

Hand-rearing Hoofstock: a Team Approach

Natalie R. Mashburn, Kimberly Bradley, and Ann M. Ward
Fort Worth Zoo, 1989 Colonial Parkway, Fort Worth, Texas 76110

There are many reasons for hand-rearing neonatal hoofstock in captivity. From 1989 until 1992 the Fort Worth Zoo had no male springbok (*Antidorcas marsupialis*) or dama gazelles (*Gazella dama*). In 1993, when males were added to these herds, offspring began to be produced. Calves were rejected by first time mothers who had also been hand-reared, and by dams with a history of maternal neglect. The keeper staff had undergone a complete turnover since animals were last hand-reared. A coordinated effort between the nutritionist and animal staff resulted in new protocols, and new milk formulas were formulated to support growth and properly formed stools. Protocols were developed to standardize methods of care and minimize differences in keepers personal style. Documented standardized protocols facilitate new staff with little experience hand-rearing animals to do so successfully. Nursery logs were set up to record formula offered, amount offered, amount consumed, stool condition, urine, and the animals, overall behavior at each feeding. Animals were weighed at the same time of the day when possible to insure comparability of weight data. Hand-rearing the first calf proved to be a challenge. Later, systems for hand-rearing were streamlined and the process of raising neonatal hoofstock went more smoothly.

Key words: hand-rearing, ungulates, dama gazelle (*Gazella dama*), springbok (*Antidorcas marsupialis*)

INTRODUCTION

The Fort Worth Zoo had no male springbok (*Antidorcas marsupialis*) or dama gazelle (*Gazella dama*) for several years. A male dama gazelle was acquired in the fall of 1992, and a male springbok was acquired in the spring of 1993. In the fall of 1993, a healthy female springbok calf was born. The calf was strong at birth and attempts were made to bond the calf with its mother. An unsuccessful attempt was made to separate the mother from the herd to allow her and the calf to be isolated from the herd. The mother was completely uninterested in the calf and after a time, the decision was made to pull the calf for hand-rearing. The calf had a very strong sucking reflex. She was rehydrated with an electrolyte solution for calves (Replenish, Fermenta Animal Health Co., Kansas City, MO 64153) every two hours for the first 24 hours. At first, the calf was fed a commercially prepared powdered doe milk replacer (The National Food Laboratory, Inc., Dublin, Ca 94568).

Due to limited availability of the doe formula and the calf's failure to thrive, evidenced by weakness, diarrhea and an elevated body temperature, a new formula was investigated. This springbok formula and protocols were used successfully for two additional springbok born in the following years.

These protocols developed for springbok were adapted for dama gazelle, who had also produced calves that were abandoned at birth. Two dama gazelles gave birth on consecutive days. Both of these animals were young and had been hand reared. At parturition, both of the females suffered

from dystocia. Both animals were sedated by the veterinarian, and the calves were delivered. These dams rejected their calves. Keepers, veterinarian and nutritional services staff began the hand-rearing process.

MATERIALS AND METHODS

A formula was made based on mother's milk for animals that produce intermediate concentration milk such as suidae, giraffidae, camelidae, and bovidae, and those animals that produce a concentrated milk such as cervidae (Tables 1 and 3), using the chapter on hand-rearing ungulates in the American Zoo and Aquarium Infant Diet Notebook (Reiter et al., 1994) as a basic reference. Dama gazelles did well on a slightly more dilute formula (Table 2). On the springbok formula (Table 3), dama gazelles did not have formed stool. Lactaid (Lactaid Inc., P.O. Box 111, Pleasantville, NJ 08232) was added to the formula to aid in lactose digestion. Formula was made 24 hours in advance for the Lactaid to be effective.

When animals were first pulled for hand-rearing, they were given a neonatal exam by the veterinarian, and put on a synthetic colostrum product (Colostrx, Protein Technology, Inc, Santa Rosa, CA 95403), mixed with electrolytes (Replenish) for the first 12 to 24 hours. The first springbok calf was given only an electrolyte solution every two hours for the first 24 hours since Colostrx was not available at that time.

A schedule to gradually increase milk concentration from half to full strength proceeded as follows: day 1 to 3, half strength formula; day 4 to 6, three quarters strength; and on day 7 formula was full strength. Through the transition period electrolytes were used in the formulas in place of water for dilution. Once full strength formula was reached, boiled water was used.

Management of the animals included regular weighing to determine amount of formula to feed by percent of body weight, and monitor growth, adhering to established feeding schedules, formula increases, documentation including formula amount offered/taken, as well as stool condition (and passage of the meconium), and amount of urine. These data were recorded on a nursery log (Figure 1). Initially, feeding 15 % of body weight, animals did well (properly formed stool, alert and active). The amount to fed was gradually increased to 18 % of body weight. New bottles (8 oz. human infant) and nipples (human, "preemie") were purchased and sterilized by boiling in tap water before each use. The commissary prepared fresh formula daily. Calves were confined to sky kennels for the first three to four weeks, and kept warm with heat lamps or heating pads, if necessary. During the first three weeks calves were transported between the zoo and the homes of keepers for around the clock care. Feeding times included offering a bottle, changing the bedding, and stimulation for urine or feces. Regular feedings were five times daily at 4 hour intervals for the first 3 weeks.

At the end of three weeks the animals resided at the zoo permanently. The feeding schedule was modified to accommodate the animal and keepers' schedules. The fifth feeding was eliminated and the fourth feeding moved to an hour later. Calves were kept in their sky kennels and given access to the barn, along with hay beds, and heat lamps if necessary. Hay, grain (Zoo Nutrition Network, Herbivore pellets, Brookfield Zoo, Chicago, IL 60513), and water were also available. It was noted when they began to consume these items.

Introductions to the herd began when the animal settled into the barn area. Animals had supervised sessions in a holding area separate from the adults, but with visual access. Introductions were supervised for the first week, and lasted for 30 to 60 minutes, depending on the interactions of the calf to the herd. It was important for the calf to explore the exhibit including its deep moats. Aggression by the adults was also monitored. By the end of a week the calf usually found its place in the herd structure, knew its way around the exhibit, and was left outside on a full time basis. At this time, bottle feedings were given to the animal in the exhibit. The calf learned to recognize a signal for the feeding such as calling them or the ringing of a bell.

The number of feedings was gradually decreased from five to two daily by nine weeks. During this time volume was not decreased. The total volume was split between fewer feedings. At week eight it became impossible to weigh the animals due to limited capacity of the scale and formula increases were made by half ounce increments per feed per day until bottles were refused (Table 4). At week ten bottles continued to be decreased with no increases in formula volume. Animals were completely weaned by 12 to 13 weeks.

RESULTS

Animals grew well (Figures 2 and 3), had well formed stool (pellets), and were successfully incorporated into the herds. Growth rates were better than or comparable to those cited in the AZA Infant Diet Notebook (Reiter et al. 1994). Springbok doubled their weight in 28 to 32 days. Dama gazelle doubled their weight in 38 days. Hand-reared dik dik (*Madoqua sp.*), Dall sheep (*Ovis dalli*), and Eld's deer (*Cervus eldi*) doubled their weight in 32 to 35 days, 35 to 49 days, and 42 days, respectively (Reiter et al. 1994). Ungulates are generally weaned by the time they reach four times their birth weights (Lee et al., 1991). Based on recorded growth for the springbok and dama gazelles they were at approximately four times their birth weights at the time of weaning.

DISCUSSION

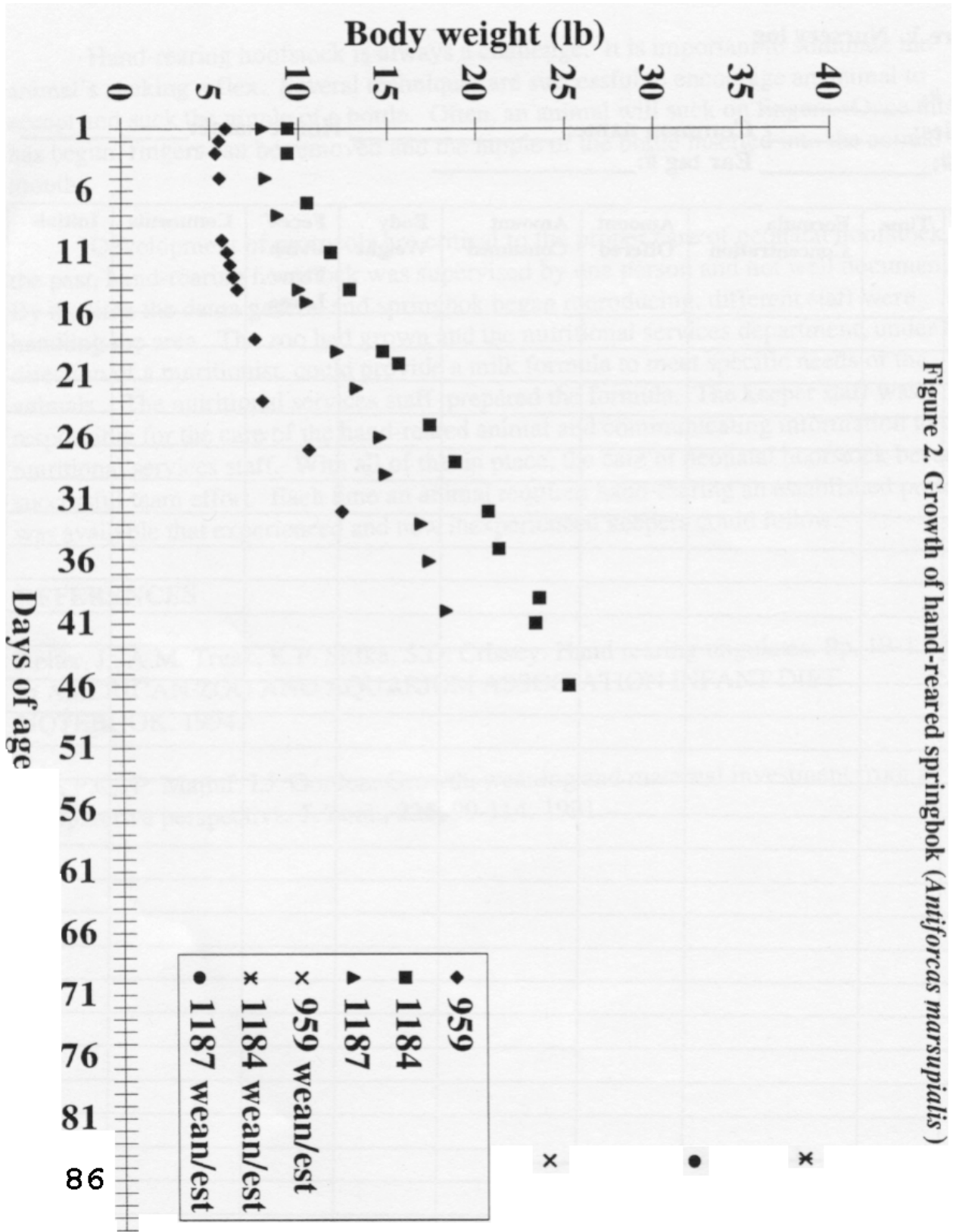
Hand-rearing hoofstock is always a challenge. It is important to stimulate the animal 's sucking reflex. Several techniques are successful to encourage an animal to accept and suck the nipple of a bottle. Often, an animal will suck on fingers. Once this has begun, fingers can be removed and the nipple of the bottle inserted into the animal 's mouth.

Development of protocols is critical to the proper care of neonatal hoofstock. In the past, hand-rearing hoofstock was supervised by one person and not well documented. By the time the dama gazelle and springbok began reproducing, different staff were handling the area. The zoo had grown and the nutritional services department, under the direction of a nutritionist, could provide a milk formula to meet specific needs of the animals. The nutritional services staff prepared the formula. The keeper staff was responsible for the care of the hand-reared animal and communicating information to the nutritional services staff. With all of this in place, the care of neonatal hoofstock became a successful team effort. Each time an animal required hand-rearing an established protocol was available that experienced and new inexperienced keepers could follow.

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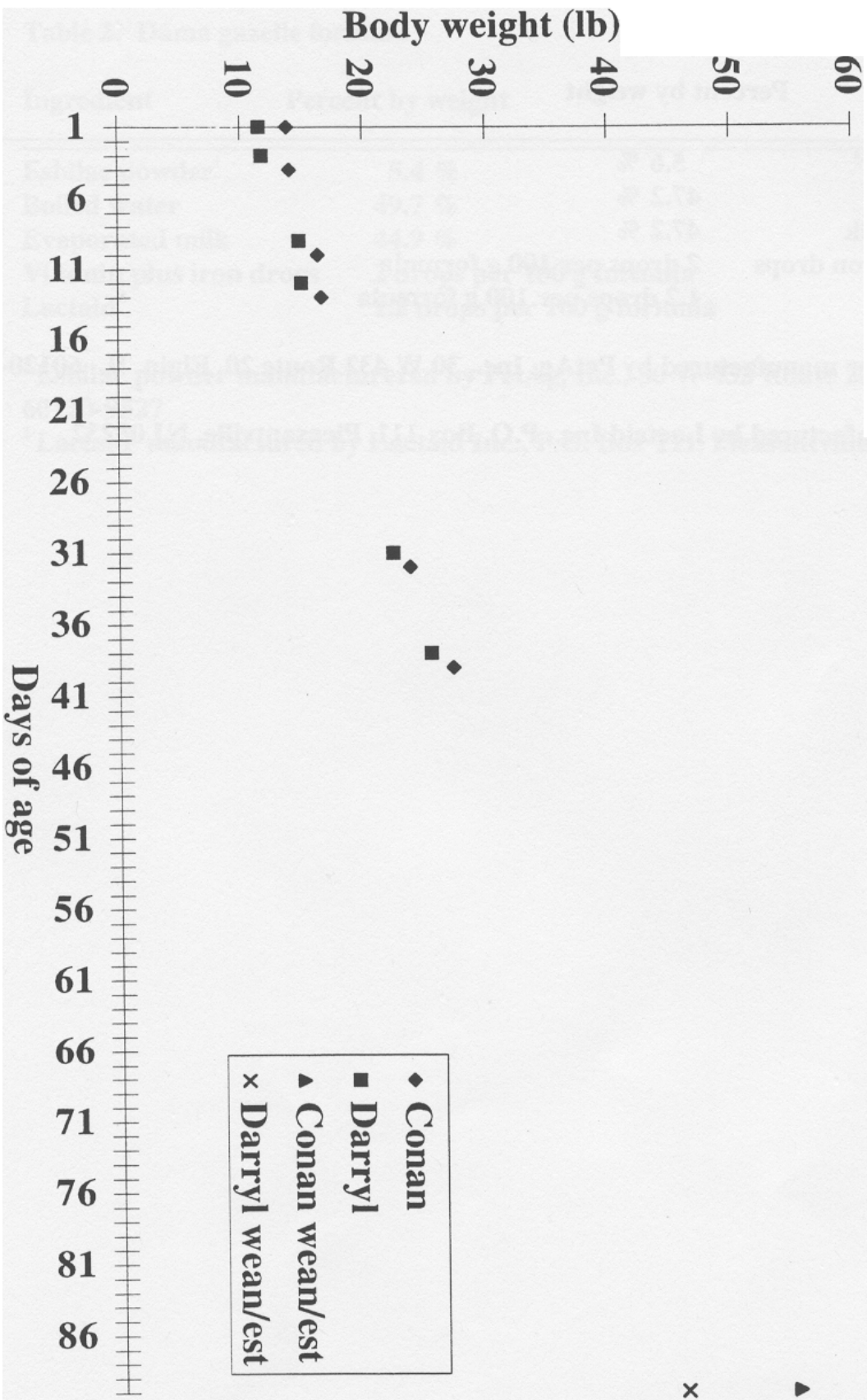


Figure 3. Growth of hand-reared dama gazelle (*Dama gazella*)

Table 1. Springbok formula

Ingredient	Percent by weight
Esbilac powder¹	5.6 %
Boiled water	47.2 %
Evaporated milk	47.2 %
Vitamin plus iron drops	2 drops per 100 g formula
Lactaid²	1.2 drops per 100 g formula

¹ Esbilac powder manufactured by PetAg, Inc., 30 W 432 Route 20, Elgin, IL 60120-9527

² Lactaid manufactured by Lactaid Inc., P.O. Box 111, Pleasantville, NJ 08232

Table 2. Dama gazelle formula

Ingredient	Percent by weight
Esbilac powder¹	5.4 %
Boiled water	49.7 %
Evaporated milk	44.9 %
Vitamin plus iron drops	2 drops per 100 g formula
Lactaid²	1.2 drops per 100 g formula

¹ Esbilac powder manufactured by PetAg, Inc., 30 W 432 Route 20, Elgin, IL 60120-9527

² Lactaid manufactured by Lactaid Inc., P.O. Box 111, Pleasantville, NJ 08232

Table 3. Nutrient analysis of springbok and dama gazelle hand-rearing formulas compared to data on milk composition of other species on an as fed basis.

Milk	Dry matter, %	Protein, %	Fat, %	Lactose, %
Intermediate milks (Suidae, Giraffidea, Camelidae, Bovidae)	12-23	2.5-6.2	3.6-10.3	2.4-8.5
Concentrated milks (Cervidae)	18-31	5.0-13	5.8-15	1.8-7.7
Springbok formula	17	5.2	6.0	5.6
Dama gazelle formula	17	4.9	5.7	5.3

Table 4. Feeding schedule for springbok and dama gazelle

Age in week	Number of feedings per day	Amount offered
1	5	18 % of body weight
2	5	18 % of body weight
3	5	18 % of body weight
4	4	18 % of body weight
5	4	18 % of body weight
6	3	18 % of body weight
7	3	18 % of body weight
8	3	Not possible to weigh, increased formula 0.5 oz per feed per day until refused
9	2	Not possible to weigh, increased formula 0.5 oz per feed per day until refused
10	2	Discontinue formula increases
11	1	Discontinue formula increases
12	1	Discontinue formula increases
13	0	Weaned