Domestic horses (*Equus caballus*) have evolved over the past 45 to 55 million years. There was widespread domestication of horses as early as 2000 BC. As a result of domestication and hunting by humans, there currently are few truly feral horses remaining. Thus, there is a lack of evidence on the natural diet of horses. Horses are thought to be primarily grazers.1 Most domestic horses are maintained on pasture, and many are fed nutritional products. However, feral horses in America and Australia have been observed consuming considerable browse from bushes and trees.1,2,a Additionally, there is new information on the negative impacts of the consumption of high-quality pasture on equine health3 that challenges the traditional beliefs regarding the dietary requirements of horses.

Australia has a population of > 1 million feral horses, which is more than the rest of the world combined.4 These horses inhabit large wilderness areas that vary from arid inland desert to lush pastoral development and tropical coastline. Assessment of the comparative nutritional intake of various populations of feral horses in Australia may provide valuable information on the natural diet of free-roaming horses and perhaps the impact of managed feeding programs on domestic horses. The study reported here was conducted with the novel...
approach of collecting fresh stomach contents from horses as a means of evaluating their diet. Nutritional analysis of stomach contents was correlated with BCS of the horses to determine the impact of free-choice diet on nutritional intake and health.

**Materials and Methods**

**Animals**—Cadavers of 41 feral horses from 5 locations in the Australian outback (Babibloora [n = 10 horses], Lawn Hill [6], Mount Tabor [6], Cliffordale [10], and Kings Canyon [9]) were included in the study. There were 24 males and 17 females that ranged from 1 to 18 years old (as determined on the basis of dental examination). Horses were light Thoroughbred type, with a mean height of 160 cm (range, 154 to 172 cm) measured at the highest point of the shoulder in horses in lateral recumbency during postmortem examination. Horses were derived from stock horses and drovers’ mounts from the late 1800s through the 1960s. There is little evidence of infusion of domestic horses into any of the sample populations for the past 50 years.

Samples of the stomach contents were collected from the cadavers of the feral horses. The collection period was from October 2008 through March 2009. Horses were killed by government-accredited expert marksmen during standard culling programs that were unrelated to the study. All feral horses located in each study area were shot at the location at which they were found; most horses were grazing at the time they were killed. The project was approved by the University of Queensland Animal Ethics Committee, which monitored compliance with the Animal Welfare Act of 2001 and The Code of Practice for the Care and Use of Animals for Scientific Purposes.

**Location**—Each habitat was unique with regard to vegetation and soil type. However, all locations have sustained a population of > 2,000 feral horses for at least the past 100 years.4,5,4

**Babibloora Station** (Prime Brigalow Country; latitude, 25.18 S; longitude, 147.49 E)

Prime Brigalow (Acacia harpophylla) country represented an area in the Warrego region of central west Queensland known for its prime grazing of cattle. Brigalow country consists mainly of clay soils mixed with other soil types, particularly yellow duplex. Much of the area has been cleared of natural vegetation. Introduced grass pastures, consisting of Buffel grass (Cenchrus ciliaris) and Rhodes grass (Chloris gayana), were mixed with native grasses that included Brigalow grass (Paspalidium caespitosum), curly windmill grass (Enteporopogon acculisaris), black spear grass (Heteropogon contortus), and spreading windmill grass (Chloris divaricata). The most widely distributed legume was Siratro (Macroptilium atropurpureum). Samples of stomach contents were collected from cadavers of 10 feral horses from 5 bands at the end of spring in November 2008. Mean annual precipitation for the area is 528.5 mm, and there was 137 mm of rain during the 6 months prior to sample collection.9

**Mount Tabor Station** (Sandy Cyprus Pine Country; latitude, 26.41 S; longitude, 147.11 E)

Sandy Cyprus pine country is a marginal area for cattle breeding in the Warrego region of central west Queensland. The area was heavily forested with narrow-leaved ironbark (Eucalyptus crebra) and white cypress pine (Callitris columellaris). The area consists largely of light sandy soils. Black spear grass (H. contortus) predominated, with only a small area of pasture in more open country. Samples of stomach contents were collected from cadavers of 6 feral horses from 3 bands. Samples were collected at the end of spring in November 2008. Mean annual precipitation is 528.5 mm, and there was 137 mm of rain during the 6 months prior to sample collection.9

**Kings Canyon** (Central Desert; latitude, 24.50 S; longitude, 132.10 E)

Central desert is a semiarid desert area consisting of a valley system bordered by high, prominent escarpments. Dominant trees were mulga (Acacia aneura) and ironwood (Acacia estrophiopeta), with river red gum (Eucalyptus camaldulensis) growing along dry riverbeds. Native perennial and annual grasses were scarce because of overgrazing by large populations of feral horses, cattle, and camels. Samples of stomach contents were collected from cadavers of 9 feral horses from 5 bands. Samples were collected at the end of a summer with abnormally high rainfall in March 2009. Mean annual precipitation is 335 mm, and there was 331 mm of rain during the 6 months prior to sample collection.9

**Lawn Hill National Park** (Inland Gulf; latitude, 18.67 S; longitude, 138.35 E)

The inland gulf savannah country of north Queensland consists of sandstone and limestone gorges, ranges, and alluvial flats. Grassy open woodlands of native Gardenia (Gardenia augusta), Turkey bush (Calotrix excipulata), and Grevillea (Grevillea spp) grew on sandstone hilltops, whereas open woodlands with emu apple (Eremophila longifolia), Acacia (Acacia spp), and Spinifex (Triodia spp) were evident on the rocky slopes. Open grasslands, predominated by Mitchell grass (Astrebla spp), supplejack (Ventilago viminialis), western bloodwood (Corymbia terminalis), and silver-leaf box (Cinerea cephalocarpa), extended over the clay plains. Samples of stomach contents from cadavers of 6 horses from 4 bands were collected at the end of a long dry period in October 2008. Mean annual precipitation is 580 mm, and the recorded amount of rain for 2008 was 512 mm, with only 5.5 mm of rain during the 6 months prior to sample collection.9

**Cliffdale Station** (Tropical Coast; latitude, 17.45 S; longitude, 138.35 E)

The tropical coast is an extensive area of marginal grazing for cattle on the northern coastal border between Queensland and the Northern Territory. Soils were coastal sands, mud flats, and infertile yellow duplex soils, which supported the native grasses sorghum (Sorghum plumosum), ribbon grass (Chrysopogon spp), and little bluestem (Schyzachyrium scoparium). Swamp paperbark (Melaleuca quinquenervis) was a main feature of much of the landscape. There occasionally were Spinifex-covered sand ridges and shallow flood chan-
nels, which were dry for most of the year. Samples of stomach contents from cadavers of 10 feral horses from 6 bands were collected at the end of a long dry period in October 2008. Mean annual precipitation is 900 mm, with most of the precipitation during the summer wet season (December through March). There was 603 mm of rain recorded for 2008, with no rain recorded during the 6 months prior to sample collection.6

Evaluation of age, sex, and BCS—Age was determined for each feral horse by dental examination. Similarly, sex of each feral horse was determined by genital examination. The BCS was graded in accordance with a standardized 9-point scoring system.7 Values of 1 to 9 corresponded to the following descriptions for body condition: poor, very thin, thin, moderately thin, moderate, moderate to fleshy, fleshy, fat, and extremely fat.

Collection of samples of stomach contents—Collection of stomach contents was performed in the same manner for each of the 41 feral horse cadavers. The stomach of each horse was removed within 15 minutes after death. Each stomach was inspected for evidence of gastric ulcers. At least 500 mL of stomach contents was collected from the cardiac region of the stomach to ensure that contents were as fresh as possible and unaffected by enzymatic digestion. Samples were placed in double-sealed plastic bags and chilled on ice until frozen at –20°C; all samples were frozen within 8 hours after collection. Samples remained frozen until laboratory analysis was performed.

Nutritional analysis—Each sample of stomach contents was analyzed at a commercial testing laboratory8 via wet chemical analysis. Variables analyzed included CP, fat, dry matter, ash, crude fiber, ADF, NDF, and starch. Digestible energy was determined by use of the following equation:

\[
\text{digestible energy} = (2.118 + [12.18 \times \text{CP} \%]) - \left[ 0.37 \times \text{ADF} \% - 3.83 \times \text{hemicellulose} \% \right] - \left[ 47.18 \times \text{fat} \% + 20.35 \times \text{nonfiber carbohydrate} \% \right] - 26.3 \times \text{ash} \% \times 0.004185
\]

where hemicellulose is calculated as NDF minus ADF and nonfiber carbohydrate is calculated as 100 – CP – ether extract – NDF – ash.

Insect larvae (bots) were manually removed from each sample. Samples then were ground to a particle size of 0.1 mm before analysis. Protein was determined by use of a protein analyzer in accordance with AOAC method 990.03.9,10 Fat content was determined by use of a Soxhlet extractor in accordance with AOAC method 973.18, 10 and NDF content was determined in accordance with AOAC method 962.09.10 Acid detergent fiber content was determined in accordance with AOAC method 973.18,10 and NDF content was determined in accordance with the Australian Fodder Industry Association method 9R.11 Starch content was determined via glucoamylase digestion by use of a commercially available test kit.5

Evaluation of macroelements and microelements—In addition to wet chemical analysis, duplicate samples of stomach contents collected from 2 horses at each location were sent to a testing laboratory9 for analysis via wet chemistry and inductively coupled plasma techniques.12 This analysis included measurement of the concentrations of the macroelements calcium, phosphorus, magnesium, potassium, sodium, chloride, and sulfur. Microelement analysis included measurement of concentrations of iron, zinc, copper, manganese, and cobalt. These data were compared against the RDI for a mature 450-kg horse performing a moderate amount of work, as indicated by the National Research Council.13 Amounts of moisture and ESC in the stomach contents of the horses were also quantified and compared with those of other forages.

Internal validity assessment—Because of the remote locations for the feral horses during sample collection, there was a delay of up to 8 hours between sample collection and storage at −20°C. To assess the effect of time delay on results of sample analysis, an internal validity assessment was performed. Samples of stomach contents were collected from 2 additional feral horses and divided equally into four 500-mL aliquots. Each aliquot was then handled in the same manner as the study samples; the internal validity samples were frozen at −20°C 2, 4, 6, and 8 hours after the time of collection. The internal validity samples subsequently were subjected to the same analysis as the study samples. A second internal validity test was performed for the sample analysis technique; that test involved the use of 4 samples of stomach contents collected from 1 additional feral horse.

Statistical analysis—The BCS and each nutritional variable was compared on the basis of sex and age group (< or ≥ 12 years old) by use of a Welch t test. The relationship between location and BCS, age, and each nutritional variable was evaluated by use of an ANOVA. A 2-way ANOVA was used to examine any interaction between age, sex, location, and BCS. When feral horses

![Figure 1—Mean ± SE BCS for 41 feral horses (black bars), which comprised 24 male feral horses (white bars) and 17 female feral horses (gray bars) at 5 locations in the Australian outback (Babbi-loora [n = 10 horses], Lawn Hill [6], Mount Tabor [6], Cliffdale [10], and Kings Canyon [9]). The BCS differed significantly (P = 0.01) among the 5 locations, and males had a significantly (P = 0.01) higher BCS than did females.](image-url)
were evaluated as a single group, the effect of each nutri-
tional variable on BCS was examined by use of linear
regression. Age, digestible energy, and protein, fat, and
NSC content of samples were correlated with BCS via
the Pearson product moment correlation. Tukey mul-
tiple comparisons of means by use of a 95% family-wise
confidence interval was used to examine the relation-
ship between variables in an ANOVA. All data were re-
ported as mean ± SE. Values of P ≤ 0.05 were consid-
ered significant. Statistical analyses were performed by
use of commercial software.6

Results

Animals—The BCS differed significantly (P = 0.01) among the 5 locations (Figure 1). The BCS also differed
significantly on the basis of sex, with males having a
significantly (P = 0.01) higher BCS than females at all
locations. However, there was no significant interac-
tion between age and location on BCS. The mean ± SE age
for all feral horses in the study was 8.17 ± 0.27 years;
age did not differ significantly among the 5 locations
(Table 1). In addition, age was not significantly cor-
related with BCS. Furthermore, when horses were clas-
sified on the basis of age into 2 groups (ie, < and ≥ 12
years old), age still did not significantly affect BCS.

Internal validation assessment—Nutritional anal-
yses conducted for the internal validity samples via the
same techniques as for the study samples revealed that
a time delay between sample collection and freezing did
not significantly affect the outcome of nutritional anal-
yses (data not shown). None of the groups differed sig-
ificantly (P > 0.05) for any of the variables measured.

Results of the second internal validity test indi-
cated that the coefficient of variation for all nutritional
variables in the internal validity assessment, except
protein, was < 5%. This was considered an acceptable
degree of within-assay variation. Protein contents in the
samples varied by 16%.

Nutritional variables—Age or sex did not signifi-
cantly affect any of the nutritional variables for feral hors-
es at all locations. However, digestible energy, protein,
fat, ash, crude fiber, moisture, starch, and NSC content of
the stomach samples differed significantly among loca-
tions (Figure 2). The ADF and NDF values were similar
for each location. When feral horses were assessed as a
single group, the amount of protein and fat in the stomach
contents was significantly (P = 0.01) correlated with BCS.
However, the amount of starch, NSC, and crude fiber in
the stomach contents was not associated with BCS.

The feral horses examined had a high ash content
(percentage weight per volume) in their diet (Figure
2. The mean ash content for grass hay listed in a database\textsuperscript{14} is 7.6%. The ash intake of the feral horses in the study reported here exceeded this value, except for those at Clifffdale, which had a value of 7.5%.

The National Research Council RDI of protein for a mature 450-kg horse performing a moderate amount of work\textsuperscript{13} is 567 g/d (6.3%).\textsuperscript{13} The mean amount of protein content (percentage of weight per volume) in stomach contents of the horses examined exceeded the RDI in 3 of 5 locations (Figure 3). The stomach contents of horses at Babbiloora contained more than twice the daily protein requirement (Table 1). These horses also had the highest BCS (Figure 2). Horses at Lawn Hill and Clifffdale consumed only approximately three-fourths and one-half of the RDI, respectively. Horses at Lawn Hill had the lowest BCS.

Comparison of microelement and macroelement concentrations with RDI—The nutritional composition of stomach contents for key nutrients for 2 horses at each of the 5 locations was compared with the RDI as determined by the National Research Council.\textsuperscript{13} Lack of a sufficient number of samples precluded determination of whether the differences among locations were significant, but analysis of results for this limited data set revealed interesting patterns. Digestible energy and concentrations of potassium and calcium in the stomach contents were equal to or greater than the RDI for all locations. Concentrations of phosphorus, magnesium, and sodium varied considerably, with intakes less than the RDI at some locations.

Composition of stomach contents was compared against RDI for microelements (Table 2). Copper intake was less than the RDI at all locations. Feral horses at Babbiloora had the highest concentration of copper in their stomach contents (mean, 7 mg/kg on a dry-matter basis); however, this was still less than the RDI of 10 mg/kg. The remaining samples had one-third or less of the recommended concentration of copper. Concentrations of zinc in the samples were also less than the RDI. The manganese concentration was marginal at Lawn Hill and Mount Tabor but higher than the concentrations for the other sites. There were extremely high concentrations of cobalt and iron in the stomach contents at all 5 locations.

Values for WSC and ESC were summarized (Figure 4). Values for WSC and ESC in stomach contents of feral horses at all 5 locations were higher than those expected for horses consuming high-quality forage.

**Table 2—Comparison of the National Research Council RDI for a mature 450-kg horse performing a moderate amount of work\textsuperscript{13} and mean ± SE values for microelement analysis of stomach samples collected from cadavers of 10 feral horses (2 at each of 5 locations in the Australian outback).**

<table>
<thead>
<tr>
<th>Variable</th>
<th>Cobalt</th>
<th>Iron</th>
<th>Copper</th>
<th>Manganese</th>
<th>Zinc</th>
</tr>
</thead>
<tbody>
<tr>
<td>RDI</td>
<td>0.5</td>
<td>360</td>
<td>80.0</td>
<td>360.0</td>
<td>360.0</td>
</tr>
<tr>
<td>Stomach contents</td>
<td>18.7 ± 2.9</td>
<td>9,716 ± 1,510</td>
<td>20.9 ± 3.73</td>
<td>470 ± 76.6</td>
<td>140.0 ± 14.5</td>
</tr>
</tbody>
</table>

**Note:** Values reported are mg/d.

**Discussion**

In the study reported here, we evaluated the BCS and conducted a point-in-time dietary analysis of feral horses at 5 locations in the Australian outback. Although other investigators have determined dietary composition in feral horses by use of fecal analysis in a single habitat,\textsuperscript{15} to our knowledge, the present study is the first in which investigators sampled dietary composition directly from fresh stomach contents in horses from a range of habitats. These data may be of assistance in furthering the understanding of the nutritional consequences of a free-choice diet. Caution should be exercised in extrapolating the results of this study to overall long-term dietary intake recommendations for horses because the stomach contents on the day of sample collection may have misrepresented the diet of the population. Seasonal variation is likely to have a large impact on diet quality and quantity. Investigators in this study sampled diets at each location at only 1 point in time.

The BCS for males was 1 to 3 points higher than that for females, and this may have reflected the energy burden for pregnant mares nursing foals. The mean BCS for the entire sample population was 3.9, which indicated a moderately thin condition. Observations made by the authors over a 3-year period confirmed that body condition of feral horses varies in relation to the amount of rain and that feral horses in the present study areas were never obese. Feral horses often travel long distances between feed and water sources,\textsuperscript{16} and this may have accounted, in part, for their thin to moderately thin body condition. In a global positioning system study\textsuperscript{16} of horse movement, it was...
found that feral horses traveled substantially greater mean daily distances (17.9 km/d in an open habitat) than do domestic horses (7.2 km/d in a 16-hectare paddock). For the horses of the present study, we inspected the gastrointestinal tracts and determined that many horses had high parasite burdens. This factor may also have contributed to low BCSs. Feral horses, particularly those in semiarid habitats, encounter drought and may die of starvation in large numbers. Horses at Lawn Hill had the lowest BCSs. At the Lawn Hill location, 3 of 5 mares from which samples were collected were accompanied by foals from the previous breeding season. At Clifdale, at the time of data collection, 9 of 17 mares were accompanied by foals from the previous breeding season. A study conducted in the Kings Canyon area indicated that even though feral horses inhabit areas with variations in available resources, they manage to increase population numbers by 20%/y. Feral horses throughout Australia typically double their population every 4 years. Despite variations in quality and quantity of feed resources in the annual and generational cycles of feral horses, the horses manage to fulfill the essential requirements of reproduction.

Evidence exists to suggest that obesity is a growing problem in companion equine populations. In that study of 300 mature domestic horses, it was reported that 57 (19%) were obese and 141 (32%) were overweight. Obesity has been associated with insulin resistance in horses and ponies, and both obesity and insulin resistance have been associated with an increased risk of developing laminitis, particularly the pasture-associated form of laminitis. Although feral horses in the present study were thin, they appeared generally healthy and there were no gross signs of laminitis.

On the basis of the RDI, samples obtained from the feral horses at Clifdale and Lawn Hill were deficient in protein. Samples were collected at both of these locations after extended dry periods, where heavy grazing had presumably depleted the highest-quality forage. Samples obtained from horses at the Kings Canyon and Mount Tabor locations contained moderate amounts of protein, and samples obtained from horses at Babbiloo-ra had high CP (mean, 14.9%). Samples were collected from horses at these latter 3 locations during the end of spring or summer, when new growth results in high protein values. It appears likely that protein availability would also decrease in these locations after extended drought and overgrazing of higher-quality forages.

Protein concentration in the stomach contents varied from 4.3% to 14.9% and was significantly correlated with BCS. Stomach contents of horses in the inland gulf and tropical coast country (Lawn Hill and Clifdale) had protein concentrations below the recommended dietary CP considered adequate for horses. This deficiency, if prolonged, would be expected to result in weight loss, abortion in broodmares, and reduced milk production in lactating mares. Other effects may include reduced feed intake, poor coat condition, and reduced hoof wall integrity. Horses at Lawn Hill had the lowest BCS. This was highly correlated with protein intake and the fact that most of the mares were accompanied by foals at the time of sample collection. The reproductive rate of these horses was compatible with survival of the population. The authors have conducted extensive research on foot health in each of the sample populations, and no obvious foot problems related to nutritional deficiencies or excessive carbohydrate intake have been detected. The lack of protein in the diet of feral horses would have to be extremely severe (more than that detected in the samples) to affect the ability of the animals to survive and reproduce in Australian outback environments. Periods of gross overpopulation and sustained drought are likely causes of severe deficiencies in protein intake that could affect survival and reproduction.

Results of the comparison of the composition of stomach contents with RDI for microelements illustrated that copper intake was below the RDI for all locations. Copper is essential for normal collagen biosynthesis, and collagen is a critical structural component of cartilage and bone. Thus, adequate dietary copper is important for skeletal development. An increased incidence of developmental orthopedic disease has been reported in foals born to mares consuming copper-deficient diets. Copper deficiency in adult horses has been linked to osteoporosis, joint effusion, and limb deformity. A lack of copper in the diet can also lead to anemia because affected horses will fail to efficiently absorb sufficient amounts of dietary iron. Amounts of zinc in stomach contents were also below the recommended requirement. Zinc is essential for development of connective tissues and for integrity of bones and joints. Zinc deficiency has also been linked to developmental orthopedic disease. However, there were no gross signs of orthopedic problems in the feral horses and intake of bioavailable zinc was apparently sufficient to prevent overt signs of deficiency.

High concentrations of cobalt and iron were detected in the stomach contents of horses at all 5 locations. High iron content may be encountered in stomach samples when there is blood contamination from gastric ulcers or the postmortem examination technique. However, these factors were not relevant because none of the horses had evidence of gastric ulcers and there was no obvious gross blood contamination of samples. Nonquartz red soils commonly contain high amounts of iron. The presence of higher-than-expected cobalt concentrations may have been attributable to the cobalt present in vitamin B12, that is a fermentation product from the normal bacterial flora in the stomach. Alternatively, the horses may have been consuming native plants that accumulate cobalt. Metal accumulation has been reported in many plant species. In 1 study, investigators identified that the small shrub violet (Hybanthus floribundus) in central Australia accumulates nickel and cobalt to a high degree. In another study, it was reported that there are 11 species of shrub violet with a disjunctive distribution across Australia. This shrub or a similar one may form part of the diet of feral horses in Australia. Another possible source is windblown cobalt- and iron-laden red soil, which may coat forages in the study locations. The requirements and toxic effects of cobalt have not been evaluated in horses. The recommendation by the National Research Council was based on the observation that horses grazing pastures low in cobalt content remained in good health, whereas cattle grazing similar pastures had signs of cobalt deficiency.

Calcium and potassium concentrations were equal to or greater than the RDI at all locations; however, phos-
Feral horses appear to obtain nutrients from sources determined by physical characteristics of the forage alone. Therefore, the quality of available food sources of feral horses cannot be determined by physical characteristics of the forage alone. Feral horses appear to obtain nutrients from sources not generally considered in the range of the typical diet of horses.

In some feral horse habitats, areas close to water typically are overgrazed and depleted of forage. However, horses farther from water find forage of increasing quantity and quality. Ground forage coverage in a semiarid habitat was < 2% within 10 km of the water hole and 30% at a distance of 65 km from water. Intermittent drought and rain create a great deal of seasonal variation in quantity and quality of available forage. During the spring and summer of 2006 with more precipitation, feral horses have the opportunity to replenish reserves and improve their BCS, thus using high-quality forage. Times of abundance and famine are part of the natural cycle of many feral horses.

Analysis of the data in the study reported here suggested that food quality in some remote regions in Australia cannot be determined simply by the physical characteristics of the apparent forage alone. Feral horses are capable of consuming browsing and obtaining nutrients from sources such as subterranean crowns, rhizomes, and stem bases of semiarid grass species that contain little above-ground plant material. Additional soil ingestion is likely as a result of horses consuming dust-laden grass and browse.

Feral horses in a free-range environment consume only 56% of their annual diet as grass species. The remaining diet consists of sedges, rushes, and browse. In another report, the diet of feral horses in the Australian desert consisted of up to 28% dicotyledonous species, and feral horses have been observed eating the tops of shrubs and trees when grass growth has ceased. The diet of feral horses may contain 35 grass species. The consumption of browse and many grass species not common in diets of domestic horses perhaps explains some of the unusual nutrient values detected in the present study.

Values for WSC and ESC in stomach contents of feral horses from all 5 locations were above those expected even for high-quality, cultivated forages, which indicated the feral horses were ingesting some form of carbohydrate-dense forage or browse. The high concentration of WSC may have been attributable to high fructan content in grasses or high concentrations of simple sugars in grains and nongrass fiber sources from browse. Observations of substantial consumption of browse support this assumption. The authors have regularly observed feral horses in all study locations grazing the sweet fragrant seed tops from Spinifex (Triodia sp.) grass. The grass is brittle with a defensive spine on the tip to discourage grazing. Ingestion of the seed may account for higher-than-expected carbohydrate content in the diets. Ingestion of subterranean crowns, rhizomes, and stem bases of semiarid grass species may also have contributed to high carbohydrate concentrations. The potential effect of salivary enzymes on the carbohydrate content of the samples was accounted for in an internal validity assessment in which stomach samples were incubated in plastic bags at environmental temperature (34°C) for 2, 4, 6, and 8 hours after collection, which was followed by freezing. Nutritional analysis revealed that a time delay between sample collection and freezing did not significantly affect the outcome of the nutritional analysis. Therefore, the quality of available food sources of feral horses cannot be determined in domestic horses.

If the National Research Council recommendations are valid, then results of the present study suggest that the diet in several large feral horse populations in Australia is less than optimal. Although it is possible that the food quality in Australia may have lower conception rates or higher rates of pregnancy failure than would be acceptable to breeders of domestic horses, the reproductive rates of feral horses are sufficient to increase the population by 20%/y and double the population in 4 years. Neither low BCS nor trace mineral deficiency appears to affect survival of the feral horse herds.

Additional evaluation of food sources in these locations, including examination of WSC, ESC, and mineral concentrations, is warranted to determine where these feral horses are acquiring such rich sources of nutrients. That information may be valuable in determining the optimal diet for domestic horses.

References


b. Symbio Alliance, Brisbane, QLD, Australia.


d. Equi-Analytical Laboratories, Armidale, NSW, Australia.


