Effects of Administering Various Blood Serum Constituents on Gamma Globulin Levels of Baby Pigs.*† (21296)

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(Introduced by G. Howard Satterfield.)

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Nutritional investigations with baby pigs that have been permitted to nurse their dams have emphasized the need for means of starting pigs without relying on the dams' colostrum. Fat studies at the North Carolina Agricultural Experiment Station which were initiated with pigs which had nursed 2 days revealed considerable variation in pig response. The quantity and quality of colostrum consumed by the pigs were considered to be an important factor in this variation. The need for means of protecting newborn pigs from disease was recognized and some success has been obtained by conducting studies in isolated quarters. However, the results have been too variable from experiment to experiment to be reliable and pigs successfully started under isolated conditions have exhibited a high mortality rate when placed in contact with swine in a natural environment.

Accordingly, an investigation was undertaken to study possible means of providing the protection to newborn pigs which is normally obtained through the dams' colostrum. This report covers investigations on the effects of administering lyophilized bovine and porcine serum solids and porcine gamma globulin on the blood serum gamma globulin content of newborn pigs.

Procedure. Investigations were conducted with newborn pigs removed from the mothers at birth. After the completion of farrowing, the pigs were identified by ear notches, weighed, and the pigs from a litter were randomly assigned to the experimental treatments on the basis of weight. Blood samples for electrophoresis were collected after the pigs had been on the treatments for 24 hours. A minimum of 4 replications were used in each trial and when additional pigs from a litter were available they were assigned to one of the treatments. Difficulty in obtaining an adequate quantity of blood from a few of the pigs made it impossible to obtain data on the total number of animals started in each trial. Eight different treatments were used in the first experiment: 1) 180 ml of sows' colostrum, 2) 120 ml of cows' colostrum, 3) 10 g, and 4) 20 g of lyophilized bovine serum solids, 5) 10 g, and 6) 20 g of lyophilized porcine serum solids, 7) fasted, and 8) permitted to nurse at will. The materials listed for the first 6 treatments were administered by stomach tube in 4 equal portions at 6-hour intervals. The quantities of cows' and sows' colostrum fed were calculated to provide approximately the same quantities of protein in the decaseinated portion of the colostrum. The serum solids were diluted in water to a concentration of 10 g of serum solids to 40 ml of water. In the second experiment the treatments consisted of: 1) porcine gamma globulin administered intraperitoneally, 2) porcine gamma globulin administered orally in cows' milk, 3) bovine serum solids administered orally in cows' milk, and 4) controls which received cows' milk only. The porcine globulin solution used contained 10% gamma globulin, and 20 ml were used for both the parenteral and oral administration. For oral administration the 20 ml of gamma globulin solution were added to 130 ml of milk and fed with a bottle and nipple in 6 equal feedings at 4-hour intervals. A total of 7.5 g of bovine serum solids was fed each pig receiving this treatment. The 7.5 g of solids were dissolved in 20 ml of water, and

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† The lyophilized bovine and porcine serum solids were provided and electrophoretic patterns were obtained through the courtesy of Dr. Chris. P. Segard of the Wisconsin Alumni Research Foundation. Porcine gamma globulin and amorphous trypsin inhibitor were provided by The Armour Laboratories through the courtesy of Dr. M. A. Schooley.

TABLE I. The Influence of Fasting, Normal Nursing and Administration via Stomach Tube of Sows' Colostrum, Cows' Colostrum, Bovine Serum Solids and Porcine Serum Solids on the Blood Serum Gamma Globulin Content of One-Day-Old Pigs. (Each value represents percent of the total protein as gamma globulin for an individual animal.)

		Administered by stomach tube					
				Porcine serum solids		Bovine serum solids	
Fasted	Nursed dams	Sows' colostrum	Cows' colostrum	10 g	20 g	10 g	20 g
0	46	18	3	0	5	0	4
0	43	25	0	3	6	0	3
0	41	11	0	4	0	14	5
0	45		0	4	7	0	0
				5	8	0	3

this was added to 130 ml of milk for feeding as indicated above. The control pigs and those receiving gamma globulin parenterally were fed 150 ml of cows' milk. The gamma globulin was injected intraperitoneally in 6 equal portions at the time the pigs were fed. The cows' milk used had been pasteurized and homogenized. In the third experiment bovine serum solids and porcine gamma globulin were compared when fed orally with and without a source of trypsin inhibitor. (Laskowski and Laskowski(1) reported that bovine colostrum contains large amounts of trypsin inhibitor.) Porcine gamma globulin was also administered parenterally. The procedures for oral feeding were the same as in the second experiment. Amorphous trypsin inhibitor was used at the rate of 750 mg to 150 ml of each milk preparation fed.

All pigs were bled 4 to 5 hours after the last feeding or treatment was given. Approximately 20 ml of blood were drawn from the anterior vena cava with a hypodermic syringe and needle as described by Carle and Dewhirst (2). The blood was permitted to stand at room temperature 2 or 3 hours and was then placed in a refrigerator for 10 to 12 hours to permit retraction of the clot. Ten ml of serum were pipetted off, sealed in vials and frozen. The frozen samples were packed with ice in an insulated container and shipped via express to the laboratory for electrophoresis.‡

Results. The results of the first experiment are shown in Table I. The only consistent response in the serum globulin levels was obtained with the pigs which nursed or were administered sows' colostrum via stomach tube. The cows' and sows' colostrum which were used represented pooled collections from 3 animals. It had been preserved in a frozen condition for approximately 3 weeks. The lower gamma globulin values for the pigs administered sows' colostrum by stomach tube may have been due to a lower intake (the pigs left with the sows nursed *ad libitum*), a lower gamma globulin content of the colostrum used, or to method of administration. The gamma globulin values for the nursing pigs are slightly higher than those reported by Foster *et al.* (3). The porcine and bovine serum solids and cows' colostrum did not cause a marked or uniform response in the serum gamma globulin levels.

The results of the second and third experiments are included in Table II. Three of the treatments were common to each experiment. The porcine gamma globulin failed to give a significant response when fed orally with cows' milk, but when it was administered intraperitoneally the serum gamma globulin levels approached the levels obtained previously with nursing pigs. The inclusion of trypsin inhibitor in the milk-gamma globulin mixture did not improve the serum gamma globulin levels. As in the first experiment, oral administration of bovine serum solids did not cause a significant response and inclusion of trypsin inhibitor did not affect the results.

Discussion. Inasmuch as porcine gamma globulin caused a marked response in serum gamma globulin levels when administered in-

‡ The determinations for the first experiment were made under the direction of Dr. J. W. Palmer of Squibb Laboratories and for the second and third experiments under the direction of Dr. Kurt G. Stern of the Polytechnic Institute of Brooklyn.

TABLE II. Influence of Porcine Gamma Globulin and Bovine Serum Solids Administered by Different Procedures on Blood Serum Gamma Globulin Content of One-Day-Old Pigs. (Each value represents % of total protein as gamma globulin for an individual animal.)

Controls	Porcine gamma globulin			Bovine serum solids	
	Orally			Orally	
Cows' milk	Orally	with trypsin inhibitor	Parenterally (i.p.)	Orally	with trypsin inhibitor
0	0	0	35	9	7
0	6	9	29	0	0
0	0	5	44	0	0
0	0	0	40	0	5
	9		27	0	
	0		41	2	
	0		37	8	
			31	6	
			16	0	
				3	

traperitoneally but not when administered orally it is evident that processes related to the alimentary tract prohibited gamma globulin from reaching the blood stream. This indicates that sows' colostrum contains a component(s) that enables the gamma globulin to be absorbed from the alimentary tract without being digested. Evidence accumulated in this work indicates that trypsin inhibitor alone is not responsible and that the component(s) is not present in lyophilized serum solids in effective amounts. The failure of cows' colostrum to give a response with baby pigs suggests a species difference in the colostrum of the pig and the cow or in factors affecting the absorption of gamma globulin by the pig and the calf.

Summary. Data have been presented which show that porcine gamma globulin, porcine and bovine serum solids and cows' colostrum do not cause a marked or consistent response in the serum gamma globulin level of one-day-old pigs when administered orally. However, parenteral administration of porcine gamma globulin gave a response which approached that obtained with nursing pigs. The inclusion of trypsin inhibitor with orally administered porcine gamma globulin and bovine serum solids did not affect the serum gamma globulin level.

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L Colonies from Hemolytic Streptococci: New Technic in the Study of L Forms of Bacteria.*† (21297)

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The peculiar, small, fragile growth form usually designated as an L form has been isolated previously from alpha hemolytic streptococci(1). L forms from this species were obtained using technics successful in other species, in that of a large number of strains exposed to penicillin on horse serum agar plates, a few yielded L type colonies. Using these methods L type colonies have not been obtained from beta hemolytic streptococci, although many attempts have been made in this laboratory in the past several years, and during the past winter alone we have examined between 50 and 100 strains.

Results. Positive results have been obtained

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