Zoo Biology 15:587–591 (1996)

BRIEF REPORT

Training to Reliably Obtain Blood and Urine Samples From a Diabetic Chimpanzee (*Pan troglodytes*)

Gail E. Laule, Robert H. Thurston, Patricia L. Alford, and Mollie A. Bloomsmith

Active Environments Inc., Lompoc, California (G.E.L.); The University of Texas M.D. Anderson Cancer Center Science Park, Department of Veterinary Sciences, Bastrop, Texas (R.H.T., P.L.A., M.A.B.)

Positive reinforcement training techniques were used to gain the cooperation of a socially housed, 3-year-old, insulin-dependent diabetic chimpanzee (*Pan troglodytes*) in obtaining blood and urine samples for monitoring of glucose levels. A urine collection device, adaptable to many types of caging, allowed collection of urine from the diabetic subject as well as other trained, socially housed animals in their home cages. Four years after initial training, the diabetic subject continued to urinate into the container any time of the day or night, usually within 2 min of presentation of the cue, without removal from the home cage or separation from her companions. Blood samples were readily obtained from the subject by heel puncture or venipuncture. © 1996 Wiley-Liss, Inc.

Key words: blood collection, diabetes, positive reinforcement, urine collection

INTRODUCTION

To properly manage cases of insulin-dependent diabetes, a veterinarian must be able to routinely monitor glucose levels in urine and blood. When treating diabetes in captive nonhuman primates, the ability to collect these samples frequently and reliably is often the greatest challenge. Traditional methods typically rely on the use of physical and/or chemical restraint, resulting in temporary isolation of the subject from conspecifics. Furthermore, the sheer frequency of sample collection needed for optimal monitoring makes these methods impractical on an ongoing basis. Consequently, monitoring of glucose levels is often performed less frequently than desired.

Received for publication March 25, 1996; revision accepted June 13, 1996.

Address reprint requests to Gail E. Laule, Active Environments Inc., 7651 Santos Road, Lompoc, CA 93436.

This case study describes a positive reinforcement training program that was developed to gain the cooperation of a socially housed, 3-year-old, diabetic chimpanzee in obtaining the urine and blood samples needed to monitor her condition.

The subject, Allie, was a female chimpanzee born at the University of Texas M.D. Anderson Cancer Center Science Park, (UTSP) in Bastrop, Texas. At 10 days of age, severe diabetes mellitus was diagnosed. As a diapered infant, she was easily monitored. Urine samples were collected from plastic sandwich bags taped to her perineum, and she was restrained by hand when blood samples were taken. In the UTSP nursery protocol, however, diapering ceases at 6 months of age. As Allie grew and was socially housed, these methods were no longer adequate.

A training program designed to gain Allie's cooperation for sampling was begun at 3 years. Allie was housed with two peers and a canine companion in two indoor rooms, with free access to an outdoor play area. The training program had two objectives. The first was to collect multiple urine samples over a 24 hr period, on an ongoing basis, without separating Allie from her companions. The second was to collect up to 4 ml of blood by venipuncture on an as-needed basis, with minimal physical restraint and without sedation. Training was based exclusively on positive reinforcement.

MATERIALS AND METHODS

Urine Collection

An instance of urine collection was judged successful when the subject urinated into a container within 10 min of presentation of a cue and without removal from home cage or separation from companions. To collect samples, a urine collection "wand" was inserted through the wire mesh cage front and held beneath the subject as she urinated. The wand, approximately 30 inches long, was made of 3/4 inch schedule 40 polyvinyl chloride (PVC) pipe fitted with an elbow at one end. A 10 ml disposable polystyrene cup (Baxter Diagnostics Inc., Deerfield, IL) was inserted into the elbow for each collection.

Initial training consisted of capturing urination by presenting a stimulus (the urine collection wand) and waiting until Allie urinated. At the onset of urination, she was rewarded with attention, praise, and sugar-free fruit-flavored drink mix offered in a squirt bottle. For the first few sessions, Allie was free to move around the cage and was rewarded for urination whenever and wherever it occurred. After that, while waiting for urination, Allie was trained to position herself at the cage front, sitting on an elevated PVC perch while grasping the cage front. This was achieved by giving her very small sips of the fruit drink every 30–60 sec as long as she remained in position. Once Allie learned to maintain position, the reward was gradually diminished to a small squirt of fruit drink upon initial positioning, followed by a large reward when she urinated.

The next phase of training focused on desensitizing Allie and her cagemates to the collection wand. While maintaining correct position on her perch at the cage front, Allie was rewarded for two events: for allowing the tip of the wand to be positioned beneath her and for not touching or grabbing the wand. Because the goal was to collect urine without separation from cagemates, it was necessary to train the other animals not to interfere. Her cagemates were rewarded during training sessions

for staying away from Allie and for not touching or grabbing the wand. After each successful collection, all animals were rewarded for compliance.

Finally, once Allie was urinating reliably into the cup in less than 10 min, the procedure was undertaken by three other caregivers, including night attendants, to accomplish round-the-clock monitoring.

Blood Sample Collection

Allie was already cooperating in blood collection by heel puncture, for which she was rewarded with sips of drink mix or bits of food from her daily ration. For this procedure, Allie was routinely carried from her cage and held by the nursery caregiver or placed prone on a fleece-covered tabletop. In the initial training for collection from forearm veins or antecubital fossa, Allie was taught to sit upright on a fleece blanket and allow her arm to be manipulated and held by the trainer but without restraint. Next, she was desensitized to having her arm touched by, first, the trainer's finger, then a cotton swab, and then a syringe without a needle, with a blunt needle, and finally with a sharp needle. Throughout the process Allie was rewarded for being calm and for tolerating each stimulus for increasingly longer periods of time. Finally, a second person, the nursery caregiver, was introduced into the process. As the caregiver positioned Allie's arm and occluded the vein, the trainer simulated the entire blood collection process.

RESULTS

Urine Collection

The results of 219 urine collections from June 19, 1991 to October 2, 1991 were analyzed. Overall, 94% (205/219) of these urine collections were successful within 10 min. Most of the samples were obtained in very short periods of time, with 76% (166/219) collected in less than 3 min and 48% (106/219) collected in less than 1 min. The first successful collection occurred in session 4 in less than 4 min after a total of 42 min of training time. To reach the point of reliable performance, defined as 9 out of 10 consecutive attempts successful within 10 min, 91 training sessions were required, totaling 462 min of training time. However, during the 91 sessions, Allie urinated 85 times, and urine was successfully collected 49 times.

Having additional staff members collect urine made it possible to monitor glucose levels on a 24-hr basis. In fact, 51% of the collections were made during the day, and 49% were made at night. More recent data indicate that Allie's performance was not negatively impacted by transferring responsibility for urine collection from the original trainer to staff. The success rate for the original trainer was 78% (128/164), which included the initial stages of the training. The success rate for the other three individuals together was 99% (259/260).

The number of collections per day ranged from 1–14. The most common scenario consisted of three or four collections in a 24 hr period. The reliability and ease of collection allowed for an intensive study to be conducted, with a maximum of 14 successful collections performed in 1 day.

It is important to note that at the time of this writing, more than 4 years since Allie was first trained for urine collection, she is still reliably cooperating. Allie continues to urinate on cue, most time in less than 2 min, any time of the day or night.

The number of staff members capable of collecting urine has grown to include the colony manager and eight caregivers.

Blood Sample Collection

With blood samples taken from Allie by heel puncture several times daily, it has only been necessary to draw blood by venipuncture eight times to date. The first attempt to actually draw blood occurred during the eighteenth training session, with a total of 275 min of training time invested prior to that. The attempt was successful; Allie showed no visible signs of stress or discomfort, sat quietly, watched the entire procedure, and eagerly accepted rewards. During the next session, the entire procedure was simulated, ending with a sharp needle touching the subject's skin. Allie was again calm and offered no resistance. During subsequent blood draws, she has never refused or disrupted the procedure.

DISCUSSION

Caregivers were able to reliably collect urine samples multiple times in a 24 hr period on a regular basis, and this allowed the adequacy of the insulin doses given to be easily monitored. The readily available urine samples decreased the need for blood sampling as a means of daily glucose monitoring; blood sampling was thus reserved for the times when the subject's condition necessitated a more detailed assessment. Furthermore, the use of positive reinforcement techniques proved to be an effective means of achieving voluntary cooperation during these diagnostic procedures. The technique of eliciting trained behaviors also proved readily transferable to other personnel, making this type of training practical for use in other institutions. Most important, urine collection has remained highly reliable over time. It is interesting to note that Allie seemed to demonstrate a high level of concentration during the procedure, and her observable effort while in a visibly relaxed state suggests that she responded positively to the training.

In some respect, this case has special features that must be acknowledged when considering the applicability of these results to other situations. Allie is a young, nursery-raised chimpanzee who was extremely tractable prior to the onset of formal training. The ability to work with Allie hands-on rather than exclusively through barriers created a context that might not be directly applicable to most other situations. Therefore, it is important to point out that trainers have taught similar behaviors to adult chimpanzees, with equally successful results, while working within the normal restrictions of limited contact through cage barriers [Laule et al., 1992; Reichard and Shellabarger, 1992].

At present, six adult or adolescent female chimpanzees at UTSP have been successfully trained to urinate on cue and to allow their urine to be collected with the wand. Nineteen others have been trained with other collection methods [Stone et al., 1994]. As in Allie's case, the target animals were not separated from cagemates, indicating success in gaining the cooperation of cagemates during sample collection. Furthermore, the ability to elicit the behavior has been readily transferred to personnel other than the trainer, and the animals have been highly reliable in repeating the trained behavior over time.

As Allie matures and the potential for aggression toward her caregivers increases, it will become necessary to train her to use a device allowing blood collection

while in her home cage. Testing of a blood collection sleeve which locks to the cage front on a false door frame has been undertaken. Two adult males have been trained, through positive reinforcement techniques exclusively, to use the sleeve for monthly or more frequent blood collections; reliability is 94% (46/49). Training of additional subjects to use the blood sleeve is in progress, and it is anticipated that Allie will be readily trained as she approaches adolescence.

The positive reinforcement training program has contributed substantially to the physical well-being of this diabetic chimpanzee by making practical the frequent, reliable monitoring of urine and blood samples in a nonstressful manner. Trained animals appear to enjoy the frequent interaction with the caregivers, and thus they benefit from the training program psychologically as well [Laule and Desmond, in press].

ACKNOWLEDGMENTS

We thank Dr. Michale E. Keeling, Mr. Tom Beck, and Mr. Adam Stone for their contributions to this program. Animals were maintained in facilities approved by the American Association for Accreditation of Laboratory Animal Care and in accordance with current United States Department of Agriculture, Department of Health and Human Services, and National Institutes of Health regulations and standards. This project was supported by the National Institutes of Health/National Center for Research Resources grants U42-RR03589 and RO1-RR03578.

REFERENCES

Laule, G.E.; Desmond, T.J. Positive reinforcement training as an enrichment strategy. FIRST ENVIRONMENTAL ENRICHMENT CONFERENCE, Portland, Oregon, 1993, in press.

Laule, G.E.; Keeling, M.; Alford, P.L.; Thurston, R.; Beck, T. Positive reinforcement techniques and chimpanzees: An innovative training program. Pp. 713–718 in PROCEEDINGS, CENTRAL REGIONAL AMERICAN ASSOCIATION OF ZOOLOGICAL PARKS AND AQUARIUMS CONFERENCE, Dallas, TX, 1992.

Reichard, T.; Shellabarger, W. Training for husbandry and medical purposes. Pp. 396–402 in PROCEEDINGS, AMERICAN ASSOCIATION OF ZOOLOGICAL PARKS AND AQUARIUMS ANNUAL CONFERENCE, Toronto, Canada, 1992.

Stone, A.M.; Bloomsmith, M.A.; Laule, G.E.; Alford, P.L. Documenting positive reinforcement training for chimpanzee urine collection. AMERICAN JOURNAL OF PRIMATOLOGY 33:242, 1994.