Beef Cattle Nutrition Symposium: Feeding Holstein steers

516 Neonatal and young (<205 kg) feeding programs in calf-fed Holsteins. Luis O. Burciaga-Robles*, *Feedlot Health Management Services, Okotoks, Alberta, Canada.*

The limited supply of beef cattle is one of the greatest challenges facing the beef industry globally and is a factor reflected in the annual decline in fed cattle harvest. Calf-fed Holsteins (CFH) represent an opportunity to fill the void in beef cattle supply; however, because of the differences that exist compared with beef cattle, a science based approach is required to optimize production and profitability. The CFH often is overlooked in academic research. The research based on dairy heifer calves or beef cattle is often extrapolated to CFH. The objective of this presentation is to discuss the implications of Neonatal Nutrition Programs (NNP) on health and lifetime performance in CFH. The success of NNP (birth to <205 kg) should take into consideration the environment, genetics, immune status, and inherent variation that exist in CFH populations. During NNP, the greatest contributor to the feed-only cost of gain is the milk feeding program. More research is required to optimize growth and production goals without compromising the well-being of the calf. Understanding how NNP affects the immune status/response of the calf and implications on lifetime health and growth is pivotal. Nutrigenomics is an avenue of research that could expand the understanding of how clinical or subclinical disease change nutrient requirements and potentially allowing for development of mitigation strategies. Another area of research required in the CFH encompasses determining the effects of lifetime feeding of CFH through understanding the potential interactions between NNP at the calf ranch and the eventual feeding program at the feedlot. Research regarding grain type, grain processing, by-product use, protein sources and concentrations, and roughage level at the calf ranch is critical. Understanding the biology of the CFH across all growth stages is needed so that economic models can be developed. Understanding the economic contribution of different aspects of biology allows for sensitivity determination of key economic variables that should help identify research priorities. A multidisciplinary research approach to understanding the CFH is required to meet the increasing demand for animal protein without compromising the overall well-being and sustainability of this industry.

Key Words: nutrition, calf-fed, feedlot

517 Morphological, microbiological, and biochemical development of ruminant gastrointestinal tract. Carl J. Yeoman and Glenn C. Duff*, *Department of Animal and Range Sciences, Montana State University, Bozeman, MT.*

It is well recognized that morphological development of the rumen is dependent on diet and microbiota. For example, dietary concentrates stimulate the microbial production of VFA, including butyrate. Butyrate is the primary form of energy to the developing rumen wall and promotes development of ruminal papillae. Microbial colonization of the ruminant gut is complex and begins at birth. Microbes found on the teat and in the colostrum rapidly replace early colonizers from the vagina and a dynamic succession takes place until a mature climax community forms between 180 to 360 d of age. By using direct-fed microbials, including live cultures of *Lactobacillus acidophilus, L. bulgaricus, Streptococcus thermophilus,* and *Aspergillus oryzae* in place of colostrum, we found no loss ($P > 0.05$) in ADG or increase ($P > 0.05$) in intake in neonatal lambs. In Holstein calves supplementation of *L. acidophilus* and *Propionibacterium freudenreichii* resulted in increased ($P < 0.05$) gastrointestinal villus height, crypt depth, and total height (crypt plus villus) before weaning with average ruminal papillae width greater ($P < 0.01$) in calves fed the live cultures versus control calves after weaning. Genus populations of *Bacteroides*, *Roseburia*, and *Eubacterium* were greater ($P < 0.05$) in fecal samples collected in nonscouring calves versus scouring calves. Using serum β-hydroxybutyrate as a marker in serum for ruminal development, milk feeding regimen (bottle versus trough) and housing (group versus individual) did not appear ($P > 0.10$) to affect ruminal development. Alterations of microbiota in the rumen to hasten ruminal development deserves attention to potentially improve animal health and performance.

Key Words: ruminant, gastrointestinal, development

518 Genetic, epigenetic, and management factors contribute to the risk of morbidity and mortality of Holstein feeder calves. Michael A. Ballou*[1], David E. Kerr[2], Kate P. Sharon[1], and Aimee L. Benjamin[2], *[1]Department of Animal and Food Sciences, Texas Tech University, Lubbock, TX, [2]Department of Animal Science, The University of Vermont, Burlington, VT.*

Holstein steers contribute significantly to US beef production. Healthy feeder calves are more efficient and produce carcasses with greater value. Holsteins have the genetic capability to produce carcasses with comparable quality to many common beef breeds, but there are unique challenges to feeding Holsteins. Genetic differences between Holsteins and common beef breeds influence health. Additionally, early life management and other environmental factors can have long-term effects on the health and productivity of Holstein feeder calves. Holstein heifers had greater inflammatory responses than Angus heifers when evaluated in both ex vivo fibroblast and in vivo lipopolysaccharide challenge models. In both models, the Holstein heifers produced approximately 3 times more inflammatory mediators than the Angus heifers. The greater inflammatory capacity is likely due to a combination of genetic and epigenetic factors. In fact, pre-weaning nutrition influenced the risk of morbidity and mortality to a combined bovine herpesvirus-1 and *Mannheimia haemolytica* respiratory disease challenge in Holstein calves a month after weaning. Calves fed a restricted quantity of milk replacer, a common management strategy, had greater ($P \leq 0.05$) mortality (4/15) compared with calves fed 2.5 times more milk replacer (0/15). In agreement, the restricted fed calves had greater measures of systemic inflammation, increased peripheral blood neutrophil:lymphocyte ratio and plasma haptoglobin concentrations. In contrast, many management strategies that are common among Holstein calves improve their health in a feed yard. These management strategies include: vaccination (viral and bacterial antigens), weaning, castration, dehorning, and feed bunk and water trough training. Implementing these management strategies to calves will reduce stress and its negative effects on immunity during arrival at the feed yard. Taken together, management decisions of Holsteins during the calf phase are important as they can have either positive or negative effects on future health.

Key Words: beef, calf, health

519 Nutrition and management of calf-fed Holstein steers. Richard Zinn*, *University of California, Davis, CA.*

This presentation provides a brief review of feedlot nutrition and management considerations for Holstein steers. Calf-fed Holstein steers

typically enter the commercial feedlot at 100 to 120 d of age, with a full purchase weight of approximately 137 ± 16 kg. On a shrunk-to-shrunk basis (full purchase and final weights reduced 4%), harvest weight, ADG, and days on feed of implanted calf-fed Holstein steers average 588 ± 16 kg, 1.31 ± 16 kg, and 349 ± 10 d, respectively. Rate of gain and gain efficiency are markedly influenced by harvest weight and placement month. Due to high summer temperatures, late summer and fall close-outs are least efficient for feedlots located in the desert southwest. Calf density should be regulated to achieve an average surface moisture level of roughly 20%. Because water consumption is greater (20 to 30%) in Holsteins than conventional beef breeds, they require more pen and shade space. In commercial practice, calf-fed Holsteins are fed a single growing-finishing diet throughout the duration of the feedlot period. A characteristic diet may contain 12–13% crude protein (urea the sole source of supplemental N), 0.70–0.80% calcium, 0.35–0.40% phosphorus,0.20 to 0.28% magnesium, 0.3 to 0.4% tracemineral salt, and 8% forage NDF. Due to very high growth potential during the initial 112 d on feed, this diet will not meet the calf's metabolizable amino acid requirements, resulting in a predictable decrease (15 to 20%) in energetic efficiency during that phase. The rather high incidence of liver abscess frequently observed among lots of calf-fed Holsteins may warrant continued low-level antibiotic supplementation. Good feedbunk management is particularly important with Holsteins. The high energy content of the diet fed over a protracted period of time poses added threat to the possibility of acidosis.

Key Words: Holstein, feedlot, nutrition

520 Feedlot: Liver abscesses. T. G. Nagaraja*, *Kansas State University, Manhattan, KS.*

Abscesses in the liver of cattle are focal infections resulting from entry and establishment of pyogenic bacteria. There are several routes by which bacteria reach the liver, but entry via portal blood is by far the most frequent, because it drains the gastrointestinal tract, a source of bacteria. Liver abscesses can occur at all ages and in all types of cattle, but are most common in feedlot cattle fed high-grain finishing diets. The generally accepted pathogenesis of liver abscess includes chronic ruminal acidosis that leads to rumenitis, which then allows bacteria, primarily *Fusobacterium necrophorum,* to cross the epithelial barrier to enter the portal circulation. Bacteria from the portal circulation are filtered by the liver, leading to growth, production of virulence factors, particularly leukotoxin, damage to hepatic parenchyma, and abscess formation. *Trueperella* (formerly *Arcanobacterium*) *pyogenes* is the second most common bacterial species isolated from liver abscesses. Another bacterial species that has been recently isolated from liver abscesses is *Salmonella enterica.* Liver abscesses in cattle are of significant economic concern to the feedlot industry because of liver condemnation, reduction in performance and carcass yield. Liver abscess data collected from several packing plants have indicated a higher incidence of liver abscesses, particularly of the A+ score (most severe), in Holstein steers than the traditional beef cattle. Holstein steers raised for beef production are different from traditional beef breeds. Among the differences include more digestive and metabolic disorders and death losses in Holstein steers compared with beef breeds. The generally accepted reason for the increased digestive disorders, liver abscesses and death loss is the greater number of days Holsteins are on feed. However, it is not known whether the bacterial flora of liver abscesses of Holstein steers is in any way different from abscesses of the traditional beef cattle. In a recent study, liver abscesses in Holstein steers had a more diverse bacterial flora compared with traditional beef cattle. However, the prevalence of the major bacterial species, *F. necrophorum,* and *T. pyogenes* were similar between the 2 cattle types.

Key Words: liver abscess, Holstein steers, etiology

521 Methods of estimating empty body composition, energy retention, and grading characteristics of calf-fed Holstein steers. T. J. McEvers*[1], N. D. May[1], J. A. Reed[1], L. J. Walter[1], J. P. Hutcheson[2], and T. E. Lawrence[1], *[1]West Texas A&M University Beef Carcass Research Center, Canyon, TX, [2]Merck Animal Health, Summit, NJ.*

A serial harvest trial investigating growth characteristics of calf-fed Holstein steers (n = 115; initial BW = 449.2 ± 19.9 kg) was conducted in 28 d intervals starting at 226 d on feed (DOF) and ending at 534 DOF. Five steers were slaughtered on d 226 and utilized as a point for growth modeling. Remaining cattle (110 steers) were randomly allocated to harvest endpoint (10 cattle per slaughter day; 254, 282, 310, 338, 366, 394, 422, 450, 478, 506, and 534 DOF) with one-half of each group receiving zilpaterol hydrochloride (ZH) for 20 d followed by a 3 d withdrawal. Shrunk BW (SBW, kg) and hot carcass weight (HCW, kg) were utilized to predict empty body weight, kg (EBW). Feeding performance {dry matter intake (DMI, kg), net energy for gain, (NEG, Mcal/kg of diet dry matter), and ZH supplementation} variables were utilized to estimate EBW and empty body fat (EBF, %). For prediction of HCW, a 2 variable equation was developed with an R^2 of 0.946 ($P < 0.01$) and root mean square error (RMSE) of 20.13 {HCW = −41.44 + (0.6637 × SBW) + (12.974 × ZH); 1 = 20-d supplementation, 0 = 0-d supplementation}. For prediction of EBW, an equation with an R^2 of 0.942 ($P < 0.01$) and RMSE of 29.9 was developed {EBW = 57.6232 + (1.39280 × HCW) – (11.0994 × ZH)}. Utilizing feeding performance data, a model with an R^2 of 0.919 ($P < 0.01$) and RMSE of 35.2 was developed for prediction of EBW {EBW = −1547.34 + (1.19 × DOF) + (21.13 × DMI) + (1005.73 × NEG) + (18.87 × ZH)}. To predict EBF using feeding performance variables, a 4 variable equation was developed with an R^2 of 0.621 ($P < 0.01$) and RMSE of 2.9 {EBF = 0.7769 + (0.0003 × DOF) + (0.0046 × DMI) – (0.4346 × NEG) – (0.0167 × ZH)}. Several variables available to calf-fed Holstein producers may be implicated for use in predictive models related to finishing performance and composition of gain for calf-fed Holstein steers.

Key Words: Holstein, body composition, carcass characteristics