

Diets for African Wild Dogs (*Lycaon pictus*)
Nutritional Management Guidelines, 1999
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Meeting the nutritional needs of African wild dogs is essential if they are to survive and reproduce in captivity. It is appropriate that animals in captivity are offered the diet that best matches their nutrient requirements. African wild dogs are one of the least typical canids in that they are reported to be exclusively carnivorous (Creel, 1995). They are nomadic animals that rely on communal hunting techniques to secure enough food for all members of the pack (Fanshawe, 1993). Feeding ecology information, along with published nutrient requirement data (which includes domestic dog and cat requirements), foods available to zoos, food preferences and palatability information have been utilized in developing appropriate dietary guidelines.

Feeding Ecology Data

African wild dogs hunt for food daily, usually at dusk and dawn. Free-ranging wild dogs live and hunt in packs composed of 2-50 animals, with all of the males being related to each other, and all of the females related, but each family originating from a different pack (Fanshawe, 1993). Wild dogs have a complex social structure that relies on team cooperation for survival. Pack size, including pups, is extremely variable. All members of the pack help feed the mother and her pups, which stay in the den for two to three weeks after birth.

Wild dogs are coursing predators that do not select their prey until after the chase has begun. The dogs are known for their ability to run long distances at speeds of up to 50 km/hr. Prey usually is selected from species that are most abundant for the hunting area and can include Thomson's gazelles, wildebeest, reedbuck, impala, and duiker. Among these prey, wild dogs tend to choose older or younger animals who are slower and easier to catch. The dogs work as a team to take the animal down and begin disemboweling it. All members present share the kill, with the dominant members of the pack obtaining more food. Older or lame dogs that cannot hunt for themselves are fed by pack members that regurgitate food after returning from a kill (Kruuk, 1967).

African wild dog packs also work together to defend their kills from other carnivores. Hyenas and wolves appear to be the most competitive. The scavengers, depending on their number and pack size, usually have to wait until the dog pack is finished with their meal before beginning theirs (Fanshawe, 1993). Only on rare occasions do African wild dogs actually scavenge themselves. It has been reported that in the wild, dogs kill between 1 – 4 animals per day, depending on pack size and prey availability (Fuller, 1990). In a study conducted by Fuller *et al.* (1990) in southwestern Kenya during July-August, 1989, the biomass (kg whole weight of prey) of prey ranged between 15.7 kg for 40 gazelles and 64.6 kg for 5 wildebeests.

Published Nutrient Requirement Data

There are no specific nutrient requirement data available for African wild dogs. Nutrient requirement data are available, however, for domestic dogs and cats (NRC dogs, 1974, 1985, and NRC cats, 1986). When evaluating the nutrient requirements for African wild dogs, it is important to examine several factors. Taxonomically, African wild dogs are canids, of which many are considered omnivores, as is the domestic dog (Legrand-Defretin, 1993). However, because of the carnivorous nature of the wild dog, the nutritional requirements for domestic cats, which are considered obligate carnivores, also should be considered. It was originally thought that dogs and cats have similar nutritional needs, however, it has become apparent that there are fundamental differences in their nutritional requirements. For example, it is thought that cats have a distinct need for both vitamin A and taurine (Legrand-Defretin, 1993). These same distinct requirements have not been proven in domestic dogs. Because the African wild dog is a canid but appears to consume a strictly carnivorous diet, the nutrient values for the African wild dog diet presented in this section are based on the range of nutrient requirements for dogs, all stages, and growing cats as described by the National Research Council, the Waltham Center for Pet Nutrition and the Association of American Feed Control Officials, Inc. (NRC dogs, 1974, 1985, NRC cats, 1986, Legrand-Defretin, 1993 and AAFCO, 1994).

Food Available to Zoos

Information on the types of food available to zoos feeding African wild dogs in captivity is important however, the primary concern must be to ensure that the quantity of nutrients consumed is appropriate for successful maintenance and reproduction of the wild dog. Both the number and type of prey species available to the captive animal are artificially limited so that the animal will never have the selection that would be available under free-ranging conditions, nor will they be able to hunt over long ranges to procure food. Activity will affect consumption through energy needs. As wild animals must travel and hunt to a significant extent, captive animals that do not, may have decreased energy demands. An African wild dog in its native setting will expend significantly more energy hunting and running at top speeds across huge expanses of land to catch their prey than a captive wild dog that does not hunt for its food. Additionally, not all food consumed is digested or utilized by the animal (Legrand-Defretin, 1993). Research on the ideal nutrient profile for an African wild dog diet, either in the wild or in captivity is unavailable. Free-ranging wild dogs' diets depend on pack size and food availability. Table 1 (Fuller, 1990) summarizes the few studies that have been conducted on the quantities of free-ranging prey consumption by African wild dogs. However, there is no nutrient composition information available for the individual prey items.

Table 1. Mean per capita consumption rate estimates for packs of wild dogs studied in East Africa

<i>Study</i>	<i>Pack Composition:</i>		<i># of days monitored</i>	<i>Consumption rate for adults^a</i>	
	<i>Adults</i>	<i>Pups</i>		<i>kg prey/dog/day</i>	<i>kg prey/kg/dog/day^b</i>
Schaller (1972)	7-16		5	1.2	0.05
Fuller (1993)	19-29		20	1.7	0.07
Frame & Frame (1981)	8		5	1.8	0.08
Estes & Goddard (1967)	12-21		8	1.6	0.07
Malcolm (1979)	8	?	4	2.0	0.09
Wright (1960)	2	4	-	-	0.15 ^c
Malcolm (1979)	8	11	18	3.0	0.15
Estes & Goddard (1967)	6-7		3	3.7	0.16
Kuhme (1965)	8	15	-	4.5	0.20

Schaller (1972)	11	14	20	5.4	0.24
Malcolm (1979)	15	11	10	5.9	0.26

SOURCE: Fuller, T.K. & Kat, P.W., Afr. J. Ecol. 28, 1990.

^aApproximately 60% of whole weight of prey killed.

^bAssumes mean wild dog weight of 23 kg.

^cRate for all pack members.

As Table 1 indicates, free-ranging African wild dogs consume between 1.2 to 5.9 kg prey/adult dog/day. This does not account for the approximately 1.0 kg of food each adult dog may regurgitate after a full meal for other members of the pack (Fuller, 1990). The lower food consumptions were found in areas where food was scarce or there were large numbers of dogs in a pack. The highest consumption rates were found with large litters and where prey was abundant. It has been estimated that wild dogs have a stomach capacity of 9 kg of food (Creel, 1995). Findings from this study indicate that intake of wild dogs is similar to that of other pack-hunting carnivores like wolves and hyenas (Fuller, 1990).

Food Preference

While the food items offered to captive wild dogs may not be the same as those available in the wild, zoos can do much to provide palatable foods. As discussed earlier, African wild dogs often prey upon species that are most abundant in the hunting area and not necessarily the most preferred. There also may be differences in food choice based on physiological condition (for example a lactating female) and day to day fluctuations in food consumed may vary dramatically.

In captivity, the food items offered to African wild dogs are limited in type and variety to what is available commercially. An animal that is offered a variety of succulent food items will not necessarily select those items needed based on its nutrient content. Instead, animals may select items based on sugar content, fat content, and even novelty. Thus, it is important to offer foods that compliment each other nutritionally while providing the foods in a number of different forms.

A survey of African wild dog feeding protocols was conducted in August, 1996 by Brookfield Zoo for 14 institutions holding a total of 25 dogs. Results from the survey are found in Table 2. Thirteen of the zoos fed their dogs once a day with two zoo that feed twice a day. All dogs were fed separately with the exception of two zoos that fed males together and females together. Most zoos offered similar quantities and type of food. The basic diet was between 1-1.36 kg of a nutritionally complete, raw meat-based canine diet per animal per day. One zoo offered a nutritionally complete raw meat-based feline diet with dry dog kibble. Some zoos fed dry dog kibble in addition to the regular meat-based diet. All zoos surveyed offered either knuckle, horse, beef, or oxtail bones at least 1-2 times per week in addition to the regular feedings. Occasionally, most dogs received a variety of whole prey that included fetal calves, chicks, rabbits, rats, mice, or deer carcasses. One institution fed their 2 animals dry dog kibble, 3-4 hard boiled eggs and a nutritionally complete raw meat-based carnivore diet. One zoo supplemented the diet of their 2 dogs with 10 g each of D-Ca-Fos and Vionate daily. Responses from the zoos indicated that all dogs found these diets acceptable and consumed 100% most of the time.

One zoo experienced problems with loose stools when 3.3 wild dogs arrived from Africa which were raised on and reportedly doing well consuming 100% dry kibble. The zoo here in the

United States found that all dogs had severe diarrhea on the dry diet alone. After experimenting with different dry foods, the zoo ultimately switched to a meat-based diet with dry kibble and found considerable improvements in the dog's stools (Toddes, pers. comm.)

Table 2. Survey of African Wild Dog Feeding Protocols

African Wild Dog Feeding Protocols					
Institution	Daily (per dog)		Occasionally:	Sex/#	Age
	Dry Kibble	Raw Meat Base			
1	454 g	454g canine	Bones	2.1	3,3,6
2	-	1.14 kg. canine	1X/week: beef leg bone only 1X/week: fetal calves blood pops (meat + blood)	2.0	10,10
3	113 g lite or HiPro	680 g feline	2X/week: Oxtail bones	2.0	5, 5
4	-	1.36 kg canine	1X/week: 1 horse knuckle bone	0.1	5
5	-	908 g canine	5X/week: 2 beef rib/femur bones	2.0	3, 3
6	-	908 g canine	1Xweek: beef femur bone	3.0	2,2,2
7	45 g	680 g canine	*fed 2X daily (340 g X 2)	2.0	8,8
8		1.13 kg feline	Daily: 3 chicks	2.0	12, 12
9		1.13 kg. canine	rabbits, rats, mice or deer carcass 1X/week: oxtail bone	N/A	N/A
10		1.13 kg. canine	1X week: beef bones	1.1	5.3
11		1.13 kg canine	M: horse bone, 1 rat, 1 rabbit (instead of canine)	2.1	9, 9.7
12		1.13-1.36 kg canine	2X/week: knuckle bone	0.1	4
13	1.36 kg	227 g canine	whole rat Daily: 3-4 hard boiled eggs	2.0	3,3
14		1.13 kg canine	1X/week: shank bone only (no canine) 3X/week: beef bones	2.2	8,8 2,2

Using NRC and Waltham Center for Pet Nutrition guidelines for both cats and dogs, the AAFCO Nutrient Profiles for Dog Foods, along with data on feeding ecology and nutrient content of food items fed at zoos, it is possible to formulate appropriate diets for captive African wild dogs (NRC dogs, 1974, 1985 and NRC cats, 1986, Legrand-Defretin, 1993 AAFCO, 1994). When formulating the diets, flexibility is needed to account for animal preferences, weight, exercise, physical condition, environment, stage of growth, and behavioral considerations as well as food

availability. Thus it is appropriate to set guidelines for nutrient content and food categories rather than recommending specific food items in set quantities.

Captive African Wild Dog Management Guidelines Diet Recommendations, 1999

Given the aforementioned data, target nutrient levels can be suggested. These should be considered target nutrient levels until more specific nutrient levels can be defined. Levels are expressed in quantity per unit of diet on a dry matter basis. Meeting the highest level should provide adequately for the needs of a canine carnivore.

NUTRIENT	DOGS* (all stages)	CATS*(growing)	AAFCO**(adult)
Energy (Kcal/g)	3.75	5	3.5
Crude Protein (%)	22	24	18
Fat (%)	5	-	5
Fiber (%)	-	-	-
Linoleic Acid (%)	1	.5	1
Arachidonic Acid (%)	-	.020	-
Vitamin A (IU/g)	5	3.33	5
Vitamin D (IU/g)	.5	.5	.5
Vitamin E (mg/kg)	50	30	
Thiamin (mg/kg)	1	5	1
Riboflavin (mg/kg)	2.2	4	2.2
Niacin (mg/kg)	11.4	40	11.4
Pyridoxine (mg/kg)	1	4	1.0
Folacin (mg/kg)	.18	.80	.18
Vitamin B12 (mg/kg)	.02	.02	.02
Pantothenic Acid (mg/kg)	10	5	10
Choline (mg/kg)	1200	2400	2400
Biotin (mg/kg)	.10	.07	-
Vitamin C (mg/kg)	-	-	-
Calcium (%)	1.1	.8	.6
Phosphorous (%)	.90	.60	.5
Magnesium (%)	.04	.04	.04
Potassium (%)	.60	.40	.6
Sodium (%)	-	.05	.06
Iron (mg/kg)	60	80	80
Zinc (mg/kg)	50	50	120
Copper (mg/kg)	7.3	5	7.3
Manganese (mg/kg)	5	5	5
Selenium (mg/kg)	.11	.10	.11
Iodine (mg/kg)	1.54	.35	1.5

*The guidelines are a range using published literature from the National Research Council Requirements (dogs, 1974, 1985, cats, 1986) and Waltham Center for Pet Nutrition (1993) (Legrand-Defretin) for both domestic cats and dogs.

- No NRC requirement stated for this nutrient. This does not mean there is no requirement, just that studies have not been performed.

**Association of American Feed Control Officials, Inc. These guidelines are adult maintenance minimums.

These nutrient values for growing cats and all stages of dogs are either known to be minimum requirements or values that are adequate for maintenance (Legrand-Defretin, 1993). Because each animal differs by breed and species, it is difficult to make generalizations about specific requirements for either cats or dogs. Table 3 compares the range of nutrient requirements for cats and dogs with the analysis of several diets offered to captive African wild dogs in zoos around the country.

Table 3. African wild dog diet analysis:

Nutrient	Target Nutrient Levels	100% Meat-Based Canine	100% Meat-Based Feline	Feline & Dry Dog Kibble 86/14*	100% Dry Dog Kibble	100% Commercial Canned Cat Food	100% Commercial Dry Cat Food
Energy (Kcal/g)	3.5-5						
Crude Protein (%)	18-24	61	50	44	30	40	34
Fat (%)	5	23	32	26	11	20	9
Fiber (%)	-	5	4	4	5	4	5
Linoleic Acid (%)	.5-1	-	-	0.5	2	-	1
Arachidonic Acid (%)	.02	-	-	-	-	-	-
Vitamin A (IU/g)	3.33-5	8	97	76	20	10	11
Vitamin D (IU/g)	.5	1	1	1	2	.8	2
Vitamin E (mg/kg)	30-50	57	42	34	12	60	11
Thiamin (mg/kg)	1-5	20	15	13	8	-	6
Riboflavin (mg/kg)	2.2-4	15	16	13	5	-	6
Niacin (mg/kg)	11.4-40	160	194	155	53	-	85
Pyridoxine (mg/kg)	1-4	12	10	10	8	-	6
Folacin (mg/kg)	.18-.80	.002	.002	0.41	1.5	-	1.1
Vitamin B12 (mg/kg)	.02	.04	.08	0.07	.03	-	.02
Pantothenic Acid (mg/kg)	5-10	45	51	40	10	-	23
Choline (mg/kg)	1200-2400	5097	5921	4642	1250	-	2500
Biotin (mg/kg)	.07-.10	-	-	.040	.15	-	.09
Vitamin C (mg/kg)	-	-	-	-	-	-	-
Calcium (%)	.6-1.1	1.9	1.6	1.6	1.8	.9	1.1
Phosphorous (%)	.5-.90	1.6	1.3	1.2	1.1	.8	.9

Nutrient	Target Nutrient Levels	100% Meat-Based Canine	100% Meat-Based Feline	Feline & Dry Dog Kibble 86/14*	100% Dry Dog Kibble	100% Commercial Canned Cat Food	100% Commercial Dry Cat Food
Magnesium (%)	.04	.16	.05	.08	.17	.10	.16
Potassium	4-6	1.3	1.1	1.0	0.7	-	.74
Sodium (%)	.05-.06	.58	.60	.59	.57	.72	.57
Iron (mg/kg)	60-80	227	221	223	227	-	284
Zinc (mg/kg)	50-120	113	96	99	108	-	102
Copper (mg/kg)	5-7.3	9	5	8	15	-	14
Manganese (mg/kg)	5	85	63	63	63	-	51
Selenium (mg/kg)	.10-.11	.23	0.18	0.13	-	-	-
Iodine (mg/kg)	.35-1.54	.71	0.58	1.11	2.5	-	1.71

*Based on 86% total diet meat-based feline and 14% dry dog kibble.

Target nutrient levels based on NRC dogs, 1974, 1985, NRC cats, 1986, the Waltham Center for Pet Nutrition, 1993 Guidelines and AAFCO Nutrient Profiles for Dog Foods.

Diet analysis provided by utilizing Animal Nutritionist software by N-squared Inc., Silverton, OR.

Feeding Frequency

African wild dogs should be fed at least once per day. Of the institutions surveyed for feeding protocols, all but two fed their dogs once daily. As discussed earlier, in the wild these animals usually hunt just before the hours of dawn and dusk (Kruuk, 1967). If possible, feeding twice daily in captivity may more closely resemble their free ranging feeding habits. Two zoos provided a beef leg bone only one day a week as a “fast day”. In the wild, African wild dogs hunt daily and fast only if prey is unavailable. Fresh water should be provided at all times. Food and water dishes should be disinfected daily to prevent bacterial build-up, especially *Pseudomonas*.

Food Items

It is possible to achieve the target nutrient levels outlined in Table 3 by offering a diet consisting of meat based and dry food items. As Table 3 indicates, a daily diet that combines either meat based canine or feline diet with a dry dog kibble should meet the needs of adult African wild dogs. Dogs should be fed separately if possible in order to monitor food intake. Vitamin and mineral supplements do not appear to be necessary as long as high quality diets are fed. If there is a question about the adequacy of the diet, it should be analyzed chemically for the nutrients in question.

Quantity of Food

Total amounts of food per day depend on activity and physiological state. Male and female African wild dogs weigh between 17-36 kg, with not much variation in size between the sexes (Walker, 1983). For weight maintenance, wild dogs should consume between .9 grams and 1.14 kg of food per day depending on the energy density of the diet. Body mass should be monitored and weights obtained on a routine schedule. Diets can be adjusted based on weight records. Overweight dogs may have their total diet decreased in 5% increments if the diet is still adequate in nutrients. Other options include decreasing calorically dense food items and/or increasing the lower calorie items.

Pack members may regurgitate food for other members of their group, especially pregnant bitches. As a result, the diets of the regurgitating animals may need to be increased (see *Gestation and Lactation* section). An example of an appropriate diet for a healthy, active African wild dog is 680 g meat based feline diet with 113 grams of dry dog kibble fed twice daily with a beef shank bone and a rat fed once per week.

Whole Prey items

While the nutrient content of many large whole prey items is unavailable, analysis of small prey items such as mice and chickens indicate that these items can provide important nutrients as well as variety (Douglas *et al.*, 1994). Occasional shank beef bones, rats, chicks and other small prey can be added to the diet to provide for behavioral enrichment and to promote good dental health.

Measuring Dietary Intake

Ultimately, it is the diet (food items) actually consumed by each animal that will determine its nutrient status. Thus, the diet offered will allow the animal to consume the nutrients needed. If it does not consume the diet, or certain portions of the diet, the animal may not be receiving the nutrients it requires. Because of this, it may be important to periodically assess the diet consumption.

Following is an example of the methodology employed in determining diet consumption. Data on diet offered and consumed should be collected for at least five days. Different keepers should facilitate collection of data to determine individual food preparation variation. Consumption can be calculated by determining the quantity (by weight) of food items offered and subtracting the quantity of food remaining. Food should be portioned out by each keeper according to their usual procedures. Each item should be weighed on a digital scale before placing it in the food pan. Orts (leftover food) should be collected by keepers at the end of the feeding time or before the beginning of the next feeding time. The Orts are weighed. Also included in any measurement of consumption are enrichment food items and should be accounted for in the same manner.

Because of the possibilities of food dehydration, desiccation should be taken into account. Likewise, addition of water from rain or misting could also be measured. To determine desiccation, a weighed sample pan should be placed near a cage (where animals are housed) in an area free from pests. The pan should be left for the same period of time as the diet and subjected to similar environmental conditions. The percentage water gain or loss should be determined and a correction factor calculated. This “factor” can then be used to determine the actual quantity of diet consumed without the conflicting problem of moisture. A computer analysis (one example: Animal Nutritionist software by N-squared Inc., Silverton, OR) can be used to calculate nutrient content of the diet offered and consumed. For nutritional advice, please consult your nutritionist or obtain a name of a professional nutritionist from the AZA Nutrition Advisory Group.

Gestation and Lactation

The National Research Council (NRC) Nutrient Requirements for Domestic Dogs suggests the energy requirements of the pregnant bitch are only slightly above maintenance for the first two-thirds of gestation. Romsos *et al.* (1981) and Legrand-Defretin and Munday (1993) found in the last trimester of pregnancy energy requirements may increase as much as 50-60% above preconception values. Legrand-Defretin and Munday also note that overfeeding early in pregnancy may lead to the accumulation of unwanted fat and predispose the animal to problems at whelping. Because African wild dogs are similar to cats with respect to their carnivorous feeding strategy, it is important to note that pregnant queens require approximately 25% more energy for gestation than maintenance (Loveridge, 1986).

Requirements for lactation depend on the size of the litter, with large litters increasing requirements up to three times maintenance in both dogs and cats (Legrand-Defretin 1993, NRC for cats 1986, NRC for dogs 1985).

Listed below are recommended guidelines. They may be altered to suit the needs of individual animals or changing situations.

1. First two thirds of gestation (up to approximately day 46 for wild dogs). An increase of 10-20% should be implemented as necessary.
2. Last trimester of gestation (day 47+). Based on the needs of the individual animal, changes should take place in 10% or 20% increments at regular intervals over the last trimester to

limit the possibilities of gastrointestinal stress. The diet should be increased a total of 60% over the maintenance amount. The full 60% increase does not have to be offered if the animal continually leaves food. During late pregnancy, the rapidly growing fetuses may push on the female's stomach making it difficult for her to consume large amounts of food. Smaller, more frequent meals may be helpful.

3. Lactation. Increases will be based on individual need, including the size of the litter. The diet should be increased up to three times maintenance (at peak lactation (about 4 weeks postpartum for dogs) with a large litter). These increases should take place in 10% or 20% increments at regular intervals again to limit the possibilities of gastrointestinal stress and reflect the needs at peak lactation.

Repeated regurgitation to feed the pregnant females may affect the condition of others in the group and thus, it is important to monitor the condition of all adult dogs in the pack.

Hand Rearing Young

Feeding regimes for hand rearing young are available from the studbook keeper and the Infant Diet/Care Notebook (newest version: 1993). Zoos have hand reared a number of infants successfully and reintroduced them after weaning to a family group for socialization and to learn parental care techniques.

Special Considerations

The importance of the inclusion of a nutritionally complete diet cannot be overemphasized and its consumption is critical to proper dietary management of African wild dogs. The diet should be reassessed for nutrient content if one nutritionally complete food item is substituted for another. A drop or increase in food intake must be carefully watched and body weight should be maintained. Oral medication may be fed to individuals in favorite items.

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