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# Growth Traits of Purebred and Crossbred Bovine Calves During Winter and Summer Seasons

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*ABSTRACT*

Twenty bovine calves healthy including 10 baladi purebred and 10 crossbred 50% (baladi cows x Brown Swiss male) were used in the experiment. The experimental calves both purebred and crossbred were exposed to winter climate followed by exposure the calves to summer climate. Results showed that live and solids daily body weight gain (DBWG) was found to be highly (P<0.001) significantly lower in summer than in winter by 52.8 and 43.3 % in live DBWG and by 35.9 and 30.4%, in solids DBWG in purebred and crossbred calves, respectively. In addition, live and solids DBWG were found to be significant (P<0.001) higher in crossbred than in purebred calves by 243.0 and 102.0 g in winter and 195.0 and 83.0 g in summer, respectively, indicating that crossbred calves are better in live and solids daily gain than purebred calves under two climatic conditions. $T_3$ and $T_4$ values were found to be significantly lower in summer than in winter and the percentage decrease in $T_3$ was 23.3 and 17.2% and in $T_4$ was 14.79 and 15.23% in purebred and crossbred calves, respectively. On the other hand, cortisol level was significantly higher during summer by 31.7 and 25.0 % than those in winter in purebred and crossbred calves, respectively. DMI was also significantly lower during summer than those during winter and the percentage decrease was 21.96% in purebred and was 24.09% in crossbred calves. $T_3$, $T_4$, cortisol levels as well as DMI were not affected significantly due to breed of calves.

*KEYWORDS*

***Purebred / Crossbred / Heat stress / Summer season / $T_4$ / $T_3$ / Cortisol / Dry Matter Intake / Bovine Calves.***

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## INTRODUCTION

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

Information on the body water of the live animals, especially under heat stress conditions is important for estimating body solids [(2)] and can be used also in detection the heat adaptability coefficient [(3,4)].

High productive imported animals can be crossed with selected high productive native animals because such practice may raise the productivity of the heat tolerant native animals [(5)]. A properly designed crossbreeding system allows the cattle producer to take advantage of appropriate combinations of the superior traits of several different breeds and it also yields heterosis which often referred to as hybrid vigor, measures the difference between average performance of crossbred animals and average performance of the breeds that were crossed to produce them [(6)]. The aim of cross breeding is to transmit the superior phenotypic characteristics of a breed or breeds to the F1 offspring. The use of exotic breeds for crossbreeding purposes, to take advantage of potential heterotic effects, has long been popular. The amount of heterosis produced by the cross is calculated by subtracting the average of the weights for purebred calves from the average of the weights for crossbred calves. The amount of heterosis produced by this cross is expressed in terms of the percentage of improvement that crossbreds exhibit above the purebred average. To determine percentage of heterosis, divide the amount of heterosis by the purebred average; then multiply by 100%; this yields a heterosis value for the Breed crossbred combination [(6)].

However, little information was available on performance of such introduced breeds and their crosses in Egypt, especially, under different climatic conditions. The study of the changes in the growth traits as well as hormonal levels in each of native baladi as purebred calves and in its crossing with Brown Swiss bull as crossbred calves reared under desert of Inshas area during winter and summer seasons was the objective of the present study.

## MATERIALS AND METHODS

### *1-Animals and Feeding*:

The present study was conducted in bovine farm project, Experimental Farms Project, Biological Application Department, Radioisotopes Applications Division, Nuclear Research Centre, Atomic Energy Authority, Inshas, Cairo, Egypt. A number of 20 bovine calves after weaning with 5 months of age were used in this research. Animals were fed the ration consisted of concentrate feed mixture (CFM) and rice straw (RS). The ingredients as percentage of the CFM were 40 crushed yellow maize, 25.5, wheat bran, 25.0 undecorticated cotton seed meal, 7.0 soybean meal,1.0 dicalcium phosphate,1.0 sodium chloride,0.5 mineral mixture (Each kg contains 20g Mn, 1.5 g Cu, 0.15g I, 0.05g Se and 15g Fe from Pfizer-Co., Egypt) and 50 g vitamins mixture (AD3 E). Chemical composition of the feed stuffs used in the feeding of the calves were 89.8, 94.0, 15.7, 8.5, 2.7, 67.2 and 6.0% in CFM and 92.3, 83.5, 3.2, 32.7, 1.8, 44.6 and 17.7% in RS for DM, OM, CP, CF, EE, NFE and Ash, respectively (on DM basis%) according to AOAC [(7)]. Calculated nutritive values of the feed stuffs were 4.00 and 1.60 for net energy (MJ/kg DM), 60.82 and 30.00 for total digestible nutrients (%), 115.0, 0.00 for digestible crude protein (g/kg DM) and 0.50 and 0.20 for starch equivalent in CFM and RS, respectively.

### *2-Experimental design*:

Twenty bovine calves healthy including 10 baladi purebred and 10 crossbred 50% (baladi cows x Brown Swiss male) were used in the experiment. The experimental calves both purebred and crossbred were exposed to winter climate (90 days from the 1st of January to the end of March), since the average of ambient temperature (AT) and relative humidity were 21.8 ± 0.87 °C and 63.7±2.5%, followed by exposure the calves to summer climate (90 days from the 1st of June to the end of August), since the average of AT and RH% were 35.25±0.72°C and 55.6±1.03%, respectively. Severity of heat stress was estimated by Temperature-humidity Index (THI) according to Livestock and Poultry Heat Stress Indices [8] as: (THI = db°C – [(0.31-0.31 RH) (db°C -14.4)], where db°C=Dry bulb in Selsius THI values obtained 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. Average of THI was 21.15 during winter and was 32.33 during summer indicating that the experimental animals were exposed to absence of heat stress during winter season and severe heat stress during summer season.

### *3-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 meters) surrounded with wire fence (1.5 meter height). One-third of the surface area of the yard was covered with concrete shading roof in the middle (3.5 meter 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 to the animals.

### *4-Live and solids daily body weight gain*:

Live body weight (LBW) of each experimental calf was weighted monthly during each of winter and summer seasons. Daily body weight gain values were estimated by dividing total live body weight gain (kg) during each season (final LBW-initial LBW) by 90 days. Solids body weight gain was estimated in each calf by injection antipyrine at the rate of 1g/100kg LBW at the beginning and end of both winter and summer periods to determined total body water (TBW) according to Habeeb [4]**.** Total body solids=LBW-TBW and then solids body weight gain was estimated by dividing total body solids (kg) by 90 days.

### *5-Feed intake and dry matter intake (DMI):*

Food consumption (CFM and RS) was measured monthly once by subtracting the residuals of feed from that offered for each calf and calculated as DMI.

### *6-Blood Samples*:

Blood samples were collected monthly from the jugular vein to estimate $T_3$, $T_4$ and cortisol hormones during the two periods of the experiment using Radioimmunoassay technique by commercial kits provided by diagnostic product corporation, Los Angeles, USA, The unknown samples or standards are incubated with $^{125}$1-labeled hormone in antibody-coated tubes. After incubation, the liquid contents of the tube are aspirated and the radioactivity is determined in gamma counter.

### *7-Statistical analysis*:

Paired t test was used to compare between each trait under winter and summer and unpaired t test was used to compare in each trait between purebred and crossbred. The percentage change due to summer heat stress (HS) as compared to mild climate of winter season (MC) was calculated as [(MC-HS) / MC] x 100. Superiority of crossbreds was calculated using the average traits values as follows [(C-P) / P] x 100 where: C= the average of crossbred and P = the value of the purebred calves.

## RESULTS AND DISCUSSION

### *1- Live and solids daily body weight gain (DBWG):*

Concerning the effect of season of the year on live and solids DBWG, Table (1) showed that averages of live DBWG of purebred and crossbred bovine calves were 600±32 and 843±7.1 g during winter season and were 283±9.3 and 478±38 g during summer season, respectively. The live DBWG was found to be highly (P<0.001) significantly lower in summer than in winter in both tow breeds by 52.8 and 43.3.4%, respectively. The same trend was found in solids DBWG. Averages of solids DBWG of purebred and crossbred bovine calves were 217±10 and 319±9 g during winter season and were 139±4 and 222±17 g during summer season, respectively. The solids DBWG was found to be highly (P<0.001) significantly lower in summer than in winter in both tow breeds by 35.9 and 30.4%, respectively. Concerning the effect of breed type, Table 1 illustrated that live and solids DBWG were found to be significant (P<0.001) higher in crossbred than in purebred calves by 243.0 and 102.0 g in winter and 195.0 and 83.0 g in summer, respectively. These results indicating that crossbred calves are better in live and solids daily gain than purebred calves under two climatic conditions (Table 1).

**Table (1)** *Comparison between purebred and crossbred bovine calves in live and solids daily body weight gain during winter and summer seasons.*

| Calf No | Live body weight gain, g/daily | | | | Solids body weight gain, g/daily | | | |
|---|---|---|---|---|---|---|---|---|
| | Winter season | | Summer season | | Winter season | | Summer season | |
| | Pure bred | Cross bred | Pure bred | Cross bred | Pure bred | Cross bred | Pure bred | Cross bred |
| 1 | 683 | 883 | 300 | 367 | 219 | 262 | 162 | 167 |
| 2 | 367 | 800 | 300 | 417 | 147 | 303 | 139 | 328 |
| 3 | 750 | 833 | 217 | 317 | 224 | 369 | 134 | 239 |
| 4 | 650 | 850 | 333 | 750 | 259 | 340 | 120 | 272 |
| 5 | 550 | 833 | 267 | 417 | 222 | 306 | 140 | 139 |
| 6 | 583 | 833 | 283 | 433 | 189 | 324 | 126 | 200 |
| 7 | 617 | 867 | 283 | 567 | 256 | 329 | 146 | 211 |
| 8 | 600 | 843 | 283 | 500 | 216.6 | 319 | 141 | 222 |
| 9 | 554 | 833 | 283 | 467 | 201.9 | 306.3 | 136 | 200 |
| 10 | 646 | 853 | 278 | 544 | 231.3 | 331.7 | 148 | 244 |
| **X ±SE** | **600 ±32** | **843 ±٧,١** | **283 ±9.3** | **478 ± 38** | **217 ±10** | **319 ± 9** | **139 ± 4** | **222 ± 17** |
| **Change% due to season** | | | **-52.8***** | **-43.3***** | | | **-35.9***** | **-30.4***** |
| **Change% due to breed** | **+243*** g** | | **+195*** g** | | **+102*** g** | | **+83*** g** | |

****= P<0.001*

As the effect of heat stress on growth traits, Marai and Habeeb [5] showed that exposure Friesian calves to heat stress decreased significantly BWG and TBS. Kamal and Habeeb [9] and Habeeb et al.[3] found that exposure Friesian calves to heat stress increased significantly TBW and decreased significantly TBS in both male and female calves. Habeeb et al. [10] reported that the heat stress induced a highly significant decline in DBWG of bovine crossing calves by 14.0, 29.0 and 22.0% during $1^{st}$, $2^{nd}$ and $3^{rd}$ months of heat stress exposure, respectively. Habeeb et al. [11] reported that the heat stress conditions of summer season induced significant decline in DBWG of buffalo calves by 18.1, 17.41 and 8.65 % during $1^{st}$, $2^{nd}$ and $3^{rd}$ months during summer season, respectively.

The adverse effect of high ambient temperature on animals may be due to a decrease in feed consumption, dehydration of animals, tissue catabolism and to the low metabolically energy left for growth, since more energy is consumed by the increase in respiratory frequency that occurs in hot ambient temperature [12]. In addition, an exposure animal to severe heat stress conditions suppresses the production of hormone releasing factors from the hypothalamic centers causing a decrease in pituitary hormonal secretion and consequently lowers the secretion of anabolic hormones [1]. The decrease in live and solids DBG of heat stressed animals may be due to increase glucocorlicoids and catecholamines and decrease in insulin, $T_4$ and $T_3$ secretions [1] and decrease in feed intake, feed efficiency, digestibility and feed utilization [13]. In addition, the animal decrease fed intake under heat stress in an attempt to create less metabolic heat, the heat increment of feeding, especially, ruminants represents a large portion of whole body heat production [14].

Concerning the importance of crossing process on DBWG, Saxena and Singh [15] reported that growth traits of the crossbred calves were higher than those of the parent purebred. These results are explained that the increases of growth performance in crossbreds are due to heterosis in growth rate of the offspring [16]. These results are similar to obtained by Nigm et al. [17] who reported that genotype crossing that influences growth performance of cattle. Nasr et al. [18] showed that the highest values in LBW at birth and weaning were reported by grading up native cows (Baladi) with Friesian or Brown Swiss bull and that superiority mainly due to heterosis in growth rate of the offspring. In another study, birth weight, weaning weight and average DBG were improved in crossing Spanish, Nubian, or Angora with Boer goats [19]. El-Fouly et al. [20] showed that crossing resulted significant improvement in calves BW and DBWG and attributed that superiority due to the heterosis in growth rate of the offspring. The same author found that crossing between Brown Swiss bull and Baladi cows resulted highly significant improvement in BW at birth, 4 (at weaning), 10 and 12 months of age, whether in male or female calves and concluded that crossbreeding between Brown Swiss bull and Baladi cows successes in increasing BW at birth and weaning as well as at 12 months of age and considered crossing with Brown Swiss bull has effective for improving low producing native cattle. Similar results obtained also by Jenkins and Ferrell [21], Sanders et al. [22] and Haque et al. [23] in cattle and Rodriguez et al. [24] in sheep and Ahuya et al. [25] in goats. Norris et al. [26] reported that DBWG were higher in all the crosses than in the purebred Brahman animals and attributed the high growth rates observed in the crosses were probably due to both heterotic and additive gene effect for growth and adaptation characteristics.

In this respect, Habeeb et al. [16] reported that genotype of crossbred (Brown Swiss bull x Baladi cow) calves is more favorable than those found in purebred (Baladi) calves because cross calves have a good structure and type of genes that collected in pure Brown Swiss bull and transported into native calves. From the nutritional point of view, El-Fouly et al. [20] reported that brown Swiss x Baladi calves were more efficient in metabolism and adsorption process of nutrients and utilizing less energy intake to produce one kilogram BDG than Baladi calves. Concerning the adaptability, Pastsart et al. [27] and Molee et al. [28] found that Holstein crossed with local breeds in the tropics and subtropics perform better than the purebred Holstein and were also resistant to heat stress.

### *2-Hormonal levels:*

Averages of $T_3$ values were 6.22 ± 0.37 and 4.77 ± 0.22 nmol /L in purebred calves and were 5.94 ±0.13 and 4.92 ± 0.19 nmol/L in crossbred calves during winter and summer seasons, respectively. The $T_3$ values were found to be significantly lower ($P<0.001$) in summer than in winter and the percentage decrease was 23.3% in purebred and was 17.2% in crossbred calves. Results showed also that crossbred calves were less affected by climatic condition in $T_3$ than purebred calves although T3 level was not affected significantly due to breed of calves (Table 2).

Averages of T4 values were 91.694.97± and 78.134.02± nmol/L in purebred calves and were 96.13 ±5.20 and 81.49 ±4.43 nmol/L in crossbred calves during winter and summer seasons, respectively. T4 values decreased significantly ($P<0.05$) due to heat stress conditions during summer seasons as compared with winter season and the percentage decrease was 14.79% in purebred and was 15.23% in crossbred calves. However, $T_4$ level was not affected significantly due to breed of calves (Table 2).

**Table (2)** *Comparison between purebred and crossbred bovine calves in T3 and T4 levels during winter and summer seasons.*

| Calf No | $T_3$ (nmol/l) | | | | $T_4$ (nmol/l) | | | |
|---|---|---|---|---|---|---|---|---|
| | Winter season | | Summer season | | Winter season | | Summer season | |
| | Pure bred | Cross bred | Pure bred | Cross bred | Pure bred | Cross bred | Pure bred | Cross bred |
| 1 | 6.1 | 5.7 | 4.5 | 4.4 | 97.6 | 84.1 | 92.5 | 66.3 |
| 2 | 4.2 | 6.0 | 4.0 | 5.1 | 86.0 | 77.6 | 79.7 | 67.7 |
| 3 | 6.3 | 5.6 | 4.3 | 4.1 | 85.5 | 84.7 | 55.3 | 65.1 |
| 4 | 6.1 | 6.8 | 4.9 | 6.4 | 90.7 | 101.1 | 78.7 | 93.3 |
| 5 | 8.9 | 6.2 | 6.5 | 4.9 | 86.2 | 93.0 | 79.8 | 82.5 |
| 6 | 6.5 | 6.1 | 4.8 | 4.7 | 66.8 | 136.9 | 62.9 | 110.7 |
| 7 | 5.6 | 5.3 | 4.3 | 4.9 | 128.7 | 95.6 | 98.3 | 85.0 |
| 8 | 6.2 | 5.9 | 4.8 | 4.9 | 91.7 | 96.1 | 78.0 | 81.5 |
| 9 | 5.8 | 5.7 | 4.5 | 4.6 | 85.0 | 88.5 | 71.8 | 75.5 |
| 10 | 6.5 | 6.1 | 5.1 | 5.2 | 98.7 | 103.7 | 84.3 | 87.3 |
| X ±SE | **6.22 ±0.37** | **5.94 ±0.13** | **4.77 ±0.22** | **4.92 ±0.19** | **91.69 ±4.97** | **96.13 ±5.20** | **78.13 ±4.02** | **81.49 ±4.43** |
| Change % due to season | | | **- 23.3*****| **-17.2*****| | | **-14.79*** | **-15.23*** |
| Change % due to breed | NS | | **NS** | | NS | | **NS** | |

*NS=Not significant, *=P<0.05, ***=P<0.001*

Similar results were obtained by Horowitz [29] and Habeeb et al. [3, 10] who found that $T_3$ and $T_4$ values in Frisian calves were found to be significantly lower in summer than in winter. The changes in thyroid hormones are consistent with the decrease in metabolic rate, feed intake and growth under heat stress [30]. Exposure animals to severe heat suppresses the production of hormone releasing factors from the hypothalamic centers causing a decrease in pituitary hormonal secretion and decrease in thyroid stimulating hormone and consequently lower the secretion of thyroid hormones [1]. 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 [31]. Moreover, reduction in thyroid activity in animal under heat stress is the process of adaptation to its environment [32].

Averages of cortisol values were 42.832.16± and 56.422.34± nmol/L in purebred calves and were 43.842.33± and 55.683.34± nmol/L in crossbred calves during winter and summer seasons, respectively. Cortisol was significantly (P<0.001) higher during summer by 31.7 and 25.0 % than those in winter in purebred and crossbred calves, respectively. Results also illustrated that crossbred calves were less affected by climatic condition in cortisol than purebred calves although cortisol level was not affected significantly due to breed of calves (Table 3).

Similar results were recorded by Habeeb et al. [3, 10]. The increase in cortisol level during acute heat stress may be attributed to the fact that the glucocorticoid hormones have hyperglycaemic action to increase gluconeogenesis and provide the expected increase in glucose utilization in heat stressed animals [33]. In addition, the increase in cortisol level, as a catabolic hormone, in the heat stressed animals may be also due to the effect of stressful conditions on adrenal gland [34]. Hormonal secretions, especially, thyroxin, cortisol, insulin and aldosterone are known to be of major importance in body thermoregulation. Thyroid hormones, either $T_4$ or $T_3$ play an important role in animal's adaptation to environment changes [1].

### 3-Dry mater intake (DMI) :

DMI values were 4.00.09± and 3.100.05± kg/day in purebred calves and were 4.240.07± and 3.190.07± kg/day in crossbred calves during winter and summer seasons, respectively. DMI was significantly lower (P<0.001) during summer than those during winter. The percentage decrease was 21.96% in purebred and was 24.09% in crossbred calves. No significant difference in DMI between the two breeds (Table 3).

**Table (3)** *Comparison between purebred and crossbred bovine calves in cortisol level and dry matter intake during winter and summer seasons.*

| Calf No | Cortisol (nmol/l) | | | | Dry matter intake (kg/day) | | | |
|---|---|---|---|---|---|---|---|---|
| | Winter season | | Summer season | | Winter season | | Summer season | |
| | Pure bred | Cross bred | Pure bred | Cross bred | Pure bred | Cross bred | Pure bred | Cross bred |
| 1 | 44.3 | 51.2 | 55.7 | 70.3 | 3.85 | 4.27 | 3.02 | 3.34 |
| 2 | 49.1 | 44.6 | 52.2 | 54.9 | 3.31 | 4.33 | 3.25 | 3.26 |
| 3 | 31.2 | 51.2 | 44.0 | 70.3 | 4.26 | 4.51 | 3.09 | 3.28 |
| 4 | 49.3 | 45.3 | 64.0 | 49.7 | 4.22 | 4.06 | 2.90 | 3.65 |
| 5 | 50.2 | 46.4 | 68.5 | 60.1 | 3.91 | 3.96 | 3.43 | 2.84 |
| 6 | 44.1 | 25.2 | 62.5 | 33.7 | 4.00 | 3.92 | 3.02 | 3.08 |
| 7 | 31.7 | 43.7 | 48.8 | 53.3 | 4.15 | 4.54 | 3.04 | 3.01 |
| 8 | 42.8 | 43.6 | 56.4 | 55.0 | 4.02 | 4.24 | 3.06 | 3.20 |
| 9 | 39.5 | 40.3 | 52.7 | 51.1 | 4.18 | 4.15 | 3.04 | 3.15 |
| 10 | 46.1 | 46.9 | 59.4 | 58.4 | 4.05 | 4.42 | 3.13 | 3.08 |
| X ±SE | **42.83 ±2.16** | **43.84 ±2.33** | **56.42 ±2.34** | **55.68 ±3.34** | **4.00 ±0.09** | **4.24 ±0.07** | **3.10 ±0.05** | **3.19 ±0.07** |
| Change % due to season | | | **+31.7*****| **+25.0***** | | | **-21.96***** | **-24.09***** |
| Change% due to breed | NS | | **NS** | | **NS** | | **NS** | |

*NS=Not significant, ***=P<0.001*

Similar results obtained by Bernabucci et al. [13, 35] and Shwartz et al. [36] who observed that the heat stress decreased DMI in cows and Monty et al. [37] ; Padua et al. [38] and Marai et al. [39] found similar results in sheep. Boer and Spanish crosses were reported to have higher DMI than Spanish goats [40]. Norris et al [26] reported also that DMI was higher in all the crosses than in purebred Brahman animals and consequently fed conversion improved due to crossing. Depression in feed consumption is the most important reaction to heat exposure. High environmental temperature stimulates the peripheral thermal receptors to transmit suppressive nerve impulses to the appetite centre in the hypothalamus causing the decrease in feed consumption, i.e., dry matter intake [1]. In addition, animal decrease feed intake in an attempted to create less metabolic heat, as the heat increment of feeding, especially, in ruminants is a large portion of whole body heat production [14].

## CONCLUSION

It is can be concluded that heat stress conditions of summer season in Egypt had adversely effects on both live and solids DBWG as well as hormonal levels in both purebred and crossbred young bovine calves. In addition, crossbred calves were better than purebred calves in both live and solids DBWG. Finally, it can be concluded that Brown Swiss crossed with local bovine breed in the subtropical conditions perform better than the purebred local bovine calves and were also resistant to heats tress of summer season in Egypt.

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# خصائص النمو للعجول البقرى الأصيلة والخليطة أثناء فصلى الشتاء والصيف

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أجريت هذه الدراسة فى مزرعة الأبقار التابعة لمشروع المزارع التجريبية بمركز البحوث النووية – هيئة الطاقة الذرية بإنشاص وقد تمت هذه الدراسة لبحث تأثير عملية الخلط بين الأبقار البلدية مع طلوقة برون سويس ومدى تاثر العجول الخليطة (٥٠٪) الناجمة عن عملية الخلط ومدى ملائمتها للنمو تحت ظروف المناخ الحار أثناء الصيف فى مصر بالمقارنة بالعجول البقرى الناجمة من تلقيح ابوين من الحيوانات البلدىة (١٠٠٪). شملت الدراسة على ٢٠ عجل بعد الفطام بمتوسط عمر٥–٦–شهور منها ١٠ عجول بلدى أصيل (١٠٠ ٪) و ١٠ عجول خليط (٥٠٪ بلدى + ٥٠٪ براون سويس) حيث تركت العجول سواء الأصيلة أو الخليطة تنمو خلال فترة الشتاء التى إستمرت ٩٠ يوم خلال أشهريناير وفبراير و مارس وكانت متوسط درجة الحرارة ٢١،٨°م ومتوسط نسبة الرطوبة ٦٣،٧٪ ثم بعد ذلك خلال فترة الصيف التى أيضا استمرت ٩٠ يوما خلال أشهريونيو ويوليو وأغسطس وكانت متوسط درجة الحرارة ٣٥،٢٥°م ومتوسط نسبة الرطوبة ٥٥،٦٪.

وتم وزن الحيوانات كل أسبوعين لمعرفة العائد اليومى من الوزن الحى وتم تقدير كمية الأكل لكل حيوان بمفرده سواء من العلف المركز أو قش الأرزمره واحده كل شهر وفى نهاية فترة الشتاء وكذلك فترة الصيف تم أخذ عينة دم من كل حيوات لتقير الهرمونات (هرمونات الغدة الدرقية وهرمون الكورتيزول ) فى بلازما الدم بطريقة المناعة الاشعاعية باستخدام الهرمون المرقم باليود١٣١ المشع. كما تم حقن الحيوانات بالآنتيبيرين فى بداية ونهاية كل من فترتى الشتاء والصيف لتقير كمية الماء بجسم كل حيوان وبالتالى طرح هذه الكمية من الوزن الحى لنحصل على محتوى جسم الحيوان من المادة الصلبة وبالتالى تقدير العائد الىومى من المادة الصلبة. وكانت أهم النتائج ما يلى:

١. متوسط العائد اليومى الحى لوزن الجسم فى فصل الشتاء تقدر ٦٠٠ و٨٤٣ جم للعجول الأصيلة والخليطة على التوالى بينما كانت فى فترة الصيف تقدر ٢٨٣ و ٤٧٨ جم أى بنسبة نقص فى العائد من الوزن الحى فى فترة فصل الصيف عن فترة فصل الشتاء قدرها ٥٢،٨ و ٤٣،٣ ٪ للعجول الأصيلة والخليطة على التوالى ومن هذه النتائج يتضح أن العجول الخليطة أعطت أعلى عائد يومى من وزن الجسم الحى سواء فى فصل الشتاء (٢٤٣ جم) أو فى فصل الصيف ( ١٩٥ جم) وبالتالى يمكن القول أن الحيوانات الخليطة أفضل من الحيوانات الأصيلة سواء شتاءا أو أثناء الصيف.

٢. متوسط العائد اليومى الصلب لوزن الجسم فى فصل الشتاء تقدر ٢١٧ و٣١٩ جم للعجول الأصيلة والخليطة على التوالى بينما كانت فى فترة الصيف تقدر ١٣٩ و ٢٢٢ جم أى بنسبة نقص فى العائد من الوزن االصلب فى فترة فصل الصيف عن فترة فصل الشتاء قدرها ٣٥،٩ و ٣٠،٤ ٪ للعجول الأصيلة والخليطة على التوالى ومن هذه النتائج يتضح أن العجول الخليطة أعطت أعلى عائد يومى من وزن الجسم الصلب سواء فى فصل الشتاء (١٠٢ جم) أو فى فصل الصيف ( ٨٣ جم) وبالتالى يمكن القول أن الحيوانات الخليطة أفضل من الحيوانات الأصيلة سواء شتاءا أو صيفا.

٣. بالمقارنة بفترة المناخ المعتدل فى الشتاء فان المناخ الحار فى فصل الصيف يسبب انخفاض معنوى فى تركيز كل من هرمون $T_3$ بنسبة ٢٣،٣ و ١٧،٢ ٪ وهرمون $T_4$ بنسبة ١٤،٧٩ و ١٥،٢٣ ٪ فى دم العجول الأصيلة أو الخليطة على التوالى ولا يوجد فرق معنوى فى تركيز هرمونى $T_3$ و $T_4$ بين العجول الأصيلة والعجول الخليطة سواء فى فترة الشتاء أو الصيف. بينما المناخ الحار يسبب زيادة تركيز هرمون الكورتيزول بنسبة ٣١،٧ و ٢٥،٠ ٪ فى دم العجول الأصيلة والخليطة على التوالى بدون فرق معنوى بين نوعى العجول فى تركيز الكورتيزول سواء فى فترة الشتاء أو الصيف.

٤. بالمقارنة بفترة المناخ المعتدل فى الشتاء فان المناخ الحار فى فصل الصيف يسبب انخفاض معنوى فى كمية المادة الجافة المأكولة بنسبة ٢١،٩٦ و ٢٤،٠٩ ٪ للعجول الأصيلة والخليطة على التوالى ولا يوجد فرق معنوى فى كمية المادة الجافة المأكزلة بين العجول الأصيلة والعجول الخليطة سواء فى فترة الشتاء أو الصيف.

1. قسم التطبيقات البيولوجية – شعبة تطبيقات النظائر المشع – مركز البحوث النووية – هيئة الطاقة الذرية.