

# CHAPTER THREE

## MANED WOLF NUTRITIONAL MANAGEMENT

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### **BACKGROUND AND CURRENT RESEARCH EFFORTS**

The difference between facultative and strict carnivores may be illustrated by comparing the domestic dog and the domestic cat. Many canids have broad feeding habits, including a variety of fruits and other plant parts in their natural diets. By contrast, felids show no tendency to omnivory; they are all essentially predators. Nutritional studies indicate that the domestic dog and the domestic cat differ markedly in nutrient requirements and in nutrient metabolism. The cat requires higher levels of essential amino acids, the building blocks of protein. Cats also require more nitrogen from non-essential amino acids to compensate for high obligatory nitrogen losses. Canids can conserve dietary nitrogen when dietary levels are low. Cats are especially sensitive to arginine deficiency and must receive a dietary source of taurine.

These unique features of the cat may be viewed as derived traits associated with an extreme degree of carnivory. Canids appear to retain a broader array of metabolic pathways for the processing of nutrients, indicating a greater degree of dietary flexibility. Facultative carnivores need the diversity of metabolic pathways that is characteristic of species that feed on a broad array of foods.

Until recently, many canid species in U.S. zoological collections have been fed the same raw, meat-based products that are offered to exotic felids. The results of a 1985 survey revealed that most U.S. zoos fed commercially available raw, horsemeat-based diets (Nebraska Brand Feline/Canine; Western Plateau Carnivore Diet) to maned wolves. Out of 14 zoos, 11 offered commercial, meat-based diets (frozen horsemeat or beef commercial diets) in addition to a variety of other items. Fruits, vegetables, bread, whole prey and rice were also commonly fed items. Since domestic canids, and probably other facultative carnivores, do not require the high levels of fat and protein characteristic of commercial meat-based diets, the feeding of these products is neither necessary or appropriate. Diets currently fed to maned wolves in most U.S. zoos now consist of dry dog food or omnivore biscuits, with supplemental fruits, vegetables and prey.

Compared to U.S. zoos, European, Australian and South African zoos have fed lower protein, higher carbohydrate diets to maned wolves. Dietary information was obtained (mid-late-1980's) from the Frankfurt Zoo (Germany), the National Zoo of South Africa and the National Zoological Park (Washington, DC). The following table includes the nutritional composition of diets offered to maned wolves at those zoos with a comparison to Nebraska Brand Feline and Canine Diets and whole prey (rat).

NUTRIENT CONTENT OF DIETS FED TO MANED WOLVES

DIETS <sup>5</sup>	DM	CP	FAT	ASH	CHO	CA	P	CA:P
NZP (US) 1985	33.4	54.4	23.7	10.6	11.2	3.95	1.62	2.1:1
SOUTH AFRICA	36.4	43.2	13.7	5.3	37.8	0.88	0.43	2.1:1
FRANKFURT	43.9	36.1	11.2	4.5	47.2	0.64	0.45	1.4:1
CANINE DIET;	41.6	37.2	39.6	9.1	< 14.0	2.7	1.2	2.3:1
FELINE DIET;	31.9	49.4	24.7	11.3	< 15.0	2.0	1.7	1.2:1
DRY DOG FOOD <sup>4</sup>	92.5	27.0	9.4	6.8	56.8	1.6	0.7	2.3:1
ADULT RAT	34.0	59.7	23.6	15.7	< 1.0	4.0	1.8	2.2:1

<sup>0</sup> Based on offered (not all items necessarily consumed) diets. Dry matter basis;  
DM= dry matter; CP= crude protein; CHO= carbohydrate; CA= calcium;  
P= phosphorus.

<sup>5</sup> Nutrient levels of all diets were calculated using the Zoo Diet Analysis Program (David J. Baer). Information on the composition of foods used at the NZP is relatively complete. Since complete information of foods used in foreign zoos was not provided, nutrient estimates for Frankfurt and South African diets were based on similar foods in the computer data base. To complete a more thorough analysis (including vitamins and minerals) of these diets, detailed product information is required. The calcium and phosphorus levels for South Africa and Frankfurt diets are minimum values only, since specific information on the supplements used was not provided.

; Nebraska Brand, Animal Spectrum

<sup>4</sup> Ralston Purina Hi-Pro Dog Chow

A significant health problem of maned wolves is cystine stone formation which leads to kidney, bladder and urethral stones. The stones in the kidney and bladder can predispose maned wolves to urinary tract infection, and the urethral stones in males can lead to obstruction and secondary rupture of the bladder. In studies with captive and free-ranging maned wolves, 80% have been shown to excrete cystine and other dibasic amino acids in the urine. This unusual pattern is believed to be due to a metabolic defect.

In domestic dogs, it is now believed that a partial control of cystine stone formation may be accomplished by reduction in methionine and cystine in the diet, by feeding less animal protein, and by promoting more alkaline urine (by the addition of urinary alkalizers). Urinary pH is typically lower (more acidic) in carnivores fed meat-

based diets while the plant-based diets fed to herbivores will result in higher urinary pH. The historical use of high protein, meat-based diets for maned wolves held in U.S. zoos may have exacerbated or promoted cystine stone formation.

The use of a commercial low protein diet (Science Diet/UD) has been tried in maned wolves at CRC (in conjunction with Thiola) with limited success. We are currently attempting to follow urinary cystine output in maned wolves fed either low protein (16%) or moderate protein (25%) diets over an 18 month period. Since maned wolves fed some commercial dry dog foods appear to produce watery, semi-formed stool, we are using products that contain no soybean meal, since this has been shown in dogs to result in less well-formed stool. We are also attempting to determine water turn-over rates in maned wolves using a stable isotope marker. The tendency of maned wolves to excrete excess water in stool, instead of via the renal route, may also exacerbate cystine precipitation because a more concentrated urine would result. It has been observed that when wolves are fed meat-based diets and/or whole prey, stool quality is improved. Consultation with dog nutritionists at the Waltham Centre for Pet Nutrition in England is ongoing in an attempt to find more suitable feed ingredients that will result in well-formed stool.

For reasons given above, lower protein dog foods may be helpful in reducing the likelihood of stone formation in maned wolves. However, commercial dog foods that are low in protein (16%) compared to the requirement (using practical diets) for the domestic dog of 22% are also typically low in fat (less than 9%). In addition, unless started as pups, maned wolves are often reluctant to accept dry dog foods or omnivore biscuits. Maned wolves are usually lean and maintaining body mass is difficult. The low protein dog foods, since they are also low in fat (energy) often require the addition of vegetable oil to increase the caloric content of the diet. One of our goals is to formulate a palatable, low protein, high fat diet with ingredients that promote the formation of well-formed stool.

## **RECOMMENDATIONS**

### **Nutrient Content of Diet**

Current knowledge supports the feeding of diets:

- 1) of low to moderate protein content, between 20-25% protein, DMB (dry matter basis) to reduce the amount of cystine that the kidneys must excrete
- 2) that promote oral health (dry feeds vs. soft)
- 3) that result in well-formed stool (soybean meal may exacerbate loose stool)
- 4) that result in more alkaline urine (foods with higher carbohydrate, lower animal protein will promote alkaline urine)

Maned wolves in many non-U.S. zoos are fed small amounts of animal protein in the form of meat, prey or eggs but the bulk of the diets consist of cooked rice and other grains, fruits and vegetables. Such "home-made" diets require supplementation with vitamins and minerals. Unless the complete diet is evaluated and analyzed it is impossible to know which supplement and how much supplement should be applied to balance such diets. These diets may be preferred over the meat-based diets of 10-15 years ago, but nutrient balance in home-made diets that consist of multiple food items is difficult to achieve. Unless supplements are applied homogeneously to the total diet, animals have the opportunity to preferentially select some food items over the others. Maned wolves may not receive all of the supplement and thus may consume vitamin or mineral deficient diets. It is therefore recommended that nutritionally complete commercial products (e.g., dry dog foods, omnivore biscuits) represent at least 60-70% of the dry matter intake for maned wolves. If this guideline is adhered to, vitamin and mineral supplements are not necessary and additional dietary items such as chopped fruits and vegetables and small amounts of prey may be fed without risk of dilution of the nutrients in the commercial product.

Adult maned wolves (body mass 30 kg) should maintain body mass by consuming approximately one pound of dry matter per day. Lactating females and growing pups may consume 1.5 to 2 times that amount.

Because low protein dog foods are often low in fat, the addition of vegetable oil or cooked chicken fat will increase the energy density of the diet and may help improve palatability. Growing maned wolves (under the age of 15-18 months) should be offered diets formulated for growing puppies. Lactating females should not be offered diets with lower than 22% (DMB) crude protein since the nutrient demands on the female during milk production may not be met. Because domestic dogs fed diets containing soybean meal may produce poorly formed stool, commercial diets with rice or other non-soy plant products are recommended. The maned wolf should be able to be maintained on commercial products that are formulated to meet the requirements of the domestic dog. High performance dog foods, because they are often in excess of 28% protein and excessive meat or prey should be avoided. It is probably safe to supplement the basal diet with one or two mice (40 g) fed daily or 3 rats per week. Medicating or shifting maned wolves is often facilitated by the use of prey.

To promote oral health, prey (rats, mice, chicks) may be fed in small amounts. Oxtails or horse bones with some meat attached are also used to stimulate gums and teeth. The extent to which soft diets promote gingivitis and dental problems seen in some maned wolves has not been determined.

### **Feeding Schedules/Locations:**

If dry dog food or dry omnivore biscuits are fed they may be offered free choice since they will not spoil readily and over-consumption is generally not of concern with maned wolves. The daily ration should be placed in the feeding bowl(s) and completely emptied on a daily basis. Food bowls or containers should be thoroughly washed and rinsed daily.

If fresh fruits, vegetables, cooked rice, whole prey, bones with meat attached or other perishable foods are offered they should be offered early or late in the day to minimize spoilage under high ambient temperatures. All uneaten perishable foods should be removed from the enclosure as soon as is practical to avoid risks associated with bacterial proliferation. Since maned wolves likely forage for food throughout much of the day, it may be advisable to offer food at least 2 or 3 times per day. More frequent feeding of smaller amounts may also promote more normal gastrointestinal function and create less demand on the GI tract. The extent to which one-meal feeding (daily allotment of food presented in one feed) promotes loose stool has not been objectively studied.

Feeding locations should be protected from the elements. There should be at least one feeding location per maned wolf for those wolves housed together. Feeding stations should be spatially, and perhaps visually separated to discourage dominant animals from taking control of the food and to encourage food consumption by subordinate animals.

Feeding smaller amounts more frequently throughout the day may promote more normal activity. Maned wolves with access to outdoor yards are often seen eating insects, small rodents, birds and grass. The feeding of 20-30 crickets once or twice per week also stimulates feeding activity and offers some diversity. Grass eating is seen in domestic dogs and does not necessarily indicate GI tract problems or a nutrient deficiency. "Grass stool" produced by maned wolves may be voided as soon as 30 minutes after consumption. Such stool boluses are often coated in foamy mucous and may not contain any other food material, other than grass.

## **NUTRIENT REQUIREMENTS AND DEFICIENCIES/TOXICITIES**

As discussed above, maned wolves should be fed diets formulated to meet the requirements of the domestic dog. There is likely some value in offering diets that do not exceed 28% crude protein since protein (amino acids) in excess of requirement must be excreted. Much of the excess dietary cystine is probably excreted via the kidneys. It is thus prudent to restrict cystine (and methionine) (See Chapter Seven).

### **DIETS THAT HAVE CAUSED PROBLEMS**

As noted above, some commercial dry dog foods and omnivore biscuits appear to result in poorly formed stool. The extent to which feeding frequency (more frequent feeds in smaller amounts) may help to alleviate loose stool has not been studied. The addition of prey (rats, mice, etc.) appears to result in firmer stool.