Milk Replacer Type Juvenile Cataracts

The resolution of juvenile cataracts developing occasionally in some breeds of puppies orphaned at an early age (0 to 3-4 days of age) and fed exclusively on milk replacers has been accomplished. The occurrence of cataracts had been observed with goat's milk homemade formulas(1), human infant formulas and commercial puppy milk replacers(2). PetAg took the initiative to determine the cause of juvenile cataract formation and modified Esbilac® as soon as the cause was identified.

History

The first hint of juvenile cataracts and possible cause was found by Vainini et al, 1981 with wolves weaned at 10 days of age(1). Subsequent reports with mixed breed puppies(2) weaned at 48 hours and Samoyed puppies(3) weaned at 24 hours showed cataract development when examined at 3 to 5 weeks of age.

Research sponsored or conducted by PetAg revealed no cataract development with Beagle puppies weaned at 4 days of age(4), Collie puppies weaned after 48 hours(5) and English Pointers weaned at 5 days of age(6), however, two Collie-cross puppies developed cataracts when weaned at 24 hours(6). An extensive project at Virginia Polytechnic Institute and Southern University (now Virginia Tech)(7) using 24-48 hour Beagle pups showed no cataracts. The objective of these studies was to see whether hypoglycemia was the cause of cataract formation by supplementing the formula with 15% glucose. This did not appear to be the cause and the development of cataracts in a controlled environment remained elusive and very frustrating.

Success

PetAg continued to pursue the problem further by sponsoring yet another research project at Colorado State University covering two years of work in 1988 and 1989. A team headed by Sarah L. Ralston, DVM in the Veterinary Teaching Hospital at CSU, used split litters of Beagle puppies in a preliminary study. Five puppies were fed reconstituted standard Esbilac powder formula, and 6 puppies were fed the same formula supplemented with arginine and methionine from 2 to 28 days of age. Colostrum was fed for the first 2 days. During this study no cataracts were found.

Subsequently, Akita puppies from 4 split litters were fed either, the regular reconstituted Esbilac powder (formula 1 – 8 puppies), the same formula supplemented with arginine and methionine (formula 2 – 6 puppies) or left with the bitch (7 puppies). The 2 formulas used in this trial were from the same lots as the previous Beagle study. The Akita puppies were on the above feeding regimens exclusively from 2 to 28 days of age. The orphaned puppies were tube fed formula 6 times per day for the first week and then 4 times per day in amounts calculated to provide 260 kilocalories of digestible energy per kilogram body weight. Ophthalmic examinations were performed on the puppies twice a week for six weeks after their eyes opened. All puppies were placed on weaning diets at 28 days and onto a commercial puppy growth diet at 35 days.

No cataracts were found in either the control (nursing) puppies or puppies fed formula 2 (arginine and methionine supplemented). Moderate to severe cataracts were present in all of the formula 1 fed puppies. These cataracts tended to resolve or reduce in severity by 8 weeks of age. The conclusion of the study was "The development of nutritional cataracts in puppies fed milk replacer formulas appears to be breed or growth rate related and influenced by the methionine and arginine content of the formula"(8).

Action Taken

Based on these results, PetAg adjusted the formulations of Esbilac powder and liquid to include supplemental arginine and methionine. All Esbilac (powder and liquid) produced after June, 1989, contain these two amino acid supplements.

While the original formulas contained more arginine and methionine than shown to be the requirement for weaned puppies, they were still below the levels which have been found in bitch's milk. The new levels of these amino acids incorporated in Esbilac reflect the higher amounts required for eye development by rapidly growing, nursing puppies under certain conditions. Why these requirements are higher or the nature of the metabolic mechanisms involved have not been determined.

Keep in mind that there are many causes of canine cataracts including those that might be seen in puppies. A discussion of these congenital and developmental cataracts can be found in many places, one of which is referenced below(9) and includes non-nutritional causes in young puppies.

By continually keeping abreast of scientific findings and making adjustments in formulas as they are indicated, PetAg remains the standard of neonatal nutrition, a position it has held for over 50 years.

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EVALUATION OF GROWTH RATES AND CATARACT FORMATION IN ORPHAN PUPPIES FED TWO MILK REPLACER FORMULAS

Proceedings of the Second International Conference on Veterinary Perinatology in conjunction with the Summer Meeting of the Neonatal Society. St. John's College, Cambridge, England 13th – 15th July, 1990 page 56.

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The purpose of this study was to evaluate growth and cataract formation in neonatal Akita puppies fed one of two milk replacer formulas days 2 to 28 of life compared to bitch fed littermates. Akita puppies from four litters were assigned at two days of age to one of three treatment groups: 1. Control: puppies left with dam (n=7); 2. Formula 1: puppies removed from bitch, raised as orphans and fed commercial puppy milk replacer formula (n=8); 3. Formula 2: puppies removed from bitch, raised as orphans and fed Formula 1 supplemented with arginine and methionine (n=6). Only puppies for which body weight data was complete to 44 days of age were included in the analysis. Orphaned puppies were tube fed formula 6 times a day for the first week and four times a day for the next two weeks. The formula was fed in amounts calculated to provide 260 Kcal DE/kgBW (26 ml/100gmBW). Puppies were individually weighed each morning to determine feeding level for the next 24 hours. Crown-rump length (CR) of the forelimb from tip to olecranon to end of P-2 (FL) and circumference of the carpus (CC) were recorded every seven days for 44 days. Ophthalmic exams were performed on all puppies twice a week for six weeks after their eyes opened. All puppies were placed on weaning rations at 23 days of age and weaned at 35 days of age onto a commercial puppy growth diet.

Control puppies were heavier and larger than the Formula 1 pups at 23 days of age ($p<0.05$) but also were subjectively judged to be obese and less active than their orphaned littermates. There was a trend for the Formula 2 puppies to be intermediate in size and weight between the Control and Formula 1 puppies. After nine days on the growth diet (Day 44) size differences were still present ($p<0.05$) though less pronounced, with the Formula 2 puppies still intermediate in size to the other two groups. No cataracts were observed in either the Control or Formula 2 puppies. Moderate to severe cataracts were present in all of the Formula 1 puppies (n=6), but tended to resolve or at least reduce in severity by eight weeks of age. In preliminary trials on Beagle puppies (n=5 on Formula 1 and n=6 on Formula 2) no cataracts were observed in any of the puppies. The addition of arginine and methionine to the puppy milk replacer formula resulted in acceptable growth and normal lens formation in neonatal Akitas. The development of nutritional cataracts in puppies fed milk replacer formulas appears to be breed or growth rate related and influenced by the methionine and arginine content of the formula.

Table 1: Growth parameters in orphaned vs. bitch fed puppies

Age (days)	Treatment	Body Weight* (gms)	CR* (inches)	FL* (inches)	CC* (inches)
2	Control	492a(75)	7.7a (.8)	2.5a (.14)	1.9a (.18)
	Formula 1	511a(57)	7.5a(.4)	2.5a(.11)	1.8a(0.9)
	Formula 2	510a(62)	7.5a(.4)	2.6a(.16)	1.9a(.11)
23	Control	2227a(404)	11.8a(1.1)	4.7a(.34)	3.5a(.26)

	Formula 1	1364b(219)	10.1b(.7)	3.7b(.31)	2.6b(.24)
	Formula 2	1782b(512)	10.3a,b(1.1)	4.2a,b,c(.44)	3.0a,b,c(.23)
44	Control	5065a(358)	16.2a(.46)	7.2a(.20)	4.2a(.22)
	Formula 1	3331b(908)	13.8b(1.5)	6.3a(.84)	3.7b(.19)
	Formula 2	3854b(947)	14.8b(1.8)	6.5a(.59)	3.7b(.33)

*Values are means (standard deviations) of measurements within each treatment; a,b,c means with different letters within a time period differ ($p<0.05$).