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SELENIUM NUTRITION OF SUCKLING BUFFALO CALVES

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SUMMARY

Suckling buffalo calves were assigned at 7 days of age into four groups to receive milk supplemented with no selenium (control), 0.1, 0.2 and 0.3 ppm Se as groups 1, 2, 3 and 4, respectively. The calves were fed on milk at 10% of body weight and a calf starter supplemented with similar amounts of selenium, as milk, was available after 4 weeks of age. The experiment lasted until weaning the calves at 15 weeks of age. Selenium content in the blood of buffalo dams at parturition was 0.09 μg/ml. Se content in colostrum was 0.05 - 0.04 decreased to 0.02 μg/ml in normal milk secreted later. Growth rates of the calves were : 0.54, 0.57, 0.55 and 0.57 kg/day in the four groups, respectively. Se content in the blood of the calves was 0.11, 0.21, 0.22 and 0.22 μg/ml in the experimental groups, respectively. The signs of white muscle disease (WMD) appeared on 5, 1, 2 and 2 calves in the groups as mentioned, respectively. All the cases of WMD, except one in control and one in group 3, responded to injection with Se and vitamin E. There were no significant differences among groups in hemoglobin and hematocrit contents and in red and white blood cell counts or in differential white blood cells percentages. It is concluded that selenium requirements of the suckling buffalo calves appear to be more than 0.3 ppm.

Keywords: Buffalo calves, selenium, suckling, growth

INTRODUCTION

Selenium has long been known for its toxic effects in animals, causing either acute (blind staggers) or chronic toxicity (alkali disease),(Underwood, 1971). Not until 1957 when Schwarz and Foltz have discovered the presence of Se in a compound which they named "factor 3" protecting the rats fed on troula yeast diets from liver necrosis. Soon after, the 'white muscle disease' in sheep and cattle was attributed to Se deficiency (Muth *et al.* 1958 and Hartley and Grant, 1961). In 1973, Rotruck *et al.* discovered that the enzyme glutathione peroxidase contains 4 atoms of Se per mole of enzyme. The enzyme is responsible for conversion of organic peroxidase formed in the body to unharmful alchols. The relationship between Se and vitamin E was focused on as the two nutrients has a synergistic relationship in protection of tissue from peroxide damage. Thus the presence of either nutrients may have sparing action on the other (Hockstra, 1975). The element was implicated in other functions in the body. Thus it was conected with immunity (Larsen, 1993), metabolism of thyroid hormones and other functions (Arthur *et al.* 1988).

The element protects the animals from the white muscle disease (muscular dystrophy). The most affected animals are newborn suckling animals. In its acute form, the animals may born stillbirth or die within days after birth. The involved symptoms in these cases is the stiff or unsteady gait. An arched back and elevation of the scapiolla has occurred in some cases resulting in a characteristic hunched stance and are unwilling to move. Muscular tremors may occur and the affected muscle masses tend to be firmer than normal (Pehrson, 1993).

There were several reasons for the high susceptibility of new born animals to WMD. Among these is low permeability of placenta to passage of vitamin E to the embryo (Njeru *et al.*, 1994), thus the new born animal may have low stores of vitamin E. The milk contains some unsaturated fatty acids which may produce organic peroxidase upon metabolism. The suckling ruminant has no ability to hydrogenate the unsaturated fat as this process is fulfilled by the microorganisms occupying the fully functioning rumen after several weeks from birth.

Most studies on selenium nutrition and deficiency have been concentrated on calves born for cows, with a little studies on buffalo calves. The buffalo calves on the other side suckle milk with higher fat content (7.0 %) in comparison to cow calves drinking milk with lower fat content (3-4%). Thus the intake of unsaturated fats in buffalo calves may be higher than cow calves, which may increase their susceptibility to WMD.

For long time the nutritional requirements of Se has been settled at 0.1 ppm in dry matter (DM) intake, but the FDA (1987) raised the requirement to 0.3 ppm.

The present study aimed at throwing some light on the selenium status of buffalo calves. The effect of graded amounts of Se added to milk was evaluated in terms of performance, blood Se concentrations and blood haematology of the calves.

MATERIALS AND METHODS

This study was conducted at Mahalet Mousa, Animal Experimental Station kafr El-Sheikh, Egypt .

Experimental animals and housing

Fourty male and female buffalo calves with an average body weight at birth of 36.7±1.0 kg were assigned at one week of age to four treatment groups, taking into account the weight and sex of the calf.

The animals were kept in individual concrete pens which were layered with rice straw . The animals were kept all the time in their pens .After 42 days from the start of the experiment the calves were allowed to exercise every other day in yards adjacent to the pens for 4-5 hours/ day .

Feeding system

The calves were left with their dams during the first week of life to receive colostrum freely. After that, the calves were fed individually on milk alone at the rate of 10% of body weight given in two meals for 4 weeks, then the milk allowances were reduced as given in Table 1. The amounts of milk were adjusted at weekly intervals according to the changes in body weights. A calf starter consisting of yellow maize 40, wheat bran 22, linseed meal 20, soybean meal 5, maize glutin 5, molasses 5, calcium carbonate 2, and Nacl 1% was available free choice to the calves from the beginning of 4 *th* week of age. Protein content (CP) of the starter was 17.5%. Also the calves were fed on green clover (*Trifolium alexandrinum*) for a period of 20 days, then it was replaced by its hay which contained 12.3% CP, *ad libitum* from the 4 th week of age.

Selenium treatment

The calves distributed to the 4 groups were assigned to the following Se treatments:

Control group received no added Se in the milk or starter, whereas groups 2, 3 and 4 were supplemented with 0.1, 0.2 and 0.3 mg/kg milk or starter, respectively.

The Se was added as sodium selenite solution 1.095 g $Na_2 SeO_3$ / l bidistilled water equivalent to 0.5 g Se / l.

Measurements

Body weights of the calves were recorded at weekly intervals until finishing the experiment at 15 weeks of age.

Blood samples of the calves were collected from the jugular vein in heparinized tubes at start of the experiment and then at biweekly intervals.

Blood samples were also collected from a group of dams (12 buffaloes) at 0, 2, 4, 8 and 12 weeks after parturition .

Selenium was determined in the blood of calves and dams in addition to hemoglobin, hematocrit, red cell count and white cell count .The different types of leukocytes were also counted

Milk samples were collected at 0, 1, 2 and 7 days and also, at 2, 4, 8 and 12 weeks postpartum and kept frozen until use in Se analysis .

Clinical observations

The calves were observed for health problems including mainly signs of WMD. The signs began with swelling of the muscles in shoulder and rump. The steps of the affected animals became irregular and unsteady. During the subsequent days the animals became unable to stand without assistance. Then the animal remained all the time in recumbency and prostration.

Upon appearance of WMD signs injections of Se and vitamin AD_3 E were given to the affected animals. Additional blood samples were obtained from the affected animals at regular intervals.

Methods of analysis

Selenium in blood, milk and feed was determined by the flourometeric method of Olson *et al.* (1975) with a little modification as the buffer solution (hydroxyl amine-EDTA) of the A.O.A.C (1980) was used. The flouroscence was measured using a flourospectrophotometer model ANA-40, Tokyo photoelectric Co., LTD, Japan.

Red and white cell counts were done using bright-line hemocytometer according to Dacie and Lewis (1984). Differential leukocyte count was performed on blood films as described by Dacie and Lewis (1984).

Hemoglobin was determined by the method of Van Kampen and Zijlstra (1961) using a kit produced by Randox laboratories LTD. Also hematocrit was determined by micro method technique of International Committee for Standardization in Hematology (1980).

Statistical analysis

The data collected were statistically analyzed following the standard statistical methods of analysis of variance. The differences among treatment means were tested by Steel and Torrie (1980).MSTAT package and SPSS were utilized for performing the statistical analysis.

RESULTS AND DISCUSSION

Selenium content in the feedstuffs

During the experimental period the buffalo dams were fed on concentrate feed mixture (CFM) and rice straw (RS) . Se content of the CFM was 0.068 ppm.This figure was much lower than 0.3 ppm recommended for the dairy cows (Smith and Conrad, 1987; Stowe *et al.,* 1988 and Podoll *et al.,*1992). The selenium concentrations did not reach the 0.1 ppm which is considered to be sufficient by the ARC (1979) and is less than one third the level permitted for supplementation to animal feeds by FDA (1987) being 0.3 ppm Se. The content of Se in calf starter was 0.095 ± 0.004 ppm . The Se content of berseem was 0.065 ppm, this level is similar to the level found by El-Ayouty *et al.* (1992) in Kafer El-Shikh region. El-Aawag (1989) determined Se content in berseem in Kafer El-Sheikh governorate and it was found to be 0.072 in one region and 0.078 ppm in another region. The content of Se in clover hay was 0.049 ± 0.002 ppm a level lower than clover.

Table 1. The suckling system of calves until weaning.

Weeks	Amount of milk, % of body weight	
	a.m.	p.m.
1	Colostrum	
2-4	5	5
5-6	4	4
7	3	3
8-9	2	2
10	4	-
11-12	3	-
13-14	2	-
15	1	-
16	Weaning	

Selenium content in milk and blood of buffalo dams:

Se content in colostrum and in natural buffalo milk is given in Table (2). It is apparent that colostrum content was 0.04-0.05 ppm Se, a level higher than the level in normal milk secreted later (0.02 ppm). The concentration of Se in colostrum fall in the ranges reported by Koller *et al.* (1984). Se levels in milk fall in the ranges by Conrad and Moxon, (1979) being 0.01 to 0.0037 µg/ml for cows consuming deficient to high Se diets. Se levels in milk in this study are similar to those found by Maus (1977) which were 0.026 µg/ml for cows receiving 0.15 ppm Se in DM and also with Perry *et al.* (1977) being 0.007 to 0.33 ppm. Maus *et al.* (1980) reported milk Se levels arround 0.05µg/ml for cows receiving from 0.2 to 0.7 ppm in DM, with little difference due to the level of supplied Se. The levels of Se in milk of beef cows supplied with 0.1 or 0.2 ppm Se were lower than the levels found herein since it was from 0.009 to 0.016 µg/ml (Ammerman *et al.*, 1980)

Whole blood Se content determined at different times after calving is presented in Table (2). The Se in blood of buffalo dams was nearly stable and it was lower than the level considered to be sufficient (0.1 µg/ml, The Scottish Agricultural Colleges and Scottish agricultural Research Institutes ,1982).

Body weight gain

Body weights of the calves at the start and the end of experiment and total weight gains and daily weight gains are presented in Table (3). The total weight gains of the calves were 53.1, 55.5, 53.2 and 56.3 kg for control and the groups given 0.1 ,0.2 and 0.3 ppm Se, respectively with no significant differences among groups. The corresponding daily weight gain were 0.543, 0.566, 0.554 and 0.573 kg/day, respectively without any significant difference among groups. These results are in agreement with many authors regarding the effect of Se on growth of sheep and cattle.

Table 2. Blood and milk selenium concentrations (µg/ml) and standard deviation (SD) for buffalo dams at parturaion and postpartum period.

Period	Blood selenium concentration (µg/ml) ± SD	Milk selenium concentration (µg/ml) ± SD
Calving day	0.09 ± 0.022	0.05 ± 0.022
2 nd day		0.04 ± 0.023
3 rd day		0.03 ± 0.003
7 th day after calving		0.02 ± 0.005
Post partum period		
2 weeks	0.09 ± 0.021	0.02 ± 0.008
4 weeks	0.08 ± 0.029	0.02 ± 0.006
8 weeks	0.09 ± 0.0027	0.03 ± 0.005
12 weeks	0.11 ± 0.017	0.02 ± 0.005

Weiss *et al.* (1983) found that injection of the weaned calves with 0.078 µg Se plus 5.4 IU vitamin E/kg body weight (B.W) at 14 days of age or at 14 and 28 days of age did not reduce incidence of diarrhea or respiratory disorders or weight gains.

Kincaid and Hodgson (1989) found that growth rate of suckling calves was not altered by injection of 0.082 mg Se/kg B.W. at birth and it was 1.26 kg/day with the control and treated calves. On the other side, Ammerman *et al.* (1980) found that Se supplementation to the pregnant cows during the dry period increased weaning weight of the calves. Spears *et al.*(1986) also found that Se injection of beef cows fed year-round on feedstuffs marginally deficient in Se (0.03-0.05 mg/kg) at 2 months intervals and injection of the calves increased the weaning weight of their calves. With older calves Se supplementation to deficient diets had no effect on growth rates (Siddons and Mills, 1981 and Arthur and Boyne, 1983).

Droke and Loerch (1989) found that Se and Vitamin E injection during the 1st period in the feedlot had no effect on growth rate and feed efficiency. However, Smith *et al.* (1984) found that injection of 15 mg Se every 28 days increased growth rate of steers fed on tall fescue pastures during 84 days period.

El-Ayouty *et al.* (1991) found that the growth rate of calves given monthly 5 mg Se injection was 80.5 kg whereas with controls, receiving no Se it was 74.6 kg in six months experiment. Also, Maas *et al.* (1993) found that Se injection increased the weight gain in 84 days from 53.1 to 63.0 ($P<0.39$).

Selenium levels in blood of calves:

Selenium levels in blood of the calves during the experiment are shown in Figure(1). The average Se level in the control group was 0.11 µg/ml raised to 0.21, 0.22 and 0.22 µg/ml in the groups which received 0.1, 0.2 and 0.3 ppm Se, respectively. The difference between the control and each of supplemented groups was significant. On the other side, there were no significant differences among the supplemented groups. The average Se level in males and females were 0.189 and 0.190 µg/ml, respectively with no significant difference between them. There were significant differences among the average Se level at different times of the experiment. Se level in the control group showed an increase at third week then it decreased gradually until the end of experiment. On the other side, the Se levels in the supplemented groups showed a decrease at third week then it increased in all groups to reach the maximum levels at the last sampling time.

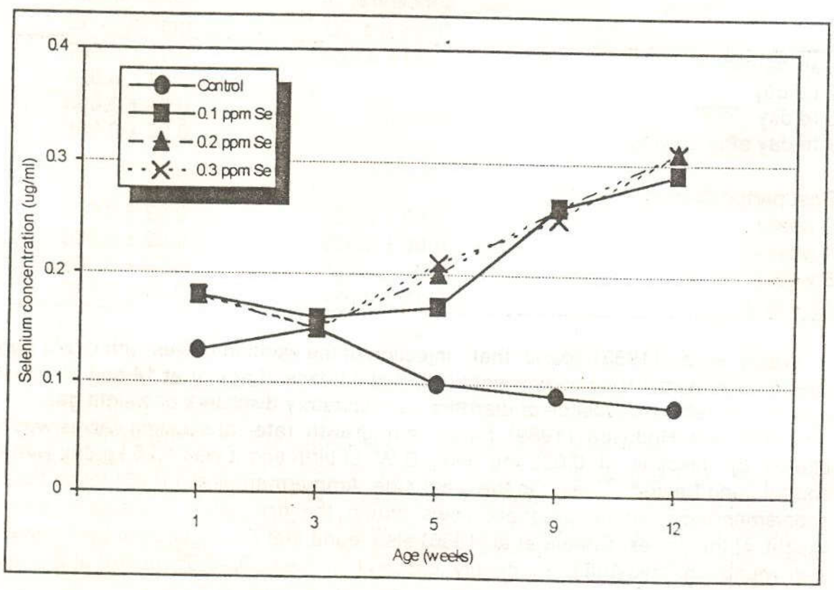

Figure 1. Selenium concentrations in blood of calves in the different experimental periods.

Table 3. Starting, weaning weight, total gain and daily gain (kg) for buffalo calves as affected by selenium levels.

Items	Se treatmens				SE
	Control	0.1 ppm	0.2 ppm	0.3 pppm	
Starting weight, kg	40.4	40.9	41.1	39.9	1.06
Weaning weight, kg	93.5	96.4	94.3	96.2	2.13
Total weight gain, kg	53.1	55.5	53.2	56.3	1.70
Daily weight gain, kg	0.543	0.566	0.554	0.579	0.03

It is noteworthy that average Se level is above the level considered by The Scottish Agricultural Colleges and Scottish Agricultural Research Institutes, (1982) which is 0.1 μg/ml. However, the Se level in the control group at the last two sampling times was lower than 0.1 μg/ml.

The results of this experiment concerning the decrease in blood Se concentrations in the control group as the calves got older agree with the results of Weiss *et al.* (1983) who found that serum Se declined linearly from 24 to 18.8 ppb from birth to day 56 of age. Also, Kincaid and Hodgson unpuplished results, C.F. Kincaid and Hodgson, (1989) found that unsupplemented calves with whole blood Se of 0.1 ppm at birth declined to 0.06 ppm at third week of age. The reasons for this decline in Se in blood with age might be that the calves have increased demand for Se to enter in glutathione peroxidase during erythrobiosis at the same time the Se intake of calves from milk is limited.

The absence of significant differences in blood Se levels among the calves supplemented with increasing levels of Se may reflect the limited increase in Se intake of the calves. This is in accordance with the findings of Jenkins and Hidirglou (1986) who reported blood Se levels of 0.075 and 0.100 μg/ml in suckling calves given 0.2 and 1.0 ppm in DM of the milk replacer (equivalent to 0.1 and 0.5 ppm in liquid diet). In the groups supplemented with 3, 5 and 10 ppm in the DM of the replacer blood Se levels of 0.19, 0.26 and 0.24 ppm were noted.

Kincaid *et al.* (1977) observed that addition of 0.1 ppm to the diet of calves (120 days old) which originally contained 0.3 ppm did not elevate Se in blood (0.11 ppm in either cases).

Blood Se levels in calves, born to dams supplemented with mineral mixture containing 20 ppm Se, were not affected by injection of 0.0825 mg Se/ kg body weight at birth until week 10 of age (Weiss *et al.,* 1984).

Also, with cows in mid-lactation Maus *et al.* (1980) supplemented the diet with 0.1, 0.2 and 0.5 mg Se/ kg dry matter (total Se in the diet was 0.334, 0.385 and .972 ppm). There were no significant differences among the treatments in plasma Se level after 7 or 13 weeks of supplementation. However, many authors found that Se in blood or blood plasma levels increases with the increase of supplementation in the diet (Moksones and Norheim, 1983) or with increase of the number of injection of suckling cows (Weiss *et al.* , 1983 and Weiss *et al.* 1984).

Health problems

A close supervision of the health of animals was done. Symptoms characteristic of WMD had appeared on a number of calves in all groups. Table (4) shows the number of animals affected with WMD and the response to Se and vitamin AD_3E injections. Most of the cases of WMD appeared after allowing the calves to excersise. The highest number of WMD appeared in the control group (5 cases). Selenium level in the affected animals in the control group was less than 0.1 ppm (0.065μg/ml). The number of WMD cases appeared in the Se supplemented groups with 0.1, 0.2 and 0.3 ppm Se were 1, 2 and 2, respectively. Selenium levels in the blood of the animals affected with WMD in the treated groups were more than 0.1 ppm. The symptoms of WMD are manifested in swelling in the muscles of the shoulder and rump, listlessness stiffness, inability to stand without assistance, unsteady gait and lameness . With the advancement of the symptoms the animal remained in a recumbencey and prostration state. In some cases the symptoms were proceeded or accompanied by diarrhea and elevated temperature. Labored breath and pain were also observed in some cases.

On the first signs of WMD the effected animals were injected with the Se solution and also with vitamin AD_3E. All the cases of WMD recovered except one in the control and one in the group given 0.2 ppm Se which did not respond to treatment. The appearance of WMD cases in the Se supplemented groups even in the group supplemented with 0.3 ppm Se is surprising. However, Whanger *et al.* (1977a) reported the appearance of WMD in lambs born for ewes fed purified diets and injected with Se or/and vitamin E. The WMD also appeared in the lambs given Se or/and vitamin E. Whanger *et al.* (1977a) concluded that vitamin E is more effective in the prevention of WMD than Se. In another work by Whanger *et al.* (1977b), the percent incidence of WMD in the lambs born for ewes fed deficient diet (0.03ppm Se) was 56 and in ewes fed adequate diets (0.1 ppm Se)
was 44%. Blood selenium in the lambs with WMD was 0.02 ppm in lambs born for ewes fed the deficient diets and 0.15 ppm in those born for ewes fed the adequate diet. This result led Whanger *et al.* (1977b) to raise questions concerning the essential relationship of Se to WMD.

The results of Whanger *et al.* (1977a,b) made them postulate that the role of vitamin E in the prevention of formation of organic peroxidase is more important than destruction of formed peroxidase by the Se containing enzyme "glutathione peroxidase" in regard to the protection from WMD. It appears that suckling buffalo calves are more susceptible to WMD than cow calves as Siddons and Mills, (1981) found that feeding suckling Friesian calves on a diet deficient in both Se and vitamin E did not result in clinical, sub clinical or histological symptoms of WMD.

Table 4. Number of calves affected with white muscle disease, duration and response to selenium and vitamin E injection.

Items	Se treatmens			
	Control	0.1 ppm	0.2 ppm	0.3 pppm
No. of animals	10	10	10	10
Clinical cases with WMD	5	1	2	2
Duration of the disease for the recovered animals (day).	12.5	3	9	5
Recovered cases No.	4	1	1	2

Blood hematology

Table 5 presents the effects of Se treatment, sex of calves and age in weeks on red blood cell-count (RBCs), white blood cell-count (WBCs), hemoglobin concentration (Hb)and hematocrit values (HT). Se treatment had no significant effect on RBCs, WBCs, Hb or HT. Females tended to show higher RBCs than males. Regarding the effect of sex on Hb and HT it was found that females had higher Hb (13.2 against 12.0 g/dl, P= 0.000) and HT (40.9 against 39.8 %, P=0.016)

The results are in agreement with those of Siddons and Mills (1981) who did not find any effect for Se on RBCs count and HT values of calves. Also Oh *et al.* (1976) found no differences in Hb or HT between lambs fed Se deficient diets or diets supplemented with 0.05, 0.1 or 0.5 ppm Se. RBCs was found to decrease at 3 weeks of age then it increased gradually up to the weaning time. Hb and HT values decreased from 1 to 4 weeks of age and then increased gradually to the time of weaning. Norton and McCarthy (1986) found that HT values decreased in lambs from 1 to 18 days of age and then increased to reach adult levels at 56 days of age . On the other hand , RBCs decreased from $9.11x10^{12}$/l at 4 weeks of age to $7.95x10^{12}$/l at 12 weeks thereafter remained relatively constant. A similar trend in Hb was noted decreasing from 139.0 g/l at fourth week to 108.0 g/l at twelfth week of age and then remainded relatively stable (Siddons and Mills , 1981)

Table 5. Effect of selenium treatments, sex and postpartum period (week) on red blood cells (RBCs) counts, white blood cells (WBCs) count, blood hemoglobin concentration and hematocrit values of buffalo calves.

Items	RBCs (mil/mm3)	WBCs (thou/mm3)	Hb (g/d1)	HT (%)
Selenium Treatment:				
Control	8.39	12.00	12.45	39.9
0.1 ppm	8.70	12.03	12.68	40.7
0.2 ppm	8.55	11.06	12.75	42.1
0.3 ppm	8.32	11.22	12.65	41.0
SE	0.18	0.38	0.27	1.0
Sex of calf:				
Male	8.36	11.63	12.00**	39.8*
Female	8.62	11.54	13.20	40.9
SE	0.12	0.27	0.19	0.69
Age (weeks):				
1	8.30^{bc}	10.04^{b}	13.52^{ab}	40.4^{bcd}
3	7.60^{c}	11.87^{a}	12.38^{bc}	38.4^{de}
5	7.71^{c}	10.93^{ab}	11.22^{d}	35.4^{e}
7	8.54^{b}	11.70^{a}	11.74^{cd}	39.7^{cd}
9	8.67^{ab}	11.76^{a}	12.42^{bc}	40.6^{bcd}
1	8.74^{ab}	11.94^{a}	1.68^{bcd}	$44.^{a}$
13	8.97^{ab}	12.27^{a}	13.37^{ab}	44.4^{ab}
15	9.39^{a}	12.17^{a}	13.76^{a}	43.7^{abc}
SE	0.25	0.53	0.39	1.37

a, b, c, d values in the same column under "age weeks" bearing different letters are significantly different at (P<0.05). *Significant at (P<0.05)

Differential WBCs percentages are illustrated in Table (6). Se treatment did not affect the percentages of lymphocytes, monocytes, neutrophil. The percentage of eosenophil was decreased in the Se supplemented groups. Sex of calf had no significant effects on differential WBCs. Lymphocytes increased as the calves advanced in age up to 11 weeks of age then remained nearly stable. On the other hand, neutrophyl percentage decreased by the advancement of age up to the 9th of age. Eosenophil decreased from an initial value of 2.53 at 1st week of age to 0.29 % at weaning.

Table 6. Effect of selenium treatment, sex of calf and age weeks on differential white blood cells percentages of buffalo calves.

Items	Lymphocyt %	Monocyt %	Neutrophil %	Basophil %	Eosenophil %
Selenium treatment:					
control	63.93	3.16	30.81	0.05^{b}	2.11
0.1 ppm	64.96	3.40	30.00	0.06^{ab}	1.45
0.2 ppm	65.03	3.19	30.34	0.01^{b}	1.44
0.3 ppm	64.43	3.23	30.46	0.15^{a}	1.75
SE	1.34	0.31	0.90	0.034	0.21
Sex of calf:					
Male	64.62	3.05	30.43	0.06	1.76
Female	64.55	3.44	30.38	0.08	1.61
SE	0.095	0.22	1.80	0.024	0.15
Age weeks:					
1	57.28^{d}	3.00	37.05^{c}	0.15^{cd}	2.53^{c}
3	1.48^{cd}	2.78	32.95^{cd}	0.23^{c}	2.13^{cd}
5	65.33^{c}	3.00	29.43^{d}	0.08^{d}	2.18^{cd}
7	65.60^{c}	3.85	28.68^{d}	0.03^{d}	1.93^{cd}
9	66.08^{c}	8.30	28.43^{d}	0.05^{d}	1.65^{cde}
11	67.10^{c}	2.48	29.13^{d}	0.00^{d}	1.33^{de}
13	66.68^{c}	3.70	28.90^{d}	0.03^{d}	1.00^{e}
15	67.15^{c}	3.35	28.68^{d}	0.00^{d}	0.78^{e}
SE	1.89	0.44	1.80	0.048	0.29

a, b values in the same column under"selenium treatment" are significantly different at ($P<0.05$). c, d, e values in the same column under "age weeks" bearing different letters are different at ($P<0.01$).

CONCLUSIONS

From the results of this experiment it is concluded that Se concentration up to 0.3 ppm in milk is not sufficient to prevent the appearance of white muscle disease in buffalo calves. Further studies are needed taking into account beside Se vitamin E nutrition and monitoring the enzymes indicating Se status (glutathione peroxidase) and the enzymes connected with muscle integrity including mainly creatine phospho kinase (CPK).

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التغذية على السيلينيوم فى عجول الجاموس الرضيعة

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وزعت عجول جاموس رضيعة عند عمر ٧ أيام على أربعة مجاميع تجريبية أعطيت : اللبن بدون إضافة عنصر السيلينيوم أو اللبن المضاف إليه ٠,١، ٠,٢، ٠,٣ جزء فى المليون على الترتيب وكانت العجول تغذى على اللبن بمعدل ١٠٪ من الوزن ثم قدمت علف بادىء عجول مضاف إليه عنصر السيلينيوم بنفس معدلات اللبن وذلك بعد عمر أربع أسابيع بالإضافة إلى البرسيم الأخضر أو دريسه . وقد أستمرت التجربة حتى الفطام على عمر ١٥ أسبوع وقد أوضحت النتائج: أن مستوى السيلينيوم فى دم أمهات الجاموس عند الولادة ٠,٠٩ ميكروجرام/مل . وكان مستوى السيلينيوم فى السرسوب ٠,٠٥ - ٠,٠٤ إنخفض إلى ٠,٠٢ ميكروجرام/مل فى اللبن الطبيعى المفرز بعد ذلك.

كانت معدلات النمو فى العجول٠,٥٤ ، ٠,٥٧، ٠,٥٥، ٠,٥٧ كجم /اليوم وذلك للمجاميع الأربع على التوالى. أما عن مستوى السلينيوم فى دم العجول ٠,١١، ٠,٢١، ٠,٢٢، ٠,٢٢ ميكوجرام/مل فى المجاميع الأربع على التوالى . وقد ظهرت علامات مرض العضلة البيضاء على ٥، ١، ٢، ٢ حيوان فى المجاميع المذكورة على التوالى. وقد أستجابت جميع الحالات المرضية بالحقن بالسيلينيوم وفيتامين هـ حيث شفيت من أعراض المرض بإستثناء حالة واحدة فى مجموعة المقارنة وحالة فى المجموعة المعطاة ٠,٢ جزء فى المليون سيلينيوم.

لم توجد إختلافات معنوية بين المجاميع فى تركيز الهيموجلوبين أو قيم الهيماتوكريت وكذلك فى عدد كريات الدم الحمراء أو البيضاء أو فى العدد النسبى لأنواع كريات الدم البيضاء.

وقد أستنتج من البحث أن إحتياجات العجول الجاموسى الرضيعة من عنصرالسيلينيوم قد تكون أعلى من ٠,٣ جزء فى المليون.