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Body composition and amino acid concentrations of select birds and mammals consumed by cats in northern and central California

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ABSTRACT: The diet of the feral domestic cat consists of primarily birds and small mammals, but the nutritional composition is relatively unknown. Because of the increasing popularity of natural diets for cats and other wild captive carnivores, the purpose of this study was to describe the body composition and AA concentrations of select birds and small mammals in northern and central California: wild-caught mice (*n* = 7), Norway rats (*n* = 2), roof rats (*n* = 2), voles (*n* = 4), moles (*n* = 2), gophers (*n* = 3), and birds (*n* = 4). Body water, crude fat (CFa), CP, ash, and AA composition for each specimen were determined. Results are reported as mean ± SD. All results are reported on a DM basis except body water (as-is basis) and AA (g/16 g N). Combined, carcasses had this mean composition: 67.35 ± 3.19% water, 11.72 ± 6.17% CFa, 62.19 ± 7.28% CP, and 14.83 ± 2.66% ash. Concentrations of Arg, Tau, Cys, and Met were 5.63 ± 0.46, 0.92 ± 0.33, 1.91 ± 0.89, and 1.82 ± 0.19 g/16 g N, respectively. Using NRC physiologic fuel values for CP, CFa, and carbohydrate by difference, the combined average energy content of the carcasses was 3,929 kcal/kg DM, but the fiber content was not determined. With the exception of mice and rats, little historical data exist regarding the body and AA composition of many of the species analyzed in this study. Wild-caught mice and rats were composed of less fat but more ash compared with previously reported data in their purpose-bred counterparts. The CP content of mice in this study was similar to previous reports in purpose-bred mice. The CP content of rats was similar or slightly greater compared with historical findings in purpose-bred rats. The N content of rats and AA concentrations on a per-N basis for both rats and mice were similar to previously published data on purpose-bred rodents. The discrepancies in nutrient composition, especially fat concentration, indicate that using purpose-bred animals to represent the diet of the feral domestic cat may not be valid in many instances. When consumed to meet energy needs, the nutrient content of the species reported in the present study exceed the NRC (2006) recommended allowances (RA) for total fat, CP, and essential AA for felines at all life stages.

Key words: amino acid, ash, body composition, diet, fat, feline

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INTRODUCTION

Cats evolved on a diet composed strictly of animal tissues and are considered obligate carnivores with unique dietary requirements. The high protein requirement of the cat is the result of the inability to regulate aminotransferases in the dispensable N metabolism and the urea cycle enzymes (Rogers et al., 1977; Green et al., 2008). The C skeletons of AA are used for maintenance of blood glucose concentrations by gluconeogenesis, even when dietary protein is limited (Rogers et al., 1977; Roswell et al., 1979; Morris and Rogers, 1982). Other nutritional idiosyncrasies include an absolute requirement for Arg, Tau, niacin, vitamins A and D, and arachidonic acid.

There has been a controversial but popular trend in companion animal nutrition to move away from commercially prepared foods and toward a feeding approach that mimics more closely the natural diet of the cat and other wild carnivores. Recent ecological research on the feral domestic cat (*Felis catus*) and the wild cat (*Felis silvestris*) has provided data

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indicating that these feline species consume a diet consisting primarily of small mammals and birds (Biro et al., 2005; Medina et al., 2008; Germain et al., 2009; Harper, 2010) although proportions of prey type vary with habitat, season, and prey availability. Although body composition data exist for some prey species, in many reports, the body size, age, and details of carcass preparation (presence of skin, fur, organs, and intestinal contents) are omitted.

The information on the AA content of any small prey species is lacking, and the body composition of wild rats is unknown, with the exception of selected variables for whole hespid cotton rats (Fleharty et al., 1973) and eviscerated, trimmed carcasses of Australian bush rats (Stewart and Barnett, 1983). The purpose of this study was to determine total body water, crude fat (**CFa**), CP, ash, and AA concentrations of wild-caught prey species in northern and central California.

MATERIALS AND METHODS

The protocol for this study was reviewed and approved by the Institutional Animal Care and Use Committee (**IACUC**) at the University of California, Davis.

Animals

Animals were wild caught and received already frozen from approved IACUC studies or routine pest control at the University of California, Davis. Animals were killed by snap trap, pincer-style trap, or accidental death in ecological studies; thus, no poison or euthanasia solution was used. Wild bird specimens were salvaged under Federal Banding Permit 22712. The following animals were collected from different areas in Northern and Central California: 3 female and 4 male house mice (*Mus musculus*) from Monterey County, 4 male California voles (*Microtus californicus*) from Monterey County, 1 male, 1 female, and 1 unknown gender house finch (*Carpodacus mexicanus*) from Yolo County, 2 male and 2 female Botta's pocket gophers (*Thomomys bottae*) from Fresno County, 2 female roof rats (*Rattus rattus*) from Yolo County, 2 male Norway rats (*Rattus norvegicus*) from Yolo County, 2 male broad-footed moles (*Scapanus latimanus*) from Sonoma County, and 1 male Audubon's warbler (*Dendroica coronata auduboni*) from Yolo County. After arrival, each animal was weighed, tagged, and photographed. Animals were stored in a freezer (–30°C) for approximately 2 mo before analysis. All animal carcasses were stored and analyzed in entirety, including abdominal contents, fur, and feathers; no body components were removed or cleaned.

Methods

Body water was determined by freeze-drying and vacuum-desiccating animals to constant weight. Total body CFa was quantified by extracting the carcass in a Soxhlet apparatus for 10 d using anhydrous diethyl ether followed by 4 d in acetone. Crude fat was calculated by the weight difference between the dehydrated carcass mass before and after extraction. Fat-extracted carcasses were ground in a hammer mill (Schutte-Buffalo Hammermill, Buffalo, NY) using a 1-mm sieve and then in a blade mill (Thomas Scientific Wiley Mill, Swedesboro, NJ) using a 1-mm sieve until the sample was homogenous. Homogenized sample DM was determined in duplicate by heating to constant weight in a forced air oven at 100°C for 12 h. Nitrogen was determined in duplicate by the Kjeldahl method (AOAC, 1980). Crude protein was determined using this equation: % CP = % N × 6.25. Ash content was determined in duplicate by heating samples to 575°C for 12 h in a furnace (Type F6000 Furnace; Barnstead Thermolyne, Waltham, MA). Amino acid analysis was performed as previously described (Spitze et al., 2003) using an automated AA analyzer (Biochrom 30; Biochrom Ltd., Cambridge, UK).

Statistical Analysis

Statistical analysis was performed using computer software (Microsoft Excel 2007; Microsoft Corporation, Redmond, WA). All duplicate values were averaged. Results are reported as mean ± SD and are provided on a DM basis with the exception of BW and moisture content (both on an as-is basis). Dry matter, CP, CFa, and ash are reported on a whole-body basis, calculated using predried carcass weights. Amino acid concentrations are reported as grams per 16 g N. Comparative data from the other studies discussed herein are reported in the same units as the data from this study.

RESULTS AND DISCUSSION

With the exception of mice and rats, little historical data exist regarding the composition of many of the species analyzed in this study. The variety of animals in this study was intended to represent what a feral domestic cat may consume or on which the domestic cat may have evolved. Before domestication, it was likely that the diet of the cat consisted primarily of small mammals but also included other small animals such as birds and reptiles. In Hungary, it was observed that the diet of the feral domestic cat (Felis catus) consisted of almost 50% voles, 20% mice, and a mixture of other small mammals and birds, with similar findings for the wild cat (Felis silvestris; Biro et al., 2005). Other studies reported similar findings, with diets consisting of primarily small mammals and birds in areas such as France, New Zealand, and the Canary Islands (Medina et al., 2008; Germain et al., 2009; Harper, 2010). Interestingly, the wild cat (Felis silvestris) can be considered a facultative specialist, as it has been shown to preferentially eat rabbits when they are abundant, but its feeding strategy can successfully shift to focus on small rodents when rabbits are not available (Malo et al., 2004). Because cats are small carnivores that typically consume much smaller prey species and generally eat them in their entirety, the animals in this study were analyzed with all bones, organs, and intestinal contents present as well as fur and feathers (Carbone et al., 1999). Although some indigestible components of the diet may function as fiber in the carnivore gastrointestinal tract, the amounts consumed are considered to be negligible (in the case of intestinal contents or voluntarily consumed vegetation or both), and there are no analytical methods to reliably quantify this component as fiber (in the case of tissue from bone, cartilage, tendons, fur, skin, and feathers; Depauw et al., 2011; Plantinga et al., 2011). Therefore, fiber analysis was not attempted in this study.

Body weight and composition data are reported in Table 1. Overall, the percentage of body water varied by less than 10% among the various species analyzed in this study. Average body water for the mice and rats in this study was similar to previous reports in their purpose-bred equivalents (Vondruska, 1987; Clum et al., 1996) and wild counterparts (Fleharty et al., 1973; Powers et al., 1989). Concentrations of fat in the species analyzed in this study differed more from that of purpose-bred animals than concentrations in other nutrients. Although CFa was variable, on average, the wild-caught mice in this study tended to be leaner compared with previous data that reported a range of CFa content in purpose-bred mice of 16.9 to 28.0% (Bird and Ho, 1976; Clum et al., 1996; Bennett et al., 2010) and in various other species of wild-caught mice of 14.6 to 22.2% (Fleharty et al., 1973; Davison et al., 1978; Powers et al., 1989). The percentage of CFa in the wild-caught rats in this study was much less compared with previous studies in purpose-bred rats that reported ranges of 22.1 to 48.0% (Bird and Ho, 1976; Vondruska, 1987; Clum et al., 1996; Bennett et al., 2010) as well as wild hispid cotton rats for which a range of 15.4 to 25.6% CFa was reported (Fleharty et al., 1973). However, the CFa of smaller meadow voles was reportedly less (6.01% DM; Bird et al., 1982) than determined in larger California voles in the present study (9.96% DM) although woodland voles were reportedly greater in CFa, with a range of 14.8 to 21.0% DM, depending on age and season (analyzed with liver and alimentary tract removed; Lochmiller et al., 1983).

The wild-caught animals in the present study may be leaner compared with their purpose-bred and some wild counterparts because of differences in age, genetics, activity level, and diet composition and availability. A previous report of the CFa content of young adult Coturnix quail indicated over threefold differences because of diet, with the smallest values being in agreement with published data for CFa content in wild sparrows as well as the wild birds in the present study (Bird et al., 1982; Clum et al., 1996). The CFa of wild birds in this study was highly variable and consistent with prior research, demonstrating that body composition of birds can vary greatly by season and location (Blem, 1976). Likewise, analysis of body composition of wild-caught mice, rats, voles, and muskrats indicated seasonal variation in previous studies (Fleharty et al., 1973; Lochmiller et al., 1983; Stewart and Barnett, 1983; Virgl and Messier, 1992).

The animals in this study with the greatest percentage of CP were the moles, voles, and warbler, and the gophers had the smallest percentage of CP. Previous studies have reported the CP content of wild-caught mice and voles and purpose-bred mice to be similar compared with the present study (Bird and Ho, 1976; Bird et al., 1982; Davison et al., 1978; Powers et al., 1989; Clum et al., 1996; Bennett et al., 2010). The CP of rats in the present study was in the same range as that reported by 1 study (59.4 to 78.6% CP DM; Clum et al., 1996) and greater than the average reported by other investigators for other purpose-bred animals analyzed in entirety (55% CP DM; Vondruska, 1987; Bennett et al., 2010); prior carcass CP data for wild-caught rats were not available for comparison. The greater percentage of CP may be due to the active lifestyle of the wild rat, with limited food availability, compared with the comparatively sedentary lifestyle of purpose-bred animals, with easy access to food, although genetics, age, and other factors also likely influence body CP content.

Table 1. Body weight and composition of carcasses[1]

Item	Mice (*n* = 7)	Voles (*n* = 4)	N. rats (*n* = 2)	R. rats (*n* = 2)	Moles (*n* = 2)	Gophers (*n* = 3)	Finches (*n* = 3)	Warbler (*n* = 1)	Average
BW, g	13.63 ± 3.74	33.95 ± 3.97	88.95 ± 40.38	109.55 ± 20.44	93.55 ± 9.26	184.10 ± 28.16	22.39 ± 0.86	12.70 ± 0.00	60.35 ± 60.12
% body water	67.67 ± 4.47	66.44 ± 1.84	71.41 ± 2.93	69.16 ± 1.30	67.18 ± 1.42	67.79 ± 1.97	65.24 ± 2.98	62.36 ± 0.00	67.35 ± 3.19
% crude fat	11.54 ± 6.94	9.96 ± 2.96	8.76 ± 4.63	8.83 ± 6.12	9.89 ± 0.73	21.65 ± 5.71	9.39 ± 5.94	12.48 ± 0.00	11.72 ± 6.17
% CP	62.78 ± 8.79	66.00 ± 4.66	63.88 ± 6.61	62.43 ± 7.47	65.31 ± 3.41	50.91 ± 5.41	62.27 ± 5.23	63.34 ± 0.00	62.19 ± 7.28
% N	10.04 ± 1.41	10.56 ± 0.75	10.22 ± 0.97	9.99 ± 1.20	10.45 ± 0.55	8.14 ± 0.87	10.12 ± 0.83	10.13 ± 0.00	9.95 ± 1.17
% ash	13.31 ± 1.12	16.39 ± 1.92	14.46 ± 0.41	13.60 ± 2.10	20.34 ± 0.04	15.19 ± 2.63	14.98 ± 2.43	10.01 ± 0.00	14.83 ± 2.66

[1]N. Rat = Norway rats; R. rat = roof rats. All data are reported as mean ± SD on a whole body DM basis with the exception of BW and body water (both on an as-is basis).

The percentage of ash in the mice and rats in this study was greater than previous studies with reported ash contents of purpose-bred mice ranging between 9.2 and 12.5% (Bird and Ho, 1976; Clum et al., 1996) and purpose-bred rats between 5.22 and 8.5% (Bird and Ho, 1976; Vondruska, 1987; Clum et al., 1996). Interestingly, studies have reported ash content of wild-caught mice and rats to be very similar to that in the present study (Fleharty et al., 1973; Davison et al., 1978). One hypothesis for the increased percentage of ash in wild-caught animals is that their presumably greater activity levels may contribute to an increase in their bone mineral density, as exercise has been reported to influence bone accrual in laboratory rats (Holy and Zérath, 2000; Chen et al., 2004). It is also possible that because the wild-caught animals were leaner, a greater percentage of their body composition was skeleton. Additionally, although body size likely has an impact, the relationship is not always clear. For example, the large (33.95 g) California voles in this study had mean ash concentration that was reasonably close to that (16.39% DM) previously reported for smaller (24.6 g) woodland voles with only 37% the body mass (Lochmiller et al., 1983); however, mean ash concentration of similar sized (32 g) meadow voles was just 10.1% DM (Bird et al., 1982).

Amino acid concentration data are reported in Table 2. Specific AA of interest to the cat and other obligate carnivores include Arg, Cys, Met, and Tau. When fed a diet void of Arg, the cat suffers from acute hyperammonemia (Morris and Rogers, 1978). Both Cys and Met are precursors for felinine, a urinary AA (Hendriks et al., 1995, 2008). These are also precursors for the β-aminosulfonic acid Tau, which is important for bile acid conjugation and retinal, cardiac, and reproductive health (Morris and Rogers, 1982). The rate of endogenous Tau synthesis is too low to maintain adequate concentrations in the cat; therefore, Tau is nutritionally essential for this species (Jacobsen and Smith, 1968; Hayes et al., 1975; Pion et al., 1987; Sturman et al., 1987; Morris, 2002).

The concentration of Arg in all individual species in this study was relatively similar. The S-containing AA Cys and Met had a similar average concentration but vastly different SD in the species analyzed. The average concentration of Cys varied more between the species analyzed in the current study than the average concentration of Met. Although it is unknown why this large range exists, it may be in part secondary to the relative amount of fur and possibly feathers on the animal, and almost 20% of swine hair has been reported to be Cys (Baker et al., 1966). In the current study, the β-aminosulfonic acid Tau was also determined to occur in varying concentrations in all individuals. The AA concentrations reported in the rats in this study were in a similar range as those in previous publications using purpose-bred rats (Williams et al., 1954; Wei and Fuller, 2006). It should be noted that Tau concentrations were not reported in either of the previous studies, and in 1 report (Wei and Fuller, 2006), only values for Ile, His, Leu, Lys, Phe, Thr, Tyr, and Val were reported. However, both of the previous investigators removed intestinal digesta before analysis (Williams et al., 1954; Wei

Table 2. Total body AA concentrations of carcasses (g/16 g N)[1]

AA	Mice (*n* = 7)	Voles (*n* = 4)	N. rat (*n* = 2)	R. rat (*n* = 2)	Moles (*n* = 2)	Gophers (*n* = 3)	Finches (*n* = 3)	Warbler (*n* = 1)	Average
Ala	5.65 ± 0.54	5.18 ± 0.24	5.91 ± 0.22	5.69 ± 0.06	5.70 ± 0.01	5.57 ± 0.76	5.87 ± 0.20	5.23 ± 0.00	5.60 ± 0.44
Arg	5.78 ± 0.50	5.66 ± 0.51	5.49 ± 0.56	5.78 ± 0.25	5.47 ± 0.18	5.24 ± 0.68	5.79 ± 0.46	5.35 ± 0.00	5.63 ± 0.46
Asp	6.88 ± 0.62	6.42 ± 0.49	6.13 ± 0.88	6.39 ± 0.27	6.37 ± 0.15	6.04 ± 0.80	6.85 ± 0.72	6.41 ± 0.00	6.53 ± 0.61
Cys	1.78 ± 0.38	3.20 ± 1.16	1.37 ± 0.15	1.35 ± 0.22	1.75 ± 0.30	0.72 ± 0.19	2.27 ± 0.18	2.63 ± 0.00	1.91 ± 0.89
Glu	12.91 ± 1.02	12.68 ± 0.99	13.17 ± 1.37	13.60 ± 0.59	12.56 ± 0.27	11.72 ± 1.45	12.86 ± 0.85	11.82 ± 0.00	12.72 ± 1.01
Gly	7.31 ± 0.80	6.90 ± 0.43	8.17 ± 0.39	7.43 ± 0.28	8.08 ± 0.15	8.06 ± 1.13	7.79 ± 0.46	6.55 ± 0.00	7.51 ± 0.75
His	2.14 ± 0.19	2.01 ± 0.14	1.94 ± 0.13	2.08 ± 0.04	2.07 ± 0.01	2.08 ± 0.30	1.92 ± 0.10	1.77 ± 0.00	2.04 ± 0.18
Ile	3.58 ± 0.32	3.28 ± 0.40	3.10 ± 0.09	3.49 ± 0.05	3.25 ± 0.09	2.88 ± 0.34	4.30 ± 0.35	4.14 ± 0.00	3.48 ± 0.50
Leu	7.18 ± 0.57	6.72 ± 0.61	6.49 ± 0.26	6.78 ± 0.20	6.78 ± 0.13	6.12 ± 0.79	7.59 ± 0.63	7.25 ± 0.00	6.90 ± 0.65
Lys	6.29 ± 0.53	5.86 ± 0.62	5.80 ± 0.27	6.20 ± 0.21	6.08 ± 0.24	5.52 ± 0.73	5.80 ± 0.50	5.50 ± 0.00	5.96 ± 0.53
Met	1.90 ± 0.18	1.70 ± 0.17	1.81 ± 0.20	1.95 ± 0.08	1.96 ± 0.06	1.63 ± 0.26	1.85 ± 0.22	1.77 ± 0.00	1.82 ± 0.19
Orn	0.21 ± 0.09	0.19 ± 0.04	0.10 ± 0.01	0.12 ± 0.03	0.18 ± 0.02	0.09 ± 0.01	0.11 ± 0.14	0.04 ± 0.00	0.15 ± 0.08
Phe	3.97 ± 0.29	3.69 ± 0.31	3.44 ± 0.42	3.72 ± 0.01	3.75 ± 0.09	3.43 ± 0.39	4.34 ± 0.34	3.82 ± 0.00	3.81 ± 0.38
Pro	4.77 ± 0.44	4.77 ± 0.31	5.53 ± 0.05	5.05 ± 0.43	5.30 ± 0.24	4.77 ± 0.67	5.75 ± 0.29	5.34 ± 0.00	5.05 ± 0.51
Ser	4.64 ± 0.39	4.88 ± 0.59	4.08 ± 0.54	4.26 ± 0.08	4.52 ± 0.21	3.68 ± 0.54	5.58 ± 0.26	5.07 ± 0.00	4.61 ± 0.65
Tau	1.19 ± 0.20	0.87 ± 0.06	0.42 ± 0.02	0.57 ± 0.24	1.04 ± 0.06	0.52 ± 0.10	1.17 ± 0.10	1.29 ± 0.00	0.92 ± 0.33
Thr	4.12 ± 0.33	4.01 ± 0.32	3.69 ± 0.38	3.91 ± 0.08	3.98 ± 0.18	3.34 ± 0.47	4.33 ± 0.34	4.16 ± 0.00	3.97 ± 0.40
Trp	0.92 ± 0.07	0.70 ± 0.24	0.86 ± 0.03	0.89 ± 0.02	0.94 ± 0.01	0.75 ± 0.08	1.05 ± 0.08	1.00 ± 0.00	0.88 ± 0.15
Tyr	3.71 ± 0.31	3.69 ± 0.46	3.36 ± 0.19	3.52 ± 0.26	3.44 ± 0.16	2.72 ± 0.30	3.63 ± 0.23	3.40 ± 0.00	3.49 ± 0.42
Val	4.66 ± 0.40	4.40 ± 0.39	4.11 ± 0.08	4.45 ± 0.18	4.36 ± 0.15	3.91 ± 0.42	5.34 ± 0.29	5.15 ± 0.00	4.54 ± 0.51

[1]N. Rat = Norway rats; R. rat = roof rats. All data are reported as mean ± SD.

and Fuller, 2006). In the current study, gastrointestinal contents were not removed, and this may have affected total body AA concentrations, as gut microbial activity has been shown to continue after death in the pig (Cummings et al., 1987). Furthermore, in the present study, some carcasses may not have been collected and frozen for up to 24 h after death, thereby permitting the continuation of microbial activity and thus variably affecting AA concentrations.

A recent report summarized data from 27 studies providing body composition information from a variety of species (primarily mammals and birds) consumed by feral domestic cats (Plantinga et al., 2011). Most of the data came from wild-caught prey except for rats, for which the nutrient composition of purpose-bred rats was used. The average value from previous studies that measured body water was similar to that reported here. However, gophers had lower CP compared to all other rodent categories in both the present study and in the review by Plantinga et al. (2011), most likely due to their proportionally higher CFa concentrations. Overall, the present study found slightly higher concentrations of ash for most species, and significantly lower concentrations of CFa for all species. There were larger numbers and a wider range of species included compared with the present study as well as substantial variability in protocols and methods of analysis used. However, the differences serve to underscore the variability in the nutrient composition of wild-caught prey.

Direct comparisons of the nutrient content of species in this study with NRC minimum requirements and recommended allowances for cats (NRC, 2006) are difficult because the energy content of each species was not directly quantified. Various methodologies have been used in other studies to estimate the energy content of prey and, thus, the energy intake of feral cats. Previous studies have determined, with bomb calorimetry, that the energy content of wild-caught mice, rats, and voles ranged from 4.9 to 5.5 kcal/g DM (Fleharty et al., 1973; Powers et al., 1989) whereas the average value of a wide variety of prey species calculated by estimation from pooled body composition data and using the modified Atwater factors of 3.5 for CP and carbohydrate and 8.5 for CFa was 4,174 kcal/kg DM (Plantinga et al., 2011). Analysis of published data has shown that the physiological fuel values of 8.5 for CFa and 4 for CP and carbohydrate as suggested by the NRC (2006) correlates well with results of digestion trials in a variety of carnivorous species including cats (Clauss et al., 2010). These NRC (2006) factors applied to the current data revealed an average energy density of 3,929 kcal/kg DM. The variation in energy content reported for wild-caught prey species likely reflects differences in both body composition and methodology. Furthermore, although any 1 survey of body composition data does not necessarily take into account the relative proportions of different prey species potentially consumed by cats, these proportions vary by population and are, therefore, not standardized (Plantinga et al., 2011).

Despite reasonable agreement in the estimates of energy content of prey species presented in this study and those previously reported for pooled analysis data (Plantinga et al., 2011), there are considerable differences in the proportions of energy from protein, fat, and N-free extract (**NFE**; defined as 100 – CP – ether extract – ash). The data reported here shows the average energy distribution of 63.2, 25, and 11.8% for protein, fat, and NFE, respectively, but Plantinga et al. (2011) estimated 52, 46, and 2%; these discrepancies likely reflect both the use of different physiological fuel values for CFa and the leaner animals analyzed in this study. Regardless, a cat consuming the variety of species reported in this study in sufficient quantities to meet their energy needs would exceed the recommendations for CP, total fat, and indispensable AA for all life stages (NRC, 2006). Although exceeding the recommendation, the means for CP and total fat of all species analyzed in this study are below the safe upper limits for all life stages. None of the concentrations of indispensable AA of prey species in the present study approached those previously reported to have adverse effects in cats (such as decreases in food intake; NRC, 2006). Many of the NRC (2006) recommendations are based on research using free, crystalline AA in semipurified diets. Although some indispensable AA have been associated with toxicity in studies using high concentrations of crystalline AA, this is unlikely to be a problem with peptide-bound AA in prey diets (NRC, 2006).

Currently, there are a variety of commercial diets on the market and the nutrient distribution and composition of these feeds vary greatly, but it is interesting to compare the findings of this study to the marketplace given the growing popularity of a natural feeding approach. However, it is important to note that such diets are usually formulated not only with consideration for raw materials costs and food technology issues but also to meet nutrient profiles for cat foods as established by the Association of American Feed Control Officials (AAFCO, 2011), which are distinct from the nutrient requirements established by NRC (2006). Informal assessment of several commercially produced extruded, canned, and raw feline diets showed a CP range of 33 to 53% (DM basis) and a CFa range of 9 to 27% (DM basis). Although no data are currently available for home-prepared raw food diets for cats, a recent publication reported ranges of 34.5 to 57.8% (DM basis) and 23.33 to 44.4% (DM basis) for CP and CFa, respectively, for similar diets for dogs (Dillitzer et al., 2011). The range of CP in both the commercial feline diets and home-prepared raw canine rations is less than reported in the current study (62.19%, DM basis) whereas the average CFa (11.72%, DM basis) in this study falls within the lower range for commercially produced diets.

The data reported in this study provide insight into the nutritional composition of animals that the feral domestic cat presumably consumes and the way the cat may have evolved. The variety of animals represents what cats may consume depending on if the cat is in a rural or suburban environment. Limitations of this study include the small sample size, the low variety of species included, the absence of rabbits, and lack of analysis of fiber and energy. Furthermore, the age of the specimens analyzed for this study was unknown. Body composition has been documented to change with age in a variety of species, including rats, dogs, and humans, and it is possible that species of different ages would have yielded different results (Harper, 1998; Wolden-Hanson, 2010). The lack of samples from different geographic locations and seasons was also a limitation, as these factors are known to affect body composition in many species. To gain a better understanding of the nutrient intake of the cat, future studies should increase both the number of species and individuals analyzed in addition to collecting animals from a range of habitats throughout all seasons of the year.

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