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Effect of supplemental vitamin C and E on the immune response of newborn calves

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ABSTRACT

An experiment was conducted to investigate the influence of vitamin C and E blood metabolites and performance of calves from one day old up to 42 days of ages. In this trial 24 one day old calves were randomly allocated to 6 experimental groups (4 calves per each treatment). Experimental group were 1.control (no supplemented vitamin), 2. Vitamin C (3g/day), 3. Supplemented vitamin C with following order (first and second weeks of age (3g/day), third and fourth weeks of ages (2g/day), fifth and six week of ages (1g/day)), 4. Combination of vitamin E (1g/day) and vitamin C (2g/day), 5. Supplemented with vitamin E (2g/day), 6. Supplemented vitamin E with following order (first and second weeks of ages (0.6g/day), third and fourth weeks of ages (0.9 g/day) and finally (1.2 g/day during fifth and six week of ages. Blood samples were taken from jugulars vein of each animal at the 3, 14, 28 and 42 day of ages. Serum was assayed for total protein, glucose, PCV, hemoglobin, the lymphocyte to neutrophil ratio, ratio of albumin to globulin and Gama globulin. The Gama globulin concentration 28 and 42 days of ages of calves, among of treatment were statistically significant ($p<0.05$). The calves that were fed with treatment 3 had higher gamaglobulin than the other groups. The ratio of albumin to globulin at 28 days of ages was significantly different among groups($p<0.05$), by consideration of that calves given vitamin supplements in group 5,3,2 the ratio of albumin to globulin were higher than other treatment. However there were no significant differences between these three groups ($p>0.05$). Total serum protein, albumin, glucose, hemoglobin concentration, PCV and the ratio of lymphocyte to neutrophil did not an affect by treatment ($p>0.05$). Dietary contained vitamin supplement had statistically significant effect on daily weight again ($p<0.01$). Animal which treated by vitamins had shown higher growth rate than other group

Keywords: *Calves, Vitamin C, Vitamin E and immune response.*

INTRODUCTION

High mortality in new born calves is the most important problem. Hence the relation between animal nutrition at an early age and health of immune system is considered by many researches. (beser and gray, 1994; rajorman , 1997; uruakpa, 2002).

Vitamin E and C may influence the immune responses of several animal species (chew and park, 2004). Dairy calves apparently do not produce endogenous vitamin C until 4 month of ages and thus rely on the relatively low concentration of vitamin C in milk (LeBlanc , 2002). Vitamin C supplementation has been reported (cumminis, 1989) to have no beneficial effect on the immune functions of calves but cumminis and burnar (1991) reported that supplementation with vitamin C enhanced resistance to infection. Also calves with enteric infection had lower concentration of ascorbic acid in plasma than did healthy calves (heming, 1991). And possible immune stimulatory effect of vitamin C was reported for calves deprived of colostrum

(Blaire and cummins, 1984). The stress associated with confinement calf housing decreases immune response to a specific antigen and decreases concentration of ascorbate in plasma (cumminis and burnar, 1991). Reddy , (1986) reported no significant differences in the concentration of IgG1 and IgG2, but IgM was significantly higher in calves supplemented with vitamin E tended to be higher than in control calves. Vitamin E is one of the antioxidant that protect cell membrane from oxidation and free radicals and these vitamin cannot synthesis during the early of life and should be supply by diets (LeBlanc and , 2002). The objective of this study was the evaluation effect of vitamin C and E on calves performance and immunity system.

MATERIALS AND METHODS

Twenty four one day- old Holstein calves (45kg) were used in this study. Calves were blocked by weight and assigned into six treatments. All the calves received whole milk up to 10% bw/d and access to starter adlibitum (table 1). Calves were fed milk up to 42 day which supplemented by vitamins as follow.

Group 1. Control (no supplemented)
Group 2. Supplemented with vitamin C (3g/day)
Group 3. Supplemented with vitamin C with following order, first and second weeks of age (3g/day), third and fourth weeks of ages (2g/day), fifth and six week of ages (1g/day).
Group 4. Combination of vitamin E (1g/day) and vitamin C (2g/day)
Group 5. Supplemented with vitamin E (2g/day)
Group 6. Supplemented vitamin E with following order (first and second weeks of ages (0.6g/day), third and fourth weeks of ages (0.9 g/day) and finally (1.2 g/day during fifth and six week of ages.

Table 1. Composition of calf starter diet

Diet composition	Ingredient (%)
grain	32
Soybean meal	20
corn	30
bran	16
Supplement vitamin	1
salt	0.5
Bicarbonate	0.5

Feed intake and body weight were recorded weekly. Sequential blood samples were taken from jugular vein of each animal at 3, 14, 28 and 42 days of ages. Serum was harvested from whole blood by centrifuge and then was assayed for total protein, gamma globulin and albumin, glucose, PCV, lymphocyte and neutrophil were accounted. Data were subjected to analysis using GLM procedure (statistical analysis system, SAS).

RESULTS AND DISCUSSION

Calves' health and diseases were control every day. Diarrhea occurred with two different Severity in calves. Mild diarrhea: in this case the body temperature is normal or was slightly higher than normal. They do not need antibiotics for treatment. Severe diarrhea: In this case the temperature had been rises. They need antibiotics for treatment.

The data of Disease observed in the calf supplemented vitamin are presented in table 2. One case of infectious pneumonia and one case of diarrhea with infection was observed in the control group. Three calves including Nasal and eye allergy. There were one cases of diarrhea and one cases of eye allergy in group 2. There was one cases of eye allergy in group 3. There was not any case of disease in group 4. All calves of group 5 showed diarrhea, but in group 6 one case of mild diarrhea was observed.

Table 2. Disease observed in the calf supplemented vitamin

treatment	Mild diarrhea	severe diarrhea	pneumonia	Umbilical cord infection	allergy of eye and nasal
Group 1	-	*	*	*	***
Group 2	*	-	-	-	*
Group 3	-	-	-	-	*
Group 4	-	-	-	-	-
Group 5	******	-	-	-	-
Group 6	*	-	-	-	-

The number of stars in each row indicates the number of calves' diseases. According to result, there was not any case of disease in group 4. These results were similar to those reported by Echerperiot (1992) and heidaroghli (1995). These indicate that vitamin E with vitamin C makes a positive effect on the response of the immune system.

Vitamin C compared with control group had prevented from the diarrhea and nasal and eye discharge. These results were similar to those reported by ciprriano , (1982)and hemingoi,(1991).

There was mild diarrhea that fed with the vitamin E 1.2G these result has shown the mild toxicity of using this amount of vitamin E. These results have not been reported in previous studies. However the vitamin level used in the previous experiment was less than the concentration used in these experiments.

There was only one case of mild diarrhea .the results indicating that vitamin E improving immune system. That was similar to those reported by redy , (1985).

Least square means and standard errors for BW gain are plotted in table 2. The resulting data showed effect of treatment, parity calf and interaction between treatment and gender in BW gain was significant ($p<0.05$). The BW gain in the calves supplemented with vitamin C and vitamin E was significantly higher than other group.

Table 3. Least square means and standard errors for BW gain

treatment	least square means(g/day)	Standard error
Group 1	206.7^{b}	21.8
Group 2	185.4^{bc}	18.6
Group 3	225.4^{ab}	19
Group 4	284^{a}	22.7
Group 5	136.7^{c}	21.6
Group 6	128.2^{c}	19.1

Least squares means with different letters are significantly different ($P< 0.05$).

The BW gain in the calves supplemented with vitamin C was significantly lower than other group but it was higher than other group. The BW gain in the calves supplemented with vitamin E (group 5 and 6) was significantly lower than other group. These indicate that vitamin E cannot make positive effect on BW gain. But BW gain in control group was higher than group of vitamin E and group of vitamin C. these result can be because of stress of consuming of vitamin. The calves supplemented with 3 g/day of vitamin C were lower than control group. Addition of vitamin C cannot make positive effect on BW gain.

These result of BW gain had shown that effect of parity calf on BW gain was significant ($p<0.05$). The calves those born from third to fifth parity, their BW gain were more favorable. Because calves under 3 parities are growing and they consume more nutrition for their growing. These results were different from those reported by heidaroghli , (1995).

Least square means for gamaglubulin, rate of albumin to globulin are presented in table 4. Effect of parity on gamaglubulin was not significant. But treatment effect was significant for calves that were 28, 42 days old age. Concentration of gamaglubulin in group 3 was significantly higher than other group ($p<0.05$). These result show that vitamin C had positive effect on gamaglubulin. Vitamins improve immune system.

These results were similar to those reported by lotfollahzade,(1999); Liblanse ,(2002) reported that vitamin C has positive effect on immune system. However concentration of gamaglubulin in control group was higher than other group, But it was not significant ($p>0.05$).

Table 4. Least square means of gamaglubulin, ratio of albumin to globulin

treatment	Gamaglubulin(mg/ml)	A/G
Group 1	1.21±0.096	0.74±0.044
Group 2	1.23±0.097	0.83±0.038
Group 3	1.55±0.095	0.91±0.038
Group 4	1.00±0.095	0.92±0.046
Group 5	1.027±0.096	0.87±0.044
Group 6	1.00±0.097	1.00±0.039

Ratio of A/G in all groups was higher than control group. The result obtained from this study indicate that increase in gamma globulin concentration in calves fed weekly supplemented vitamin C was associated with synthesis of antibodies. Decreasing of

albumin concentration related to starvation, malnutrition of protein, liver dysfunction and infectious disease. Concentration of A/G in calves supplemented with vitamin C+E and vitamin E following was higher than other group.

Concentration of gamaglubulin in calves supplemented with vitamin E following was less than other group. Concentration of albumin in calves supplemented with vitamin E following was higher than other group. These results were similar to those reported by chew and bark, (2004) and sigel , (1997).

Least square means for plasma total protein, glucose, PVC in calves fed with different protein supplemented are presented in table 5.

There were not significant among groups in total protein. Concentration of plasma total protein in early life to passive transfer of iminoglubin and hormone balance is related.(speer, 2000). These results were similar to those reported by blum and hamon,(1999).

Effect of treatment on concentration of glucose was not significant. Concentration of glucose with aging is decreased, because calved in early life by glucose of milk and Colostrum are fed.

Ratio of lymphocytes to neutrophil only in day 42 was significant. Ratio of lymphocytes to neutrophil in day 42 in Male calves was higher than Heifer. Due to the increase of lymphocytes in the first two weeks of life, it can be concluded that consuming of vitamin E and vitamin C in beef has created a good defensive barrier. These results were similar to another reported (ciprriano , 1982; corwin and brunner, 1991; hidiroglou, 1995). Effect of treatment on PVC was not significant.

Table 5. Least square means of plasma total protein, glucose, PVC in calves fed with different protein supplemented

parameter	Day after birth	Group 1	Group 2	Group 3	Group 4	Group5	Group 6
	3	7.08	4.95	6.3	6.45	6.91	6.45
	14	5.92	5.85	6.35	5.81	5.73	5.61
total protein(gr/dl)	28	63.06	5.82	6.43	5.92	5.92	6.15
	42	6.12	6.35	6.66	5.59	5.65	5.71
	3	63.7	69.75	69.25	58.25	56.75	66.50
Glucose(mg/dl)	14	61.75	65.5	63.25	55.75	54.25	56.50
	28	43.75	47.75	55.75	58.00	54.5	61.75
	42	69.75	49.00	49.50	50.00	59	50.75
	3	1.43	1.89	1.89	1.75	1.99	1.58
Lymphocyte/neutrophil	14	1.96	1.99	1.94	2.09	1.98	2.154
	28	1.97	1.92	1.87	1.91	1.4	1.88
	42	1.78	1.97	1.86	2	2.23	1.78
	3	34.5	36.75	36.00	36.00	36.25	39.25
PVC (%)	14	36.25	36.25	36.00	38.75	37.00	42.50
	28	34.75	36.5	34.50	38.00	35.50	38.75
	42	35.25	34.5	37.00	35.00	34.25	39.75

CONCLUSION

This study indicated that combination of vitamin C and E improve the immune response in Suckling calves. It is suggested that these vitamins to be use in calves farm for preventing from occurring of some disease.

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