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Efficacy of Feeding Bovine and Caprine Colostrum to Neonatal Camel

K.A. Al-Busadah
Camel Research Center, King Faisal University, Al-Jafr,
P.O. Box 45345, Al-Ahsa 31982, Saudi Arabia

Abstract: Failure of passive transfer of colostral IgG and efficacy of administered bovine and caprine colostrum as a source of lgG to camel neonates have been investigated. Neonates (N = 32) were randomly assigned to 1 of 3 treatments. Group 1 (N = 16) were left to suckle their dams. Group 2 neonates (N = 8) were colostrum deprived but supplemented with 500ml of pooled bovine colostrum given orally at 2 hour intervals from 2 to 20 hours after parturition. Group 3 neonates (N = 8) were treated similar to group 2 but with caprine colostrum. Suckling produced a peak concentration of 2700±270 mg dL^{-1} of IgG in 75% of neonates. Twenty five percent of neonates had a maximum concentration of less than 800 mg dL^{-1} and considered to be failure of passive transfer of lgG. Comparable neonatal serum IgG peak levels, apparent efficiency of absorption and t 1/2 was demonstrated between natural suckling (Groupl) and bovine (group 2) and caprine (group 3) colostrums. It is suggested that administration of bovine and caprine colostrums could be considered in camel neonates when no cameline colostrum is available.

Key words: Colostrol, neonates, bovine, caprine, cameline colostrum

INTRODUCTION

Placentation in camelidae is diffuse epitheliochorial type (Van leenep, 1964; Nova 1970; Ghazi *et al*., 1994) that prevents the transfer of immunoglobulins during fetal life. Therefore camels transfer immunoglobulins to their neonates through colostrums fail to achieve adequate transfer of passive immunoglobulin which has been associated with excess mortility risk of neonates (McGurire *et al*., 1975; Rea *et al*., 1996). Serum immunoglobulin measurement has been recommended for predisposing risk assessment in healthy calves (White, 1983) and for evaluation of sick calves (Blood *et al*., 1979).

The aim of this experiment was to investigate the possibility of failure of passive transfer of immunoglobulins in camel neonates and to evaluate the colostrums of bovine and caprine as a possible source of immunoglobulin in camel neonates.

MATERIALS AND METHODS

Camel neonates were removed from their dams immediately after birth to prevent suckling and ingesting of colostrums. Neonates (N = 32) were randomly assigned to 1 of 3 treatment groups. Group 1 neonates (N = 16) were left to suckle their dams. Group 2 neonates (N = 8) were colostrum deprived but supplemented with 500 mL of pooled bovine colostrum given orally at 2 h intervals from 2 to 20 h after parturition (Total of 5 L). Administration of colostrum based on the accepted rule that feeding colostrum to newborn calf is to feed 5% of body weight (30 kg) within the first 6 hours of life (Donovan *et al*., 1986). Group 3 neonates (N = 8) were treated similar to group 2 but with pooled caprine colostrum.

Sample collection: blood was collected from neonates by jugular venipunture into chilled tubes. Blood samples were collected before suckling and at 6, 12 and 24 h after first suckling. Additional blood samples were collected on days 2, 3, 7, 14, 21, 28. All samples were centrifuged at 800 g for 10 min. Serum was separated and stored at -20°C until analysis. Samples of colostrums from camels, cows and goats were collected and stored at -20°C until analysis.

Determination of serum IgG concentration: A radial immunodiffusion assay for camelid immunoglobulin was performed according to manufacture's specifications (Triple J Farms, Redmond USA). Briefly, 0.05 mLof serum is added to 1 well of a 24-well plate containing antiserum to camelid IgG in agarose. Three standards supplied by the manufacturer are run concurrently with each test sample. The diameter of the diffusion ring is measured and compared to a log graph generated from the standards. For statistical comparisons,all samples with serum IgG concentrations lower than the assay's lowest detectable concentration, 144 mg dL^{-1}, are designated as having 0 mg dL^{-1} of IgG.

Determination of apparent efficiency of IgG absorption (%AEA): For each neonate suckled naturally or received supplemental colostrums,% AEA of IgG was calculated by multiplying the estimated blood volume (mL) by the peak serum IgG concentration (mg mL^{-1}), dividing the product by the amount of IgG (mg^{-1}) administered and multiplying the resulting value by 100 (McEwan *et al*., 1970). The blood volume of camel neonate was estimated on the basis of 60 mL of blood kg^{-1} of body weight (Swenson, 1984). In the neonates suckled naturally the amount of IgG ingested was calculated using the correlation equation (Lavoie *et al*., 1989). Colostral IgG ingested = 0.022×concentration of IgG at calving+81. To calculate the% AEA, it was assumed that there were equal proportions of IgG in intravascular and extravascular pools as determined in neonatal foals after colostrums ingestion (Lavoie *et al*., 1989).

Determination of the half life ($t^1/_2$) of IgG: The biological $t^1/_2$ of cameline, bovine and caprine IgG was determined from linear regression curves generated by plotting the natural logarithm (Ln) of serum IgG concentrations against time. The time points extended from peak concentration to the lowest concentration were considered. The $t^1/_2$ value was calculated as Ln2 divided by the slope of the regression line (b) (Paul *et al*., 1982).

RESULTS

The pooled cameline, bovine ad caprine colostrums had IgG concentration of 11,6000, 9800 and 9600 mg dL^{-1}, respectively. Serum IgG in all neonates was below the detectable limit of the assay. Four out of 16 (25%) neonates in group 1 had a maximum IgG concentration of 800 mg dL^{-1} for the first 3 days. In the other 12 neonates in group 1 an appreciable IgG concentration (2500±250 mg dL^{-1}) was reached at 12 h after first suckling, thereafter, serum IgG concentration were 2700±270, 2600±250 and 2300±250 mg dL^{-1}, on days 1, 2 and 3, respectively.

Neonates of group 2 and 3 appeared clinically healthy after administration of bovine and caprine colostrum. The %AEA of IgG was 35.1% for cameline; 32.1% for bovine and 31.3% for caprine colostrum. Similar pattern of serum IgG concentration in neonates fed bovine and caprine colostrums (group 2 and 3) to that of group 1 was observed. Peak levels was seen on day 1 followed by a gradual decline with 17.9±1.4 days for bovine colostrums and 17.1±1.5 days for caprine colostrum (Table 1).

Table 1: The concentration of IgG declined slowly with a t ½ of 18.2 ± 1.6 days

	Cameline IgG (mg dL^{-1})		
Time	Control	Bovine IgG	Caprine IgG
6 hrs	600±50	550±50	520±50
12 hrs	2500±250	2100±200	2000±200
24 hrs	2700±270	2500±250	2200±220
2 days	2600±250	2400±220	2000±200
3 days	2300±250	2100±200	1800±200
7 days	2000±210	1600±200	1400±120
14 days	1500±190	1100±70	1000±70
21 days	1300±180	1000±70	900±60
28 days	900±60	800±60	600±50

DISCUSSION

Pre colostral serum IgG concentration in the first hour after delivery in all neonates was below the detectable limit of assay suggesting neligable transfer of colostrum during fetal life. Suckling produced appreciable levels of IgG as early as 12 h after first suckling which peaked during first day in 75% of neonates. Four out of 16 neonates failed to have IgG concentration more than 800 mg dL^{-1} suggesting that the rate of failure of passive transfer in this study was 25%. A rate of 20% or more have been reported in alpaca and llama (Garmenda *et al*., 1987, Johnston *et al*., 1997, Weaver *et al*., 2000).

Comparable concentration of IgG in pooled colostrums of camels, cows and goats was demonstrated. Furthermore, IgG from bovine and caprine colostrums were absorbed by neonates with similar efficiency to that of camel colostrums; the efficiency of absorption being 35.1, 32.1 and 30.1% for cameline, bovine and caprine colostrums, respectively. Bovine colostrum IgG was also absorbed in newborn foals with similar coefficient of absorption (Lavoie *etal*., 1989). Natural sucking resulted in a t½ of 18.2±1.6 days. Feeding of bovine and caprine colostrum resulted in a similar value of t½ of IgG. The t½ of cameline IgG was similar to that reported for passively acquired IgG in piglets Klobasa *et al*. (1981), calves (Husband *et al*., 1972; Weaver *et al*., 2000) greater than that reported in puppies Pollock and Carmichael (1982) and fox cubs Muller *et al*. (2002).

CONCLUSION

Neonatal serum IgG measurement could be recommended as a mean of evaluating excess morbidity or mortality of neonates within a herd. Administration of bovine and caprine colostrums could be considered in camel neonates when no cameline colostrum is available. However further studies are indicated to evaluate the protection provided by bovine and caprine colostrums against infection.

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REFERENCES

Blood, D.C., J.A. Henderson and Radostits, 1979. Veterinary Medicine. Lea and Febiger, Philadelphia, PA.

Donovan, G.A., L. Badinga, R.J. Collier, C.J. Wilcox and R.K. Braun, 1986. Factors influencing passive transfer in dairy calves. J. Diary Sci., 69: 754-759.

Garmendia, A.E., G.H. Palmer and J.C. DeMartini, 1987. Failure of passive immunoglobulin transfer; a major determinant of mortality in newborn alpacas (*Lama pacos*). J. Am. Vet. Res., pp: 48-1476.

Ghazi, S.R., A. Oryan and Pourmirzali, 1994. Some aspects of microscopic studies of the placentation in the camel. Anat. Histol. Embrol., 23: 337-342

Husband, A.J., M.R. Brandon and A.K. Lascelles, 1972. Absorption and endogenous production of immunoglobulins in calves. J. Aust. Exp. Biol. Med. Sci., pp: 491-498.

Johnston, N.A., S.M. Parish and J.W. Tyler, 1997. Evaluation of serum Y-glutamyltransferase activity as a predictor of passive transfer status in crias. J. Am. Vet. Med. Assoc., 211: 1165-1166.

Lavoie, J.P., M.S. Spensley and B.P. Smith, 1989. Absorption of bovion colostral immunoglobulins G and Min newborn foals. J. Am. Vet. Res., 50: 1598-1603.

Klobasa, F., W. Werhahn and J.E. Butler, 1981. Regulation of humoral immunity in the piglet by immunoglobulins of maternal origin. Res. Vet. Sci., 31: 195-206.

McEwan, A.D., E.W. Fisher and I.E. Selman, 1970. An estimation of the efficiency of the absorption of immunoglobulin from colostrums by newborn calves. Res. Vet. Sci., 11: 239-243.

McGuire, T.C., M.J. Poppie and K.L. Banks, 1975. Hypogamma globulinemia predisposing to infection in foals. J. Am. Vet. Med. Assoc., 166: 71-75.

Muller, T., T. Selhorst and P. Schuster, 2002. Kinetics of maternal immunity against rabies in fox cubs (*Vulpes vulpes*). Infect. Dis., 2: 10-16.

Paul, P.S., W.L. Mengeling and E.C. Pirtle, 1982. Duration and biological half-life of passively acquired colostral antibodes to porcine parvovirus. J. Am. Vet. Res., 43: 1376-1379.

Pollock, R.V.H. and L.E. Carmichael, 1982. Maternally derived immunity to canine parvovirus infection; transfer, decline and interference with vaccination. J. Am. Vet. Med. Assoc., 180: 37-42.

Rea, D.E., J.W. Tyler, D.D. Hancock, 1996. Prediction of calf mortality by use of tests for passive transfer of colostral immunoglobulin. J. Am. Vet. Med. Assoc., 208: 2049-2051.

Nova, C., 1970. Reproduction in the camelidae. Rev. J. Rep. Fert., 22: 3-20.

Swenson, M.J., 1984. Blood circulation and the cardiovascular system. In: Dukes' Physiology of Domestic Animals. Melvin, J. Suenson (Ed.), 10th Edn., Cornell University Press Ltd, London, pp: 15-40.

Vanleenep, E.W., 1964. The placenta of the one humped camel during the second half of gestation. Acta Morph. Neesl. Scand, 5: 373-379.

Weaver, D.M., J.W. Tyler and M.A. Scott, 2000. Passive transfer of colostral immunoglobulin G. in neonatal llamas and alpacas. J. Am. Vet. Res., 61: 738-741.

White, M.E., E.G. Pearson, J.N. Davidson and H.N., 1983. An algorithm for minimizing financial losses due to immune deficiency in calves. Cornell Vet., 73: 76.