ASSOCIATION OF ZOOS & AQUARIUMS

CHIMPANZEE
(*Pan troglodytes*)
CARE MANUAL

CREATED BY THE
AZA Chimpanzee Species Survival Plan®
IN ASSOCIATION WITH THE
AZA Ape Taxon Advisory Group

Chimpanzee (*Pan troglodytes*) Care Manual

Published by the Association of Zoos and Aquariums in association with the AZA Animal Welfare Committee

Formal Citation:

AZA Ape TAG 2010. Chimpanzee (*Pan troglodytes*) Care Manual. Association of Zoos and Aquariums, Silver Spring, MD.

Original Completion Date:

December 8, 2009

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Disclaimer: This manual presents a compilation of knowledge provided by recognized animal experts based on the current science, practice, and technology of animal management. The manual assembles basic requirements, best practices, and animal care recommendations to maximize capacity for excellence in animal care and welfare. The manual should be considered a work in progress, since practices continue to evolve through advances in scientific knowledge. The use of information within this manual should be in accordance with all local, state, and federal laws and regulations concerning the care of animals. While some government laws and regulations may be referenced in this manual, these are not all-inclusive nor is this manual intended to serve as an evaluation tool for those agencies. The recommendations included are not meant to be exclusive management approaches, diets, medical treatments, or procedures, and may require adaptation to meet the specific needs of individual animals and particular circumstances in each institution. Commercial entities and media identified are not necessarily endorsed by AZA. The statements presented throughout the body of the manual do not represent AZA standards of care unless specifically identified as such in clearly marked sidebar boxes.

This nutrition chapter is an excerpt from the complete Animal Care Manual available at the

Association of Zoos and Aquariums (AZA)'s website:

http://www.aza.org/animal-care-manuals/

Further information about diets and the nutrition of this and other species can be found at the

AZA's Nutrition Advisory Group (NAG)'s website:

http://nagonline.net

5.1 Nutritional Requirements

> **AZA Accreditation Standard**
>
> **(2.6.2)** A formal nutrition program is recommended to meet the behavioral and nutritional needs of all species and specimens within the collection.

A formal nutrition program is recommended to meet the behavioral and nutritional needs of all animals (AZA Accreditation Standard 2.6.2). Diets should be developed using the recommendations of Nutrition Advisory Groups (www.nagonline.net/feeding_guidelines.htm), AZA Taxon Advisory Groups (TAGs), Species Survival Plan® (SSPs) Programs, as well as veterinarians. Diet formulation criteria should address the animal's nutritional needs, feeding ecology, as well as individual and natural histories to ensure that species-specific feeding patterns and behaviors are stimulated.

Although daily human caloric needs can be a guide for chimpanzees, NRC guidelines were published recently for non-human primates (NRC 2003). More research is needed to identify specific nutrient requirements for chimpanzees.

Nutritional needs: As complete diets provided to chimpanzees (see section 5.2) should be balanced for vitamins and minerals, routine supplementation is not generally necessary, although non-human primates have a dietary requirement for vitamin C. Where supplementation is provided, human products can be used by label direction. However, selection of products without excess iron (i.e., greatly exceeding the 2003 NRC guidelines) is important unless iron-deficiency anemia is specifically under treatment.

Vitamin D: In juveniles, documented cases of vitamin D deficiency (metabolic bone disease) have occurred in chimpanzees housed exclusively indoors. Vitamin D requirements can be met with an appropriate diet and/or UVB exposure, which may include routine outdoor access. When this is not possible due to exhibit design or season, appropriate supplementation of calcium and vitamin D is essential.

Pregnant females: Pregnant females may benefit from adjustments in their diet; however, there are no definitive data to guide these changes. Managers might consult guidelines that address dietary requirements for pregnant humans – such as adding prenatal vitamins to best meet their needs for folic acid and iron. Caloric intake may be increased during pregnancy (last trimester only) and lactation.

Seasonal changes: There are no definitive data to support the requirement to change the composition of diets based on seasonal changes. Care should be taken to ensure that sufficient vitamin D is being provided during extended indoor living that might result from cold winter conditions in northern climates.

Target ranges of nutrients for all life stages: This information is available in Nutrient Requirements of Nonhuman Primates, Second Revised Edition, 2003 published by the National Research Council.

Energy requirement calculations: The maintenance energy requirement (MER) is the amount of energy used by an animal in a thermoneutral environment, that is, at the optimal ambient temperature. It represents the energy expended in obtaining and using food in an amount sufficient to maintain body weight, but not to support growth, pregnancy or lactation. It is important to remember that the calculated MER only represents an estimate of energy need. To calculate the MER of a given individual, body weight in kg should be raised to the 0.75th power and then the resulting value multiplied by 100 to estimate total kcal needed per day. For chimpanzees weighing approximately 76.5 kg (168.7 lb), this results in 1800 to 2600 kcal per day, depending on conditions (NRC, 2003; page 45). The result is the approximate energy expenditure of a mature individual in a day and can be used to estimate diets and nutritional needs.

5.2 Diets

> **AZA Accreditation Standard**
>
> **(2.6.3)** Animal diets must be of a quality and quantity suitable for each animal's nutritional and psychological needs. Diet formulations and records of analysis of appropriate feed items should be maintained and may be examined by the Visiting Committee. Animal food, especially seafood products, should be purchased from reliable sources that are sustainable and/or well managed.

The formulation, preparation, and delivery of all diets must be of a quality and quantity suitable to meet the animal's psychological and behavioral needs (AZA Accreditation Standard 2.6.3). Food should be purchased from reliable, sustainable and well-managed sources. The nutritional analysis of the food should be regularly tested and recorded.

Sample diets: In the wild, chimpanzees primarily eat fruit, but their diets also include leaves, pith, seeds, flowers, insects, and meat (Wrangham 1977; Goodall 1986). Insects and meat make up between 1-5% of the diet. Although chimpanzees in zoos and aquariums receive enough protein in the form of commercial primate diets, the amount of complex carbohydrates and fiber in their diets is generally less than wild chimpanzees (Pruetz and McGrew 2001). While the variety of food types found in the diet of the wild chimpanzee is not likely to be matched by chimpanzees in zoos and aquariums, some attempt should be made to give chimpanzees in zoos and aquariums varied food types that resemble the diet of wild chimpanzees as much as possible (Pruetz and McGrew 2001).

Chimpanzees should be fed a balanced diet that includes a mixture of vegetables, fruits, and nutritionally complete dry food. A good quality complete food (biscuits) with mixed produce (vegetables, fruits, greens) will compose the base diet, with minimal or no dairy and additional protein sources provided. Providing a supply of browse is important whenever possible by seasonal availability.

A staple portion of the chimpanzee diet should be a 15-25% protein monkey biscuit with low calories (<3 kcal/g if possible), high fiber (10-12%), and low fat (3-4%). In addition, a variety of other foods should also be provided throughout the day at frequent intervals for enrichment, and to enhance nutrition (Lee and Guhad 2001). Foraging and eating account for the largest proportion of a chimpanzee's daytime activity in the wild. Chimpanzees at Gombe eat during 47-60% of their waking day (Wrangham 1977), and at Tai, chimpanzees eat for an average of 54% of their waking time (Boesch and Boesch 2000). In contrast, adult females in mixed parties at Mahale spend only 30% of their time foraging and eating (Matsumoto-Oda et al. 1998), perhaps indicating increased feeding competition in mixed parties, or replacement of eating with other activities such as socio-sexual behavior (Pruetz and McGrew 2001).

The nutritional status of chimpanzees also influences many aspects of their health and behavior. Nutritional requirements may vary depending on the individual's health, growth stage, activity, immune status, or housing conditions. An approximation of chimpanzee nutritional requirements can be developed using human RDA and Nonhuman Primate NRC tables (2003), however, these should be considered rough estimates because a chimpanzee's diet in the wild is much higher in fiber. Dietary fiber levels for chimpanzees in zoos and aquariums are important, and overall levels provided may need to be increased. This can be accomplished in several ways:

- Offering all fruits raw and unpeeled, as fiber is often localized in the peels.
- Replacing soft fruits (e.g., bananas, grapes, citrus fruits), which contain low fiber levels, with hard fruits (e.g., apples, pears) or vegetables (e.g., yams, potatoes, squash), which contain relatively more fiber. Overall, the fiber content of fresh produce is low. The most efficient way to increase fiber intake is to feed a high fiber biscuit (see Milton and Demment 1988).
- Increasing green produce in the diet, and/or adding browse on a daily basis.
- Provision of hay, steel cut oatmeal, beet pulp, corn husks, and/or banana leaves.

Fruits are an important diet component for chimpanzees in the wild and in zoos and aquariums, and may provide valuable behavioral stimulation. The domesticated fruits fed in zoos and aquariums contain more simple sugars and less fiber, but similar available protein levels, than fruits obtained in natural habitats. A variety of fresh fruits should be offered, with choice dictated by local or seasonal availability, and with price a major consideration. Fruit should not exceed 25% of the total weight of the diet, and may even contribute much less, providing approximately 5% of the dry matter. Greens in the form of locally available browse plants, or dark green leafy produce (iceberg lettuce is acceptable but is not as good a source of nutrients) should be offered in amounts up to 45-50% (as fed basis) of the total diet. Palatable forage plants can even be incorporated into exhibits to allow natural foraging activity. Increased greens would also provide natural sources of dietary fiber, protein, calcium, B vitamins, beta-carotene, and alpha-tocopherol (vitamin E). All diet ingredients as consumed should meet the suggested guidelines in the Nonhuman NRC (2003). The following table (Table 3) lists the percentage fiber of various fruits and vegetables according to the USDA database:

Table 3: The fiber content of select fruits and vegetables based on 100g of each item (fresh weight).

Food item	% Fiber content (fresh weight)
Bananas (no peel)	2.6
Oranges (no peel)	2.4
Oranges (with peel)	4.5
Apples	2.4
Pears	3.1
Grapes	0.9
Yams	4.1
Potatoes	2.2
Winter squash	1.5
Summer squash	1.1

Of additional interest is replicating wild chimpanzees' interest in pith. In the wild, when available chimpanzees spend the late afternoon sitting in a patch of elephant grass, stripping off the outer cover of the stems (approximately the size of sugar cane) and eating the relatively soft pith or core. More research is needed to determine how these food choices can be replicated in zoo environments (i.e. fresh corn stalks, sugar cane).

Feeding schedule: Since the predominant daytime activity of wild chimpanzees is searching for and consuming food, great effort should be made to increase the amount of time that chimpanzees in zoos and aquariums spend in similar endeavors. The presentation of food is an obvious form of enrichment, and can help increase foraging time and decrease aggression and abnormal behavior (Bloomsmith et al. 1988). Recommended feeding schedules should include multiple feedings throughout the day of a wide variety of food. Seeking, processing, and ingesting food are vital components of chimpanzee daily life, and so variability in food type and presentation should be a primary goal within chimpanzee management programs in zoos and aquariums.

Food variety and presentation: The diet of wild chimpanzees includes fruits, leaves, pith, blossoms, seeds, stems, bark, resin, honey, insects, eggs, and meat. Food intake varies by season, consisting on an annual basis of about 60% fruits, 30% vegetation, and 5 - 10% animal matter. Termites are the most frequently consumed animals, but chimpanzees also stalk, kill, and eat young hoofstock, baboons, and other monkeys. Although providing live prey is not desirable in zoos and aquariums, a wide range of food items can be provided to chimpanzees as long as the nutritional composition of the total diet is known.

Encouraging species-appropriate foraging has been a recognized aim of most enrichment programs. For example, Bloomsmith and Lambeth (1995) used an unpredictable feeding schedule to reduce inactivity and abnormal behavior in chimpanzees in zoos and aquariums. Taking into account the varied aspects typical of eating and foraging by wild chimpanzees, such as the number and time of feeding bouts per day, can enhance eating and foraging and reduce inactivity and excessive caloric intake in zoo and aquarium animals (Pruetz and McGrew 2001).

The way that food is presented is an obvious a form of enrichment. Bloomsmith et al. (1988) found that aggression and abnormal behaviors declined significantly when four feeding regimes were simultaneously implemented with chimpanzees:

- Monkey biscuits *ad libitum*
- Presentation of foods with high process time (e.g., corn on the cob, celery, artichokes, sugar cane).
- Foraging foods (e.g., popcorn, sunflower seeds, peanuts) distributed over a grass substrate.
- Availability of food in a puzzle feeder.

Providing foods that require processing was found to be the most successful technique for eliciting long feeding bouts. Providing a variety of manipulatable objects to chimpanzees in zoos and aquariums both increases the amount of time spent in foraging-type activities and increases their well-being (Mellen and Shepherdson 1992). Designing structures that allow the chimpanzees to climb to obtain food may mimic foraging in the trees; for example, fruits suspended from climbing structures and varied seasonally to mimic seasonal fruiting of wild plants in the rain forest (Coe et al. 2001). The addition of browse encourages processing and consumption of food items. Damen (1990) found that the addition of browse increased foraging time from 3 - 17%, and resulted in a drastic decline in coprophagia. The provision of feeding opportunities such as browse, puzzle feeders, and termite mounds, may increase the potential for competition and conflict, but these situations can be managed by providing multiple sites for food acquisition.

Puzzle feeders: Wild chimpanzees, especially adult females, make use of tools to acquire termites (Goodall 1986). This predisposition has been used extensively in the development of artificial termite mounds and puzzle feeders for chimpanzees in zoos and aquariums. In an evaluation of tool use, Nash (1982) found that the presence of an artificial termite mound stimulated the exhibition of these wild behaviors, and that the termite mound was most often utilized by younger chimpanzees. Similarly, Brent and Eichberg (1991) found that the presence of a puzzle feeder decreased aggression, affiliative, inactive, and self-directed behaviors; in this study, females used the puzzle boards more than males. Maki et al. (1989) found that chimpanzees showed a significant decrease in abnormal behavior and inactivity in the

presence of termite fishing feeders. The provision of multiple feeders to preclude aggressive competition, and the use of different types of feeders to cater to individual task preference, are recommended. Maple and Finlay (1989) provide a review of a variety of puzzle feeders. The type of foods available in termite mounds/puzzle feeders should also be varied (Mellen and Shepherdson 1992), and a variety of novel food items have been offered, including barbecue sauce, jellies, syrup, honey, applesauce, oatmeal, and various condiments. The ability to easily access and clean a device such as an artificial termite mound should be considered in its design. The dental health impact of the foodstuffs chosen should also be considered, as well as their caloric content, which should be included in the overall nutrient evaluation of the diet. Please contact the AZA Chimpanzee SSP Coordinator for more information on specific food companies for primate diets.

Current diets and schedules:
Diets should be tailored to meet individual's needs. Lactating, pregnant, and geriatric chimps may have different nutritional needs than others. Diet changes should be made and assessed according to each chimpanzee's needs, consumption and behavior.

Nutrient analysis comparing to target nutrient ranges:
Any listed diet examples should be analyzed for nutrient composition; diets are not officially endorsed, but rather have been successfully implemented, by the AZA Chimpanzee SSP.

AZA Accreditation Standard

(2.6.1) Animal food preparations must meet all local, state/provincial, and federal regulations.

AZA Accreditation Standard

(2.6.4) The institution should assign at least one person to oversee appropriate browse material for the collection.

Food preparation must be performed in accordance with all relevant federal, state, or local regulations (AZA Accreditation Standard 2.6.1). Meat processed on site must be processed following all USDA standards. When preparing food for chimpanzees, one should not mix produce utensils and equipment with meat utensils and equipment. The shelf life of primate biscuits is limited to 6 months from the date of manufacture due to the loss of Vitamin C in the product.

If browse plants are used within the animal's diet or for enrichment, all plants must be identified and assessed for safety. The responsibility for approval of plants and oversight of the program should be assigned to at least one qualified individual (AZA Accreditation Standard 2.6.4). The program should identify if the plants have been treated with any chemicals or near any point sources of pollution and if the plants are safe for the species. If animals have access to plants in and around their exhibits, there should be a staff member responsible for ensuring that toxic plants are not available.

Browse plants: The Association of Zoological Horticulture (www.azh.org) has a searchable database of acceptable browse species. If plants are considered toxic to pets, it is safe to assume that chimpanzees should not consume them either. The American Society for Prevention of Cruelty to Animals website, maintains a list of plant species that are toxic to dogs and cats (www.aspca.org/pet-care/poison-control/plants/). The Humane Society of the United States also has a comprehensive list of poisonous plants on their website: (www.hsus.org/pets/pet_care/protect_your_pet_from_common_household_dangers/common_poisonous_plants.html). Also consult Burrows and Tyrl (2006) for a complete overview of poisonous plants.

Chemical sprays or pollution: All plant species offered to chimpanzees or grown in their enclosure should be free of chemical sprays such as herbicides, pesticides, and insecticides. If there is any doubt about the presence or previous presence of these types of chemicals the plant should not be offered. All plants that are determined to be free of chemical contamination should always be thoroughly rinsed with clean water before offering to chimpanzees

5.3 Nutritional Evaluations

Body size evaluations: The degree of variation in body size of chimpanzees is relatively small once factors of sex, age, and health (e.g., obesity) are removed. As a result, there are no conclusive dietary recommendations for chimpanzees of different size. Further research will help clarify this issue.

Health issues: For adults, obesity is a substantial risk factor for cardiac disease, and is inconsistent with good long-term health. It is important to include calories obtained from enrichment and operant conditioning sources as part of the balanced diet. Judicious use of sugar free or low sugar products will assist in maintaining appropriate weight and body condition. Regular weighing (e.g., several times yearly) is critical to long-term nutritional maintenance and weight loss when indicated. Foods high in sodium and fat are linked to cardiac disease in humans, and a similar relationship can be expected in chimpanzees. Poor diet can also be a contributing factor in the development of diabetes, and there are several reported cases of diabetic chimpanzees that require substantial health and diet management, including regular insulin injections. Consultation with a clinical nutrition (veterinary or human) specialist will provide guidance in these specific cases, and positive reinforcement techniques can be used to reliably obtain blood and urine samples to monitor glucose levels (Laule et al. 1996).

Tools and methods used for clinical nutritional evaluation: Evaluate body condition using numerical scale; body weight; evaluate individual's diet consumption to ensure that a balanced diet is being taken and that the chimpanzee is not being selective.

bonding period. In some cases, such as the presence of a particularly troublesome adolescent, it may be necessary to separate the pregnant female temporarily, but it is strongly recommended that the female remain with other conspecifics if at all possible. Chimpanzees that are pregnant or with young should not be subjected to social introductions with unfamiliar conspecifics.

Pregnancy can be monitored with urinary human chorionic gonadotropin tests, and concurrently confirmed with ultrasonography. Gestation has been reported in the range of 227 + 12 days (see Chapter 7, section 7.3 for additional information). It is recommended that reproductively active females receive oral folic acid supplementation at 400 mcg/day for the month prior to conception, in order to minimize neural tube defects. This vitamin is routinely provided in most adult human vitamin supplementations. Routine iron supplementation during pregnancy is not needed to prevent anemia in either the dam or fetus, but may be provided in known cases of iron-deficiency anemia of the dam. Pregnant females should receive iron supplementation during the last trimester of pregnancy when fetal blood formation is greatest (Beard 2000).

Serial serum levels of gonadotropins, prolactin and sex steroids in the non-pregnant and pregnant chimpanzees were studied by Reyes et al. (1975). They reported that serum levels of FSH, LH, chorionic gonadotropin (CG), prolactin, estrone (E1), estradiol-17Beta (E2), estriol (E3) and progesterone were measured at 2-3 day intervals in 4 chimpanzees through 2-3 menstrual cycles, and serially through subsequent pregnancies. The hormone patterns of the menstrual cycles were similar to those in humans, with high levels of FSH in the early follicular phase, followed by rising E2 concentrations to a peak (up to 35 ng/dl) at or just before a midcycle LH/FSH peak. In most cycles there was a secondary E2 rise and progesterone rose to values above 500 ng/dl during the luteal phase. There was no consistent pattern in prolactine levels through 3 menstrual cycles. A simultaneous increase in E2 and LH/CG levels and a fall in FSH about 10 days postovulation indicated fertilization and implantation. Other early signs of pregnancy were persistent luteal range progesterone concentrations and rising levels of E1 and E3. Peak CG levels (56-154 IU/ml) occurred 30-50 days after the midcycle LH/FSH peak, followed by a decline and then a small secondary rise to (to 1 IU/ml) before term. E1, E2 and E3 levels rose more rapidly after 80 days to a peak at term (E1: 180-300 ng/dl; E2: 500-800 ng/dl; and E3:400-1000 ng/dl). Progesterone levels showed one peak coincident with the CG peak, and a secondary rise after about 80 days to maximal values at term of 49-120 ng/ml. Prolactin levels increased during pregnancy with irregular fluctuations (7-127 ng/ml). These findings indicate that the hormonal patterns during pregnancy in the chimpanzee are remarkably similar to those in humans.

There is relatively little published data on the behavior of pregnant female chimpanzees and associated group interactions. More detailed accounts of these circumstances will help define future management considerations to improve the health and welfare of mothers and offspring. Predicting parturition is also a difficult endeavor and rife with mythology and unsubstantiated methodology. There are accounts of females socially separating from the group, becoming irritable, less active and changing eating patterns, but none of these have been empirically evaluated. Given the association of human activity and chimpanzee behavior (Lambeth et al. 1997) it was postulated that zoo chimpanzees might be more likely to give birth on less-crowded weekdays than busy weekends (Alford et al. 1992) – however, a recent analysis of parturition dates for zoo-housed chimpanzees discounted this effect (Wagner and Ross 2008), showing that zoo-housed chimpanzees are no more likely to give birth on any particular day of the week.

7.4 Birthing Facilities

As parturition approaches, animal care staff should ensure that the mother is comfortable in the area where the birth will take place. The mother should be allowed to give birth in her home enclosure and with the rest of the social group present. As such, there is not a separate birthing facility per se. Ensure that this area is “baby-proofed” by ensuring that there are no small openings in which the baby may get stuck. Any pools or water-elements should be drained for at least the first 6 months and kept shallow for the first couple years to prevent accidental drowning. An over-abundance of bedding material should be provided around the time of parturition and maintained at a high level throughout the first year as mother-infant nesting is particularly important. The temperature of the facility should be carefully monitored and colder microclimates (i.e. drafty areas) should be eliminated when possible.

7.5 Assisted Rearing

In the wild, female chimpanzees maintain close relationships with their offspring for a relatively long period of infancy and juvenile development. Most mothers have their infants in constant, or nearly constant, contact until the infants first break contact with the mother between 6-12 months. Around 4-5 years of age, youngsters begin to sleep separately from their mothers, and will forage independently (Clark 1977). However, the maternal bond remains strong for many more years, and young chimpanzees will maintain a close association with their mothers until the age of 8-11 years when they achieve some degree of adult-like independence. Although social maturity tends to happen earlier for chimpanzees in zoos and aquariums, these facts underscore the importance of the mother-infant relationship.

The AZA Chimpanzee SSP recommends that in virtually all circumstances, mothers have the opportunity to rear their infants themselves and without human intervention. The rare circumstances of human intervention include maternal abuse, neglect, or significant illness or injury to the mother or infant. In these conditions, where the life of the mother or

infant is in danger, managers should intervene. In some circumstances, the infant may be able to be reintroduced to the mother soon after the initial separation, and mother-rearing may be continued. However, in cases of life-threatening abuse or neglect, alternative rearing strategies should be considered. It is recommended that the first alternative to mother-rearing is to re-socialize the infant with other chimpanzees as soon as it is safely possible. Ideally this would be with a surrogate mother in the natal group, but it is also possible that an unfamiliar surrogate could suffice.

In many cases, the adequacy of the mother's care is not clear. Institutions should stay in close contact with the AZA Chimpanzee SSP to receive advice on whether particular behaviors are deemed enough to pull the baby into a temporary human-rearing situation. New mothers may not want to carry the baby all the time, and will occasionally put the newborn on the ground by itself. While this behavior is not preferable is does not necessarily brand the mother as neglectful. Note how the mother reacts when the baby cries or is in apparent danger (perhaps due to proximity to another chimpanzee). If the mother returns to collect the infant in these circumstances, there is reason for optimism. If the infant appears not to be getting fed on a regular basis (once every 1-3 hours), there may be reason to supplement his diet by bottle-feeding through the mesh if possible. In one recent case, a mother ignored her newborn and as a result the infant was not getting fed enough. The mother was anesthetized and the infant placed on the nipple. When the mother awoke, the bond was established and there was no need for human rearing intervention (S. Tanner, personal communication).

The age at which to introduce an infant to a potential surrogate will vary with the infant's health and personality, as well as the surrogate's health, personality, and maternal skill. This introduction can occur as early as 6 months of age. Before this time, the infant will likely have to be reared by human caregivers. Managers should be in touch with the AZA Ape TAG's Birth Management Subcommittee to discuss potential surrogates, contemporary hand-rearing strategies, and other re-socializing information.

A hand-rearing protocol should meet both the physical needs of the infant as well as the psychological and social needs of the infant (Porton 1992). In general, the recommendations for hand-rearing an infant chimpanzee requires:

- 24-7 care
- Rearing in the presence of conspecifics for early reintroduction
- Species-specific handling of infant (mimicking a mother chimp)
- Institutional commitment to follow through with the rearing process until full re-integration is complete

Nursery environment: An off-exhibit nursery should be used, as having a nursery on public view may affect public perception of ape infants and encourage primates as pets. The nursery area should be made "primate-proof" (i.e., no accessible containers, foods, or hazardous or breakable materials). It is essential to have a small kitchen and bathroom in proximity to the nursery, and these areas should contain a refrigerator, microwave, sink, and storage (washer and dryer are optional). The entrance area to the nursery should be equipped with a footbath. This is a staging area where animal caretakers leave shoes and street clothes, and change into scrubs. Sanitary protocols should be used at all times. Keepers should wash their hands before entering the nursery, after changing diapers, before preparing food, and at all other appropriate times. Hospital scrubs or gown, surgical mask and foot covers should be worn when an infant is pulled. When an infant's health is stabilized, the mask is optional. Animal caretakers that are ill should not be in the nursery.

An isolette should be available for potential intensive care. If used, keepers should maintain continual contact with the infant by placing hands on the infant through isolette openings. The area outside the isolette should have sufficient climbing opportunities (mesh and climbing structures) for strengthening motor skills, and a scale is necessary for obtaining daily weight data.

Pre-birth preparations: One month before the impending birth, management preparations should begin. The nursery area should be cleaned and disinfected in case it is needed. Appropriate milk-substitute formulas should be ordered (e.g., Enfamil and Similac, or the soy-based Isomil if the infant is allergic to milk protein or lactose – see Porton 1992). Small quantities of 5% glucose, sterile water, and Pedialyte should also be purchased, as these may be necessary to mix with or substitute for formula. At this time, it is also recommended to create a tentative staffing schedule for three 8-hour shifts that provide 24-hour coverage. Twenty-four hour care should be provided from the time the infant is pulled from the dam until it is returned to the mother or a surrogate.

Record keeping: Record keeping is an integral part of the nursery protocol. Keepers should record behaviors, development of motor skills, food consumption, sleep patterns, and milestone information such as tooth eruption. Information on the stool (e.g., color, consistency, and amount) should also be recorded. The first two weeks after the infant has been pulled, vitals should be taken between each bottle-feeding, while the infant is in a quiet mode or asleep. If the infant is active, this procedure is too stressful for both infant and caretakers. By the third week, and if the infant is stable, vitals should be taken once each shift at approximately the same time each day. Taking vitals consistently establishes a pattern. When there is a deviation to this pattern, it may be an indication that something is wrong. A follow up on unstable vitals can lead to early diagnosis, treatment, and a quicker recovery. These records also give a guideline for future nursery infants. When the infant sleeps through the night, vitals can be discontinued on this shift. Table 7 provides a sample of vital information to be recorded during hand-rearing.

Table 7: Information to be recorded in routine infant assessments during hand-rearing

Procedure	Notes
Weight	Taken each morning before feeding by placing infant on its stomach. The diaper should be removed. Infant can hold blanket for security if additional weight is subtracted.
Resting respiration	Infant's breathing should be visually watched, or hand placed on back or stomach. Breaths for 15 seconds should be counted using a watch or clock, and multiplied by 4 for respirations per minute.
Resting pulse	Infant stethoscope should be used on infant's chest; and each heart beat counted for 15 seconds and total multiplied by 4 for pulse per minute.
Resting temperature	A digital thermometer should be used to take temperature under the arm. Veterinarians should be alerted, and measures taken more frequently, when temperatures over 37.8°C (100°F) are recorded.
Girth	With diaper off, a measuring tape with centimeters should be used to circle the waist. Top of tape should touch bottom of navel. When performed consistently, procedure can be used to indicate gastric distension.

Caregivers should be alert for physical and physiological signs of concern, such as loose stools, constipation, increased girth size, increase in temperature, cough/congestion, nasal mucous, changes in normal pulse or respiration, dull hair coat, weight loss, and a white coating on the tongue. Behavioral indicators of concern include the infant not gripping the keeper, excessive clinging, loss of appetite, lethargy, decrease in activity, and excessive vocalizations. In these cases, a veterinarian should be notified immediately.

Feeding protocol: The infant should be bottle-fed formula every 2-3 hours for approximately 3 months. Small amounts of human infant electrolyte solution (e.g., Pedialyte) (about ½ the volume of the formula) can be fed in-between feedings if the infant becomes hungry. Bottle-feedings can be given once every 4 hours as solid foods are added. If infants are to be introduced to a surrogate female, the infant should be fed a bottle through wire mesh as early as 2 months old. This will help the infant become comfortable with this type of feeding, as this is the only way the infant can be fed after the introduction to the surrogate. The infant should be held close to the caretaker's heart, and fed slowly to prevent aspiration. This nursing position emulates the normal ventral/ventral (V/V) position of the dam, but will change as the infant gets older.

Solid foods: Before solid foods are offered, the infant can be shown animal caretakers or conspecifics eating, or if necessary, video of other apes eating. Having food around in the exhibit to be smelled and touched, even if not eaten, should be part of the learning process. Solids foods can be fed when interest is shown and the infant's teeth begin to erupt. Large pieces of raw carrot and celery may be offered for teething. Soaked primate biscuits in formula can be given first, followed by soft vegetables and fruit (such as cooked sweet potatoes, cooked carrots, and bananas). Approximately 1-2 g (0.04-0.07 oz) of each new food can be offered until acceptance, and then portions can be increased in 5 g (0.18 oz) increments. During feeding, the infant should be held in an upright position. Small bites should be smashed between fingers and put in the infant's mouth. Soft species-appropriate food vocalizations (grunts) can be made during eating. When the infant has mesh access to the other chimpanzees, food can be scattered along both sides of the mesh. The infant can watch the other chimpanzees eat and hear them vocalize while eating near them. When keepers are hand-feeding the group, they can also feed the infant through the mesh.

Human-animal interactions: For the first few weeks of life, the infant should be carried constantly to provide warmth and contact. It should be held close to the left side of the keeper's chest, near the heart. The keeper should hold or stay in close contact with the infant while performing nursery tasks. If anything necessitates removing the infant from the keeper's body (diaper change, weighing etc.), it should be placed in a safe location on its stomach, holding a fuzzy toy or blanket.

As the infant becomes older and aware of its surroundings, it should be given the choice to climb off and move around. Even then, the keeper should remain close through touching and voice contact. When there is a staff change, the transfer should be calm and slow. The infant will become more accepting of any new experience or situation because of its close contact with the keeper.

When interacting with the infant, the animal keepers should be quadrupedal as much as possible. This allows the infant an opportunity to grab the keeper's arms or legs so they can locomote together. As the infant grows older, the infant can be carried on the keepers' backs as they crawl around. Kneepads should be worn by the keepers to prevent joint discomfort.

Socialization: It has been suggested that infants being nursery-reared are better socialized later in life when raised with conspecifics. King and Mellen (1994) reported that early rearing experience is a key factor in predicting future

reproductive success. Infants removed from their mothers before two years of age frequently failed to exhibit functional reproductive behavior as adults. Chimpanzees reared in social isolation frequently failed to exhibit the appropriate behaviors that could eventually be incorporated into copulatory behavior (Rogers and Davenport 1969; Davenport and Rogers 1970). In contrast, infants housed in groups with females experiencing menstrual cycles, and/or displays of copulatory behavior, showed an increased likelihood of exhibiting normal copulatory behavior as adults. These studies suggest that early learning can strongly influence the eventual expression of functional reproductive behavior (Bettinger and DeMatteo 2001).

There are conflicting reports regarding how early rearing experience influences the subsequent development of maternal competency. King and Mellen (1994) reported that early experience affected reproductive and maternal competence in zoo-housed chimpanzees, while Toback et al. (1992) reported no effect of rearing history on maternal competence. Bloomsmith et al. (1991) indicated that at least 18 months with the mother seemed critical. Variables such as parity, alloparenting, opportunity, and length of time spent with her mother may also influence a female chimpanzee's tendency to exhibit competent maternal care of her infant (Bettinger and DeMatteo 2001).

The infant has the best chance of becoming socialized if it is introduced to conspecifics at an early age. This may require that zoos and aquariums cooperate by sending out or receiving infants that need to be hand-reared. Peer companionship allows the infants to safely socialize with conspecifics while still dependent on human care (Porton 1992). Due to the strong bond that develops in male chimpanzees, infant males raised together should remain together to form the core of a breeding group as adults (McNary 1992). Note that peer-rearing by itself (i.e., only peer-rearing) should be used only if no appropriate surrogate can be identified. Careful attention should be given to providing the young chimpanzee with a stimulating and challenging environment. The AZA Chimpanzee SSP strongly advocates that an area within the actual ape facility should be set aside or constructed for the infant so they can grow up near adults at an early age (Porton 1992).

Re-socialization and reintroductions: It is crucial for a hand-reared infant to develop a normal repertoire of species-appropriate social behaviors early on. If possible, socialization back to the mother should be done within 6 months. It may be necessary to apply operant condition techniques to train the mother to allow an infant of this age to be bottle-fed. If an infant cannot be reintroduced to its mother, and is to be introduced to another group member or another group, this should be done as early as 18 months (McNary 1992).

It is critical to evaluate the appropriateness of pairings with these young infants. Ultimately, if there is no individual in a group who responds to the infant's needs, and the infant's psychological well-being is at stake, then the infant may need to be introduced to another group. The initial introduction of these younger infants should be to a female who has demonstrated a strong propensity for maternal care or, in the absence of this, an adult or adolescent female who has shown strong "aunting" behavior towards siblings or other young chimpanzees in the group (McNary 1992).

During re-socialization attempts, contact with the caregiver staff will be important to the infant for security, but should be gradually decreased as the surrogate mother takes over. The infant should be allowed access to an area where it cannot be reached by the adult chimpanzees. The process may be slowed down if the infant begins to show signs of duress. Loss of appetite, sudden changes in normal behavior patterns, excessive temper tantrums, and constant loose stools could all be signs that the infant may need a rest from the introduction process. Even an infant who has remained energetic and enthusiastic will need an occasional time out to relax (McNary 1992).

7.5 Contraception

Many animals cared for in AZA-accredited zoos and aquariums breed so successfully that contraception techniques are implemented to ensure that the population remains at a healthy size.

The three general approaches to prevent reproduction are: 1) separation of the sexes, 2) reversible contraception, and 3) permanent sterilization. The decision to perform any permanent contraception should be made in coordination with the AZA Chimpanzee SSP. Since chimpanzees are a social species, separation of the sexes is not generally recommended. The following information summarizes reversible contraception and permanent sterilization methods for chimpanzees. More details on products, application, and ordering information can be found on the AZA Wildlife Contraception Center (WCC) webpage: www.stlzoo.org/contraception.

Surgical sterilization can provide an effective, low cost form of contraception, but in many cases a reversible short-term method may be preferred. Reversible contraceptives such as implants, pills, injectables, and intrauterine devices (IUD), can provide control of reproduction with select individuals while maintaining species-typical behavior within a group. Not all reversible contraceptives permit the maintenance of normal behavior. It is important to balance the efficacy, safety, and method of delivery for a contraceptive with the particular animal's age, reproductive status, and the potential ramifications of the regimes on social behavior (Bettinger and DeMatteo 2001). Because of the profound effects on the normal sociosexual behavior of chimpanzees, genital swelling should not be completely eliminated by the contraceptive option elected. In considering contraceptive options, both genders should be evaluated to permit prevention of pregnancy while minimizing impact on group behavior. It is important to consider reversibility and safety of these options as well as the tendency of weight gain observed with the hormonal methods of contraception.

Oral contraceptives: Oral contraceptives ("birth control pills") are the same products utilized for human females with a combination of synthetic progestin and estrogen (see Table 8). It is important to note that the human menstrual cycle is shorter at 28 days, but the typical to higher-dose products can be prescribed successfully for chimpanzees at this dose frequency. Oral contraceptives are reported with a <4% failure rate in chimpanzees. In addition to good contraception, these products are rapidly cleared by the body following discontinuation, and so are rapidly reversible. In some cases, minimal to moderate impact on the cyclic intumescence is seen in females on this method of contraception with various degrees of swelling and breeding behavior possible. However, without a pill-free or placebo week, as with newer products such as Seasonale®, swelling and sexual behavior are more likely to be suppressed. It is critical that the female receive this product daily, consistently at the same time of day, and completely without refusal, for optimal pregnancy prevention. Chimpanzees can be experts at secreting pills offered, and so complete consumption should be assured, and the training maintained by utilizing the package placebos. When a pill is missed, a second dose should be administered promptly, and if one day is entirely missed, two doses should be offered within 24 hours to maintain efficacy. A side effect of concurrent antibiotic administration, particularly by the oral route, may be reduced efficacy of oral contraceptives.

Concern in regard to oral contraceptives administered during the postpartum interval is limited to its impact on lactation rather than passage of active hormones through the milk to the offspring. By waiting until the infant is one year of age – or demonstrating substantial solid food intake, the impact of possible reduction of milk is minimized. If birth control for adult females is absolutely necessary during this first year of age, low-dose progesterone oral contraceptives or other progestin-only method such as Depo-Provera® or MGA implants can be used, and then the female rotated to the more standard estrogen-progestin combination pill after this time.

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Appendix H: Example Enrichment List for Chimpanzees

Approved Enrichment List

Category A - Scents and Spices

Allspice
Basil
Bay leaves
Catnip
Chives
Cilantro
Cinnamon
Citrus zest
Cloves
Dill
Diluted Essential Oils
Extracts
Fennel
Garlic
Hunting scents
Lavender
Mint
Nutmeg
Onion
Oregano
Pepper
Rosemary
Sage
Tabasco
Tea
Thyme

Category B - Change in Diet Presentation

Cooked fruit
Cooked vegetables
Diced fruit
Diced vegetables
Dried fruit
Dried vegetables
Food floating in water
Food frozen in ice
Frozen fruit
Frozen vegetables
Grated produce
Mashed potatoes
Pureed produce
Whole fruit
Whole vegetables
Skewered on branches

Category C - Food Items

Ice treats
Kool-Aid - sugar free (can be used for ice treats)
Jello - sugar free
Applesauce (see forage sheet for amount)
Jam - sugar free (see forage sheet for amount)
Raisins (see forage sheet for amount)
Frozen blueberries (see forage sheet for amount)
Cereal - sugar free (see forage sheet for amount)
Pasta (see forage sheet for amount)
Popcorn - air popped (see forage sheet for amount)
Rice (see forage sheet for amount)
Steel Cut Oatmeal (see forage sheet for amount)
Honey (1-2 x's per month, 1 TBSP per animal)
Peanut butter (1-2 x's per month, 1 TBSP per animal)
Peanuts (10 per animal)
Sunflower Seeds (1 TBSP per animal)
Crickets (10 per animal)
Waxworms (10 per animal)
Mealworms (10 per animal)

Category D - Browse

Alder
Amelanchier
Apple
Arborvitae
Aspen
Bamboo
Blackberry
Box Elder
Cottonwood
Dogwood
Elm
Ficus
Grapevine
Grass Hay
Hackberry
Hawthorn
Hibiscus
Linden
Mulberry
Pear
Poplar
Raspberry
Redbud
Rose
Silver Maple
Snowberry
Sugar Maple
Willow
Also see Browse List on LPZ Intranet

Category E - Occupational

Stream of water from hose or sprinkler
Termite mound (non-study periods only)
Food in brown paper bags
Food buried in browse
Food buried in substrate
Food in burlap (prevent ingestion of burlap)
Food in gourds
Food in puzzle feeders
Food wrapped in large greens / browse leaves
Food in baskets *
Kids activity toys * (prevent ingestion)
Bubbles (must have MSDS for approval) *

Crayola chalk & crayons (Chimpanzees only) *
Crayola washable finger paint (Chimpanzees only) *

Category F - Attached Furniture

Bamboo wind chimes hung
Black rubber tubs hung
Boomer balls hung
Cargo nets hung
15 gallon barrel hung *
30 gallon barrel hung *
55 gallon barrel hung *
Hammock hung *
Pallets hung *
Ropes hung *
Spools hung *
Tires hung *
(All hung furniture must be done safely to prevent entrapment)

Category G - Manipulable Objects

Black rubber tubs (prevent ingestion)
Boomer balls
Branches (non-toxic)

Grapevine balls

Grapevine wreaths
15 gallon barrel *
30 gallon barrel *
55 gallon barrel *
Kiddy pools * (prevent ingestion)
Kids activity toys * (prevent ingestion)
Spools * (prevent ingestion)
Tires * (prevent ingestion)
Combs * (prevent ingestion)
Deckbrushes * (prevent ingestion)
Hairbrushes * (prevent ingestion)
Toothbrushes * (prevent ingestion)
Kong toys * (prevent ingestion)

Category H - Paper

Cardboard boxes*
Cardboard tubes* (NO toilet paper rolls)
Paper bags*
(Only brown boxes, paper bags, tubes with no printing & with staples, stickers, tape removed can be used on exhibit)
Paper cones *
Shredded paper *
Phone book pages *

Category I - Approved Source Substrate

Branches (non-toxic)
Grass clippings
Grass Hay
Leaf litter (non-toxic)

Peat moss
Sand

Snow
Sod
Sphagnum moss
Straw

Category O - Other Sensory Items

Auditory
Plastic mirror * (prevent ingestion)
Alpaca hair (properly cleaned per SMRH protocol)
Snake sheds (properly cleaned per SMRH protocol)
Blankets * (NOT JoJo's troop) (prevent ingestion others)
Burlap (prevent ingestion)
Sheets * (NOT JoJo's troop) (prevent ingestion others)
Tablecloths* (prevent ingestion)
(Only brown, tan & green tablecloths used on exhibit)

Top soil
Wood shavings (non-toxic)
Wood wool

Category J - Keepers' choice

* Non-naturalistic items. To be used only in holdings or Auxiliary exhibit. If used in holdings, make sure the items cannot be taken back into A, B, C exhibits.

Appendix I: Example of Enrichment Calendar

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
				1 **E**	2 **F** or **A**	3 **G** or **B**
4 **D**	5 **I**	6 **J**	7 **H**	8 **O**	9 **A**	10 **B**
11 **D**	12 **C**	13 **E**	14 **H**	15 **F** or **J**	16 **G** or **C**	17 **I**
18 **D**	19 **J**	20 **O**	21 **H**	22 **A**	23 **B**	24 **C**
25 **D**	26 **E**	27 **F** or **A**	28 **H**	29 **G** or **B**	30 **I**	31 **J**

DIRECT OBSERVATION

5 Significant interaction (>5 minutes & returned)
4 Minimal interaction (<5 minutes)
3 Looked at / No interaction
2 Fled from / Avoided
1 No reaction

INDIRECT OBSERVATION

A Significant contact
B Contact (knocked over, moved)
C No evidence of contact