding types showed that globulin increased significantly in calves fed untraditional ration as compared to traditional ration by 8.0 and 40.0% under MC and HC conditions, respectively, indicating that untraditional ration increased the immunity, especially, under hot summer season.

Replacing 25, 50 and 75% of concentrate mixture (CM) in control ration 50% Berseem Hay (BH) + 50% (CM) by data seeds had no marked effect on albumin, globulin, total protein and cholesterol *(26,27)*. Feeding goats rations containing agro-industrial by-products mixtures (30 and 60%) on DM basis showed that serum total protein, albumin, globulin and A/G ratio were not significantly different from control rations which had 0% agro-industrial by-products mixtures *(28)*. No significant differences were observed in blood concentration of total protein, albumin and globulin in cows fed on dried citrus pulp than in those fed on the control diet *(29)*.

Table 7. Serum protein fractions concentrations in crossing calves as affected by climatic conditions, feeding type and their interactions, during experimental period.

Items	Serum protein fractions		
	Total proteins (g/dl)	Albumin (g/dl)	Globulin (g/dl)
Climatic conditions(C)			
Mild climate	6.58 ± 0.8	3.93 ± 0.02	2.65 ± 0.08
Hot climate	5.79 ± 0.8	3.79 ± 0.02	2.00 ± 0.08
Change%	-12.0	-4.0	-25.0
Significance (p≤)	0.01	0.24	0.001
Feeding type(F)			
Traditional	6.09 ± 0.8	3.98 ± 0.02	2.11 ± 0.08
Untraditional	6.29 ± 0.8	3.75 ± 0.02	2.54 ± 0.08
Change%	+3.0	-6.0	+20.0
Significance (p≤)	0.23	0.05	0.001
C×F interactions			
Mild climate			
Traditional	6.51 ± 0.2	3.96 ± 0.03	2.50^{b} ± 0.12
Untraditional	6.60 ± 0.2	3.90 ± 0.03	2.75^{a} ± 0.12
Change%	+2.0	-2.0	+8.0
Significance (p≤)	0.43	0.24	0.05
Hot climate			
Traditional	5.66 ± 0.2	3.99 ± 0.03	1.67^{c} ± 0.12
Untraditional	5.92 ± 0.2	3.59 ± 0.03	2.33^{b} ± 0.12
Change%	+5.0	-10.0	+40.0
Significance (p≤)	0.44	0.01	0.001

a,b,c:Means with the different superscripts in the same column, within each item differ significantly (P<0.05).

4.Liver function

Period of the year increased significantly the activities of serum glutamic pyruvic transaminase (GPT), glutamic oxalocetic transaminase (GOT) and gamma glutamic transaminase (γGT). GPT and GOT activities while γGT activity decreased significantly due to stressful conditions of the summer season (Table 8). Generally, the blood enzymes are easily and often influenced by the external environment including feeding practices, type of shelter and many other aspects of hard management, since they are intimately related to metabolism *(13).*

Feeding untraditional ration as compared to traditional ration decreased GOT and γGT activities while GPT activity was not affected due to type of feeding. The interactions between conditions and feeding types showed that GOT, GPT and γGT activities decreased significantly in calves fed untraditional ration as compared to traditional ration by 36.0, 41.0 and 15.0% under MC conditions and γGT by 25.0% under HC conditions although GOT and GPT activities showed opposite trend under HC conditions. These results indicated that untraditional ration may be decrease the heat load on animals during hot summer season.

SGOT and SGPT were not significantly different in control rations and agro-industrial byproducts mixtures *(26,27,30).* It could be concluded that using agro-industrial byproducts mixtures as feed components for ruminants is reasonable and is not expected to change the enzymatic activity in the ruminants.

Table 8. Serum liver enzymes activities in crossing calves as affected by climatic conditions, feeding type and their interactions, during experimental period.

Items	Serum liver enzymes activities (Liver function)		
	GOT (U/ml)	GPT (U/ml)	γGT (U/l)
Climatic conditions(C)			
Mild climate	54.50 ± 3.8	26.88 ± 2.2	14.51 ± 0.49
Hot climate	66.60 ± 3.8	38.10 ± 2.2	11.29 ± 0.49
Change%	+22.0	+42.0	-22.0
Significance (p≤)	0.001	0.001	0.001
Feeding type(F)			
Traditional	64.46 ± 3.8	32.61 ± 2.2	14.29 ± 0.50
Untraditional	56.64 ± 4.8	32.38 ± 2.3	11.50 ± 0.52
Change%	-12.0	-1.0	-20.0
Significance (p≤)	0.01	0.67	0.001
C×F interactions			
Mild climate			
Traditional	66.42^{b} ± 3.2	33.71^{b} ± 3.0	15.68^{a} ± 0.64
Untraditional	42.57^{c} ± 2.2	20.05^{c} ± 3.0	13.33^{b} ± 0.69
Change%	-36.0	-41.0	-15.0
Significance (p≤)	0.001	0.001	0.01
Hot climate			
Traditional	62.50^{b} ± 3.2	31.50^{b} ± 3.0	12.90^{b} ± 0.49
Untraditional	70.71^{a} ± 3.2	44.70^{a} ± 3.0	9.67^{c} ± 0.59
Change%	+13.0	+42.0	-25.0
Significance (p≤)	0.01	0.001	0.001

a,b,c:Means with the different superscripts in the same column, within each item differ significantly (P<0.05).

5.Kidney function and glucose

Serum urea-N and creatinine concentrations, as indication for kidney function, increased significantly due to heat stress conditions. On the other hand, glucose concentration decreased significantly in heat stressed calves as compared to those exposed to mild conditions (Table 9). The decrease in glucose level in heat stressed calves may be due to increase in glucose utilization to produce more energy for greater

muscular expenditure required for high respiratory activity *(1)*. In addition, decrease in feed intake or increase in water intake and consequent dilution of the blood components that occur under heat stress conditions may be responsible for the decrease in glucose level *(16,25)*.

Both urea-N and glucose concentrations were higher significantly in the group took traditional ration than that fed the untraditional. The percentages decrease values were 30.0 and 16.0, respectively. The interactions between conditions and feeding types showed that both urea-N and glucose concentrations decreased significantly in calves fed untraditional ration as compared to traditional ration by 36.0 and 14.0% under MC conditions and by 26.0 and 18% under HC conditions.

No significant differences were observed in blood concentration of glucose in cows fed on dried citrus pulp than in those fed on the control diet *(29)*. Blood plasma glucose slightly increased in group fed 50% concentrate feed mixture + 50% vegetable fruit market wastes silage treated with lactic acid bacteria; and group fed 50% concentrate feed mixture +50% vegetable and fruit market wastes with silage treated formic acid compared to the group which was fed concentrate feed mixture and the roughage source was Darawa (Sweat clover) *(31)*.

Table 9. Serum urea-N, creatinine and glucose concentrations in crossing calves as affected by climatic conditions, feeding type and their interactions, during experimental period.

Items	Serum Kidney function		Glucose (mg/dl)
	Urea-N (mg/dl)	Creatinine (mg/dl)	
Climatic conditions(C)			
Mild climate	23.75± 1.7	1.50 ± 0.06	97.71 ± 4.0
Hot climate	36.73 ± 1.8	2.14 ± 0.06	71.67 ± 4.0
Change%	+55.0	+43.0	-27.0
Significance (p≤)	0.001	0.001	0.001
Feeding type(F)			
Traditional	35.54± 1.6	1.83 ± 0.06	91.88 ± 4.0
Untraditional	24.94± 1.7	1.81 ± 0.06	77.50 ± 4.0
Change%	-30.0	-1.0	-16.0
Significance (p≤)	0.001	0.54	0.02
C×F interactions			
Mild climate			
Traditional	28.89^{b} ± 1.2	1.53 ± 0.08	105.16^{a} ± 5.7
Untraditional	18.60^{c} ± 1.3	1.47 ± 0.08	90.25^{b} ± 5.7
Change%	-36.0	-4.0	-14.0
Significance (p≤)	0.001	0.76	0.01
Hot climate			
Traditional	42.18^{a} ±1.3	2.12 ± 0.08	78.59^{b} ± 5.7
Untraditional	31.28^{b} ±1.1	2.15 ± 0.08	64.75^{c} ± 5.7
Change%	-26.0	+1.0	-18.0
Significance (p≤)	0.001	0.92	0.001

a,b,c:Means with the different superscripts in the same column, within each item differ significantly (P<0.05).

6.Serum total lipids, total cholesterol and triglycerides concentrations

Serum cholesterol, total lipids and triglyceride concentrations were significantly lower in heat stressed calves than calves exposed to mild conditions (Table 10). The decrease in feed intake and increase in water intake and consequent dilution of the blood components that occur under heat stress conditions may be responsible for the decrease in serum cholesterol, total lipids and triglyceride concentrations *(16,25)*.

Total lipids, total cholesterol and triglycerides concentrations were higher significantly in group intake traditional ration than that fed the untraditional. The percentages decrease values were 10.0, 13.0 and 14.0, respectively. The interactions between conditions and feeding types showed that serum lipids fractions concentrations decreased significantly in calves fed untraditional ration as compared to traditional ration under both MC and HC conditions (Table 10).

Plasma cholesterol recorded a significant increase in the group that fed 50% concentrate feed mixture + 50% vegetable fruit market wastes silage treated with lactic acid bacteria and group fed 50% concentrate feed mixture +50% vegetable and fruit market wastes with silage treated formic acid compared to the group which was fed concentrate feed mixture and the roughage source was Darawa *(31)*. No significant differences were observed in blood concentration of triglycerides, while serum concentration of cholesterol was higher in cows fed on dried citrus pulp than in those fed on the control diet *(29)*.

Table 10. Serum total lipids, total cholesterol and triglycerides concentrations in crossing calves as affected by climatic conditions, feeding type and their interactions, during experimental period.

Items	Serum lipids fractions		
	Serum total lipids (mg/dl)	Total cholesterol (mg/dl)	Triglycerides (mg/dl)
Climatic conditions(C)			
Mild climate	535.3 ± 12.8	89.52 ± 2.8	77.73 ± 2.9
Hot climate	438.6 ± 10.8	84.43 ± 2.8	73.41 ± 2.9
Change%	-18.0	-6.0	-6.0
Significance (p≤)	0.01	0.05	0.05
Feeding type(F)			
Traditional	512.3 ± 12.9	93.09 ± 3.8	81.42 ± 2.9
Untraditional	461.6 ± 12.0	80.86 ± 2.8	69.72 ± 1.9
Change%	-10.0	-13.0	-14.0
Significance (p≤)	0.01	0.01	0.01
C×F interactions			
Mild climate			
Traditional	557.7^{a} ± 9.8	96.32^{a} ± 2.6	82.71^{a} ± 2.7
Untraditional	512.9^{b} ± 8.8	82.71^{c} ± 2.6	72.74^{b} ±2.7
Change%	-8.0	-14.0	-12.0
Significance (p≤)	0.05	0.01	0.01
Hot climate			
Traditional	466.9^{c} ± 9.8	89.85^{b} ± 2.6	80.13^{a} ± 2.7
Untraditional	410.3^{d} ± 10.8	79.00^{c} ± 2.6	66.69^{c} ± 2.7
Change%	-12.0	-12.0	-17.0
Significance (p≤)	0.01	0.01	0.01

a,b,c:Means with the different superscripts in the same column, within each item differ significantly (P<0.05).

7.Blood hormonal levels

Period of the year affected significantly (P<0.01) each of serum thyroxin (T_4), triiodothyronine (T_3), cortisol and parathormone hormonal levels concentrations in the crossing calves. Under hot conditions, the levels of T4, T3 and parathormone were lower significantly by 20.0, 22.0 and 22.0%, respectively, than under mild conditions (Table 11). The opposite trend was observed in cortisol level and the increase percentage was 30.0.

The decrease in the thyroid hormone levels in the hot period was recorded in Frisian calves *(15, 31)* and in sheep *(16)*. Thyroid hormones, either T_4 or T_3 play an important role in the adaptation of animals to environment changes *(13)*. The decline which occurs in cortisol during the chronic heat stress is attributed to the fact that it is thermogenic in animals and consequently, the reduction of adrenocortical activity under thermal stress is a thermoregulatory protective mechanism preventing metabolic heat production in a hot

environment. This indicates the role of the adrenal cortex gland in adaptation to stress *(33)*.

Effect of feeding type on hormonal levels is in Table 11. Generally, no significant differences in concentrations of T4, T3, cortisol and parathormone hormones due to type of rations. However, the interactions between conditions and feeding types showed that under MC conditions, T3 and cortisol decreased while T4 and parathormon increased significantly in calves fed untraditional ration as compared to calves fed traditional ration. Under HC, T4 decreased significantly in calves fed untraditional ration by 7.0% while T3, cortisol and parathormone concentrations were not affected by type of feeding.

Table 11. Serum hormonal concentrations in crossing calves as affected by climatic conditions, feeding type and their interactions, during experimental period.

Items	Serum hormonal levels			
	T_4 (nmo/l)	T_3 (nmo/l)	Cortisol (ng/dl)	Parathormone (pg/ml)
Climatic conditions(C)				
Mild climate	97.63±3.2	2.34 ± 0.05	12.20 ± 0.12	18.09 ± 0.64
Hot climate	78.48±3.2	1.83 ± 0.04	15.82 ± 0.15	14.15 ± 0.50
Change%	-20.0	-22.0	+30.0	-22.0
Significance (p≤)	0.01	0.01	0.01	0.01
Feeding type(F)				
Traditional	85.67±3.2	2.10 ± 0.02	14.18 ± 0.13	15.89 ± 0.45
Untraditional	86.11±3.2	2.07 ± 0.04	13.85 ± 0.12	16.35 ± 0.54
Change%	+1.0	-1.0	-2.0	+3.0
Significance (p≤)	0.87	0.55	0.76	0.57
C×F interactions				
Mild climate				
Traditional	90.00^{b}±3.3	2.40^{a} ± 0.03	12.81^{b} ±0.11	17.33^{b} ± 0.62
Untraditional	96.60^{a}±3.3	2.28^{b} ± 0.02	11.59^{c} ±0.12	18.84^{a} ± 0.72
Change%	+7.0	-5.0	-10.0	+9.0
Significance (p≤)	0.05	0.05	0.05	0.05
Hot climate				
Traditional	81.33^{c}±3.3	1.80^{c} ± 0.03	15.54^{ab} ± 0.13	14.44^{c}± 0.82
Untraditional	75.62^{d}±3.3	1.86^{c} ± 0.02	16.10^{a} ±0.14	13.85^{c} ± 0.82
Change%	-7.0	+3.0	+4.0	-4.0
Significance (p≤)	0.05	0.32	0.52	0.56

a,b,c:Means with the different superscripts in the same column, within each item differ significantly (P<0.05).

8.Blood mineral concentrations

The heat stress induced significantly decline in each of serum sodium, potassium, calcium and inorganic-phosphorus. The percentage decrease values were 9.0, 10.0, 13.0 and 30.0, respectively (Table 12). It has been suggested that the decrease of blood minerals in heat stressed animals may be due to a decrease in aldosterone and parathormone hormone secretions with associated rise in urinary mineral excretion at one side and increase in the body fluids and water turnover rate which dilute the absolute quantities of plasma minerals and help in washing out these minerals during heat stress *(1)*.

Sodium, potassium and inorganic phosphorus concentrations were higher significantly in the group intake traditional ration than that fed the untraditional. The percentages decrease values were 7.0, 12.0 and 7.0, respectively. The interactions between conditions and feeding types showed that potassium concentration decreased significantly in calves fed untraditional ration as compared to traditional ration under both MC and HC conditions while sodium and inorganic phosphorus showed similar decrease under MC and HC conditions, respectively (Table 12).

From these results it can be concluded that daily body weight gain of crossing calves was

not affected by feeding the untraditional ration and concentrations of most blood components were in normal range indicating the importance of untraditional feeding, especially, during hot summer season particularly that ration without any addition cost except their trance from Factories to Farms. .

Table 12. Concentrations of some serum minerals in crossing calves as affected by climatic conditions, feeding type and their interactions, during experimental period.

Items	Serum minerals content			
	Na	K	Ca	Pi
Climatic conditions(C)				
Mild climate	142.6 ± 4.2	3.94 ± 0.07	9.13 ± 0.28	3.98 ± 0.17
Hot climate	129.1 ± 3.2	3.54± 0.08	7.93 ± 0.28	2.79 ± 0.17
Change%	-9.0	-10.0	-13.0	-30.0
Significance (p≤)	0.05	0.01	0.01	0.001
Feeding type(F)				
Traditional	140.8 ± 5.2	3.97 ± 0.05	8.54 ± 0.38	3.51 ± 0.17
Untraditional	130.8 ± 4.2	3.50 ± 0.06	8.52 ± 0.28	3.26 ± 0.17
Change%	-7.0	-12.0	0.00	-7.0
Significance (p≤)	0.05	0.05	--	0.05
C×F interactions				
Mild climate				
Traditional	149.3^{a} ± 4.2	4.12^{a} ± 0.09	9.32 ± 0.40	4.05^{a} ± 0.24
Untraditional	135.8^{b} ± 3.1	3.75^{b} ± 0.07	8.93 ± 0.40	3.91^{a} ± 0.24
Change%	-9.0	-9.0	-4.0	-3.0
Significance (p≤)	0.05	0.05	0.52	0.32
Hot climate				
Traditional	132.3^{b} ± 4.2	3.82^{b} ± 0.08	7.75 ± 0.30	2.97^{b} ± 0.24
Untraditional	125.8^{bc} ± 4.1	3.25^{c} ± 0.07	8.11 ± 0.35	2.61^{c} ± 0.24
Change%	-5.0	-15.0	+5.0	-12.0
Significance (p≤)	0.37	0.01	0.36	0.01

a,b,c:Means with the different superscripts in the same column, within each item differ significantly (P<0.05).

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الملخص العربى

تأثير الظروف الجوية ونوعين من التغذية على العائد اليومى لوزن الجسم وبعض المقاييس الفسيولوجية والبيوكيميائية فى العجول الخليطة (فريزيان مع بلدى)

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أجرى هذا البحث على ٣٢ عجل خليط (فرزيان x بلدى) عمر ٦- ٨ شهور على فترتين الأولى تحت ظروف الجوالمعتدل شتاءا على ١٦ عجل والثانية تمت تحت ظروف الجو الحار صيفا على ١٦ عجل بنفس العمر والوزن تقريبا وفى كل فترة قسمت الحيوانات إلى مجموعتين حيث كانت المجموعة الأولى (٨ عجول) تغذى على العليقة العادية للنمو المكونة من علف مركز مع قش الأرز (العليقة التقليدية) بالمزرعة أما المجموعة الثانية (٨ عجول) كانت تغذى على عليقة غير تقليدية مكونة من مخلفات التصنيع الغذائى المتمثلة فى تفلة طماطم ومخلفات بطاطس و مخلفات بسلة و قشر برتقال .

وقد أظهرت النتائج الأتى :-

١- الجو الحار يحدث إنخفاض معنوى فى العائد اليومى لوزن الجسم ونركيز بروتينات الدم والجلوبيولين وانزيم الكبد γGT والجلوكوز ومكونات الدهون الكلية وهرمونات الغدة الدرقية وهرمون الباراثورمون والصوديم والبوتاسيوم و الكالسيوم والفوسفور وفى نفس الوقت يحدث زيادة معنوية فى معدل التنفس ودرجة حرارة كل من الشرج و الجلد والأذن وزيادة معنوية فى مستوى هرمون الكورتيزول و إنزيمات الكبد GPT ، SGOT والكرياتنين واليوريا فى الدم.

٢- إستخدام العلائق غيرالتقليدية والتى تتكون من المخلفات الغذائية لاتؤثركثيراعلى العائد اليومى لوزن العجول ولاتؤثر سلبا على الحالة الفسيولوجية للحيوان بل قد تكون ضرورية خاصة أثناء الجو الحار و خاصة أن المخلفات الغذائية غير مكلفة سوى نقلها من مصانع انتاجها الى المزارع مما يؤدى إلى إنخفاض تكلفة التغذية وبالتالى إنخفاض تكلفة إنتاج كيلو جرام من اللحم بالإضافة الى أن استخدام هذه المخلفات الزراعية نظرا لاحتوائها على عدد كبير من البفيتامينات ومضادات الأكسدة تسبب زيادة فى مناعة الحيوان وبالتالى إنخفاض اصابتها بالأمراض وزيادة الحيوية البيولوجية خصوصا تحت تأثير الجو الحار مما يحسن العائد الإقتصادى وفى نفس الوقت يتم التخلص من هذه المخلفات الناتجة من مصانع التصنيع الغذائى والتى قد تسبب مشاكل بيئية.