

Effect of divergence in residual feed intake on feeding behavior, blood metabolic variables, and body composition traits in growing beef heifers

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Abstract :

This study examined the relationship of feed efficiency and performance with feeding behavior, blood metabolic variables, and various body composition measurements in growing beef heifers. Individual DMI and growth were measured in yearling Limousin x Holstein-Friesian heifers [$n = 86$; initial BW = 191.8 (SD = 37) kg] fed a TMR diet comprising 70:30 concentrate:corn silage on a DM basis (ME of 2.65 Mcal/kg of DM; DM of 580 g/kg) for 82 d. Meal duration (min/d) and meal frequency (events/d) were recalculated for each animal on a daily basis using an Insentec computerized feeding system. Physical measurements as well as ultrasonic fat and muscle depths were recorded on 3 equally spaced occasions during the experimental period. Blood samples were collected by jugular venipuncture on 4 equally spaced occasions and analyzed for plasma concentrations of IGF-I, insulin, leptin, and various metabolites. Phenotypic residual feed intake (RFI) was calculated for all animals as the residuals from a multiple regression model regressing DMI on ADG and midtest BW^{0.75}. Overall, ADG, DMI, feed conversion ratio (FCR), and RFI were 1.51 (SD = 0.13), 6.74 (SD = 0.99), 4.48 (SD = 0.65), and 0.00 (SD = 0.48) kg/d, respectively. Residual feed intake was positively correlated with DMI ($r = 0.47$) and FCR ($r = 0.46$), but not with ADG or midtest BW. Positive correlations (ranging from $r = 0.27$ to $r = 0.63$) were estimated between ultrasonic measures of final lumbar fat and lumbar fat accretion over the test period and DMI, FCR, and RFI. The inclusion of gain in lumbar fat to the base RFI model increased R^2 (0.77 vs. 0.80) value for the degree of variation in DMI not explained by midtest BW and ADG alone. The Pearson rank correlation between RFI and carcass-adjusted RFI (RFI_c) was high ($r = 0.93$). From the plasma analytes measured, NEFA ($r = -0.21$; $P < 0.05$) and β -hydroxybutyrate ($r = 0.37$; $P < 0.05$) concentrations were correlated with RFI. Plasma leptin ($r = 0.48$), glucose:insulin ($r = -0.23$), NEFA ($r = -0.32$), and β -hydroxybutyrate ($r = 0.25$) were associated with FCR. However, systemic IGF-I and insulin were unrelated ($P > 0.05$) to any measure of feed efficiency. The feeding behavior traits of eating rate, daily feeding events, and nonfeeding events were positively correlated ($P < 0.05$) with RFI and RFI_c. This multifactorial study provides new information on some of the biological processes responsible for variation in feed efficiency in beef cattle.

Key Word :

beef cattle, body composition, feed efficiency, feeding behavior, plasma analyte