ADSA-SAD (Student Affiliate Division) Undergraduate Competition: Dairy Production

220 The effects of heat stress on reproductive fertility: An effective solution. Alexandra T. Lemus* and Peter J. Hansen, *University of Florida, Gainesville, FL.*

By virtue of its high metabolic heat production (4–5 times maintenance), the lactating dairy cow is very sensitive to heat stress. A rise in body temperature of 1–2°C can have negative effects on various aspects of reproductive function. Heat stress can reduce luteinizing hormone and steroid hormone secretion, alter folliculogenesis, disrupt oocyte quality and inhibit embryonic development. The net result is reduced expression of estrus and low fertility. Effects on oocyte quality take place over a broad time frame. The ovarian follicle requires about 4 mo to develop from the primary stage to ovulation. The effects of heat stress on the oocyte within the follicle can persist for as long as 103 d. This stress in turn alters the integrity of the follicle and consequently makes it more difficult for the fertilized oocyte to develop into a blastocyst. The newly formed embryo is also susceptible to maternal heat stress. After 2–3 d, however, the embryo becomes increasingly resistant to heat stress and by d 7, when embryo transfer is ordinarily performed, elevated temperature has little effect on the embryo. Still another effect of heat stress is the depression of estrus behavior where both the duration and the intensity of estrus decrease resulting in an increased percentage of missed estruses. The combined effects of reduced detection of estrus and reduced fertility after insemination result in lower conception rates during warm months. These negative effects of heat stress can be bypassed by incorporation of 2 reproductive technologies. Ovulation synchronization protocols such as Ovsynch allow farmers to predict the time of ovulation without the need for estrus detection. Fertility is improved when synchronization is performed in conjunction with embryo transfer. Embryo transfer bypasses causes of infertility due to loss of oocyte competence and damage of the early embryo due to elevated maternal body temperature. The d 7 embryo used for transfer has acquired resistance to heat stress; therefore, maternal heat stress no longer affects the embryo.

Key Words: fertility, embryo transfer, synchronization

221 Effects of colostrum and milk intake on future performance in dairy calves. Katherine M. Kelly*, Donna M. Amaral-Phillips, and Jeffery M. Bewley, *University of Kentucky, Lexington, KY.*

The first 56 d of a calf's life are critical for improving future milk production. Doubling birth weight within the first 56 d increases future milk production. Colostrum harvested from the mother within 10 h after calving loses 27% of IgG (Jaster, 2004). Consuming 4 L of colostrum compared with 2 L improves average daily gain (ADG), which has a direct effect on milk production (Soberan et al., 2012). Insulin found in colostrum affects gut absorption and growth (Van Amburgh et al., 2011). Without immunity from colostrum, calves that are given antibiotics, due to illness, are 2.5 times more likely to die within the first 2 years of life (Soberan et al., 2012). Milk intake also affects ADG. Calf metabolizable energy (ME) requirement is about 2.34 Mcal/d for a 50 kg calf, to support maintenance. Conventional feeding systems provide the calf with reduced amounts of milk so the calf will began eating calf starter sooner. Conventional feeding systems provide the calf with enough ME for maintenance (Drackley, 2011). Higher intakes of whole milk provide the calf with enough dietary fat to support maintenance and growth (Van Amburgh, 2011). Increased growth increases milk production in Holstein calves during their first lactation and decreases age at first breeding (Khan et al., 2010). Through increased colostrum and milk intakes, milk yields and production life can be increased.

Key Words: calf performance, colostrum, milk intake

222 The effects of feeding heat-treated colostrum to dairy calves. Rebecca N. Klopp* and Dale R. Olver, *Pennsylvania State University, University Park, PA.*

Heat-treated (HT) colostrum offers many benefits when fed to dairy calves. Calves are born agammaglobulinemic because the placenta does not allow antibodies to pass from the dam to the fetus. As a result, neonatal calves rely on passive absorption of antibodies from colostrum in the first few hours after birth to protect them from infectious diseases. The most prevalent of the colostral antibodies is IgG. This antibody is commonly used as an indicator to show that immunity through passive absorption was achieved. In the past, commercial pasteurizers were used to process both waste milk and colostrum, and they achieved temperatures of at least 63°C to reduce risks of microbial contamination from collection and storage. However, heating colostrum to this temperature reduced IgG concentrations and increased viscosity. Recent studies have demonstrated that heating colostrum to a lower temperature (60°C) for up to 120 min drastically decreased bacterial populations while still maintaining IgG levels and viscosity. Research also shows that calves have a reduced risk for illness when fed HT colostrum compared with fresh colostrum because the heat treatment process significantly reduces total coliform counts. Calves that are fed HT colostrum will more efficiently absorb immunoglobulins compared with calves fed unheated colostrum. Plasma samples taken from calves showed that IgG concentrations in calves that were fed HT colostrum increased by 18.4% with a 21% increase in apparent efficiency of absorption compared with calves fed fresh colostrum. Heat treating colostrum is a continually improving technique resulting in an increased rate of IgG absorption in dairy calves.

Key Words: heat-treated colostrum, calves

223 Rumen development in dairy calves. Morgan Richard* and Cathleen C. Williams, *Louisiana State University, Baton Rouge, LA.*

At birth, a dairy calf's rumen is not yet developed physically or metabolically. Thus, the calf functions as a monogastric animal until 4 to 8 weeks of life. In order for a calf to transition to a ruminant, the rumen must be able to support fermentation. This development of the rumen is necessary for successful weaning and is primarily affected by dietary change. The rumen changes physically by increasing mass and growth of papillae. At birth, a calf's rumen is only 25% of the stomach capacity, but a mature cow's rumen can compose up to 80% of its stomach. The physical stimulation of feed in the rumen can cause increases in rumen weight and muscular development. However, physical bulk alone has not been proven to promote papillary development. When calves drink milk they stimulate the opening of the esophageal groove. This closure keeps milk from entering the reticulo-rumen and prevents fermentation in the rumen. Calves should be given free choice water to produce the liquid environment needed for microbial growth. Besides liquid and muscular

action, the ingredients needed in rumen development consist of bacteria, absorptive ability of the tissue and substrate. A newborn calf has a sterile rumen, but by 2 d after birth microbes are colonized. These microbes influence growth and development. The earlier dry feed and forage is given to calves, the earlier microbial development occurs. Higher rumen metabolic activity and increased Volatile Fatty Acid concentrations are a direct reflection of the nutrient substrate required for rumen microbes. The fermentation end products of butyrate and propionate are responsible for the growth of ruminal papillae. In conclusion, early consumption of dry feed develops the calf rumen physically and metabolically by promoting growth of rumen epithelium and mobility.

Key Words: dairy calves, rumen development

224 The effect of automated calf feeders on calf welfare. Kelly H. Leatherman*, David R. Winston, and Robert E. James, *Virginia Tech, Blacksburg, VA.*

The dairy calf usually spends its first 6 to 8 weeks in individual pens. The reasons for this practice are to provide individual calf care and to prevent disease. However, there is a push from consumers to consider the welfare of dairy calves by moving away from individually housed, limit fed calves to a system of group housed calves fed ad libitum. The inclusion of an automated calf feeder into a farm's calf rearing program would, if managed correctly, provide the opportunity to increase the overall welfare of dairy calves. Group housed calves tend to be more relaxed when introduced to new situations and are quieter during the weaning process as opposed to their individually housed counterparts (Vieira et al., 2010). By using automated calf feeding systems, calf growers can offer more milk, more often to calves. Calves on automated calf feeders with an ad libitum milk feeding program consume up to 10 kg of milk per day (Jensen and Weary, 2002) which is similar to how a calf would nurse if left with the cow. Calf growing programs that incorporate an automated calf feeder can greatly increase the welfare of pre-weaned calves though increased nutrition and reduced stress.

Key Words: automatic calf feeder, calf management

225 Effectiveness of DHIA herd testing frequency on management decisions and dairy herd performance. Lauren E. G. Clemency*, Kasimu Ingawa, Steven Washburn, John Clay, and Shannon Davidson, *North Carolina State University, Raleigh, NC.*

Statistical analyses indicate that more data points usually improve the reliability of results; hence the objective of this study is to test the hypothesis that higher testing frequency of a dairy herd by Dairy Herd Improvement Associations (DHIA) affects management decisions and herd performance. Higher frequency of DHIA testing provides more information that can be used to make management decisions, thereby enhancing the decision making process; consequently, resulting in improved dairy herd performance. DHIAs are a farmer-owned organizations originating in 1905 as Newaygo Dairy Testing Association, the first Cow Testing Association (CTA) in the US; it assumed its current name, Dairy Herd Improvement Association in 1927. Throughout its more than 100-year history, the core focus of DHIA has not changed from being the means for dairy cattle genetics improvement in the United States. Basically, dairy farm data are periodically collected on each cow and processed into reports which dairy farmers use to manage their herds. Such records include milk and fat weights, percent butterfat, milk fat price, reproduction parameters, weights of different roughages and grains fed, etc. Values of performance variables are computed to determine periodic profits or losses for each cow in the herd. The National DHIA reports a declining trend in DHIA dairy herd testing participation in the last 11 years; in 2004, about 25,077 dairy herds were on test compared with 17,875 as of 1/1/2015. However, number of dairy cows on DHIA test increased during the same period which indicates shrinking number of dairy farms but an increase in dairy farm size. The report also indicates the Holstein breed to be the predominant breed of DHIA testing. A preliminary study by Minnesota DHIA indicated a production increase resulted from a higher frequency of DHIA dairy herd testing, however, variation due to management approach was not considered. In this study, higher frequency of dairy herd DHIA testing resulted in more valuable herd management information and that management approach should be considered when analyzing how the information should be used to manage dairy herds.

Key Words: DHIA, testing, reports

226 Hyperkeratosis: A costly consequence of milking equipment. Kayla J. Alward* and Jillian F. Bohlen, *University of Georgia, Athens, GA.*

Milking a cow causes stress to the teats and damage that is normal, but that can become severe due to variations in cow genetics, management, and equipment. Problems with the teats can be assessed through teat conditioning and may be the result of regular milking or faulty equipment. One alteration of the teat due to milking is hyperkeratosis, which is a thickening of the skin that lines the teat canal, characterized by excessive keratin growth. This excessive growth leaves an area for bacteria to hide and breed, which cannot be sanitized, and increases the risk of mastitis or intramammary infections (IMIs). The severity of the hyperkeratosis is drastically increased due to milking equipment factors. Duration of milking or over-milking, milk flow rate, liner closed phase, vacuum level and the amount of time the cups are on the teats all contribute to hyperkeratosis. The total time that the milk flow rate is less than 1.0 kg/min per day is the main contributing factor to hyperkeratosis severity. Faulty milking equipment has the potential to further exacerbate issues with hyperkeratosis by exposing the teat end to a higher number of bacteria than normal. Once present, these IMIs decrease producer profits by reducing total milk production, increasing somatic cell counts, treatments, cull rates, and milk lost due to treated cows. Although average somatic cell count (SCC) has fallen in herds over the past 20 year, national estimates still cite a to $300 per cow per year loss to elevated SCC. Comprehensive teat assessment and milking equipment checks are an effective way to help minimize incidences of hyperkeratosis. Understanding how and when to do both may help producers to reduce profit loss to IMIs as a result of hyperkeratosis due to milking equipment.

Key Words: hyperkeratosis, milking equipment, mastitis