

Preliminary observations of a revised formula for hand-rearing a Malayan sun bear (*Helarctos malayanus malayanus*): days 0-75

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A Malayan sun bear (*Helarctos m. malayanus*) was removed, for medical reasons, from the dam for hand-rearing at two days of age. The initial formula offered was composed of Esbilac® (Bitch's milk replacer) and water in a 1:3 ratio (Rosenthal, 1994). Due to the previous formation of a lactobezoar in a spectacled bear (*Tremarctos ornatus*) hand-reared by our staff using this formula (Esbilac® liquid:water 1:3), a revised formula was developed.

Lactobezoars are an indigestible, hard, rubbery milk curd which may lead to the partial or complete obstruction of the animal's gastrointestinal tract. The physical characteristics of the milk curd formed are species specific and based upon the concentrations of casein, or more specifically the whey to casein ratio (WC) of the species milk. This condition has been well documented in humans, in which the milk whey to casein ratio is 80:20. The standard, cow's milk-based infant formula, containing 82% casein forms a hard curd which appears to be a significant factor in the formation of lactobezoars in humans. As a result, "humanized" formulas containing 60% whey have been developed, which form a soft, easily digested and propelled curd in the stomach (Schreiner et al., 1982).

Analysis of milk from three bear species is provided in table 1 (Jenness et al, 1972). Sun bear milk contained the higher concentrations of whey as well as having a higher whey to casein ratio (W:C 45:55) than black bears (*Ursus americanus*) or polar bears (*U. maritimus*). It should be noted that the information available on sun bear milk composition is limited to a single sample collected from a captive animal,

Esbilac contains significantly more casein than whey (W:C 12:88). In order to align the ratio closer to that of reported sun bear milk analysis, a low iron human milk formula (Enfamil) was mixed with Esbilac in a 1:1 ratio, producing a W:C of 28:72. Esbilac® was maintained as a component of the total formula to provide specific nutrients required by carnivores, which may not be present in appropriate concentrations in the human milk replacer. The resulting formula contained 0.75 kcal GE/mi. Selected nutrient composition of the components and the formula offered are provided in table 2,

This formula was fed from day 7 through day 37. During this period, the individual consumed an average of 180.0 (\pm 17.70) kcal GE/kg BW. An iron fortified human milk formula (Enfamil with iron®) replaced the low iron formula component of the total formula and was offered on day 38 and continued through day 75. The energy density of the

Table 1. Selected nutrient composition of milk from three bear species expressed on an as-fed AFB and dry matter basis (DMB)

Nutrient	Sun Bear		Black Bear		Polar Bear	
	AFB	DMB	AFB	DMB	AFB	DMB
Moisture (%)	72.80	0.00	55.50	0.00	52.40	0.00
Total Solids (%)	27.20	100.00	44.0	100.00	47.60	100.00
Crude Protein (%)	8.40	30.88	14.50	32.58	10.90	22.90
Crude Fat (%)	10.60	39.71	24.50	55.06	33.10	69.54
Lactose (%)	3.2	11.76	0.40	0.90	0.30	0.63
Whey (%)	3.80	13.97	5.70	12.81	3.80	7.98
Casein (%)	4.60	16.91	8.80	19.76	7.10	14.92
Whey : Casein	45:55		39:61		35:65	

^EJenness et al, 1972.

second formula was also 0.75 kcal GE/ml. During this period, the individual consumed an average of 132.0 (\pm 12.13) kcal GE/kg BW. The growth rate from day 2 through 75 demonstrated by this individual was nearly linear with an average daily gain of 49.6 g (Figure 1).

Although the W: C ratio is not identical to that reported in sun bear milk, the W:C ratio and absolute concentrations provided by this formula appear adequate to prevent the formation of a lactobezoar and support normal growth.

Literature Cited

Jenness, R, A W. Erickson and." J. Craighead, 1972, Some comparative aspects of milk from four species of bears. *Journal of Mammalogy* 53(1): 34-47.

Rosenthal, M. 1994. Hand-rearing members of ursidae. In: AZA Infant Diet Notebook. American Zoo and Aquarium Association.

Schreiner, R.L. M.S. Brady, J.A. Ernst and J. Lemon, 1982. Lack of lactobezoars in infants given predominantly whey protein formulas. *American Journal Disease Children* 136:437.

Table 2. Selected nutrient composition of components and milk formula for a Malayan sun bear expressed on an as-fed (AFB) and dry matter basis (DMB)

Nutrient	Enfamil®		Esbilac® ²		Sun Bear Formula	
	AFB	DMB	APB	DMB	AFB	DMB
Moisture (%)	90.72	0.00	84.85	0.00	87.79	0.00
Total Solids (%)	9.28	100.00	15.15	100.00	12.21	100.00
GE (kcal/ml)	0.68	7.33	0.82	5.41	0.75	6.14
Crude Protein (%)	1.42	15.30	5.09	33.60	3.25	26.65
Crude Fat (%)	3.59	38.69	6.38	42.11	4.98	40.80
Total Carbo (%)	7.38	79.53	2.88	19.01	5.13	42.00
Whey (%)	0.89	9.60	0.63	4.17	0.84	6.90
Casein (%)	0.59	6.40	4.45	29.40	2.19	17.90
Whey:Casein	60:40		12:88		28:72	
Calcium (%)	0.05	0.54	0.15	0.99	0.10	0.81
Phosphorus (%)	0.04	0.43	0.11	0.73	0.07	0.60
Magnesium (%)	0.01	0.05	0.12	0.79	0.01	0.07
Vitamin A (IU/L)	2031	21885	18280	120660	10145	83057
Vitamin D (IU/L)	406	4375	950	5271	676	5534
Vitamin E (IU/L)	13.53	145.47	18.00	118.81	15.72	128.74

¹Human milk replacer formula, Mead-Johnson Nutritionals_ ²Bitdh's milk replacer formula, Pet-Ag, Inc.