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PHYSIOLOGICAL RESPONSES OF BUFFALO AND FRIESIAN CALVES TO VITAMIN E AND SELENIUM INJECTION IN COLD CONDITIONS

El-Barody, M. A.A.[1]; E.B. Soliman[1] and Zenat B.H. Rabie[2]

1) Animal Production Department, Faculty of Agriculture, Minia University, Minia,

2) Animal Production Research Institute, Dokky, Giza.

ABSTRACT

Twenty four (12 buffalo and 12 Friesian) weanling male and female calves aged 4 months were used in this study. Average body weights of buffalo and Friesian calves were 113.83 ± 2.30 and 122.83 ± 1.10 kg of males and were 100.0 ± 2.30 and 102.0 ± 1.10 and kg of females, respectively. They were randomly allocated within sex into two equal groups three of each in each breed. The first group in each sex within each breed was injected weekly intramuscularly with 5 ml/head of viteselen (each one ml contains vitamin E 150 mg and sodium selenite 1.67 mg) and the other group served as control. The injection protocol continued for 90 days. Animals were housed outdoor during cold winter conditions (Dec-Feb, 1998). Body weights, daily gain and feed conversion were recorded. Rectal temperature (RT, °C) and respiration rate (RR, r.p.m) were recorded out at 6 a.m and 3 p.m. Blood samples were taken and plasma glucose, total lipids, total protein, triiodothyronine (T_3) and thyroxin (T_4) hormones, selenium and vitamin E were assayed. T_4/T_3 ratio was calculated.

Injected buffalo calves recorded better ($P<0.05$) growth rate and feed conversion than control. However, Injected Friesian calves showed insignificant response. Males in both buffalo and Friesian calves recorded better ($P<0.05$) growth rate and feed conversion than females. Injected buffalo calves had higher ($P<0.05$, $P<0.01$) plasma total lipids, total protein, T_3, selenium, vitamin E and T_4/T_3 ratio than control. However, injected Friesian calves did not significantly differ in the same blood parameters than control. Male buffalo calves had higher ($P<0.05$) in plasma total lipids, selenium, and vitamin E than female ones. Injected buffalo calves had higher ($P<0.05$) RT and RR at 6 a.m and 3 p.m. than control. While, injected Friesian calves showed insignificant response. Male calves recorded higher ($P<0.05$, $P<0.01$) RT and RR in buffalo and in Friesian than female ones.

In conclusion, viteselen injection in weanling cold stressed calves could improve growth rate, feed conversion and led to efficient metabolic activities that were accompanied by high thyroid activity. These improvement in buffalo calves were exhibited especially in males than females.

Keywords: Vit.A, selenium, buffalo, Friesian, calves, physiological response.

INTRODUCTION

Vitamin E (a-Tocopherol) is a crucial lipid soluble antioxidants that protect unsaturated fatty acid in feeds and tissues against oxidation. Indeed, some believe that deleterious effects of vitamin E deficiency are related to the accumulation of fatty acid peroxides in the tissues (Harper *et al*., 1979; McCoy and King, 1980) and produces liver fat degeneration, muscular dystrophy and sudden moralities by cardiac lesions (Albert *et al.*, 1985).

Vitamin E acts as a physiological synergistic and as functioning portion of specific enzymes. Animals that were supplemented vitamin E consumed more dry matter (DM) and had a higher growth rate in several species including calves (Reddy *et al*., 1985) and sheep (Asadian *et al*., 1996). On the other hand, supplementing vitamin E to neonatal calves did not affect body weight gain, feed intake and feed efficiency (Quigley and Bernard, 1995). Under heat stress circumstances, Politis *et al*. (1995) demonstrated that supplemental vitamin E will be beneficial in aiding to optimum function of the immune system in calves.

Selenium has long been known as a toxic element causing either acute (blind staggers) or chronic toxicity (alkali disease) as stated by Underwood (1971). However, selenium supplementation has been shown to prevent white muscle disease in young ruminants (Muth *et al*., 1958), and increased serum concentration of immunoglobin G (IgG) in dairy cows (Swecker *et al*., 1995).

Vitamin E and selenium play a synergistic role in the nutrition of calves. Some deficiency signs such as white muscle disease may respond to vitamin E or selenium (Hoekstra, 1975). In addition, injection of vitamin E and selenium in ewe lambs was reported to increase the reproductive performance in term of fertility, prolificacy, number of lambs born and live weight of lamb at birth (Gabryszuk, 1994)

Newborn and weanling animals usually have a low blood tocopherol probably due to three causes: poor placental transfer (Paulson *et al.,* 1968), stress conditions induced by weaning and shifting from hutches to group pens and interrelationships with certain other nutrients such as selenium and polyunsaturated fatty acids in the diet (Reddy *et al.*, 1985). Vitamin E and selenium appear to be needed during rapid growth of animals (Farrell, 1980). Therefore, the objectives of the present study were to investigate the influence of vitamin E and selenium injection on growth performance and physiological responses of growing buffalo and Friesian calves under cold stress conditions.

MATERIAL AND METHODS

Twenty four (12 buffalo and 12 Friesian) weanling male and female calves averaged 4 months of age were used in this study. Average body weight of buffalo and Friesian calves were 113.8±2.30 and 122.8±1.10 kg for males and were 100±2.30 and 102±1.10 kg for females, respectively. Animals belonged to the Animal Production Department Farm, Faculty of Agriculture, Minia University. This study was carried out during the coldest months of winter season (Dec, Jan and Feb., 1998).

The animals were randomly allocated within sex into two equal groups, three of each in each species. The second group (G_2) in each sex within each species was injected weekly intramuscularly with 5 ml/head of viteselen for veterinary use (manufactured by the Egyptian Co. for Chemicals and Pharmaceuticals). Each ml contained 150 mg vitamin E and 1.67 mg sodium selenite. The first group (G_1) served as control. The injection protocol was continued for 90 days. Body weights were recorded at 10 day intervals. Daily gain and feed conversion (Kg TDN/Kg gain) were calculated.

Animals were housed outdoor and were individually fed berseem (*Trifolium alexandrinum*) and concentrate mixture according to Tommi (1963) allowances. Feeds were offered twice a day at 9 a.m. and 5 p.m. Beside these feeds, sugar cane bagasse was offered *ad libitum*. The concentrate mixture contained 35 % yellow maize, 33 % wheat bran, 10.5 % decorticated cotton seed meal, 20 % rice bran, 1 % limestone and 0.5 % common salt. The calculated feeding value for the concentrate mixture was 65.4 starch value and 12.27 % crude protein. Calculated selenium content of concentrate mixture was 0.073 ppm and berseem was 0.066 ppm. This value was much lower than 0.3 ppm recommended for dairy cows (Podoll *et al*. 1992). . The calculated vitamin E content of berseem was 9.6 IU/kg DM and that of concentrate mixture was 15 IU/kg DM. For young calves, vitamin E requirements are estimated to range from 25 to 60 IU of vitamin E /kg of dry diet (NRC, 1988). Drinking water was always available.

Thermal and respiratory responses of the animals included rectal temperature (RT, °C) and respiration rate (RR, r.p.m) were recorded every 10 days at 6 a.m and 3 p.m. Rectal temperature was recorded by using digital thermometers. Respiration rate was determined by counting the flank's movements/min. Climatological data including air temperature and relative humidity were recorded. Air temperature (AT, °C) was recorded daily throughout the experimental period using a thermometer hanged at a level of about two meters from the floor with a psychrometer for the relative humidity (RH %).

Heparenized blood samples were collected every 22 days at 8.30 a.m. before animals axcess to feed or drink. Blood samples were centrifuged at 3000 r.p.m for 10 minutes to separate plasma. Plasma samples were harvested and stored at -20°C till analysis. Plasma vitamin E (a-tocopherol) was determined by modification of the calorimetric procedure of Christie *et al*. (1973). The analysis of selenium concentration in plasma was performed using the fluorometric procedure described by Olson *et al*. (1975) as modified by Whether and Ullrey (1978). Plasma glucose, total lipids, and total protein concentrations were determined by using kits (Cal-test diagnostics, INC, Chino, USA). Plasma triiodothyronine (T_3) and thyroxin (T_4) concentrations were determined by a direct solid-phase ^{125}I radioimmunoassay techniques using (Coat-A-Count TKT_3 and TKT_4) RIA kits purchased from Diagnostic Products Corporation (DPC, Los Angeles, CA, USA). T_4/T_3 ratio was calculated.

The data were analyzed by least square means analysis of variance using General Linear Models (GLM) procedure of the statistical analysis system (SAS, 1992). The data were analyzed by the following statistical model :

$Y_{ijk} = \mu + T_i + S_j + TS_{ij} + e_{ijk}$

where : μ = mean; T_i = effect of i^{th} treatments, G_1=control and G_2=viteselen injected;

S_j=effect of j^{th} sex, TS_{ij}= effect of interaction (ij^{th}) between treatments and sex; eijk= random effect of error with mean=0 and variancesσ^2e.

Duncan's Multiple Range test was used to detect differences among means of the experimental groups (Duncan, 1955).

RESULTS

1- Climatic data:

Climatic data showed that average monthly air temperature (AT, °C) was 12.2 ±0.6 °C. Maximum value was 18.7±0.4 °C while minimum value was 3.1 °C. Average monthly relative humidity (RH, %) was 72.2±1.1 % with maximum value of 95.2±1.3 % and minimum value of 44.4±1.2 %. There was a diurnal variation of outdoor in AT (°C) and RH (%); with averages of AT (7.7 ±0.4 °C) and RH (72.8±1.0 %) at 6 a.m. and 19.0±0.3 °C and 48.2±1.01 % at 3 p.m., respectively.

2-Thermal and respiratory responses of animals:

Viteselen injection in buffalo calves had a significant effect (P<0.05) to increase the rectal temperature and respiration rate either at 6 a.m. or 3 p.m. (Tables 1 and 2). The increase in RT and RR due to the viteselen injection were 0.61 °C and 1.69 r.p.m at 6 a.m and 0.78 °C and 1.93 r.p.m at 3 p.m., respectively (Table 1). In contrast, viteselen injection in Friesian calves had no significant effect on rectal temperature and respiration rate at the two different times when compared with control ones (Tables 1 and 2).
Male buffalo calves recorded higher (P<0.05) RT and RR compared with female ones. The increases were 0.55 °C and 1.79 r.p.m at 6 a.m., and were 0.64 °C and 1.61 r.p.m at 3 p.m. compared with female ones (Table 1). Male Friesian calves also tended to exhibit higher (P<0.01) RT and RR compared with female ones (Table 2). The increases were 0.59 °C and 3.84 r.p.m at 6 a.m. and were 1.01 °C and 2.48 r.p.m at 3 p.m. (Table 1).

Table (1) : Rectal temperature (°C) and respiration rate (r.p.m) of buffalo and Friesian calves at 6 a.m. and 3 p.m. as affected by viteselen injection (means ± S.E).

Items	Rectal temperature (°C)		Respiration rate (r.p.m)	
	6 a.m	3 p.m	6 a.m	3 p.m
	Buffalo			

Treatment:	*	*	*	*
G1	37.38±0.02 ^{b}	38.13±0.01 ^{b}	20.12±1.4 ^{b}	21.11±2.4 ^{b}
G2	37.99±0.02 ^{a}	38.91±0.01 ^{a}	21.81±1.4 ^{a}	23.04±2.4 ^{a}
Sex:	*	*	*	*
Male	37.97±0.02 ^{a}	37.64±0.02 ^{a}	22.85±1.3 ^{a}	23.33±2.3 ^{a}
Female	37.42±0.02 ^{b}	37.00±0.02 ^{b}	21.06±1.3 ^{b}	21.72±2.3 ^{b}
	Friesian			
Treatments :	NS	NS	NS	NS
G1	37.93±0.01	38.09±0.02	22.06±1.3	24.94±1.0
G2	37.94±0.01	38.14±0.02	22.28±1.3	26.94±1.0
Sex :	**	**	**	**
Male	38.23±0.02 ^{a}	38.92±0.03 ^{a}	25.58±1.4 ^{a}	26.35±1.0 ^{a}
Female	37.64±0.02 ^{b}	37.91±0.03 ^{b}	21.74±1.4 ^{b}	23.87±1.0 ^{b}

Means within the same column having different superscripts significantly different .
*** (P<0.05), ** (P<0.01), NS=not significant, G1=control, G2=viteselen injected**

Table (2): ANOVA table for rectal temperature and respiration rate of buffalo and Friesian calves as affected by viteselen injection

Mean square						**Time**
Friesian			**Buffalo**			
Interaction	**Sex**	**Treatment**	**Interaction**	**Sex**	**Treatment**	
RT ^{o}C						
2.8920*	11.668* *	0.1041 NS	1.1773 NS	4.2988*	1.02776*	6 a.m.
0.0045 NS	4.6045* *	0.0489 NS	0.26445*	0.62564*	0.64045*	3 p.m.
RR (r.p.m)						
12.2080 NS	94.6391 *	17.2791 NS	10.0484 NS	86.8447*	8.3499 *	6 a.m.
5.3333 NS	166.259 *	14.7000NS	19.59259NS	13.3703*	14.81481*	3 p.m.

Degree of freedom: Treatment (T)=1 Sex (S) = 1 Interaction (TXS)= 1
*** * (p<0.01) *(P<0.05) NS= not significant**

Results presented in Table 2 revealed that the interaction between treatment and sex (TxS) was not significant in RT and RR at 6 a.m of buffalo calves but it was significant (P<0.05) at 3 p.m. in RT only. The interaction (TxS) of RT in Friesian calves was significant only at 6 a.m, but it was not significant at 3 p.m. The interaction related to RR in Friesian calves was not significant at both 6 a.m. and 3 p.m.

3-Growth performance responses:

Results in Tables 3 and 4 revealed that viteselen injection in buffalo calves had a significant effect (P<0.05) on average daily gain, feed consumption and feed conversion compared with control**.** The values were 0.41 ± 0.03 kg/d, 2.47 ± 0.02 kg TDN/head/day and 6.02 kg TDN/kg gain (G_1) vs. 0.56 ± 0.03 kg/d, 3.05 ± 0.02 kg TDN/head/day and 5.44 ± 0.07 kg TDN/kg gain (G_2) for daily gain, feed consumption and feed conversion, respectively (Table 3). Viteselen injection in Friesian calves had no significant effect on those performance parameters compared with control.

The concomitant values were 0.56 ± 0.04 kg/d, 2.83±0.02 TDN/head/day and 5.02±0.08 kg TDN/kg gain (G_1) vs. 0.59± 0.04 kg/d, 3.29±0.02 kg TDN/head/day and 5.57± 0.08 TDN/kg gain (G_2) for daily gain, feed consumption and feed conversion, respectively (Table 3).

In buffalo, results in Table (4) indicate that sex had a significant effect (P<0.05) on daily gain, feed consumption and feed conversion. Male buffalo calves tended to have a higher daily gain, feed consumption and better feed conversion compared with female ones. Also, male Friesian calves had greater (P<0.05) weight gain (0.62 vs. 0.48 kg/day) and better (P<0.05) feed conversion (5.74±0.07 vs. 7.38±0.07) than female (Tables 3 and 4).

Table (3):Average daily gain (kg/d), feed consumption (kg TDN/head/day) and feed conversion (kg TDN/kg gain) of buffalo and Friesian calves as affected by viteselen injection (means±SE).

Items	Average daily gain	Feed consumption	Feed conversion
	Buffalo		
Treatment:	*	*	*
G1	0.41 ±0.03 ^{b}	2.47 ±0.02 ^{b}	6.02 ±0.07 ^{a}
G2	0.56 ±0.03 ^{a}	3.05 ±0.02 ^{a}	5.44 ±0.07 ^{b}
Sex :	*	*	*
Male	0.52 ±0.04 ^{a}	3.25 ±0.03 ^{a}	6.25 ±0.06 ^{b}
Female	0.42 ±0.04 ^{b}	2.96 ±0.03 ^{b}	7.05 ±0.06 ^{a}
	Friesian		
Treatments :	NS	NS	NS
G1	0.56 ±0.04	2.83 ±0.02	5.05 ±0.08
G2	0.59 ±0.04	3.29 ±0.02	5.58 ±0.08
Sex :	*	NS	*
Male	0.62 ±0.05 ^{a}	3.56 ±0.03	5.74 ±0.07 ^{b}
Female	0.48 ±0.05 ^{b}	3.54 ±0.03	7.38 ±0.07 ^{a}

Means within the same column having different superscripts significantly different
*** (P<0.05), NS= not significant, G1=control, G2= viteselen injected**

Data in ANOVA (Table 4) showed that the interaction between treatment and sex was significant (P<0.05) in buffalo in term of daily gain, feed consumption and feed conversion. Inversely, it was not significant of those traits in Friesian calves.

Table (4) : ANOVA table for daily gain, feed consumption and feed conversion of buffalo and friesian calves as affected by viteselen injection .

Item	Mean Square	
	Buffalo	**Friesian**

	Treatment	Sex	Interaction	Treatment	Sex	Interaction
Daily gain	0.246 *	0.210 *	0.183 *	0.041 NS	0.0903 *	0.021 NS
Feed consumption	6.231 *	5.673 *	4.818 *	8.033 NS	6.14 NS	5.218 NS
Feed conversion	6.431 *	8.132 *	5.416 *	2.308 NS	5.214 *	3.607 NS

Degree of freedom Treatment (T)=1 Sex (S)=1 Interaction (TXS)=1
*** *(P<0.01) * (P<0.05) NS= not significant**

4-Blood constituents responses :

a-Plasma metabolites :

Glucose, total lipids and total protein analysis were used as indicators for the nutritional status and give an idea about the on-going biological processes. Glucose, total lipids and total protein concentrations of buffalo and Friesian calves in both sexes as affected by viteselen injection are illustrated in Table (5).

Table (5): Averages of glucose (mg/dl), total lipids (mg/dl), total protein (g/dl), T3 (ng/ml), T_4 (ng/ml), selenium (µg/ml), vitamin E (µg/dl) concentrations in plasma and T_4/T_3 ratio of buffalo and Friesian calves as affected by viteselen injection (means ±S.E).

Items	Treatment		±S.E	Sig.	Sex		±S.E	Sig.
	G1	G2			Male	Female		
	Buffalo							
Glucose (mg/dl)	93.47	93.15	2.11	NS	91.21	95.41	3.10	NS
Total lipids(mg/dl)	238.83 b	265.71 a	3.34	**	267.30 a	237.20 b	2.67	*
Total protein (g/dl)	8.84 b	9.22 a	1.88	**	9.12	8.94	1.92	NS
T3 (ng/ml)	1.525 b	1.838 a	0.07	**	1.715	1.648	0.09	NS
T4 (ng/ml)	70.37	76.03	1.32	NS	75.59	70.81	1.63	NS
T4/T3 ratio	40.30 b	61.22 a	3.54	**	51.01	50.50	3.54	NS
Selenium (µg/ml)	0.10 b	0.21 a	0.01	*	0.188	0.189	0.01	NS
Vitamin E (µg/ml)	78.11 b	120.10 a	2.14	*	118.23	116.24	3.41	NS
	Friesian							
Glucose (mg/dl)	89.74	84.26	1.53	NS	85.34	88.66	1.62	NS
Total lipids(mg/dl)	376.35	402.05	2.20	NS	381.74	396.66	3.01	NS
Total protein (g/dl)	8.84	9.26	1.73	NS	9.07	8.92	1.81	NS
T3 (ng/ml)	1.397	1.375	0.02	NS	1.545 a	1.227 b	0.04	**
T4 (ng/ml)	81.62	82.59	1.44	NS	81.37	82.84	1.45	NS
T4/T3 ratio	66.01	69.02	1.69	NS	61.77 b	73.26 a	1.69	**
Selenium (µg/ml)	0.04	0.04	0.01	NS	0.048	0.049	0.02	NS
Vitamin E (µg/ml)	94.33	99.33	2.71	NS	132.25 a	104.20 b	4.11	*

Means within the same row having different superscripts significantly different.

*** (P<0.05), ** (P<0.01), NS= not significant, G1=control, G2=viteselen injected.**

Viteselen injection in buffalo calves induced a significant effect on total lipids and total protein concentrations in plasma. Injected animals tended to have higher (P<0.01) values of total lipids and total protein than control ones (Tables 5 and 6). However, there was no significant effect of viteselen injection on the concentration of plasma glucose. In buffalo calves, sex had a significant effect on plasma total lipids, but no significant changes were specific to glucose and total protein. Plasma total lipids were in males significantly higher than females (Tables 5 and 6)).

Table (6): ANOVA for the different studied blood parameters of buffalo and Friesian calves as affected by viteselin injection

Item	Mean square					
	Buffalo			Friesian		
	Treatment	Sex	Interaction	Treatment	Sex	Interaction
Glucose	1.2129 NS	212.310 NS	771.60 *	360.09 NS	132.10 NS	1945.02 *
Total lipids	8669.07 * *	10890.49 *	9261.57 * *	7921.77 NS	2672.47 NS	40168.73 *
Total protein	176.372 * *	36.523 NS	12.803 NS	123.97 NS	26.11 NS	2.24 NS
T_3	1.16875 * *	0.05267 NS	0.01505 NS	0.006 NS	1.213 * *	0.0063 NS
T_4	383.974 NS	274.850 NS	188.97 NS	11.233 NS	26.11 NS	133.13 * *
T_4/T_3 ratio	5250.86 * *	3.2204 NS	74.699 NS	108.32 NS	1584.68 * *	299.66 *
Selenium	0.377 *	0.081 NS	0.212 *	0.07 NS	0.05 NS	0.03 NS
Vitamin E	289.22 *	119.85 NS	248.24 *	111.576 NS	292.107 *	263.386 *

Degree of freedom Treatment (T) =1 Sex (S) =1 Interaction (TXS) = 1
*** *(P<0.01) * (P<0.05) NS = not significant**

In Friesian, there was no significant effect of viteselen injection on the metabolic blood compounds mentioned above. Similarly, sex had no significant effect on these traits (Tables 5 and 6).

The interaction between treatment and sex (TxS) was significant (P<0.05) in buffalo calves related to glucose and total lipids, but it was not significant of the total protein.. In Friesian calves, the interaction (TxS) was significant (P<0.05) related to glucose and total lipids and was not significant of total protein (Table 6).

b-Thyroid activity:

Data of triiodothyronine (T_3) and thyroxin (T_4) hormone concentrations and T_4/T_3 ratio as influenced by injection of vitamin E and selenium are presented in Tables 5 and 6. Viteselen injection in buffalo calves showed a significant increase in T_3 hormone concentration (P<0.01) and T_4/T_3 ratio (P<0.05). Sex had no significant effect on T_3 and T_4 concentrations and also on T_4/T_3 ratio (Table 6). However, in Friesian calves, viteselen injection had no significant effect on T_3, T_4 and T_4/T_3 ratio. With exception of T_3 concentration, sex had no significant effect on the plasma T_4 and also T_4/T_3 ratio. But, males of Friesian calves tended to exhibit higher (P<0.01) values of T_3 and T_4/T_3 ratio compared with female ones (Tables 5 and 6).

In buffalo calves, the interaction (TxS) was not significant related to T_4, T_3 and T_4/T_3 ratio. In Friesian calves, the interaction (TxS) was significant (P<0.05) related to T_4 and T_4/T_3 ratio and was not significant of T_3 (Table 6).

c-Selenium and vitamin E:

In buffalo calves, viteselen injection resulted in a significant increase (P<0.05) the concentration of plasma selenium and vitamin E (Table 6). However, no significant effect in Friesian calves in this respect. Male of buffalo calves did not differ significantly than female in plasma selenium and vitamin E concentration. However, male of Friesian calves exhibited a higher (P<0.05) plasma vitamin E concentration than female ones. But, no effect on plasma selenium concentration related to sex of Friesian calves (Table 5 and 6).

Data in Table 6 illustrated that the interaction (TxS) was significant in plasma selenium and vitamin E of buffalo calves. But it was not significant in Friesian calves related to selenium, however, it was significant in vitamin E.

DISCUSSION

The insignificant effect of vitamin E and selenium injection on daily weight gain and feed conversion of Friesian calves coincides with several reports (Weiss *et al*. 1983) in weaned calves which were injected with 0.078 µg selenium plus 5.4 IU vitamin E/kg body weight. In this respect, Droke and Loerch (1989) found that selenium and vitamin E injection during the 1st period in the feedlot had no effect on growth rate and feed efficiency. Growth performance (body weight and feed conversion) is considered as indicator of metabolic activity. Therefore, another explanation could be concluded from the data in Tables (5 and 6) which indicated that there was no significant effect of viteselen injection on any of blood constituents such as glucose, total lipids, total protein, T_3, T_4, T_4/T_3 ratio, vitamin E or selenium that may be responsible for metabolic activity.

In the present study, the insignificant effect of vitamin E and selenium on blood constituents in Friesian calves (Tables 5 and 6) agrees with previous results reported by Naziroglu *et al* (1998) in which they indicated no significant effect of selenium and vitamin E supplementation on plasma thyroid hormones (T_3 and T_4) in lambs. Cuesta *et al.* (1994) found that selenium and vitamin E intake of cows had no effect on serum vitamin E concentration in their calves. In addition, Reddy *et al*. (1985) reported that vitamin E supplementation had no significant effect on glucose and total protein in blood. It has also been demonstrated that blood selenium levels in calves, born to dams supplemented with mineral mixture containing 20 ppm selenium, were not affected by injection of 0.0825 mg selenium/kg body weight at birth until 10 weeks of age (Weiss *et al*. 1984). Similar results were obtained by Maus *et al* (1980) in dairy cows. Njeru *et al.* (1995) found that there was no significant effect of vitamin E treatment on the concentration of blood lipid fractions (cholesterol and triglycerols).

The significant effect of sex on daily gain and feed conversion observed in the present study is consistent with the findings of Norton and McCarthy (1986). Improvement of daily gain in Friesian males than females obtained in the present study may be due to the higher efficiency of feed utilization in males as previously reported by El-Feel (1984) and Morsy (1987). Another explanation that higher concentrations of plasma T_3 and vitamin E in Friesian males in the present study (Table 5) led to better daily weight gain. Two previous studies supported this interpretation. Firstly, Marai *et al*. (1994) reported that thyroid hormones increased significantly live body weight, daily gain and feed efficiency in rabbits. Secondly, Shetaewi *et al.* (1992) demonstrated that lambs supplemented with vitamin E recorded higher daily gain and feed efficiency.

The positive effect of viteselen injection in buffalo calves on growth performance is consistent with those previously reported by Ammerman *et al.* (1980) who noticed that selenium supplementation to the pregnant cows during the dry period increased weaning weight of the calves. Also, Spears *et al.* (1986) observed that selenium injection of beef cows fed year-round on foodstuffs marginally deficient in selenium increased the weight gain of their calves. Additionally, Maas *et al.* (1993) found that selenium injection increased the weight gain from 53.1 to 63.0 kg in calves at age of 84 days. However, the present results disagree with the previous findings of El-Ayouty *et al.* (1996) who concluded that selenium injection in Buffalo calves at different levels ranging from 0.1 ppm to 0.3 ppm/kg of milk or starter had no significant effect on animal performance. The differences between their results and the present results could be due to vitamin E injection in the present study that may acts as a physiological synergistic with selenium in controlling performance as reported in calves (Hoekstra, 1975) and in sheep (Gabryszuk, 1994 and Asadian *et al*. 1996).

The significant increases of plasma vitamin E and plasma selenium in injected buffalo calves in the present study (Table 5) are in keeping with previous work by Naziroglu *et al* (1998) in lambs. They found that the levels of serum vitamin E were significantly higher in vitamin E and vitamin E with selenium supplemented groups compared with those of the control group. Moreover, the levels of serum selenium were significantly greater in both vitamin E and selenium supplemented lambs. However, the presented results disagree with the results of Cuesta *et al*. (1993) in calves who demonstrated that calves from cows supplemented with vitamin E, but not selenium, had higher serum vitamin E than calves from cows receiving selenium and vitamin E or control. Also, they disagree with those reported in calves by Cuesta *et al.* (1994) who observed that selenium and vitamin E intake had no effect on serum vitamin E, but selenium supplements increased selenium concentration in cow serum and colostrum.

Hence, injection of vitamin E and selenium in the present study led to an increase in plasma concentrations of vitamin E and selenium in buffalo calves(Table 5). Therefore, the increase in plasma total protein in injected buffalo calves of the present study, may be explained by the concomitant increase in plasma vitamin E. In this regard, Shetaewi *et al.* (1992) demonstrated that serum total protein was high in lambs injected with vitamin E (200 mg/head). Also, the increase in plasma concentrations of total lipids in the present study as a result of viteselen injection in buffalo calves (Table 5) could be attributed to the linear relationship between serum a-tocopherol concentration or serum tocopherol : cholesterol plus triglycerol ratio (lipid fractions) and vitamin E intake as reported by Njeru *et al*. (1995) in cattle. In addition, Herdt and Smith (1996) concluded that plasma vitamin E and cholesterol are distributed in equal proportions of lipoproteins in the different density fractions that would not affect the overall vitamin E : cholesterol ratio of plasma. Therefore, it is suggested that total plasma vitamin E : cholesterol ratio is a valid relative estimator of vitamin E concentration per lipoprotein particle, regardless of the density distribution of particles.

In the present study, the insignificant effect of vitamin E and selenium injection on plasma glucose concentration (Tables 5 and 6) consistently agree with Reddy *et al.* (1985) who noticed that no significant differences in glucose attributed to treatment with vitamin E injection or oral intake.

The observed increase in plasma T_3 hormone concentration as a result of viteselen injection in buffalo calves (Tables 5 and 6) are in agreement with the results of Naziroglu *et al.* (1998) in which they reported that levels of T_3 were increased in lambs when vitamin E, selenium or vitamin E with selenium were supplemented in their diets. But, it disagrees with their results related to T_4 concentration and T_4/T_3 ratio. They reported that T_4 and T_4/T_3 ratio decreased with vitamin E, selenium or vitamin E with selenium supplementation to lambs in their diet. The differences between the previous studies and the present study could be due to the different levels of selenium and vitamin E used and the animal species.

The significant increase of the RT and RR (Table 1) of buffalo calves injected with viteselen at both 6 a.m. and 3 p.m. in the present study could be attributed to the significant increase of feed consumption which led to increasing the metabolic activity in term of (total lipids , total protein, T3, T4/T3 ratio) of those calves (Table 5). Previous report by (El-Feel *et al*.(1984) indicated that increase feed consumption of buffalo and Friesian calves accompanied with increasing the concentration of total protein , total lipids and cholesterol in serum. In addition, previous report by Baiomy (1999) indicated that increase of feed consumption in dairy buffaloes and cows associated with increase in serum T3 and T4 . Recent report by El-Barody *et al*.(1998) revealed that increasing circulating levels of thyroid hormones (T3 and T4) may stimulate metabolic activity. Such increase in metabolic activity was associated with increased heat increment, as reflected by increased RT and RR.

In conclusion, the results of the present study indicate that stressed calves given vitamin E and selenium injection showed higher growth performance (body gain and feed conversion), possibly due to a favorable metabolic profiles with superior responses in buffalo calves than Friesian ones. Further study is needed with different levels of vitamin E and selenium to determine the suitable requirements in calves.

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الاستجابات الفسيولوجية لعجول الجاموس و الفريزيان للحقن بفيتامين هـ و السيلنيوم تحت ظروف البرد

محمد عبد الفتاح احمد البارودي[1] ، عصام بسيوني سليمان[1] ، زينات بيومي حسن ربيع[2]
قسم الإنتاج الحيواني-كلية الزراعة-جامعة المنيا
معهد بحوث الإنتاج الحيواني-الدقي-الجيزة

استخدمت في هذه الدراسة عدد 24 من العجول (الذكور والإناث) المفطومة (12 عجل جاموسي؛ 12 عجل فريزيان) وكان متوسط وزن الذكور (6جاموس-6فريزيان) 113.83 ± 2.30؛ 122.83 ± 1.10 كجم وكان متوسط وزن الإناث (6 جاموس-6 فريزيان) 100.0 ± 2.30 ؛ 102.0 ± 1.10 كجم علي التوالي و ذلك في عمر 4 شهور وتم إسكان الحيوانات في أماكن مفتوحة تحت ظروف الشتاء البارد (ديسمبر إلى فبراير 1998) وقد قسمت الحيوانات عشوائيا داخل كل جنس إلى مجموعتين متساويتين كل منها تضم 3 عجول في كل نوع0 المجموعة الأولى في كل جنس داخل كل نوع استخدمت كمجموعة مقارنة بينما المجموعة الثانية من العجول تم حقنها أسبوعيا بالعضل بمعدل (5 مل/راس) من الفيتيسيلين (كل 1 مل يحتوي علي 150 ملجم فيتامين ه –67و1 ملجم سلينات صوديوم)0 وقد استمر نظام الحقن حتى 90 يوم0وقد سجلت أوزان الجسم للحيوانات وكذلك معدلات الزيادة اليومية والكفاءة التحويلية للغذاء0 كما سجلت قياسات لدرجة حرارة الجسم و معدل التنفس عند الأوقات 6 صباحاو3 بعدالظهر0 تم اخذ عينات من الدم لتحليل مكونات البلازما (جلوكوز-البروتينيات الكلية-الليبيدات الكلية –هرمونات التراي أيود ثيرونين والثيروكسين- والنسبة بينهما-السيلينيوم-فيتامين هـ)0وقد أظهرت النتائج آن عجول الجاموس استجابت للحقن حيث كانت معدلات النمو و استهلاك الغذاء اعلي معنويا من مجموعة الكنترول بينما كانت استجابة عجول الفريزيان غير معنوية0

سجلت ذكور العجول الجاموس والغريزيان معدلات نمووكفاءة تحويل للغذاء اعلي معنويا من الاناث0 سجلت عجول الجاموس التي حقنت زيادة معنوية في تركيز كلا من الليبيدات الكلية و البر وتينات الكلية والتراي ايودوثيرونين وكذلك النسبة بين والتراي ايودوثيرونين والثيروكسين والسلينيوم وفيتامين هـ وذلك بالمقارنة بمجموعة الكنترول بينما لم تختلف هذه المكونات في البلازما معنويا في عجول الفريزيان التي حقنت بالمقارنة بمجموعة الكنترول0سجلت ذكور الجاموس تركيزات عالية معنويا لكل من السيلينيوم و فيتامين هـ و الليبيدات الكلية في بلازما الدم وذلك بالمقارنة بالاناث0 كما سجلت ايضا عجول الجاموس قياسات اعلي معنويا لكل من درجة حرارة الجسم و معدل التنفس وذلك الساعة السادسة صباحاوالثالثة ظهرا مقارنة بالكنترول - بينما كانت الفروق لهذه القياسات غير معنوية بالنسبة لمجموعة الفريزيان مقارنة بالكنترول 0 سجلت الذكور لكلا من العجول الجاموس والفريزيان قياسات اعلي معنويا في درجة حرارة المستقيم و معدلات التنفس مقارنة بالاناث0

نستنتج من هذه الدراسة إن الحقن بالفيتسيلين في العجول حديثة الفطام تحت ظروف البرد يمكن آن تؤدي إلى تحسين صفات النمو و معدلات تحويل الغذاء بما يحافظ علي كفاءة الأنشطة الحيوية مصحوبا بنشاط عالي للغدة الدرقية و زيادة المقاومة لظروف البرد وهذه الاستجابة كانت في عجول الجاموس اعلي معنويا عن العجول الفريزيان وفي الذكور اعلي من الأناث0