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Tapir
(Tapiridae)
CARE MANUAL

CREATED BY
AZA Tapir Taxon Advisory Group®
IN ASSOCIATION WITH
AZA Animal Welfare Committee

Tapir (Tapiridae) Care Manual

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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

Chapter 5. Nutrition

5.1 Nutritional Requirements

A formal nutrition program is recommended to meet the nutritional and behavioral needs of all tapirs (AZA Accreditation Standard 2.6.2). Diets should be developed using the recommendations of nutritionists, the Nutrition Scientific Advisory Group (NAG) feeding guidelines (http://www.aza.org/nutrition-advisory-group/), and veterinarians as well as AZA Taxon Advisory Groups (TAGs), and Species Survival Plans® (SSP) Programs. 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.

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.

Tapirs are primarily browsing herbivores. Free-ranging individuals select broadly across plant taxa, including a diversity of herbaceous species, grasses, shrubs, fruits, twigs, and leaves of trees (Medici et al., 2007; Medici, 2010; Medici, 2011). When the frequency of plant species parts recovered in tapir feces is compared to the occurrence of those species in the habitats studied, the relationship suggests that these animals are selecting for preferred plant species, regardless of that species abundance (Downer, 2001).

The digestive system of the tapir is described as a, ceco-colinic hindgut fermenter, analogous to the domestic horse (*Equus caballus*). Since overeating can result in colic or founder in domestic horses, feeding herbivores with similar gastrointestinal tracts two to three times daily is recommended (Janssen, 2003). The dental formula of *Tapirus terrestris* is I3/3-C1/1-P3-4/3-M3/3. Salivary glands are well developed, a characteristic typical of browsing herbivores. The stomach is small in relation to other portions of the gastrointestinal tract, but more elongated than that of the horse (Stevens, 1988). Epithelia found in the esophageal region (cardia) of the stomach is squamous and nongladular. The remainder of the stomach epithelia is glandular, increasingly toward the pylorus (Padilla & Dowler, 1994). The small intestine length is 8.2–11 m (27–36 ft) (Padilla & Dowler, 1994). The gall bladder is absent, but the bile duct empties into the duodenum 7.5 cm (2.95 in) from the pylorus. The tapir's hindgut is similar in arrangement to the domestic horse (Stevens, 1988). This is the primary site of alloenzymatic digestion of ingesta by symbiotic bacteria, as well as anaerobic protozoa (Stevens, 1988). Four fibrous teniae create sacculations in the cecum. The colon is enlarged and attached to the cecum by fibrous tissue. The enlarged lumen of both the cecum and proximal colon is the site of alloenzymatic digestion of food materials not degraded by autoenzymatic digestion and absorbed in the small intestine. The distal colon is not attached to surrounding tissues. For additional nutritional information please contact the AZA Tapir TAG Nutrition Advisor:

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5.2 Diets

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.

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.

Food preparation must be performed in accordance with all relevant federal, state, or local regulations (AZA Accreditation Standard 2.6.1). The appropriate hazard analysis and critical control points (HACCP) food safety protocols for the diet ingredients, diet preparation, and diet administration should be established for the taxa or species specified. Diet preparation

AZA Accreditation Standard

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

staff should remain current on food recalls, updates, and regulations per USDA/FDA (Food and Drug Administration). Remove food within a maximum of 24 hours of being offered unless state or federal regulations specify otherwise and dispose of per USDA guidelines.

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 tapirs. 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.

AZA Accreditation Standard

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

Supplemental Formula: In the event that supplemental formula feeding is required, the suggested formula is 96% whole goat's milk, 2% lactose, and 2% whey protein isolate. For additional information please contact:

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Foods recommended for *ex situ* tapirs can be divided into three broad categories:

Roughages: Any food containing relatively high levels of structural carbohydrates (e.g., fiber). Foods in this broad category appropriate for feeding tapirs would include, but are not limited to: alfalfa hay, grass hays and freshly harvested leafy plant materials. Species offered vary significantly on a regional basis throughout the United States, Canada, and Mexico. Institutions should use their own on-site specialists to develop lists of safe browse plants that are available regionally. Each of these foods provides sources of long-stem, or physically effective, fiber important for gastrointestinal health of hindgut fermenters. As always, when including harvested leafy plant materials in any animal diet, such plants should be evaluated for suitability by a trained professional. Harvest sites should be monitored for injurious agents.

Concentrates: Any food containing relatively low levels of fiber (< 20%) and with > 60% total digestible nutrients (TDN). Foods in this broad category appropriate for feeding tapirs would include, but are not limited to, several types of feeds manufactured for herbivores with post-gastric fermentation. Such feeds should be formulated to complement the nutrient composition of the roughages consumed in the balance of the ration. Based on the similarities between the gastrointestinal tract of tapirs and domestic horses, such feeds should contain controlled amounts of hydrolysable carbohydrates (CHO-H) and rapidly fermentable carbohydrates (CHO-F_R). Again, it is essential that the selection and evaluation of feeds with these characteristics be made under the guidance of individuals professionally trained in nutrition.

Supplements: A feed used with another to improve nutrient balance of the total diet. The use of supplements to correct for the nutritional inadequacies of the consumed balance of roughages and concentrates is not necessary, but is often practiced in applied zoo animal programs. Supplements may include any number of items, such as: cultivated fruits, roots, and other plant parts; vitamins; minerals; and even supplemental sources of fiber.

General guidelines (Lintzenich & Ward, 1997) for diets consumed (1.5% BW) by tapirs suggest the following distribution of foods:

Table 3: Recommended Foods

Category	Description	Distribution (90% DM basis)
Roughages	Alfalfa hay, quality grade 1 (> 15.9% CP; < 42.8% NDF)	40–50%
	Grass hays (> 9.8% CP; < 67.4% NDF)	20–30%
Concentrates	Lower fiber herbivore pellet	30%

Table 4: Nutrient Concentrations

Nutrient	Concentration	Nutrient	Concentration
Crude protein, %	14–18	Magnesium, %	0.07–0.10
Vitamin A, IU/kg	1000–3500	Potassium, %	0.27–0.38
Vitamin D, IU/kg	200–500	Sodium, %	0.09–0.27
Vitamin E, mg/kg	120–350	Iron, mg/kg	36–45
Thiamin, mg/kg	2.0–4.5	Zinc, mg/kg	36
Riboflavin, mg/kg	2.0	Copper, mg/kg	9
Calcium, %	0.20–0.65	Manganese, mg/kg	36
Phosphorus, %	0.15–0.34	Selenium, mg/kg	0.09
		Iodine, mg/kg	0.09–0.54

Target dietary nutrient concentrations (90% DM basis) of generalized diet for tapirs (Lintzenich & Ward, 1997)

The following tables (Tables 5-8) are practical diets and target nutrient components for tapirs supporting all life stages. These are not from any one institution, but are common ingredients listed in quantities and proportions based on referenced guidelines.

Table 5: Practical Diet for Baird's Tapir (*Tapirus bairdii*)*

Item	Description	Amount	Comment
1	High fiber (ADF 25%) herbivore pellet	1300 g	15% CP, 3% Fat, 25 ppm Cu
2	Roots (turnip, carrot, sweet potato)	165 g	May be reserved to reinforce management behaviors
3	Fruit (apple, pear, tomato)	230 g	May be reserved to reinforce management behaviors
Items 1–3 offered AM in holding			
4	Alfalfa hay	665 g	> 18% CP, < 32% ADF
5	Browse, variable species	3–1 m sections	Constant portion of this diet but difficult to quantify mass provided
Items 4–5 offered on exhibit			
6	High fiber (ADF 25%) herbivore pellet	1300 g	15% CP, 3% Fat, 25 ppm Cu
7	Roots (turnip, carrot, sweet potato)	165 g	May be reserved to reinforce management behaviors
8	Fruit (apple, pear, tomato)	230 g	May be reserved to reinforce management behaviors
9	Alfalfa hay	665 g	>18% CP, < 32% ADF
Items 6–9 offered PM in holding			
10	Banana, with peel	325 g	May be reserved to reinforce management behaviors
11	Psyllium fiber	60 g	This supplement was added as prophylaxis against sand colic
Items 10–11 mixed together; offer as indicated			
12	Salt block, plain	ad libitum	Offered in a secure manner that prevents overconsumption

*Target bodyweight range = 210–275 kg (462–606 lb)

Downer, 2001; Stevens, 1988; Padilla & Dowler, 1994; Lintzenich & Ward, 1997; National Research Council, 2007; Janssen et al., 1999; Murphy et al.,1997; Clauss et al., 2009

Table 6: Nutrient Components Baird's Tapir Diet

Nutrient	Concentration (DMB)	Nutrient	Concentration (DMB)
Crude protein, %	15.5	Calcium,%	0.89
Fat, %	3.0	Phosphorus,%	0.66
Ash, %	10.5	Magnesium, %	0.27
ADF, %	24.4	Potassium, %	1.89
Vitamin A, IU/kg	3961	Sodium, %	0.39
Vitamin D, IU/kg	1209	Iron, mg/kg	261
Vitamin E, mg/kg	249	Zinc, mg/kg	102
Thiamin, mg/kg	4.7	Copper,mg/kg	22
Riboflavin, mg/kg	9.7	Manganese, mg/kg	78
		Selenium, mg/kg	0.36

Downer, 2001; Stevens, 1988; Padilla & Dowler, 1994; Lintzenich & Ward, 1997; National Research Council, 2007; Janssen et al., 1999; Murphy et al.,1997; Clauss et al., 2009

Table 7: Practical Diet for Asian Tapir (*Tapirus indicus*)*

Item	Description	Amount	Comment
1	High fiber (ADF 25%) herbivore pellet	1300 g	15% CP, 3% Fat, 25 ppm Cu
2	Roots (turnip, carrot, sweet potato)	1000 g	May be reserved to reinforce management behaviors
3	Browse, variable species	1-1m section	Constant portion of this diet but difficult to quantify mass provided
Items 1-3 offered AM in holding			
4	High fiber (ADF 25%) herbivore pellet	2600 g	15% CP, 3% Fat, 25 ppm Cu
5	Roots (turnip, carrot, sweet potato)	1000 g	May be reserved to reinforce management behaviors
6	Greens (dandelion, kale, collard)	350 g	May be reserved to reinforce management behaviors
7	Alfalfa hay	2660 g	> 18% CP, < 32% ADF
Items 4-7 offered PM in holding			
8	Banana, with peel	325 g	May be reserved to reinforce management behaviors
9	Psyllium fiber	60 g	This supplement was added as prophylaxis against sand colic
Items 8-9 mixed together; offer as indicated			
12	Salt block, plain	ad libitum	Offered in a secure manner that prevents overconsumption

*Target bodyweight range = 365–375 kg (805–827 lb).

Downer, 2001; Stevens, 1988; Padilla & Dowler, 1994; Lintzenich & Ward, 1997; National Research Council, 2007; Janssen et al., 1999; Murphy et al.,1997; Clauss et al., 2009

Table 8: Nutrient Components for Asian Tapir Diet

Nutrient	Concentration (DMB)	Nutrient	Concentration (DMB)
Crude protein, %	16.6	Calcium,%	1.00
Fat, %	1.9	Phosphorus,%	0.56
Ash, %	6.5	Magnesium, %	0.27
ADF, %	25.2	Potassium, %	1.87
Vitamin A, IU/kg	2935	Sodium, %	0.41
Vitamin D, IU/kg	704	Iron, mg/kg	221
Vitamin E, mg/kg	177	Zinc, mg/kg	75
Thiamin, mg/kg	3.3	Copper, mg/kg	18
Riboflavin, mg/kg	5.5	Manganese, mg/kg	62
		Selenium, mg/kg	0.31

Downer, 2001; Stevens, 1988; Padilla & Dowler, 1994; Lintzenich & Ward, 1997; National Research Council, 2007; Janssen et al., 1999; Murphy et al.,1997; Clauss et al., 2009

It should be noted that, with the exception of larger quantities of foods in the Asian tapir diet to support the nutrient and energy demands of a larger body mass, the differences between the two diets are largely a function of animal management and not species-specific nutrient requirements. Those subtle differences in food quantities result in differences in nutrient intake. Again, those differences should not be interpreted as unique species requirements, as no such controlled studies have been conducted. However, they do suggest the variability of nutrient intake under which the species can thrive. Target ranges of nutrients for all life stages are provided above. These ranges are based on known nutrient requirements of the domestic horse (NRC, 2007) and application of diets that support animals in zoos and aquariums.

The two practical diets above demonstrate an example of temporal distribution of foods. These diets are not from a specific institution, but are common ingredients listed in quantities and proportions based on referenced guidelines. Tapirs are continuous feeders and, as suggested by their gastrointestinal tract anatomy, are best suited to consume multiple small meals throughout the day. A minimum of three separate feedings should be encouraged. Overconsumption of certain foods, particularly those high in hydrolysable carbohydrates (e.g., starch, sugar) and/or rapidly fermentable carbohydrates (e.g., fructooligosaccharides, pectins) may result in abnormal fermentation in the hindgut. Such foods, combined with feeding practices inconsistent with the species needs could contribute to colic, torsion or other digestive related pathologies. The formation of enteroliths in two species of tapir has been reported at three AZA institutions in North America. The composition of those enteroliths is chemically dissimilar to struvite enteroliths in horses. Dietary regimes proposed here are consistent with those proposed to reduce the formation of these mineralized foreign bodies in the animal's gastrointestinal tract (Murphy et al., 1997).

All produce should be cut up into bite size pieces and fed fresh daily in individual containers/tubs atop a cement feeding area. All food and water containers should be durable and able to be washed and disinfected daily. To reduce risk from disease and parasites, food items should not be fed on the ground (soil) from which an animal would directly eat.

Scheduled feedings are often used to facilitate training and shifting of individuals, locking the animals into a holding area or for other management needs. No variations in the above diet are required, but additional foods (fresh fruit and vegetables, browse, etc.) are appreciated on a random schedule and provide stimulation and enrichment to the dietary routine. Care should be taken to ensure that food enrichment items are not offered in such quantities as to decrease consumption of the carefully balanced base diet. To avoid obesity, the caloric content of enrichment foods should be factored into the overall diet. When animals are fed together in groups, multiple feeding sites should be offered within the enclosure to prevent dominant individuals from monopolizing the feed and to reduce aggression at feeding time. Presentation of food should extend the time spent feeding. This may include timing of meals, distribution of foods and actual foods selected. Appropriate freshly harvested plant materials are one type of food that has been used to promote increased feeding time in these species.

Animals should be routinely weighed as a response variable to diet management programs. In addition to objective measurement of weight, subjective assessment of animal body condition may be useful in establishing individual target body weight ranges. Scoring systems for both body condition and fecal consistency have been proposed by Clauss et al. (2009).

5.3 Nutritional Evaluations

Based on preliminary clinical data, tapirs may have a unique metabolic requirement for copper. The mean serum copper concentration across *ex situ* individuals of the four species consuming presumable adequate diets were 0.21 ug/mL (n = 22). Field results (lowland tapirs in Brazil) found copper concentrations between 14–110 ug/mL in the Atlantic Forest, and between 4–76 ug/mL in the Pantanal (P. Medici, personal communication).

This is compared to 700 ug/mL, which is the mean normal concentration in horses (Janssen et al., 1999). It is important to consider the interactions of copper with other trace minerals, such as sulfur, molybdenum, zinc and iron, when interpreting these values. *Ex situ* tapirs have a history of rectal prolapses (Janssen et al., 1999). The cause has yet to be determined but diets that are low in adequate plant fiber (e.g., excessive amounts of commercial produce) may contribute. To minimize this risk, diets should not include large quantities of fruits and produce; these items can be used as treats, enrichment techniques, and means for giving medicine. As previously mentioned, the gastrointestinal tract anatomy precludes these species to colic, including volvulus, torsion, impaction, and obstruction (Janssen et al., 1999). The importance of adequate intake of foods higher in structural carbohydrates as it relates to promoting normal gut function cannot be emphasized enough. Overconsumption of non-fibrous foods, such as commercial produce, bread, and similar foods should be avoided.

serologic method. The transducer should be of 3.5 to 5 MHz, and be placed on the ventral belly region and then crossed over the whole zone to visualize the fetal images. The female belly will have to be wet with alcohol to decrease the air coat that is between the skin and the hair and gel should be spread out on the transducer and on the skin (P. Fernandez Jurado, personal communication, 2004).

The recommended measurements to determine the fetal development would be the biparietal and the thoracic diameter. Also, it is important to register the total length of the fetus. In *T. terrestris*, the biparietal diameter of a 6 month fetus could be about 3.02 cm (1.19 in), the abdominal diameter at gastric axis level could be 7.25 cm (2.85 in), the thoracic dorsum ventral could be 6.5 cm (2.56 in) and the total length could be 20 cm (7.87 in) (P. Fernandez. Jurado, personal communication, 2004).

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, and that this area is "baby-proofed." Neonatal mortality is high unless a suitable birthing environment is available (Janssen, 2003). Females should be separated from the male(s) several weeks before parturition. Note that vulvar edema and mucoid discharge may precede parturition by 2–3 weeks; the udder may also become enlarged. Pools should be barricaded to prevent accidental drowning of the neonate. Depending on personalities of the parents, females with young can be reintroduced to the male 1–3 months after birth after first allowing visual and olfactory contact. Female tapirs are usually good mothers but first time mothers and hand-raised mothers have a higher incidence of maternal neglect of their young.

Tapirs give birth after a short labor period. Calves are relatively small at birth and usually weigh between 4.9–11 kg (11–25 lb). Calves are usually able to stand within one to two hours after birth and should make frequent attempts to find the mother's nipple. Mothers should lie on their sides to allow the calf to nurse. Inexperienced mothers may need to be scratched down on their sides and the calf manually positioned on the nipple. Nursing should occur within the first 2–5 hours after birth. Mothers nurse their calves five to ten times every 24 hours. Each nursing bout can last as long as 10–15 minutes. It is common for both calf and dam to fall asleep in the nursing position. Newborn tapirs grow very rapidly and should double their body weight within 14–21 days of birth. They can be offered tiny pieces of fruit and vegetables as early as two weeks of age. Newborn calves should be provided with a warm enclosure (21–29 ºC [70–85 ºF]) and should never be left to lie on bare (cold) concrete. Hard packed dirt floors or hay bedding provides insulation and a non-slip surface for the unstable newborn. Pine shavings are not good material for maternity stalls as they can be ingested by the calf and cause gastrointestinal blockages.

Tapir calves should not have access to a pool for at least one week after birth. After that, depending on the design of the pool and temperature of the water, young tapirs are strong swimmers.

Neonatal Death: Causes include drowning, hypothermia, and failure of passive transfer/septicemia. Causes include failure to nurse from primiparous females, and it can be prevented by suitable birthing environment. It is suggested to remove the male and drain the pool for 1–3 weeks after birth.

Neonatal Isoerythrolysis: Reported in two neonates from the same Baird's tapir pair, acquired by feeding of maternal or equine colostrums to sensitized neonate; causes hemolytic anemia. This can be prevented by agglutination testing of colostrum in suspect animals.

7.5 Assisted Rearing

Although mothers may successfully give birth, there are times when they are not able to properly care for their offspring, both in the wild and in zoo populations. Fortunately, animal care staffs in AZA-accredited institutions are able to assist with the rearing of these offspring if necessary.

Although females should be allowed to raise their young if possible, newborn tapirs can be hand-reared when females show no interest in nursing or the death of the mother. Hand-raised young are still likely to breed and behavioral problems are not as likely as with other, more social species. Regardless of rearing technique, hand or parent, a general health exam should be conducted 1-3 days after birth to assess overall condition of the neonate, including heart and lung auscultation, hydration, suckling response, temperature (hyper- or hypothermia), herniated umbilicus, blood values, and immunoglobin status. The umbilicus should be dipped in a solution of 2% iodine in order to prevent infection. Calves should be weighed on a regular basis to monitor growth. Transfaunation (feeding strained feces from

normal tapirs) has been useful to encourage growth of normal flora in young tapirs raised in isolation (Janssen et al., 1999), and 0/22% orally at standard equine dose has been used with varying degrees of success in tapirs.

7.6 Contraception

Many animals cared for in AZA-accredited institutions breed so successfully that contraception techniques are implemented to ensure that the population remains at a healthy size. In some cases it is desirable to prevent reproduction in tapirs that are genetically well represented in the zoo and aquarium population. If possible, separating the male from the female is the simplest approach. Castration, melengestrol acetate implants, medroxyprogesterone acetate (Depo-Provera, Upjohn) injections (5.0 mg/kg every 3 months), and altrenogest (Egumate® 0/22%) orally at standard equine dose have been used with varying degrees of success in tapirs. Regumate is a hormonal product. It is best to check the current recommendations of the AZA Contraceptive Advisory Group prior to initiating contraception.

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