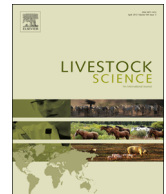




ELSEVIER

Contents lists available at ScienceDirect

Livestock Science

journal homepage: www.elsevier.com/locate/livsci

Short communication

Seasonal diet quality and metabolic profiles of steers grazing on Chihuahuan desert rangeland

M. Murillo-Ortiz^{a,*}, M. Mellado-Bosque^b, E. Herrera-Torres^a,
O. Reyes-Estrada^a, F.O. Carrete-Carreón^a

^a Universidad Juárez del Estado de Durango, Facultad de Medicina Veterinaria y Zootecnia, Km 11.5 Carretera Durango-Mezquital, Durango, México

^b Universidad Autónoma Agraria Antonio Narro, Blvd. Antonio Narro s/n, Buenavista, Saltillo, Coahuila, México

ARTICLE INFO

Article history:

Received 19 June 2013

Received in revised form

7 March 2014

Accepted 20 March 2014

Keywords:

Rangeland

In vitro gas production*In situ* degradability

Rumen digestion

Blood metabolites

Insulin

ABSTRACT

Four Angus steers (BW=350 ± 3 kg) with esophageal cannulae and four fitted with ruminal cannulas (BW=351 ± 5 kg) as well as fifteen steers of the same racial characteristics (BW=320 ± 2 kg), were used to evaluate seasonally across four years (2005–2009, excluding 2007) the nutritive quality of diet and the blood metabolites and insulin levels in grazing beef cattle a Chihuahuan desert rangeland. The diet consumed by grazing cattle during spring and winter was low quality because of crude protein (CP) was less than 70 g/kg DM and neutral detergent fiber (NDF) higher than 720 g/kg DM. Initial washing loss at time zero “A”, digestion rate “c”, effective degradability of NDF (EDNDF) and CP (EDCP), potential gas production (PGP), ruminal ammonia–nitrogen (NH₃N), total volatile fatty acids (TVFA) propionate, butyrate, glucose (G), urea nitrogen (UN) and insulin were highest in summer compared to spring ($P < 0.05$). In contrast, ruminal acetate concentrations and blood non-esterified fatty acids (NEFA) level were highest in spring as compared to summer ($P < 0.05$). It was concluded that season of grazing had a marked influence on diet quality as well as in the blood metabolites and insulin levels in grazing beef cattle a desert rangeland.

© 2014 Elsevier B.V. All rights reserved.

1. Introduction

Native rangelands are widely distributed in the arid and semi-arid regions of northern Mexico and constitute a source of forage for grazing cattle. In these regions, the range beef cattle nutrition programs are influenced by seasonal fluctuations in the nutritive quality of rangelands, which subsequently affects diet composition and selectivity of grazing cattle (Obeidat et al., 2002). These changes are accompanied by decreased in degradation and fermentation ruminal and therefore affected nutritional state of grazing cattle. It is well

recognized that nutritional state of the grazing cattle is related with blood glucose, urea nitrogen, non-esterified fatty acids as well as insulin and growth hormone levels (González-García et al., 2011). However, the mechanisms by which this metabolites and hormones may influence nutritional state of grazing cattle have not been elucidated. Owens et al. (1991) suggested that evaluation of metabolite and hormone profiles is paramount to our understanding of biochemical mechanisms at work in the grazing animal. Nevertheless, the information concerning the relationship between diet quality, ruminal environment and nutrient utilization in grazing cattle is quite limited. A more complete understanding of these relationships across years and seasons, will aid in the development of nutrition and grazing management programs that will improve efficiency of livestock production in arid rangelands. Thus, in current study is

* Correspondence to: Universidad Juárez del Estado de Durango, Constitución No. 404, Sur Colonia Centro, CP 3400, Durango, México. Tel.: +52 1 618 8189932; fax: +52 1 618 8100703.

E-mail address: muom8@yahoo.com.mx (M. Murillo-Ortiz).

<http://dx.doi.org/10.1016/j.livsci.2014.03.023>

1871-1413/© 2014 Elsevier B.V. All rights reserved.

assumes that blood concentrations of glucose, urea nitrogen, non-esterified fatty acids and insulin are sensitive to seasonal changes in the nutritive quality and ruminal fermentation of diet consumed by grazing beef cattle. This study was conducted to evaluate seasonally across four years the nutritive quality of diet and the blood metabolites and insulin levels in grazing beef cattle a Chihuahuan desert rangeland.

2. Material and methods

2.1. Study site and vegetation

This study was carried out during four years (2005–2009, excluding 2007) in rangeland in northern Mexico (24°N 106°W). Annual precipitation averages was 507 mm, with a maximum of 138.3 mm during July and a minimum of 4.7 mm in March. Pasture were classified as short grassland with shrub dominated by *Melinis repens* Willd (rose natal grass), *Bouteloua gracilis* (bluegrama), *Prosopis juliflora* (mezquite), *Opuntia spp* (prickly pears chollas) and *Viguiera linearis* (romerillo).

2.2. Animals, sample collection periods and laboratory analyses

Surgical and animal handling procedures utilized in this study, were conducted using protocols approved by Animal Protection Committee of Durango State (México). Twelve sampling periods, each 11-d long were conducted during the four season: March–May (spring), June–August (summer), September–November (fall) and December–February (winter). During the first 4 days of each sampling period four Angus steers with esophageal cannulae were used to collected diet extrusa samples. Extrusa was dried and ground to 2 mm in a Willey mill (Thomas Scientific) and were analyzed for CP, calcium, phosphorous (AOAC, 2005), NDF, IVDMD (ANKOM, 2008) and metabolizable energy (ME) (Menke and Steingass, 1988). The chemical composition of extrusa samples are presented in Table 1. The *in vitro* gas production of extrusa sample was carried out using the ANKOM gas production system (ANKOM, 2008). A 300 mg of ground extrusa samples were placed in triplicate in each module of incubation. The gas volume was recorded at intervals of 0, 3, 6, 9, 15, 24, 36, 48, 72 and 96 h of incubation. On days 5–8 and during grazed of four ruminal-cannulated steers the *in situ* degradability of extrusa sample was determined. In this trial, polyester bag with 10 g of diet sample ground to 2 mm were incubated in the rumen for intervals of 0, 3, 6, 9, 15, 24, 36, 48, 72, 96 h. The bags obtained from each incubation time were rinsed in cold tap water until effluent was clear and dried at 60°C for 48 h in a forced-air oven. Degradability of NDF and CP was determined at time “0” by immersing the bags containing 10 g of sample in the rumen for 1 min and then washing them as described above. Crude protein degradability was corrected by subtracting of residues the CP linked to acid detergent fiber (N-ADF × 6.25) (Klopfenstein et al., 2001). On day 9 of the sampling period and before initiating grazing, ruminal content was removed in each steer and was weighed and dried. Acid insoluble ash (AIA) was measured in the diet and ruminal content for to estimate ruminal passage rate (kp). The reciprocal of the kp

Table 1

Chemical composition of extrusa samples of steers grazing a Chihuahuan desert rangeland during the four seasons of the year.

	CP	NDF	IVDMD g/kg DM	Ca	P	*ME MJ/kg DM
Year						
2005	90	756	642	5	1	6.2
2006	83	785	601	4	0.9	5.0
2008	118	699	701	7	2	9.6
2009	96	709	373	55	1	7.9
Season						
Spring	57	748	565	4	1	7
Summer	128	673	705	7	2	10
Fall	115	693	619	6	1	9
Winter	61	738	581	4	1	8

CP=crude protein, NDF=neutral detergent fiber, IVDMD=*in vitro* dry matter digestibility; Ca=calcium, P=phosphorous, ME=metabolizable energy.

* Estimated with equation: ME (MJ/kg DM)=(2.20+0.136GP₂₄+0.057%CP+0.0029%CF²)/4.184. Where GP₂₄ is gas production in 24 h; CP is crude protein and CF is crude fat.

was used to estimate the mean ruminal retention time (MRRRT). Beginning at 1200 h on days 10 and 11 of the sampling period, ruminal fluid samples (100 ml) were taken and immediately pH was recorded. Ruminal fluid samples were frozen –40 °C for later NH₃-N and TVFA analysis (Galyean and May, 1997). Fifteen Angus steers belonging to the flock of study area (BW=320 ± 2 kg), were drawn from the jugular vein in the morning (07:00 h) using vacutainer with heparin to separate the plasma. The blood samples (10 ml) were taken monthly and centrifuged at 2500 rpm for 20 min at 10 °C. The harvested plasma was stored into polypropylene vials and frozen for later analysis for G, UN, NEFA and insulin (Reynolds et al., 1989).

2.3. Statistical analyses

Data was analyzed using procedure MIXED for repeated measures (SAS, 2003). The model contained fixed effects for year, season and year × season. Compound symmetry was used as the covariance structure for the presentation of the results. The models proposed by McDonald (1981), Ørskov and McDonald (1979), and AFRC (1993) were used for to estimate the parameters of *in vitro* gas production, ruminal degradability and effective degradability, respectively.

3. Results and discussion

3.1. *In situ* degradability, *in vitro* gas production and passage rate

In general, the diet consumed by grazing cattle during spring and winter was low quality because of crude protein (CP) was less than 70 g/kg DM and neutral detergent fiber (NDF) higher than 720 g/kg DM. The values of “A”, “B”, “c”, EDNDF, EDCEP, PGP, kp and MRRRT were different among years and seasons ($P < 0.01$; Table 2). There is very little information about ruminal degradability fractions and *in vitro* gas production of diets selected by range beef cattle in Europe and

Download English Version:

<https://daneshyari.com/en/article/8502206>

Download Persian Version:

<https://daneshyari.com/article/8502206>

[Daneshyari.com](https://daneshyari.com)