EFFECTS OF BREED AND PASTURE LOCATION ON BLOOD SERUM COMPONENTS OF BEEF CATTLE

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SUMMARY

Six blood serum components, glucose, total lipids, blood urea nitrogen (BUN), total protein, calcium, and phosphorus, were evaluated in 144 cows and heifers while grazing forage grown on three different pasture locations in South Central Florida. Cattle in the pasture location offering forage of highest quality and quantity (reclaimed marsh improved) had the highest serum concentrations of glucose, total protein, and blood urea nitrogen and the lowest level of serum total lipids, calcium, and phosphorus. In the pasture location offering the poorest forage and nutrition level (sand ridge improved and range), cattle had the lowest levels of serum total protein and BUN, and the highest calcium and phosphorus serum values. Predominately Brahman cattle had higher levels of glucose, total lipids, total protein, BUN and calcium in the serum while predominately Bos taurus cattle had higher levels of serum phosphorus. The implications of these results are that different management practices should be used with cattle in such diverse pasture locations.

INTRODUCTION

The analysis of blood samples from grazing beef cattle has been suggested as a means of detecting subclinical diseases, selection of superior producers, and prediction of future production potential. A barrier to the practical use of blood profiles has been the need for a standardized set of normal values for all breeds, ages, sexes, and environments. Florida has two diverse beef cattle breed groups; namely, predominately Brahman and predominately British or European. Most pastures in Florida fall into three location classifications; namely, flatwoods, sand ridge and reclaimed marsh. An evaluation of the variation in blood values for the predominate cattle breed groups producing on these pasture classifications is needed.

OBJECTIVES

This study was designed to develop multiparameter metabolic blood profiles of beef cattle to (1) establish normal values for designated blood components with respect to breed (predominately Brahman or predominately Bos taurus origin), age, production status (lactating or non-lactating), and pasture location and (2) relate the nutrient content of pasture forage from each pasture location to the nutritional status of cattle as judged by their blood composition.
PROCEDURE

Thirty-two cows and 16 heifers, 9 to 11 months old, were selected from each of three herds on three different pasture locations. These pastures were classified as flatwoods improved (FIP), sand ridge improved and range (SIR), or reclaimed marsh improved (RMI). All of the pasture locations were within two miles of each other and were located in South Central Florida near Kenansville. The FIP location was a 425-acre Pangola digitgrass pasture on Immokalee, Myakka, Basinger, and Anclote sandy soils. About one-half of the area was seepage-irrigated and planted in white clover. The SIR location was a 450-acre tract, 250 acres unimproved range and 200 acres Pensacola bahiagrass, on Pomello, St. Johns, Anclote, Myakka, and Immokalee sandy soils. The RMI location was a 250-acre drained and seepage-irrigated marsh on the St. Johns River headwaters, planted in torpedograss, white clover, and Pensacola bahiagrass on Holopaw, Floridana, and Felda sandy soils.

The cattle evaluated were selected and stratified on the basis of breed origin (predominately Brahman or predominately Bos taurus), age, and production status (lactating or non-lactating). No supplemental feed was offered to the cattle except for a complete mineral mixture (PDQ, 7% crude protein, Lakeland Cash Feed Co., Lakeland, FL) offered ad libitum. Forage, soil and cattle blood samples were taken for analysis by standard procedures.

RESULTS AND DISCUSSION

Table 1 shows that levels of glucose were higher in cattle on reclaimed marsh improved (RMI), intermediate on the sand ridge improved and range (SIR), and lowest on flatwoods improved pasture (FIP). Previous research had shown lower glucose values on restricted diets of low quality feedstuffs. It was expected to observe higher glucose in cattle on the RMI location where forages had the highest nutrient content (Table 2). It was unexpected to find the lowest glucose values in cattle on the FIP location. A possible explanation is that lactating cows on the poor quality SIR forage had physiologically decreased their milk production to conserve glucose while those on the FIP location were on a higher plane of nutrition that encouraged milk production; therefore, demand for glucose for lactose synthesis was reflected in lowered serum glucose. Concentrations of serum glucose were higher in heifers than cows, and slightly higher in predominately Brahmans, and lower in lactating than in non-lactating cows.

In contrast with glucose, serum total lipids were highest in cattle on FIP, lowest on RMI, and intermediate on the SIR location. These observations agreed with previous cattle research which indicated that a physiological response to nutritional stress is expressed as a mobilization of lipids from body fat to meet energy demands. Since low glucose on FIP was probably due to a larger nutritional demand, the finding of the highest levels of serum total lipids in these cattle fit this hypothesis.
Lipids were highest in predominately Brahmans and in cows that were lactating.

Two nitrogen-containing serum components, total protein and blood urea nitrogen (BUN) are expected to reflect the protein nutritional status in grazing cattle. Both BUN and total protein values reflected availability of protein in the forages in the three pasture locations (table 2). Cattle grazing the RMI location had the highest levels of BUN; however, these exceptionally high values (17.4 mg/100 ml) compared to levels found in cattle grazing FIP (10.9 mg/100 ml) and SIR (9.1 mg/100 ml) probably reflected selective grazing by cattle on the RMI area. Since this location had an abundant legume (white clover) growth, the cattle may have consumed a higher proportion of high protein forage than was in the composite hand-plucked sample which analyzed 7.7% protein (table 2). Like BUN, serum total protein was highest in cattle on the RMI location and lowest on the SIR location. While not shown in table 1, almost all of the increase in serum total protein level was attributed to the globulin fraction, contrasted to little change in the albumin fraction. BUN and total protein concentrations were highest in predominately Brahmans reflecting an ability of Zebu-type cattle to better utilize nitrogen-containing compounds in the diet, especially when consuming fibrous feedstuffs.

Concentrations of serum phosphorus were highest in cattle on the less productive SIR location, intermediate on FIP, and lowest on the most productive RMI area. The lowest levels of serum phosphorus were expected in cattle grazing the RMI location. Due to better nutritional conditions, these cows were probably lactating heaviest and gaining weight at a faster rate. Since phosphorus is an essential element in energy metabolism and growth, lower serum phosphorus values in cattle on RMI reflected a larger demand. Similarly, the highest serum phosphorus values in cattle on SIR were a result of lower levels of milk production in cows and growth rate in heifers. In addition, forage phosphorus was lowest in the RMI area and the calcium to phosphorus ratio was approximately 4:1 compared to forage calcium to phosphorus ratios of approximately 2:1 in both SIR and FIP locations. Although concentrations of blood calcium are more closely physiologically regulated than phosphorus, serum calcium values paralleled serum phosphorus values with cattle on RMI having the lowest levels while cattle on SIR had the highest levels. Phosphorus and calcium serum concentrations were highest in younger cattle, an observation in agreement with previous studies.

The implications of these results are that different management practices, especially mineral supplementation, should be used with cattle in such diverse pasture locations.
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<th>Item</th>
<th>Glucose mg/100 ml</th>
<th>Total lipids mg/100 ml</th>
<th>Urea nitrogen mg/100 ml</th>
<th>Total protein g/100 ml</th>
<th>Calcium mg/100 ml</th>
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\(^a\)Abbreviations: OM, organic matter; IVOMD, organic matter digestibility; CP, crude protein; Ca, calcium; P, phosphorus