Supplementing early lactation dairy cows with branched-chain amino acids. C. J. McCabe1, F. Leal-Yepes1, and D. Van Nydam2, 1Department of Animal Science, Cornell University, Ithaca, NY; 2Cornell University College of Veterinary Medicine, Ithaca, NY.

The transition period for dairy cows has been highlighted as the period of time where cows are most susceptible to metabolic disorders due to the strong nutrient demands from lactation (Drackley, 1999). This leads to negative energy balance and cows must mobilize their tissue reserves to compensate for the difference, which can cause immune dysfunction and lead to disorders such as hyperketonemia and mastitis (Overton and Waldron, 2004). Hyperketonemia is defined as a concentration of β-hydroxybutyrate ≥1.2 mmol/L in blood and a case is estimated to cost a farmer up to $289 (McArt et al., 2015). The branched-chain amino acids (BCAA) leucine, isoleucine, and valine are all essential amino acids (AA) cows must obtain through their diet or microbial protein synthesis to meet daily requirements. BCAA are unique compared with other AA because they are not directly metabolized by the liver. Branched-chain aminotransferase (BCAT2), the first enzymatic step in the oxidation of BCAA shows higher activity in muscle tissue than in liver (Herman et al., 2010). Leucine plays a particularly important role in activating the signaling factor of the mammalian target of rapamycin (mTOR) pathway to promote protein synthesis in skeletal muscle. Previous studies have shown the mTOR pathway results in decreased food intake by stimulating leptin release and improving glucose metabolism (Herman et al., 2010; Laplante and Sabatini, 2012). Studies in lactating dairy cows have shown no significant difference in milk protein yield, milk volume yield, or changes in the milk profile with BCAA supplementation (Appuhamy et al., 2011; Mackle et al., 1999; Huhtanen et al., 2002). Thus, indicating that BCAAs play a role in muscle protein synthesis with a particular emphasis on leucine (Mackle et al., 1999). By supplementing BCAAs in the early postpartum diet, there is an opportunity to reduce the negative energy balance by stimulating skeletal muscle tissue synthesis through the BCAA mTOR pathway.

Key Words: branched-chain amino acids, transition cows, health

Judicious use of antibiotics in pre-weaned dairy calves: A sustainable future for producer, calf, and consumer. W. Jenkins*, K. Alward, and J. Bohlen, University of Georgia, Athens, GA.

Antibiotic use in today’s animal agricultural industries is heavily scrutinized by the public due to increased risk of antibiotic resistance of pathogens. Development of these antibiotic resistant pathogens causes great concern for both the welfare of animals and the potential of today’s antibiotics becoming ineffective for human health. Modifications of the Veterinary Feed Directive has limited the concerns with human health but productivity of dairy calves remains a topic necessitating discussion with regards to prophylactic use of antibiotics. Pre-weaned dairy calves are often fed a milk replacer containing antibiotics (medicated) and antibiotics are additionally used to treat health conditions such as scours and respiratory disease. While many feed medical milk replacers as part of a preventative program, recent studies have shown that the overuse of antibiotics in healthy pre-weaned dairy calves can potentially have a negative effect on their growth and can even lead to increased morbidity cases. These studies also suggest that restricting the use of medicated milk replacers and only therapeutically treating calves with antibiotics, increases the daily feed intake and average daily gain of calves. Further, in healthy calf groups, morbidity and mortality rates did not differ whether calves were fed a non-medicated versus medicated replacer. The additional incentive to a producer is a reduced price point for milk replacer. Coupled with higher rates of gain, this represents significant economic value. Producers must work to improve management programs to ensure healthy calf groups and reduce reliance of medicated milk replacers as preservation of today’s antibiotics and the reduction of antibiotic resistance needs to be a top priority for dairy producers. Judicious use of antibiotics correlates to improved calf health, growth, and financial incentive while simultaneously reducing the use of antibiotics in otherwise healthy calves. Restricting antibiotics to only a therapeutic use in dairy calves represents a sustainable future for dairy producers.

Key Words: antibiotics, pre-weaned calves, sustainable


Fever is a biological response in animals that comes from their co-evolution with pathogens. When the immune system recognizes pathogens, a chain of events is activated that stimulates the hypothalamus to raise the body temperature above thermal homeostatic levels. Cattle’s normal body temperature range is from 38.0 to 39.3°C. Fever is defined as a cow’s body temperature reaching a temperature of 39.5°C. The rise in body temperature makes it difficult for bacteria and some viruses to replicate within cattle, giving a better chance for the animal to overcome the illness. The rapid immuno-response that produces fever often makes it the first detectable sign of illness, coming before changes in physical appearance. Rectal temperature has been the gold standard for disease detection for decades. However, reliance on rectal temperature is being questioned for its accuracy and convenience. To detect the onset of illness via initial change in body temperature, rectal temperature would need to be taken continuously. Individuals’ body temperatures can vary between animals, throughout the day, and in response to disease or stress. Because of this variance, a single temperature measurement has a high probability of being a false positive or false negative when identifying a fever. All individuals’ temperature patterns should be considered for accurate fever detection. The act of taking the rectal temperature of an animal may increase temperature, reducing the accuracy of the reading further. Automated temperature reading systems may provide a solution for inaccurate fever detection. Systems including infrared cameras, rumen boluses, and implanted or vaginally inserted temperature data loggers automatically measure temperature. Automated temperature measurements can provide more accurate readings and early fever detection. Studies show improvement with non-invasive and automatic systems that could allow for management practices and early detection of diseases. This would allow producers to limit the spread of disease and more effectively treat their livestock, reducing disease cost, and improving overall cattle health and welfare in the dairy field.

Key Words: disease, health, precision dairy technology


Diseases in dairy calves affect dairy herd profitability. The ability to identify respiratory diseases can be difficult, but is a critical part of calf care. With different technologies, such as accelerometers, pedometers,
and automatic calf feeders, farmers are able to detect when a calf is becoming ill sooner. Bock et al. (2013) used accelerometers alone to monitor changes in calf activity to indicate onset of disease. Placement of the technology on the right hind leg was most effective. Swartz et al. (2016) used pedometers in addition to accelerometers to monitor lying bouts and calf activity in efforts to detect respiratory diseases in calves. Both steps from pedometers and lying bouts from accelerometers provided critical information to detect respiratory disease. Automatic calf feeders can provide information such as drinking speed, number of visits, and intake. Swartz et al. (2017) used a combination of an automatic calf feeder, accelerometers and pedometers to validate the ability of these technologies to detect respiratory disease. Sick calves ate less, drank slower, had an increase in lying bouts and took less steps than healthy calves. With the introduction of accelerometers, pedometers, and the automatic calf feeders, workers are able to indicate diseases in calves at an earlier stage to ensure that calves are treated promptly, thereby reducing recovery times and mortality rates.

Key Words: accelerometer, pedometer, automatic calf feeder


As the global population continues to grow, food production must rise to meet increasing demands. The dairy industry is a highly dynamic sector of the agricultural market, from both a national and international perspective. The United States is encountering a unique issue in the industry when compared with overseas operations: the greatest American challenge is countering the drop in fluid milk consumption due to negative consumer perspective. In comparison, densely populated nations, such as China and other countries of Southeast Asia, are still struggling to balance consolidation and growth with resource usage and pollution. While economies, markets, and social attitudes toward the dairy industry vary between individual countries, a clear theme of increased quality and quantity of product with ever-decreasing input resonates globally. Sustainability is a practice ideology that is becoming more prevalent as it relates to the challenges of the dairy industry across the world. The traditional concerns such as water and land consumption and air pollution remain as relevant as always. However, developed dairy economies will find that sustainability challenges exist beyond the physical aspects of resources into social perspectives. An example is the falling fluid milk consumption rates in the United States due to consumer misconceptions and the increasing popularity of milk-alternatives. Well-established industries are moving toward transparency in their operations, or risk their survival in the fast-paced market shifts. Growth demands constant change and challenges. The evolution of today’s dairy farm is rooted in the difficulties that our predecessors faced. Like the industry always has, it will continue to meet obstacles head on, and create efficient, sustainable solutions out of struggle. Somewhere along the line may be an answer to the ever-present question: what is the future of the dairy industry?

Key Words: dairy, sustainability, production

243 Strategies for reducing methane emission by dairy cattle. N. P. Uzeze* and C. C. Williams, Louisiana State University, Baton Rouge, LA.

Methane is the second most prevalent greenhouse gas, and plays an important role in global warming. Methane is generated from many sources, including natural production in the environment, by livestock, and as a result of human activity. Approximately one-fourth of anthropogenic methane emission in the United States is from enteric fermentation primarily from livestock, particularly ruminants. While the effects of methane are generally focused on its global warming potential, methane also results in a net loss of feed energy to the animal. There are numerous strategies that have been utilized to potentially reduce methane production in ruminants. Increasing feed efficiency by feeding highly digestible forages is one approach that has been used. Feeding ionophores has also been shown to reduce methane production in the rumen. Grinding and pelleting of forages may also reduce methane emissions, but this practice is not cost effective for producers. Increasing dietary fat has the potential to decrease methane emissions, but this method could negatively affect milk components and producer income. Methane emission inhibitors are chemical compounds with inhibitory effects on rumen methanogenic microorganisms. These compounds have been studied for their efficacy in reducing methane emissions and effects on production in dairy cattle. Among the more efficient methane inhibitors is 3-nitrooxypropanol (3NOP), which blocks an enzyme necessary for microbial production of methane in the rumen. This inhibitor has been shown to decrease methane emission by 30% and increase body weight gain in dairy cattle, with no effects on dry matter intake, milk production, or feed efficiency. Research with dairy cattle, as well as other livestock species, has shown that methane inhibitors as feed supplements could lead to substantial reductions in greenhouse gas emissions. While there are several strategies that have been proven to reduce methane emission from ruminants, the FDA approval of 3NOP could prove to be a more efficacious method of reducing greenhouse gas emission while improving livestock performance.

Key Words: methane emission, feeding strategies, methane inhibitors

244 Environmental enrichment in dairy cows and calves. J. E. Uren* and M. L. Eastridge, The Ohio State University, Columbus, OH.

Environmental enrichment for dairy cows and calves has gained interest with increased focus on animal well-being. Much of the focus with cows has been with mechanical brushes, but broader research has been conducted with calves with less in-field use. Also, limited research has occurred to address enrichment with mechanical brushes for calves in comparison to adult cows. Wilson et al. (Applied Animal Behavior Sci; 76:259, 2002) highlighted the importance of grooming tools, such as mechanical brushes, and revealed that enrichment tools for scratching purposes are used most among the items studied and have sustained interest for feedlot cattle. DeVries et al. (J. Dairy Sci. 90:2241, 2007) illustrated that duration and frequency of grooming behaviors increased (by 508% and 226% respectively) after dairy cows were exposed to a mechanical brush. Furthermore, Mandel et al. (J. Dairy Sci. 96:6506, 2013) examined the possibility of using analysis of cow behavior around a mechanical brush as a gauge of well-being because mechanical brush use may be a luxury activity since use of the brush declined during periods of decreased energy (e.g., food placed far away or post artificial insemination). Research has provided evidence that calves utilize enrichment devices, such as lollies, artificial teats, stationary brushes, and rubber chain links (Pempek et al., J. Dairy Sci. 100:4807, 2017). Finally, Zobel et al. (Animal 7:84, 2017) focused on dairy calf enrichment via manila ropes and mechanical brushes, demonstrating that calves housed in pairs utilized both mechanical brushes and manila ropes for 27.1 min/d. The differences in brush to rope use between individual calves in this study demonstrate a need for additional research to determine preferred and effective enrichment devices. Review of past
studies suggests that mechanical brushes are beneficial enrichment tools for dairy cows and that they may be convenient tools to monitor dairy cow welfare and possibly health. As animal welfare research continues to expand, additional studies need to be conducted focusing on dairy calf enrichment and behavior in individual and group housing systems.

Key Words: enrichment, behavior, welfare

Factors that affect lying times of dairy cattle and the effect of increased lying time on milk production. J. R. Sexton* and P. Erickson, University of New Hampshire, Durham, NH.

Lying time is affected by factors such as proper stocking density, specific stall dimensions, feed time management and comfortable, compressible bedding that encourages increased lying times while still keeping the incidence of mastitis low. Lying times are indicators of stress because cows that spend longer than normal periods standing have more stressors in their environment, while cows that spend most of their day lying down and ruminating are more comfortable. Increased lying times in dairy cattle increases milk yield and profit.

Key Words: lying time, cow comfort, production

Controlling potassium from the field to the diet. D. M. Dietz* and D. R. Olver, The Pennsylvania State University, University Park, PA.

One of the most expensive metabolic diseases facing dairy producers is milk fever. In addition to the costs associated with this disease, cows with milk fever are susceptible to other health problems such as retained placentas, displaced abomasums, and ketosis. Although calcium is the key mineral in controlling milk fever, the role of potassium cannot be overlooked. Elevated potassium levels have a profound impact on dietary cation-anion difference (DCAD). Many dry cow forages contain high levels of potassium that can disrupt the calcium homeostasis of close-up dry cows. These high potassium levels are often associated with fields that have been heavily fertilized with manure. Because potassium is a cation, diets with high potassium levels cause an increase in blood pH. Alkaline blood pH levels decrease the mobilization of calcium from bone, thus increasing the cow’s risk of developing milk fever. Anionic salts can be used as a method to reduce the effects of excess potassium in the diet. These acidic compounds lower incidences of milk fever by increasing calcium mobilization, but many of these products are unpalatable. The need for these anionic salts to decrease DCAD can be reduced by controlling potassium levels in forages. Forage potassium levels should be kept under 2%. Soil tests can be used to designate specific fields for production of dry cow grasses. Earlier cuttings often contain higher potassium levels than other cuttings, so later cuttings can be designated for use in dry cow rations. Finally, reducing manure application on fields can help lower forage potassium levels. Careful management of potassium levels in the field and in the dry cow diet can help reduce the risks of milk fever and other health issues.

Key Words: potassium, dietary cation-anion difference, milk fever