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Use of a Raw Meat-Based Diet or a Dry Kibble Diet for Sand Cats (*Felis margarita*)¹

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ABSTRACT: Limited information is available on the utilization of different types of diets by captive exotic felid species. Utilization of diets by small exotic felids may differ depending on the diet fed. Eight sand cats (*Felis margarita*), which are small, 2- to 4-kg cats, were used to examine the digestibility of two types of diets: a raw meat-based diet and a dry kibble diet. Dry matter, crude protein and energy intakes and digestibilities were evaluated. Digestibilities for dry matter, energy, and crude protein were 83.5 ± 4.8 , 89.6 ± 5.2 , $92.4 \pm 5.3\%$ for the raw meat-based diet and 72.7 ± 12.3 , 76.8 ± 14.5 , and $77.9 \pm 13.5\%$ for the kibble diet. Physiological variables also were ex-

amined and included plasma taurine, vitamin A, retinyl palmitate, β -carotene, calcium, and phosphorus. Plasma taurine means were 91.4 ± 8.4 $\mu\text{mol/L}$ in cats consuming the raw meat-based diet and 248.0 ± 23.2 $\mu\text{mol/L}$ in cats consuming the kibble diet. Plasma phosphorus was $5.2 \pm .1$ and $4.5 \pm .1$ mg/dL, respectively, in cats consuming raw meat-based and kibble diets. β -Carotene was 25.2 ± 2.9 and $2.9 \pm .3$ $\mu\text{g/dL}$, respectively, for cats consuming the raw meat-based and kibble diets. These results indicate that diets formulated for small captive exotic felid species should be evaluated with respect to diet type and nutrient utilization.

Key Words: *Felis*, Cats, Digestibility, Intake, Utilization

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Introduction

The type of diet offered to captive exotic felids should be evaluated. Although some digestibility studies have been conducted using captive exotic felids (Hackenburger and Atkinson, 1983; Hamor, 1983; Wynne, 1989), much was extrapolated from work with domestic felids (NRC, 1986). However, diets may be digested differently (Kendall et al., 1982). Captive exotic cats typically are fed raw meat-based diets, which may be more digestible than plant-based diets (McDonald, et al., 1981). Additionally, certain nutrients are of specific concern when evaluating cat diets (Rogers and Morris, 1982; Czarnecki, 1983). Taurine, essential for cats, is naturally found in meat sources but not in plants, indicating a need for animal protein (Knopf et al., 1978; MacDonald et al., 1984) unless taurine is provided in the diet in a crystalline form. It was thought that cats did not absorb oral β -carotene (Ahmad, 1931). However, β -carotene has

been detected in the blood of domestic (Baker et al., 1986) and exotic felids (Slifka, 1994). Felid requirements for other nutrients such as calcium and phosphorous seem to be similar to those of other mammals (Krook et al., 1963; Bland-Sutton, 1988).

Thus, the suitability of diets for exotic cats should be ascertained before a feeding regimen is instituted. This study was designed to investigate the utilization of two types of diets in sand cats (*Felis margarita*): a raw meat-based diet and a dry kibble diet.

Materials and Methods

The study was conducted at Brookfield Zoo, Brookfield, IL between January 13 and June 30, 1995, according to the guidelines set forth by the Brookfield Zoo Biological Research Steering Committee and the Institutional Animal Care and Use Committee. Sand cats were selected for study because of the significant numbers of animals available. Sand cats are considered small exotic cats and are found naturally in arid areas of North Africa and the Middle-East (MacDonald, 1984). Eight sand cats of differing age and body mass were used: five males (1.5 to 5 yr of age; approximately 3.0 to 3.9 kg) and three females (1.5 to 5 yr of age; approximately 2.0 to 2.6 kg). The cats

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Table 1. Guaranteed analysis for Nebraska Canine Diet (Animal Spectrum, Inc., North Platte, NE)^a

Component	%
Crude protein	≥ 19.0
Crude fat	≥ 7.0
Crude fiber	≤ 1.5
Moisture	≤ 69.0

^aIngredients: horsemeat, meat by-products, dried beet pulp, salt, D-activated amino sterol (source of vitamin D3), vitamin B₁₂ supplement, vitamin E supplement, menadione sodium bisulfate (source of vitamin K activity), riboflavin supplement, niacin, calcium d-pantothenate, choline chloride, thiamine, pyridoxine hydrochloride, folic acid, copper oxide, cobalt carbonate, iron carbonate, manganous oxide, ethylene diamine dihydriodide, zinc oxide.

were housed, off exhibit, in adjacent steel and concrete enclosures (.24 m × .17 m × .17 m) with shifting walls to allow for grouping and separation during feeding and fecal collection. All environmental conditions were similar for both trials. Housing was inside with ambient temperature held near 21°C and a 12 h light/dark cycle supplied by artificial lighting only. Between trials, cats were kept in groups of 3:0, 0:3, 1:0, and 1:0 (males:females, respectively). Enclosures contained cardboard, wood, or plastic hiding boxes, rubber litter tubs filled with clay litter, and plastic bowls for water, which was available for ad libitum consumption.

Digestibility of two diets was determined. Each trial extended for 12 d. Trial 1 included a raw meat-based diet (Animal Spectrum, North Platte, NE; Table 1), which was the primary food item of the sand cats before this study was started. Trial 2 included a dry kibble diet (kibbles measured approximately 2 cm × .6 cm × .6 cm; Purina Mills, St. Louis, MO; Table 2). Both diets met or exceeded the requirements of domestic cats (NRC, 1986; Dzanic, 1994). Each diet used was from the same manufacturer's lot number.

Table 2. Guaranteed analysis for Mazuri Diet 5M54 (Purina Mills, St. Louis, MO)^a

Component	%
Crude protein	≥ 36.0
Crude fat	≥ 20.0
Crude fiber	≤ 4.0
Moisture	≤ 12.0

^aIngredients: poultry by-product meal, soybean meal, corn gluten meal, ground rough rice, corn flour, dried whole egg, meat meal, poultry fat, fish oil, animal fat preserved with BHA, animal digest, soybean oil, phosphoric acid, salt, dried whey, brewer's dried yeast, ground beet pulp, wheat germ meal, fish meal, taurine, DL-methionine, choline chloride, potassium chloride, pyridoxine hydrochloride, menadione dimethylpyrimidinol sulphite (source of vitamin K), thiamin mononitrate, DL-alpha tocopheryl acetate (source of vitamin E), vitamin A acetate, ferrous sulfate, cholecalciferol (source of vitamin D₃), d-biotin, inositol, cyanocobalamin, ethoxyquine (a preservative), riboflavin, sodium selenite, nicotinic acid, zinc oxide, copper sulfate, folic acid, calcium iodate, manganous oxide, ferrous carbonate, zinc sulfate, cobalt carbonate.

The cats were offered the appropriate test diet for the duration of each trial. The quantity of food offered to each cat was based on body mass and corresponded to the quantity offered before the study (2.7 to 3.5% of body mass, DM basis). The cats were fed twice daily at approximately 0900 and 1500. Each cat was separated for feeding and then reunited with the groups approximately 1 h after feeding until the last 5 d of each trial when the cats remained separated. Daily food offerings per cat remained constant within cats throughout the study with the exception of the last 7 d of Trial 2, during which each cat was given ad libitum access to food to allow additional time to consume its ration. Food intake was recorded daily, and body mass was recorded before and after each trial.

Trials 1 and 2 were separated by a transition period in which the sand cats gradually were converted from the raw meat-based diet to the kibble diet. This was done by homogenizing the raw meat-based diet in a Stephan Machinery vertical cutter mixer (Stephan Machinery Corp., Haelin, Germany) and mixing in (either with the mixer or by hand) the kibble until the combination seemed to be ground and well-mixed. The conversion began at 10% increments per week until it reached 70% kibble and 30% raw diet. All cats were fed at this ratio for approximately 8 weeks to stabilize body mass fluctuations. When body mass was stabilized, the transition resumed, and the cats were successfully converted to 100% kibble. The entire transition took approximately 6 mo. Cats were fed the raw meat-based diet before Trial 1 and were continued on the kibble diet for approximately 2 mo after the end of Trial 2.

The sand cats were moved to separate enclosures for the last 5 d of each trial to allow for fecal

Table 3. Analyzed composition of diets fed to sand cats^a

Nutrient	Raw meat-based diet	Dry kibble diet
Dry matter, %	32	94
Gross energy, kcal/g	5.88	5.55
Protein, %	57.2	40.2
Calcium, %	1.7	1.9
Phosphorous, %	1.1	1.5
Magnesium, %	.10	.13
Potassium, %	.93	.73
Sodium, %	.44	.41
Iron, ppm	769	438
Zinc, ppm	130	228
Copper, ppm	9	21
Manganese, ppm	36	82
Taurine, mg/kg	4,800	2,900
Retinol, µg/100 g	57	566
α-tocopherol, mg/100 g	.14	.85
β-carotene, µg/100 g	60	86

^aMeans for two feed samples, except six samples for retinol, α-tocopherol, and β-carotene. All nutrients are expressed on a dry matter basis.

Table 4. Dry matter intake of a raw meat-based diet and a dry kibble diet in sand cats

Cat	Daily intake, g ^a	
	Raw meat-based diet	Dry kibble diet
1	82.5 ± 3.3 ^a	102.2 ± 6.7
2	91.4 ± .4	134.5 ± 10.3
3	62.7 ± 5.7	109.4 ± 6.3
4	69.5 ± 6.8	89.0 ± 7.5
5	70.8 ± 1.4	87.6 ± 11.4
6	109.5 ± 10.0	88.8 ± 8.6
7	70.7 ± 6.6	108.2 ± 10.6
8	95.5 ± 5.2	117.8 ± 6.2
Mean	81.6 ± 2.2	104.7 ± 3.4

^aMeans for each cat reflect daily intakes for 12 d.

^bMean ± standard error.

collections. Total fecal collections were made for 24-h periods at the morning feeding on each of the 5 d. Litter tubs were removed from the enclosures, and all fecal samples were collected using a plastic sifter. The clean tubs were then put back into the enclosure. Fecal samples were frozen until sample preparation.

Blood samples were collected from each sand cat approximately 1 mo before Trial 1, on the last day of Trial 1, on the last day of Trial 2, and approximately 1 mo after Trial 2. Samples were analyzed for plasma taurine, vitamin A, retinyl esters, carotenoids, calcium, and phosphorus. Plasma (in heparin) and serum were collected. Samples were processed as follows: 1 mL of plasma was collected for each sand cat and frozen for taurine analysis by HPLC (Slocum and Cummings, 1991); 2 mL of serum was wrapped to avoid light and frozen for vitamin A and carotenoid analysis by HPLC (Stacewicz-Sapuntzakis, et al., 1987); and .5 mL of serum for blood calcium and phosphorus was immediately analyzed (Johnson & Johnson, Rochester, NY) using a Kodak 250 dry reagent analyzer (Eastman Kodak, 1994).

Diet and fecal samples were prepared for analysis of dry matter, protein, and energy. Food items not eaten

Table 5. The mean digestibilities of dry matter, energy, and protein in sand cats

Item	Apparent digestibility % ^a	
	Raw meat-based diet	Dry kibble diet
Dry matter, %	83.5 ± 4.8 ^b	72.7 ± 12.3
Energy, %	89.6 ± 5.2	76.8 ± 14.5
Protein, %	92.4 ± 5.3	77.9 ± 13.5

^aApparent digestibility means reflect daily digestibility per cat (5 d × 8 cats).

^bMean ± SE.

were prepared for analysis of dry matter only because both diets were from the same manufacturer's lot and appeared homogenous. Preparation of fecal samples included removing litter residue; this was performed by freezing the samples in a Revco Elite ultra-low freezer (Revco, Asheville, NC) at -80°C for 24 h and removing litter particles with tweezers. All samples were weighed on a Mettler AE 100 balance (Mettler, Hightstown, NJ) and dried at 60°C in a Fisher Scientific Isotemp Oven (Model 655F, Fisher Scientific, Philadelphia, PA). Samples were ground in a Thomas Scientific Grinder (Thomas-Wiley, Philadelphia, PA) with a 2-mm screen. Dry matter (AOAC, 1985) was determined, and ground samples were analyzed for protein with the Kjeldahl nitrogen method (AOAC, 1995) using a Tecator Kjeltac Digestion System 6 and a 1026 Distilling Unit (Hoganas, Sweden). Energy was determined by complete combustion using a Parr 1261 Bomb Calorimeter (Parr, Moline, IL). All results were calculated on a dry matter basis. Apparent digestibility was determined.

Data were not statistically analyzed due to confounding variables. Even though the environmental conditions were similar for both trials, the diets were fed to all cats in the same trial during the same time period. Additionally, food was restricted during Trial 1 and fed for ad libitum consumption during Trial 2. Animal management did not allow cats to be fed different diets for several reasons, which included the

Table 6. Individual dry matter, energy, and protein digestibilities

Cat	Dry matter, %			Energy, %			Protein, %		
	Raw ^{ab}	Kibble ^b	Mean ^b	Raw	Kibble ^b	Mean ^b	Raw	Kibble ^b	Mean ^b
1	84.6	79.7	82.2 ± 1.8	91.2	85.4	88.3 ± 1.4	94.6	85.5	90.0 ± 1.8
2	85.1	73.7	79.3 ± 3.3	75.1	79.7	85.6 ± 2.8	77.3	79.7	87.0 ± 3.2
3	83.7	78.8	81.3 ± 2.1	90.5	84.6	87.6 ± 1.7	93.8	84.7	89.3 ± 2.0
4	84.3	75.4	79.9 ± 2.2	91.0	81.9	86.5 ± 1.9	94.0	81.5	87.7 ± 2.4
5	88.6	79.0	83.8 ± 2.2	93.4	85.0	89.2 ± 1.8	95.8	84.4	90.1 ± 2.2
6	72.2	42.8	57.5 ± 6.2	76.9	40.7	58.8 ± 7.4	79.1	44.9	62.2 ± 6.8
7	85.2	75.6	80.5 ± 2.1	91.4	82.2	86.8 ± 1.8	94.2	80.2	87.6 ± 2.5
8	84.4	76.8	80.6 ± 2.6	91.0	82.9	86.9 ± 2.1	93.3	81.1	87.4 ± 2.7
Mean			78.1 ± 2.8			83.7 ± 2.6			85.2 ± 2.9

^aRaw = raw meat-based diet.

^bMeans for 5 d digestibility and means ± SE.

Table 7. Body mass of sand cats^a

Cat	Sex ^b	Raw meat-based		Kibble			Meat ± SE
		Pre-trial 1	Trial 1	Pre-trial 2	Trial 2	Post-trial 2	
		kg					
1	M	3.8	3.6	4.0	4.4	4.3	4.0 ± .1
2	F	2.6	3.1	2.9	3.2	3.1	2.9 ± .1
3	M	3.7	3.2	3.0	3.8	4.1	3.5 ± .2
4	F	2.5	2.9	2.5	2.7	2.5	2.6 ± .1
5	M	3.1	3.2	2.5	2.2	2.2	2.6 ± .2
6	F	2.0	2.4	2.2	2.1	2.2	2.2 ± .1
7	M	3.1	3.2	3.2	3.2	3.3	3.2 ± .03
8	M	3.0	2.9	2.8	3.0	3.4	3.0 ± .1
Mean ± SE		3.0 ± .2	3.1 ± .1	2.9 ± .2	3.1 ± .3	3.1 ± .3	

^aOne measurement per entry.

^bM = male, F = female.

following: 1) the conversion to the dry diet was slow (6 mo) and gradual (10% increments); 2) there were some extreme body mass fluctuations during the conversion; and 3) the cats were to be maintained on the kibble diet as their primary source of feed after the diet was converted.

Results

Even though statistical analyses were not performed, strong trends in the results were observed.

Diets used in the trials were chemically analyzed (Table 3). On a dry matter basis, the energy density of the two diets was similar, but on an as-fed basis, the kibble diet seemed denser (5.22 vs 1.88 kcal/g).

Consumption of dry matter seemed to be affected by diet and the individual cat, as shown in Table 4. Dry matter intake seemed less when the raw meat-based diet was consumed, and some cats (e.g., cat 5) had low intakes of both diets. Energy intake for cats consuming the raw meat-based diet was 479 ± 10.1 kcal/d and was 598 ± 17.3 kcal/d for cats consuming the kibble diet. Protein intake for cats on the raw meat-based diet was 46.7 ± 1.2 g/d and was 42.1 ± 1.3 g/d for cats on the kibble diet.

Comparing the means of the two diets, differences in digestibilities of dry matter, energy, and protein

seemed to indicate that the kibble diet was less digestible than the raw meat-based diet (Table 5). The values for each cat for dry matter, energy, and protein digestibilities are shown in Table 6. One of the cats (cat 6) had digestibility values that seemed less than those for the other cats, especially for the kibble diet.

Body mass determinations are shown in Table 7. The three female cats weighed 2.5 ± .1 kg, and the males weighed 3.3 ± .1 kg.

Plasma taurine concentrations are shown in Table 8. When the cats consumed the raw meat-based diet as their main source of nutrients, taurine values seemed less than when they consumed the kibble diet.

Serum phosphorous was 5.2 ± .2 mg/dL when the cats consumed the raw meat-based diet and 4.5 ± .3 mg/dL when cats consumed the kibble diet (Table 8). Serum calcium averaged approximately 10.4 ± .2 mg/dl (Table 8) regardless of diet.

Retinol was similar between diets (Table 8). Serum retinyl palmitate concentrations ranged from 24.9 to 421.4 µg/dL among the cats for the two diets (Table 9). β-Carotene concentrations in cats consuming the raw meat-based diet averaged 25.2 ± 2.9 µg/dL, and they averaged 2.9 ± .3 µg/dL in cats consuming the kibble diet. Values for each cat are presented in Table 10.

Table 8. Plasma taurine and serum phosphorus, calcium, and retinol in sand cats^{ab}

Item	Raw meat-based		Kibble	
	Pre-trial 1	Trial 1	Trial 2	Post-trial 2
Taurine, µmol/L	103.6 ± 26.6	79.3 ± 19.3	306.2 ± 58.5	189.8 ± 55.1
Phosphorus, mg/dL	5.2 ± .3	5.2 ± .1	4.5 ± .2	4.5 ± .3
Calcium, mg/dL	10.6 ± .2	10.4 ± .1	10.5 ± .1	10.2 ± .1
Retinol, µg/dL	34.7 ± 5.8	31.7 ± 1.8	29.8 ± 5.9	29.9 ± 2.8

^aMeans ± SE.

^bEach mean represents eight cats.

Table 9. Serum retinyl palmitate in sand cats

Cat	n ^a	Raw meat-based diet	Kibble diet	Mean ^b
		$\mu\text{g/dL}$		
1	4	226.6 \pm 61.0	226.2 \pm 58.8	226.5 \pm 29.9
2	3	239.4	421.4 \pm 123.0	365.4 \pm 66.2
3	4	143.3 \pm 37.8	87.1 \pm 37.0	115.2 \pm 27.04
4	3	155.0 \pm 7.3	47.2	99.6 \pm 32.2
5	4	120.3 \pm 5.9	53.4 \pm 4.0	86.9 \pm 19.5
6	4	68.4 \pm 14.8	24.9 \pm 1.9	46.7 \pm 13.3
7	2	164	474.9	257.3 \pm 76.3
8	4	105.5 \pm 2.6	180.4 \pm 68.4	143.0 \pm 35.3
Mean ^a		145.9 \pm 15.2	179.2 \pm 45.4	

^an = number of samples providing >1 $\mu\text{g/dL}$.

^bAll values are means \pm SE.

Discussion

On an as-fed basis, sand cats consumed approximately 229% more of the raw meat-based diet than of the kibble diet (255 vs 111 g/d), but on a DM basis, the cats consumed approximately 22% less of the raw meat-based diet. However, the daily DM consumption of the raw meat-based diet provided 31.7% more digestible protein and only 3.9% less digestible energy than the kibble diet. Despite the apparent magnitude of the differences between the two diets, the design of the study did not permit us to determine whether the differences were statistically significant, but we believe that the data are useful for managing the nutrition of sand cats.

Digestibility of raw meat-based diets in exotic cats has been evaluated by others, and our data are similar to the previous data. For tigers, dry matter, energy, and protein digestibilities ranged from 86 to 98%, 91 to 98%, and 92 to 98%, respectively (Hackenburger and Atkinson, 1983). Protein digestibility for lions, tigers, pumas, and leopards ranged from 73% to 85% (Wynne, 1989). In smaller cats, (i.e., serval, lynx, and

caracal) digestibilities ranged from 58 to 76%, 78 to 98%, and 81 to 98% for dry matter, energy, and protein, respectively (Hamor, 1983).

The kibble and raw meat-based diet met or exceeded the requirements of domestic felids (NRC, 1986; Dzanic, 1994). However, the raw meat-based diet was almost 15% more digestible than the kibble diet. This may be due to the constituents of the diet. Felid species are considered strict carnivores (Czarnecki, 1983), and they utilize little, if any, fiber (Maskell and Johnson, 1993). Thus, they may be able to digest and absorb nutrients more readily from a raw meat-based diet than from a kibble diet, which contains a considerable amount of plant matter (McDonald et al., 1981). Indeed, digestibilities for dogs consuming animal matter (i.e., lung, tripe, or minced meat) were greater than those for dogs consuming a soy-based diet (Neirinck et al., 1991).

The digestible energy values for sand cats fed the kibble diet were less than for domestic cats fed dry diets (Sunvold et al., 1995). Energy digestibility for our sand cats averaged 77%, and it ranged from 85 to 91% for domestic cats (Sunvold et al., 1995). Dry

Table 10. β -Carotene in sand cats

Cat	Raw meat-based		Kibble	
	Pre-trial 1	Trial 1	Trial 2	Post-trial 2
	$\mu\text{g/dL}$			
1	19.1	25.5	3.8	2.6
2	35.3	36.5	3.2	3.5
3	23.1	21.9	3.1	4.8
4	24.4	39.0	2.5	2.3
5	21.2	28.0	3.5	3.4
6	<1.0	3.2	<1.0	<1.0
7	23.5	35.8	3.8	2.7
8	25.0	41.0	4.0	2.9
Mean \pm SE	21.5 \pm 3.5	28.9 \pm 4.4	3.0 \pm .5	2.8 \pm .5

matter digestibilities for sand cats consuming the raw meat-based diet were similar (72 to 89%) to those for domestic cats consuming canned diets (85 to 90%; Nott et al., 1994). Additionally, our results indicate that there can be considerable animal-to-animal variation.

Plasma taurine was over twice the level when sand cats consumed the kibble diet than when they consumed the raw meat-based diet. Plasma taurine levels indicated that taurine intake was adequate regardless of the diet (Pion et al., 1987). However, the kibble diet contained 40% less taurine than the raw meat-based diet. The bioavailability of taurine from cat foods may differ considerably (Glass et al., 1992; Odle et al., 1993). Of the two diets fed to sand cats, only the kibble diet contained added taurine; however, it also contained poultry by-product meal, dried whole egg, and meat meal. The sources of taurine in the raw meat-based diet were presumably horsemeat and meat by-products. Even though the design of the study did not allow for direct comparison, it may be that added crystalline taurine was more available to the sand cats than that from the meat sources.

Within the normal range for domestic cats, serum phosphorus was 14% less when cats consumed the kibble diet than when they consumed the raw meat-based diet (Merck, 1986). Because the kibble diet contained a greater proportion of grain than the raw meat-based diet, binding of phosphorus with phytates may have occurred (Kutsky, 1981). Serum calcium also was within the normal range for domestic cats (Merck, 1986).

The overall mean for retinol was 32.1 $\mu\text{g}/\text{dL}$, which is within the range for domestic cats: 21.3 (Schwiebert, 1990) to 96 $\mu\text{g}/\text{dL}$ (Baker et al., 1986). Retinyl palmitate values for sand cats (means, calculated for both diets, of 46.7 to 365.4 $\mu\text{g}/\text{dL}$) were as great or greater than those reported for domestic and exotic cats. Values for cheetah and leopards ranged from 30.9 to 70.5 $\mu\text{g}/\text{dL}$ (Schwiebert, 1990), and Pallas cats averaged 370 $\mu\text{g}/\text{dL}$ (Slifka, 1994).

β -Carotene values for domestic cats averaged 19 $\mu\text{g}/\text{dL}$ (Baker et al., 1986), and the values for exotic cats ranged from 8.3 to 56.8 $\mu\text{g}/\text{dL}$ (Slifka, 1994). These values compare favorably with those for sand cats consuming the raw meat-based diet (means of 21.5 to 28.9 $\mu\text{g}/\text{dL}$), but when sand cats consumed the kibble diet the values seemed low (2.8 to 3.0 $\mu\text{g}/\text{dL}$).

Implications

Our results indicate that kibble diets may not be as digestible as raw meat-based diets fed to small exotic cats. This difference in digestibility has important implications for required food consumption. Dietary

components may have different effects on circulating nutrient levels, as illustrated by circulating taurine, β -carotene, and phosphorous levels when the cats consumed the different diets. Animal-to-animal variation seemed to affect digestibility and retinyl palmitate values. Even though direct comparisons of domestic vs exotic small cats consuming the same diets were not performed, domestic cats, for which kibble diets are appropriate, may utilize this type of diet differently than exotic small cats.

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