Vol 15 No 2, p 191-193

EFFECT OF ASCORBIC ACID IN COLOSTRUM-DEPRIVED NEONATAL CAMELS

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ABSTRACT

Deprivation of colostrum in calves results in increased leukocytes, neutrophils and cortisol, but decreased eosinophils, serum ascorbate and lysosomal enzyme activity. Subcutaneous administration of ascorbic acid at a dose of 10 mg/kg body weight daily to colostrum-deprived calves increased serum ascorbate and lysosomal activity but had no effects on other parameters.

Key words: Ascorbic acid, camel calves, colostrums, immunostimulant, lysosomes

The camel calf is born almost devoid of serum immunoglobulins and depends on colostrum for virtually all of its humoral passive immunity (Ghazi *et al,* 1994). Failure to achieve adequate transfer of passive immunoglobulin has been associated with increased risk of diarrhoea, respiratory affections and motility of neonates (McGuririe *et al,* 1975; Rea *et al,* 1991).

An important vitamin found in colostrum is ascorbic acid which is known to enhance immunity in neonates (Thomas and Holat, 1978; Dallegri *et al,* 1980). This study was carried out to investigate the effects of administration of ascorbic acid on some immune parameters of colostrum deprived camel calves.

Materials and Methods

Animals and treatments: Camel neonates were removed from their dams immediately after birth to prevent suckling and ingestion of colostrum. Four groups of 9 animals each were used. Calves of group 1 were left to suckle their dams (controls) and those of group 2 were deprived of colostrum but supplemented with 500 ml camel milk given orally at 2 h interval from 2 to 20 h after parturition (Total of 5 l/day) alongwith ascorbic acid 10 mg/kg subcutaneously. Group 3 calves were also deprived of colostrum and given camel milk as in group 2. Calves of group 4 were colostrum deprived and injected with saline. These treatments continued for 10 consecutive days.

Sample collection: Blood samples were collected at day 10 of age into heparinised tubes for haematology or plain tubes for serum which was separated and stored at 20°C until analysis. White blood cell count was determined by a Counter Model 2B1 Counter (Counter Electrics , Hialeah , FL, USA). The differential leukocyte counts were carried out using blood smears stained with Giemsa and May-Grunald solutions. Serum lysosome concentrations were measured using Micrococcus lysodieticus a substrate (lysosome reagent kit, Warthington Biochemicals, Co. Freehold, NN, USA) as per manufacturers recommendations (Al-Ankari and Homeida, 1996). The percentage change in transmission at 510 nm per minute were recorded in spectrophotometer (Hatachi, Japan). Serum cortisol was estimated with solid phase radioimmunoassay (Ekpe and Christopherson, 2000) using specific kit (Tkco5, Coat-a-Count, Diagnostic Products Corporation, Lost Angoles, CA, USA). The intra-assay coefficient of variation were 5.4±0.1% and sensitivity was 0.20 µg/dl. Serum ascorbate was determimed by the method of Okamura (1980). Standard curves for ascorbate were linear over the range of 0 to 10 mg/dl. Recovery of added ascorbic acid was 98%. Data obtained was analysed statistically using the student t-test.

Results

Results are summarised in table 1. Significantly increased leukocyte, neutrophils and decreased eosinophils counts were found in all colostrum deprived groups when compared with controls (Group 1). Cortisol levels were increased in all colostrum deprived groups when compared with controls. Administration of ascorbic acid significantly increased serum ascorbate in group 2 calves.

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Table 1. Effects of colostrum deprivation and administration of ascorbic acid on leukocyte counts, serum ascorbate and lysosomal enzymes in camel calves at 10 days of age.

Variable	Group 1 (N=9) Colostrum fed calves (controls)	Group 2 (N=9) Colostrum deprived–calves and treated with ascorbic acids	Group 3 (N=9) Colostrum deprived calves	Group 4 (N=6) Colostrum-deprived and injected with saline
Leukocytes $x10^9/l$	13,200±1,100	19,400±1600*	19,200±1500*	19,100±1400*
Neutrophils $x10^9/l$	4,150±600	10,200±1200*	10,400±1300*	10,100±1300*
Lymphocytes $x10^9/l$	8220±800	7,900±650	8100±600	8200±500
Eosinophils x $10^9/l$	320±20	22±4*	30±4*	31±4*
Lysosome activity (µ/l)	6.3±0.11	6.1±0.12	3.4±0.11*	3.3±0.12*
Ascorbate (mg/dl)	0.45±0.03	1.10±0.11*	0.23±0.04*	0.22±0.03*
Cortisol (µg/dl)	0.65±0.03	1.93±0.09*	2.13±0.11*	2.11±0.10*

*P<0.05 significantly different from controls.

Lysosomal activity was significantly low in group 3 and 4 of colostrum deprived calves compared to controls.

Lysosomal activity was not affected by colostrum deprivation in ascorbic acid treated animals group 2.

Discussion

Deprivation of colostrum has resulted in leukocytosis, neutrophilia and eosinopenia with little effect on lymphocyte counts suggesting that leukocytosis was mainly due to neutrophilia. Deprivation further has resulted in an increased levels of cortisol and decreased levels of ascorbate and lysosomal activity whereas animals with subcutaneous injection of saline were without effect. The effect on leukocyte count, ascorbate concentration and decreased lysosomal activity may be ascribed to increased cortisol activity elicited as a result of colostrum deprivation. Similar observations on levels of ascorbate and cortisol in neonatal calves have been reported previously following parturition or disease (Salageanu *et al,* 1971; Wegger and Moustgaard, 1982; Cummins and Brunner, 1991). A link between adrenal glucocorticoid secretion and ascorbate release and uptake has been established in guinea pig (Kipp and Rivers, 1987). Glucocorticoids or stress have been reported to cause leukocytosis, neutrophilia, eosinopenia and decreased ascorbic content of neutrophils (Grandon *et al,* 1961; Roth and Kaeberle, 1985; Cummins and Brunner, 1991). Serum lysosome activity was considered to be an index of macrophage function (Currie and Eccles, 1976).

Administration of ascorbic acid had no effect on neutrophil counts or cortisol levels in dexamethasone treated cattle (Roth and Kaeborle, 1985). However, the injection of ascorbic acid has effectively increased lysosomal concentration in animals of present study. Injection of ascorbic acid therefore, may produce an immunostimulant effects in camel neonates. Indeed, dietary ascorbate supplementation did increase plasma immunoglobulin and has stimulated cellular and humoral immunity in a variety of species, indicating a direct effect of ascorbate on the function of cells of the immune system (Li and Lovell, 1985; Prinz *et al,* 1980; Cummins and Burnner, 1991).

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