

FEEDING VALUE OF CHOLLA CACTUS

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ABSTRACT: Cholla cactus has been used as an emergency feed during drought conditions in New Mexico for many years. Three wethers (avg wt 65 kg) were used in a replicated 3 x 3 Latin Square to determine the digestibility of singed cholla cactus (*Opuntia imbricata*) when fed with a basal diet of mature blue grama hay (9.0% CP and 69.0% NDF, OM basis). Treatments consisted of 0%, 15%, and 20% cholla in the diet on a DM basis (treatments 0, 15, and 20, respectively), which were assumed to be similar to amounts that would be consumed by grazing animals. Cholla contained 20.3% DM, 79.6% OM and 36.4% NDF (OM basis). Cholla was harvested in September and clippings consisted of green, non-woody segments. The cactus was singed with a propane torch until no spines remained, chopped into 5.1 x 5.1 cm cubes and added to the diet each day. Cholla and hay were sampled daily and compiled for each period. Total fecal collections were subsampled and reserved for later analysis. Feed and fecal samples were analyzed for DM, OM, and NDF and digestibilities were calculated. Digestibilities of cholla were calculated by difference. Mean cholla DM, OM, and NDF digestibilities averaged 32.6%, 44.3%, and 27.9%, respectively. Diet dry matter digestibilities averaged 52.6%, 50.2%, and 47.8% ± 1.6 for treatments 0, 15 and 20, respectively ($P > 0.05$). Organic matter digestibilities of the diet were 59.3%, 57.7%, and 55.4% ± 1.6 for treatments 0, 15 and 20, respectively ($P > 0.10$). The diet NDF digestibilities were 58.0%, 54.2%, and 51.0% ± 1.9 for treatments 0, 15 and 20, respectively. The NDF digestibility of the diet containing 20% cholla (51.0% ± 1.9) was lower ($P < 0.05$) than that of the diet with no cholla (58.0% ± 1.9). When the diet contained 20% cholla, overall diet NDF digestibility decreased because of the greater concentration of the poorly digestible cholla. Due to its poor feeding value, the use of cholla cactus as an emergency feed should be carefully considered.

Key Words: Cholla, Digestibility, Feeding Value

Introduction

Drought is a recurring situation faced by livestock producers in the western United States that results in reduced forage quality and quantity. Under these conditions, it is often necessary to supply emergency feeds or reduce herd size. Cholla cactus has been used as an emergency feed in New Mexico for many years (Griffiths and Hare, 1906; Wooten, 1911). Sawyer et al. (2001) suggested that cholla could be a viable emergency feedstuff.

Pricklypear cactus has been the focus of most research concerning cactus as a livestock feed, however cholla is more common on New Mexico rangelands and a limited amount of current information is available about its nutritive value. Since the early work from the turn of the century, the only research concerning cholla as a livestock feed was conducted by Sawyer et al (2001), who compared chemical constituents and OM disappearance of burned and unburned cholla cactus.

The objective of this study was to evaluate the digestibility of singed cholla cactus when fed with a basal diet of mature blue grama hay.

Materials and Methods

Three whiteface wethers (avg wt 65 kg) were used in a replicated 3 x 3 Latin Square. Treatments consisted of 0%, 15%, and 20% cholla in the diet on a DM basis (treatments 0, 15, and 20). These values were assumed to be similar to amounts that would be consumed by animals grazing rangeland where stands of cholla exist. Tables 1 and 2 present nutrient compositions of mature blue grama hay and cholla and the nutrient composition of the diet for each treatment, respectively. Cholla was harvested at the Corona Range and Livestock Research Center, Corona, NM in early September 2001. The Corona Range and Livestock Research Center is located 300 km northeast of Las Cruces, NM (average elevation = 1900 m; average annual precipitation = 400 mm). Cactus clippings consisted of green, non-woody terminal segments of the plants. The clippings were stored under tarps on the New Mexico State University town farm in Las Cruces throughout the duration of the study. Cholla was burned in small batches with a propane torch until no spines remained and little or no singeing of the green portion of the plant occurred. Burned segments were then chopped into 5.1 x 5.1 cm cubes and added to the mature blue grama hay diet each day.

Each 12-d experimental period was made up of two phases. The first phase consisted of 7 d of adaptation to the diet, while the second 5 d made up the collection phase. Wethers were placed in metabolism crates on d 7 of each period and collections began on d 8. During the adaptation phase, wethers were housed outside in individual pens.

Total fecal collections were taken daily. A 10% aliquot was reserved each day and compiled by period for later analysis. Cholla and hay were also sampled daily and compiled for each period. Feed and fecal samples were

analyzed for DM, OM, N (AOAC, 2000) and NDF (Van Soest et al., 1991), and digestibilities were calculated. Cholla digestibilities were calculated by difference. Data were analyzed by analyses of variance using the GLM procedure of SAS (SAS Inst., Inc., Cary, NC).

Results and Discussion

Nutrient composition of cholla is detailed in Table 1. Dry matter content of cactus fluctuates throughout the year, thus difficulty exists in comparing the results of the present study with that of other researchers. The cholla used in this experiment was harvested in September and contained 20.3% DM. Dry matter for pricklypear ranged from 14.6% in June to 45.8% in February in Colorado (Shoop et al., 1977). Pieper et al. (1974) found that DM content of cholla in New Mexico was 16% to 20% during the summer and increased to 38% in February. Cholla harvested in June at the Corona Range and Livestock Research Center had a DM of 12.7% (Sawyer et al., 2001). Organic matter (79.6%) and neutral detergent fiber (36.4%) for cholla agree with values observed by other researchers. Sawyer et al. (2001) found cholla to be 81.0% OM and 39.2% NDF. Cholla CP (9.9%) contrasted with the results of Sawyer et al. (2001) and Shoop et al. (1977) who found 13.6% CP for cholla and 5.3% CP for pricklypear, respectively.

Mean cholla DM, OM, NDF, and CP digestibilities averaged 32.6%, 44.3%, 27.9%, and 67.6%, respectively. Many of these values disagree with results found by other researchers. Shoop et al. (1977) observed a DM digestibility (in situ) of $66.4\% \pm 3.8$ for pricklypear cactus after 48 hr of incubation, while Meyer and Brown (1985) reported a DM digestibility (in vitro) of $75.7\% \pm 1.4$ for the same species in Texas. Sawyer et al. (2001) found in situ OM disappearance of cholla to be $77.3\% \pm 2.4$ after 20 h of incubation. Several explanations are possible for these contrasts. The outside covering of the cholla is composed of cutin and wax, and animals may not have the ability to completely chew the cactus. Ground (1 to 2 mm) particles of cholla used in the nylon bag digestibility or in vitro digestibility methods may also explain the differences when compared to our in vivo results.

Table 3 presents nutrient digestibilities of the diet for each treatment. Diet DM digestibilities averaged 52.6%, 50.2%, and $47.8\% \pm 1.6$ for treatments 0, 15 and 20, respectively ($P > 0.05$). Organic matter digestibilities of the diet were 59.3%, 57.7%, and $55.4\% \pm 1.6$ for treatments 0, 15 and 20, respectively ($P > 0.10$). The diet NDF digestibilities were 58.0%, 54.2%, and $51.0\% \pm 1.9$ for treatments 0, 15 and 20, respectively. The NDF digestibility of the diet containing 20% cholla ($51.0\% \pm 1.9$) was lower ($P < 0.05$) than that of the diet with no cholla ($58.0\% \pm 1.9$). When the diet contained 20% cholla, overall diet NDF digestibility decreased because of the greater concentration of the poorly digestible cholla. Diet digestibilities of CP were 63.1%, 61.9% and $66.5\% \pm 1.0$ for treatments 0, 15, and 20, respectively ($P > 0.10$).

Implications

When drought conditions occur, energy is often the most limiting nutrient. Cholla cactus, when fed as an emergency feed, would be used to supply energy. Due to the high moisture content of cholla, a large amount must be fed in order to make up a notable part of the diet dry matter. For example, in order to consume 5 pounds of dry matter from cholla that is 20% dry matter, an animal would have to eat 25 pounds of cholla on an as fed basis. Although laboratory, in situ, and in vitro measurements indicate that cholla is readily digestible, physical characteristics may reduce its energy value in a practical setting. The true feeding value of cholla is lower than expected and producers should carefully consider the use of cholla cactus as an emergency feed.

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Table 1. Nutrient composition of mature blue grama hay and cholla cactus.

Item	DM, %	OM, %	NDF, % OM	CP, % OM
Mature blue grama hay	92.7	90.8	69.1	9.0
Cholla cactus	20.3	79.6	36.4	9.9

Table 2. Nutrient composition of three mature blue grama hay and cholla cactus diets. Cholla was added to the diet at 0%, 15%, and 20% of the DM (treatments 0, 15, and 20, respectively).

Item	Treatment		
	0	15	20
DM, %	92.7	81.9	78.3
OM, %	90.8	89.1	88.5
NDF, % OM	69.0	63.6	61.8
CP, % OM	9.0	9.1	9.2

Table 3. Nutrient digestibilities of three mature blue grama hay and cholla cactus diets. Cholla was added to the diet at 0%, 15%, and 20% of the DM (treatments 0, 15, and 20, respectively).

Item	Treatment			SE
	0	15	20	
DM digestibility, %	52.6	50.2	47.8	1.6
OM digestibility, %	59.3	57.7	55.4	1.6
NDF digestibility, %	58.0 ^a	54.2 ^{ab}	51.0 ^b	1.9
CP digestibility, %	63.1	61.9	66.5	1.9

^{a, b}Means lacking a common superscript differ ($P < 0.05$).