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Hand-feeding a Black rhinoceros

Diceros bicornis

calf at Dvur Kralove Zoo

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In December 1992 a Black rhinoceros *Diceros bicornis* was born to a 22-year-old ♀ at Dvur Kralove Zoo. Because this was her first calf and she appeared to have an under-developed udder, preparations were made for hand-rearing. The tolerant behaviour of the dam allowed us to hand-feed the calf which remained with its mother until weaning at 15 months. This paper describes the feeding formula, feeding technique and veterinary care involved.

Hand-rearing Black rhinoceros *Diceros bicornis* in captivity has not been attempted often and only if the calf is weak or if the dam has died or is aggressive towards the calf. Calves have been separated for hand-rearing from a few days to several weeks old but on most occasions the animal has failed to survive (Kreag, 1966; Maruska *et al.*, 1986). Successful hand-rearing has been reported at Cincinnati Zoo for a calf weighing 37.3 kg at birth (Maruska *et al.*, 1986) and at London Zoo where an 18 kg newborn was extremely weak (Kirkwood *et al.*, 1989). At Dvur Kralove the calf had a low birth

weight and appeared to be weak. In addition, the dam failed to produce sufficient milk and the calf required hand-feeding.

BIRTH

At 0300 hours on 14 December 1992, after successful hormone induction of oestrus using an oral application of synthetic progesterone allyl trenbolone (Regumate), consequent mating and a gestation period of 469 days, the 22-year-old primiparous Black rhinoceros ('Jarča', stdbk no. 178) gave birth to a ♀ calf (stdbk no. 456). As this was her first calf and because of her age, she was monitored using closed-circuit TV 24 hours a day for two weeks before parturition. Female rhinoceroses usually begin to secrete milk about 14 days prior to parturition but because Jarča's udder was poorly developed and as she appeared to be producing only a small amount of milk, preparations were made for hand-rearing.

DAYS	MEAN VOLUME FORMULA FED PER DAY (litre)	COMMENTS
1	1.71	
2	3.81	
3	4.11	
4	5.21	
5-8	6.51 (5.2-7.5)	
9-26	9.75 (9.4-10.5)	a reduced volume of food was ingested on days 12-21 (mean 7.65 litre) associated with a bout of diarrhoea and treatment
27-40	10.55 (9.7-11.7)	
41-215	13.55 (9.7-16)	a reduced volume of food was ingested on days 74-78 (mean 10.5 litre) associated with a bout of diarrhoea and treatment
216-225	14	intake stabilized at 14 litre per day
226-451		the volume of milk offered was gradually decreased by 0.5 litre in 10 day intervals until weaning at 15 months. Last volume 2.5-3.5 litre

¹Ranges in parentheses.

Table 1. Mean volume of formula fed per day to a Black rhinoceros *Diceros bicornis* calf until weaning at 15 months of age.

There were no complications with the birth as the calf had a caudolongitudinal presentation with upper positioning. The newborn was markedly weaker than calves previously born at Dvur Kralove and after four hours it was still not able to stand, even with help from a keeper. The calf first stood at six hours and appeared to search for a teat. Keepers fed the calf 20 ml of colostrum using a syringe and at ten hours gave a second small feed of colostrum mixed with milk from another ♀ ('Elvira', stdbk no. 244) that had given birth successfully six days earlier. From the following morning the calf was fed totally by hand. The small quantity of colostrum produced by the dam was combined with horse colostrum and milk from two other ♀♀ (stdbk no. 244 and also stdbk no. 282 which had given birth 11.5 months previously). Milking of these two females was attempted daily. One keeper would feed and scratch the animal while another keeper milked her through the enclosure barrier. This required constant vigilance and a good knowledge of the ♀'s temperament to ensure safety. Not all attempts at milking

were successful and the quantity of milk obtained varied: it was possible to milk up to 2 litres from Elvira.

FEEDING

Preparations for hand-feeding included obtaining a reserve of horse colostrum which was collected during veterinary health checks from mares at the horse breeding centre in Slatiňany. On days 1 and 2 the calf was fed Black rhinoceros colostrum and milk, and horse colostrum. From day 3 reconstituted dried, centrifuged domestic cow's milk (Laktino) was gradually introduced to the mixture. The feed was offered in a metal-plated bottle with a 100 mm calf nursing nipple. Substitute milk was prepared from 50 g of dried milk (Laktino), 40 g of glucose and 4 ml of radicle (corn sprout) oil/Klickovy olej (a mixture of unsaturated butyric acids with vitamin E, 0.26 mg in 100 g of oil), diluted in one litre of boiled water. Although the volume of formula offered increased, the frequency of feeds decreased and the proportion of rhinoceros milk and milk substitute varied (Tables 1, 2 and 3), the proportion of

DAYS	NUMBER OF FEEDS
1	eight feeds starting at 0900 hours ¹
2-10	a mean 11 feeds in 24 hours
11-30	a mean eight feeds in 24 hours
30-182	five to six feeds in 24 hours
182-310	four feeds per day
310-395	three feeds per day
395-426	two feeds per day
426-451	one feed per day

¹First feed offered six hours after birth.

Table 2. Number of feeds offered per day until weaning at 15 months.

dried milk, glucose, radicle oil and water in the milk substitute remained the same. The calf readily accepted the formula throughout the period of hand-feeding with the exception of two periods when she suffered from bouts of diarrhoea.

The nutritional compositions of Black rhinoceros milk from the two ♀♀ at Dvur Kralove, two other females reported by Gregory *et al.* (1965) and Greed (1960), Laktino and our milk substitute are compared in Table 4.

The first attempt at suckling was observed on day 6 when the calf tried to suckle for ten seconds after being brought into contact with the dam's teats. Over the next few days short suckling sessions (several seconds to several minutes with some pauses) were observed.

From day 2 vitamins A, D and E were added to the feed three times per week and vitamin E was added daily from nine months. Salts, in the form of calcium chloratum in 10% solution and Calcimag inj. and Glyphostan inj., were added to the formula daily and at three months iron preparations were added to the solid food. Mineral supplements Calcite, Vubimag and Farmaferr, were administered in food from four-and-a-half months.

On day 29 the calf was offered grated carrot and oat flakes by hand as she had begun to eat some of the food offered to the dam. From day 60 she started to eat some hay and grain and from then she was offered solid food regularly.

WEIGHT

On day 5 the calf weighed 28.2 kg and it was weighed daily up to day 166. From day 167 to day 291 the calf was weighed every three to six days (Table 5). Up to seven months of age scales for 0-200 kg were used (0.1 kg accuracy) and after that scales for 0-500 kg with 0.5 kg accuracy (Transporta Úpice). The growth curve shows a generally steady increase (Fig. 1). Although no weight gain was recorded during the two bouts of diarrhoea the calf did not suffer any significant weight loss.

At 15 months (after weaning) the body measurements were similar to those of a mother-reared ♀ calf of the same age

DAYS	RHINOCEROS COLOSTRUM (%)	RHINOCEROS MILK (%)	HORSE COLOSTRUM (%)	SUBSTITUTE MILK (%)
1	1	69	30	
2	9	46	45	
3	17	10	70	3
4		36	36	28
5		49	15	34
6		59		41
7-15		36 (28-44)		64 (54-72)
16-52		18 (10-28)		82 (72-90)
53-weaning				100

Table 3. Composition of formula fed until weaning at 15 months.

	BLACK RHINOCEROS				LAKTINO ⁴	COMPOSITION OF SUBSTITUTE MILK USED AT DVUR KRALOVE ZOO ¹
	JARČA LACTATION AT DAY 57 ¹	ELVIRA LACTATION AT DAY 65 ¹	LACTATION AT 19 MONTHS ²	LACTATION AT 30-330 DAYS ³		
Dry matter (%)	9.3	10.18	8.1	8.8	93	8.73
Fat (%)	1.3	2	traces	0.2	0.3	0.3
Lactose (%)	8.29	6.83	6.06	6.6	53	8.43
Protein (%)	0.986	1.033	1.54	1.4	32.2	1.452
Ash (%)	0.451	0.493	0.34	0.3	7.5	0.625
Ca (%)	0.53	0.49	0.06		1.31	0.36
pH	6.3	6				6.4

¹Analysis of rhinoceros milk and substitute milk, prepared from dried milk, glucose, radicle oil and water, was carried out by the State Veterinary Institution, Hradec Kralove, Czech Republic.

²Greed (1960).

³Gregory *et al.* (1965).

⁴Composition given by manufacturer.

Table 4. Nutrient content of the milk of Black rhinoceros compared with that of substitute milk.

(stdbk no. 455) born on 8 December 1992 (Table 6).

VETERINARY CARE

Although the calf was fed colostrum for the first five days and only partially fed with rhinoceros milk up to day 53 no significant health complications arose. The temperature of the enclosure was maintained at 20–25°C. All veterinary care was directed at disease prevention and increasing the immune status of the calf. For the first three days after birth the umbilicus was treated with 1% antiseptic solution (pyoctanin), and vitamins A, D and E (Axetocal and Erevit) and selenium (Selevit) were administered intramuscularly on day 3 and day 32.

Subcutaneous passive immunization was applied to the calf against navel ill (Serum proti ochromě) on days 3 and 15, and tetanus (Serum proti tetanu) on days 8 and 17. Active immunization, against navel ill (Vakcína proti ochromě) and tetanus (Vakcína proti tetanu), was subcutaneously administered on days 43 and 57, and days 87 and 108 respectively.

The calf had two bouts of diarrhoea (day 15 and day 76) each lasting for three days. On the first occasion bacteriological

examination revealed enteroinvasive *Escherichia coli*, *Streptococcus*, *Staphylococcus* and *Clostridium perfringens*. After treatment with intramuscular injections of a combination of sulphadimidin-trimethoprim (Duon) for five days and a single intramuscular injection of iron preparations (Ferridextran), only *Citrobacter* was isolated in a faecal sample collected two days after the treatment when the consistency of the faeces was back to normal. A four-day course of sulphadimidin-trimethoprim, penicillin (Procain penicilin G inj.) and amoxicillin (Clamoxyl LA inj.) cleared up the second bout of diarrhoea.

AGE (days)	WEIGHT (kg)	MEAN DAILY WEIGHT INCREMENT (kg)
5	28.2	
14	37	days 5-14 0.87
30	42.6	days 14-30 0.6
90	90.4	days 30-90 0.78
180	175.8	days 91-180 0.94
272	274	days 181-277 1.13
291	298	days 278-291 1.28

Table 5. Weight gain of a Black rhinoceros calf handled at Dvur Kralove Zoo.

Pustular dermatitis was observed in both ears on day 50 and was treated locally with antiseptic ointment (Dermazulen). No other disorders were observed in the calf until weaning.

SOCIAL BEHAVIOUR

Although the calf was hand-fed she was housed with the dam and this may have had an important influence on the development of her social behaviour. Up to day 30 the calf was separated from the dam every two to three hours for feeding. After this time the calf was fed over the enclosure barrier and only removed for weighing or veterinary treatment which only took a few minutes. The early attempts at suckling may have helped to establish a close relationship between the dam and newborn and the behaviour of the calf was comparable to mother-reared calves in all respects: defecation, food consumption, reactions to the environment and throwing hay about.

BODY PARAMETERS (cm)	STUDBOOK NUMBER	
	455	456
Body height at withers	112	114
Length of body without tail	284.5	291
Thorax circumference	212	202

Table 6. A comparison of measurements of mother-reared (stbkb no. 455) and hand-fed (stbkb no. 456) Black rhinoceros calves.

DISCUSSION

While it is not always evident that an infant is not receiving adequate maternal care during the immediate post-birth period, the decision to remove an animal for hand-rearing must be made early enough to ensure that basic care is provided. The calf at Dvur Kralove was given supplemental feeds not only because of a relatively low body mass at birth and low vitality but also because of the age of the dam at her first delivery and insufficient udder development. Birth weight can be

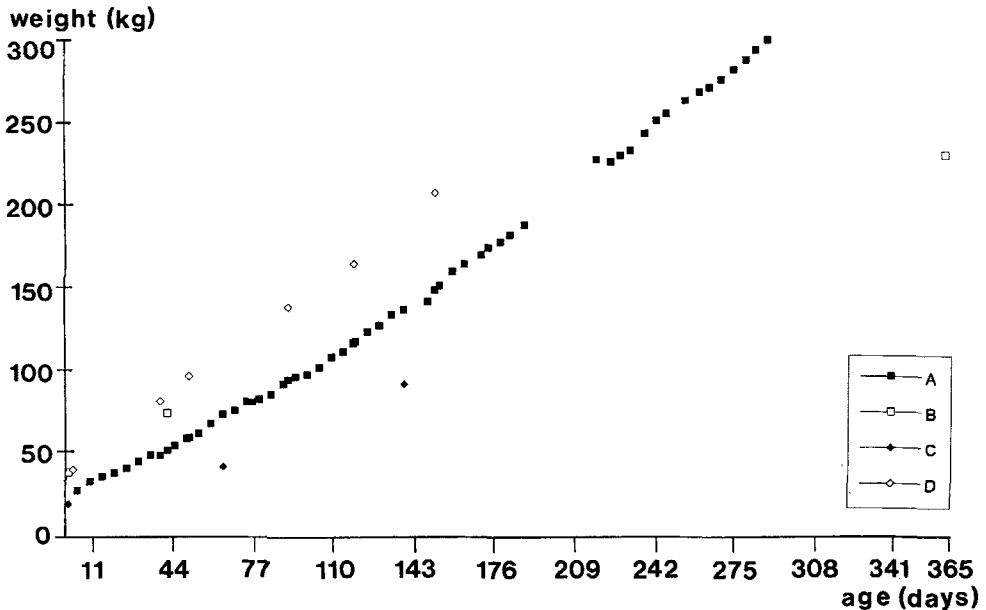


Fig. 1. Comparison of weights of Black rhinoceros *Diceros bicornis* calves: A. hand-fed ♀ at Dvur Kralove Zoo; B. hand-reared ♀ at Cincinnati Zoo; C. hand-reared ♀ at London Zoo; D. mother-reared ♂ at Hanover Zoo.

estimated as 23–24 kg based on the weight on day 5 (26.2 kg) and average daily increment in the first two weeks (0.87 kg between days 5 and 14). The estimated birth weight was low compared to the weights of three other rhinoceroses born at the Zoo (range 28–35 kg) (Váhala, 1990) and other records (Dittrich, 1967; Maruska *et al.*, 1986). However, a lower birth weight was recorded for a successfully hand-reared ♀ calf at London Zoo (Kirkwood *et al.*, 1989).

The composition of the milk substitute corresponds to that of Black rhinoceros milk (Table 4) and was prepared according to previous experience of attempting to hand-rear an Indian rhinoceros *Rhinoceros unicornis* (P. Špála, pers. comm.). Although during the initial post-birth period rhinoceros milk and colostrum were fed, the change to milk substitute was without complications.

Actual body mass increased steadily and the developmental curve approximated that of body mass development of a mother-reared ♂ calf (Dittrich, 1967) (Fig. 1) and was visually comparable with the ♀ calf born six days earlier. The two calves also had similar body dimensions at weaning (Table 6). In comparison with a hand-reared ♀ calf at Cincinnati Zoo, which had a markedly higher birth weight (37.3 kg) (Maruska *et al.* 1986), our calf weighed 227 kg by day 228 while the Cincinnati ♀ only reached this weight by day 365.

The dam and calf were housed together for the duration of the hand-feeding period and their relationship was possibly reinforced by the calf's attempts to suckle. The time and frequency of suckling was extremely low when compared to those of mother-reared calves and, moreover, a comparison of udder size and volume of milk production between the dam and a ♀ with 'normal' lactation revealed that the calf could not have survived without hand-feeding.

The calf was weaned at the age of 15 months. Mother-reared calves are often

weaned by 10 to 12 months (J. Váhala, pers. obs) when they are sufficiently developed and largely independent of their mothers. Weaning has been as early as six months (St Louis Zoological Park) and 12 months was reported at San Antonio Zoo (Smith & Read, 1992). The calf at Dvur Kralove was simultaneously separated from the dam and weaned. However, Black rhinoceroses are able to lactate for longer and, in the wild, a young rhinoceros may be driven away from the mother at between two and four years of age (Skinner & Smithers, 1990). Greed (1960) reported that in captivity a ♀ was still lactating when her calf was weaned at 19 months.

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PRODUCTS MENTIONED IN THE TEXT

Axetocal inj and Erevit inj: vitamin injections, manufactured by Biotika, Slovenská Lupča, Slovak Republic.

Calcimag inj. and Glyphostan inj: salts, manufactured by Biotika, Slovenská Lupča, Slovak Republic.

Calcite: mineral supplement, manufactured by Krkonoše Lime Works, Kunčice, Czech Republic.

Calcium chloratum: salts, manufactured by Galena, Opava, Czech Republic.

Clamoxyl LA inj.: amoxicillin, manufactured by Smith Kline Beecham Animal Health, Belgium.

Combinol AD2 & Combinol E forte: vitamins, manufactured by Galena, Opava, Czech Republic.

Dermazulen ung: antiseptic ointment, manufactured by Léčiva, Praha, Czech Republic.

Duon inj.: sulphadimidin-trimethoprim injection, manufactured by Léčiva, Praha, Czech Republic.

Farmaferr: iron supplement, manufactured by Farmakon, Olomouc, Czech Republic.

Ferridextran inj.: iron injection, manufactured by Léčiva, Praha, Czech Republic.

Glukopur: glucose, manufactured by Novamyl a.s., Žďár nad Sázavou, Czech Republic.

Laktino: milk substitute (skimmed low-fat cow's milk powder), manufactured by Mlékárna Opočno, Czech Republic.

Procain penicilin G.: penicillin injection, manufactured by Biotika, Slovenská Lupča, Slovak Republic.

Radical oil/Klickovy olej: corn sprout oil, manufactured by Galena, Opava, Czech Republic.

Regumate Equine: synthetic progesteron allyl trenbolone, manufactured by Roussel Uclaf, Paris, France.

Selevit inj: selenium injection, manufactured by Biotika, Slovenská Lupča, Slovak Republic.

Serum proti ochromě: passive navel ill immunization, manufactured by Bioveta, Ivanovice na Hané, Czech Republic.

Serum proti tetanu: passive tetanus immunization, manufactured by Bioveta, Ivanovice na Hané, Czech Republic.

Vakcína proti ochromě: active navel ill immunization, manufactured by Bioveta, Ivanovice na Hané, Czech Republic.

Vakcína proti tetanu: active tetanus immunization, manufactured by Bioveta, Ivanovice na Hané, Czech Republic.

Vubimag: mineral supplement, manufactured by Farmakon, Olomouc, Czech Republic.

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Breeding the White-lipped peccary

Tayassu pecari

at Berlin Zoological Garden

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The White-lipped peccary *Tayassu pecari* is hardy and breeds well in zoos. At Berlin Zoological Garden a founder group of 1.4 imported between 1979 and 1985 has bred successfully and by August 1994 has resulted in a living population of 38 animals, housed at a number of European Zoos. Data have been obtained on age at sexual maturity, annual distribution of births, gestation period, litter size, sex ratio at birth, juvenile mortality and interbirth intervals.

The White-lipped peccary *Tayassu pecari* is distributed from northern Argentina to

the Mexican States of Chiapas and Yucatan (March M., 1991). It is exhibited in many South and Central American collections where it is found more frequently than the Collared peccary *Tayassu tajacu*, which is the more popular species elsewhere. Although *T. pecari* is not considered threatened and its export is not banned, it is poorly represented outside its native area and there are few breeding records.