

Formulation of Colostrum Supplements and Acquisition of Passive Immunity in Neonatal Calves

J. D. Quigley III, R. E. Strohbehn, C. A. Jaynes, M. L. Miller

Ruminant Products Division, American Protein Corporation, Ames, IA 50010

Introduction

Acquisition of adequate passive immunity is essential to calf health and growth. Factors that influence acquisition of passive immunity include metabolic state of the animal, age at first colostrum feeding, amount and IgG concentration of maternal colostrum (MC) consumed, and chemical and physical characteristics of the MC. Colostrum supplement (CS) products have been developed to supplement or replace MC and increase IgG and nutrient concentration. However, the apparent efficiency of IgG absorption (AEA) from some CS is poor, while the AEA of CS derived from edible-grade bovine serum is equivalent to MC. Differences in AEA and IgG absorption from CS may be due to chemical composition or mass of IgG fed to calves. Our objective was to determine the absorption of IgG from CS derived from bovine serum or processed Ig concentrates containing 10% to 27% IgG.

Materials and Methods

Newborn calves (n = 157) were used in 2 experiments. In experiment 1, CS were prepared by collecting, processing and spray drying bovine serum (BS1) or further processing bovine serum by two proprietary methods (method A, IG1 or method B, IG2) to increase

IgG concentration to >20% IgG. In experiment 2, CS were prepared using bovine serum (BS2) or Ig concentrate as in experiment 1, except lipid was removed and CS was manufactured without inclusion of 5% animal fat (IG3) or with inclusion of animal fat (IG4). All CS were reconstituted in 1.89 L of water and 454 g was fed at < 1 h and at 8 to 12 h (BS1, BS2, IG3-2, IG4-2). Blood was collected by jugular venipuncture, plasma IgG was determined by turbidimetric immunoassay at 0.3 hours and 24 h of age, and AEA was calculated based on fixed plasma volume as a percentage of body weight. Concentration of IgG in MC was determined by radial immunodiffusion.

Results and Conclusions

Plasma IgG concentrations (PIgG) at 24 h of age were indicative of IgG intake, and averaged 5.6 to 14.1 g/L in calves fed CS and 18.8 g/L in calves fed MC. Calculated AEA was reduced slightly when IgG as prepared using method B, but not with the addition of animal fat. Method of processing can have a material impact on efficiency of IgG absorption from CS. Provision of IgG to prevent failure of passive transfer is possible with CS containing >20% IgG, and fed at 454 g per dose, if fed in one or two doses.

Item	Experiment 1					Experiment 2					
	MC	BS1	IG1	IG2	SE	BS2	IG3	IG3-2	IG4	IG4-2	SE
N	15	14	14	14	...	20	20	20	20	20	...
IgG intake, g	429	100	100	100	...	90	122	244	122	244	...
PIgG, 0 h, g/L	1.0	0.8	0.2	0.1	0.3	0.2 ^{ab}	0.2 ^{ab}	0.7 ^a	0.2 ^{ab}	0.0 ^b	0.1
PIgG, 24 h, g/L	18.8 ^a	8.4 ^b	7.6 ^b	5.6 ^b	0.8	7.4 ^a	11.2 ^{bc}	13.0 ^{cd}	10.1 ^b	14.1 ^d	0.6
AEA, %	14 ^a	25 ^b	26 ^b	19 ^{ab}	2	28 ^a	32 ^a	19 ^b	29 ^a	20 ^b	1

^{a,b,c,d}Means within experiment and row with different superscripts are different ($P < 0.05$).