

INTERPRETIVE SUMMARIES, SEPTEMBER 2020

Invited review: Maintaining and growing fluid milk consumption by children in school lunch programs in the United States. *By Sipple et al., page 7639.* Establishing childhood milk consumption is critical. The decline in milk consumption by children raises long-term nutrition and health concerns. This review describes current school lunch regulations and intrinsic and extrinsic aspects of fluid milk that affect child liking of fluid milk.
<https://doi.org/10.3168/jds.2020-18216>.

The potential risks of paclobutrazol residue on yogurt fermentation from the level of chiral enantiomers. *By Guo et al., page 7682.* The potential risks of paclobutrazol residue on the yogurt fermentation process from the level of chiral enantiomers were investigated. We combined high-throughput sequencing technology and pesticide residue analysis to investigate the selective degradation behavior of paclobutrazol during yogurt fermentation and evaluated the influence of paclobutrazol on microbial community composition in fermentation systems.
<https://doi.org/10.3168/jds.2019-17988>.

Effect of gestational age (preterm or full term) on lipid composition of the milk fat globule and its membrane in human colostrum. *By Pérez-Gálvez et al., page 7742.* Human colostrum is the first milk secreted by the mother after birth and constitutes the ideal food for the newborn. Given the key role played by the polar lipids (phospho- and sphingolipids) of the milk fat globule membrane in the immune system and cognitive development of the newborn, it is worthwhile to analyze whether their content and distribution are affected by gestation period. Therefore, this study aimed to determine the neutral and polar lipid compositions of human colostrum samples from preterm and full-term mothers.
<https://doi.org/10.3168/jds.2020-18428>.

Short communication: Dietary bovine milk-derived exosomes improve bone health in an osteoporosis-induced mouse model. *By Yun et al., page 7752.* Osteoporosis is the most common degenerative disease in advanced countries. As the elderly population increases, the peak bone mass acquired during youth, nutritional status, and medications can significantly affect the incidence and severity of osteoporosis. Because degenerative diseases decrease quality of life, prevention through proper exercise and nutrition is important. This study showed that milk-derived extracellular vesicles play a beneficial role in suppressing osteoclast differentiation and improved bone health in osteoporotic mice. The relationship between milk and osteoporosis is still controversial. This study suggests

that milk-derived extracellular vesicles can contribute to reducing social and medical costs by preventing osteoporosis.
<https://doi.org/10.3168/jds.2019-17501>.

Effect of frozen and refrigerated storage on proteolysis and physicochemical properties of high-moisture citric mozzarella cheese. *By Ali-novi et al., page 7775.* High-moisture mozzarella is one of the most-exported Italian cheeses worldwide. As it is usually consumed fresh, its quality is largely affected by storage. Frozen storage (up to 4 mo) was assessed as a method to prolong mozzarella storability and convenience. During frozen storage, residual proteolysis was observed; during an 8-d refrigerated storage after thawing, frozen-stored cheeses showed an increased rate of proteolysis compared with the fresh cheeses. After frozen storage, oxidized and bitter tastes were observed.
<https://doi.org/10.3168/jds.2020-18396>.

Sensitive immunoassays based on a monoclonal antibody for detection of marbofloxacin in milk. *By Luo et al., page 7791.* In this work, 4 monoclonal antibodies (M4E3, M7A6, M3C7, and M5C6) were prepared. The indirect competitive enzyme-linked immunosorbent assay we performed revealed that the monoclonal antibody M4E3 exhibited the highest sensitivity for detection of marbofloxacin. Based on M4E3, an indirect competitive enzyme-linked immunosorbent assay was developed for the quantitative detection of marbofloxacin in milk, whereas a colloidal gold-based immunochromatographic assay was established for the semiquantitative detection of marbofloxacin in milk.
<https://doi.org/10.3168/jds.2019-18108>.

Quantification of the *kokumi* peptide, γ -glutamyl-valyl-glycine, in cheese: Comparison between cheese made from cow and ewe milk. *By Kuroda et al., page 7801.* Contents of the *kokumi* peptide, a peptide with a flavor-modifying effect, γ -glutamyl-valyl-glycine (γ -Glu-Val-Gly), were quantified in cheese from cow and sheep milk. The γ -Glu-Val-Gly was present only in cheese from sheep milk and not from cow milk. The reason for this seems to be that sheep caseins include the Val-Gly sequence, which is presumed to be a precursor of γ -Glu-Val-Gly, but cow caseins do not. This is the first report to indicate the existence of γ -Glu-Val-Gly in dairy products and to show that the difference of the contents is due to the difference of the amino acid sequence of milk proteins.
<https://doi.org/10.3168/jds.2020-18512>.

Short communication: Effect of purple corn pigment on change of anthocyanin composition and unsaturated fatty acids during milk stor-

age. By Tian et al., page 7808. Unsaturated fatty acids in milk contribute to its rapid deterioration and the development of rancidity during storage. Anthocyanin is a powerful scavenger of superoxide radicals, which can effectively prevent the oxidation reaction. Supplementation of milk with anthocyanins from purple corn pigment could maintain unsaturated fatty acid levels during storage, and various stronger positive correlations between anthocyanins and unsaturated fatty acids were found.
<https://doi.org/10.3168/jds.2020-18409>.

Dual-mode immunoassay system based on glucose oxidase-triggered Fenton reaction for qualitative and quantitative detection of danofloxacin in milk. By Wang et al., page 7826. In this work, streptavidin-linked biotinylated anti-danofloxacin (DAN)-monoclonal antibody (SA-Bio-mAb) and biotinylated glucose oxidase (Bio-GOx) form the immune complex mAb-Bio-SA-Bio-GOx. The Fenton reaction between H₂O₂ and Fe₂⁺ could generate hydroxyl radicals, which oxidize the *o*-phenylenediamine to 2,3-diaminophenazine. A dual-signal immunoassay with colorimetry and fluorescence as the signal readout was established. The proposed enzyme-linked immunosorbent assay (ELISA) of the fluorescence immunoassay sensitivity for the detection of DAN was 5.24-fold lower than that of traditional ELISA. The colorimetric immunoassay cut-off value was 30 ng/mL in milk. This work provides an improved screening strategy with high sensitivity and accuracy for the qualitative or quantitative detection of DAN in milk monitoring.
<https://doi.org/10.3168/jds.2020-18256>.

Integrated metabonomic-proteomic analysis reveals the effect of glucose stress on metabolic adaptation of *Lactococcus lactis* ssp. *lactis* CICC23200. By Qi et al., page 7834. *Lactococcus lactis* strains are widely used in food preservation and the dairy industry. Given the prevailing environment in the fermentation industry, *L. lactis* might encounter local high-sugar stress; however, the molecular mechanisms underlying the proteomics and metabolism remain unclear. This research will advance our understanding of the mechanisms underlying the metabolic adaptation of *L. lactis* to higher levels of glucose. Moreover, the study data support the potential possibilities for the reduced formation of biogenic amines in improved sugar parameters in the dairy fermentation industry.
<https://doi.org/10.3168/jds.2019-17810>.

***Lactobacillus gasseri* JM1 with potential probiotic characteristics alleviates inflammatory response by activating the PI3K/Akt signaling pathway in vitro.** By Sun et al., page 7851. *Lactobacillus gasseri*, a well-characterized species, has the ability to confer beneficial effects to the host. In this

study, we investigated probiotic properties of *L. gasseri* JM1 using biochemical and genomic technologies. We found that the strain could alleviate lipopolysaccharide-induced inflammatory response by modulating proinflammatory and anti-inflammatory cytokines. To our knowledge, this is the first report that the PI3K/Akt pathway is activated by *L. gasseri* and involved in immunomodulatory effects. The significance of our work is to provide clues for the potential application of *L. gasseri* JM1, a novel strain isolated from infant feces, in functional foods.
<https://doi.org/10.3168/jds.2020-18187>.

Effect of *Pseudomonas fluorescens* proteases on the quality of Cheddar cheese. By Paludetti et al., page 7865. High levels of psychrotrophic microorganisms can negatively affect the manufacture of dairy products because they produce thermoresistant proteases that remain active in the milk after thermal treatments ($\geq 60^\circ\text{C}$). Further investigations are necessary to determine the dynamics of those proteases when subjected to different processing conditions. Cheese products can vary greatly in relation to their manufacture and physicochemical properties (e.g., pH), which can determine activity of proteases. Cheese production has been increasing considerably worldwide, and studies in this area could aid manufacturers in improving cheese quality.
<https://doi.org/10.3168/jds.2019-18043>.

A novel fluorometric aptasensor based on carbon nanocomposite for sensitive detection of *Escherichia coli* O157:H7 in milk. By Yang et al., page 7879. We fabricated magnetic carbon nanotubes without irritating and corrosive reagents for the first time. An improved sensing platform of an aptasensor between nanocomposite and DNA aptamer was applied for detection of *Escherichia coli* O157:H7 in milk. The results show that this developed assay is a new possibility for effective synthesis of nanocomposites and sensitive tests of *E. coli* O157:H7 in the dairy industry.
<https://doi.org/10.3168/jds.2020-18344>.

Stability assessment and improvement of a *Lactobacillus plantarum* mutant with low post-fermentation acidification characteristics. By Chuah and Mao, page 7898. Low postfermentation acidification during storage is a desired characteristic of starter cultures or probiotics for the dairy industry. We identified that the low postfermentation acidification phenotype of a *Lactobacillus plantarum* strain was caused by a single nucleotide mutation in the highly conserved region of adenosine triphosphatase. The low postfermentation acidification phenotype, however, was lost due to a back mutation during passaging. Its stability was significantly improved by supplementing potassium phosphate buffer to the growth medium. Additionally,

it was demonstrated that application of this mutant in a fermented dairy product resulted in less change in acidity during storage at ambient temperature. <https://doi.org/10.3168/jds.2020-18285>.

Minor acidification of diafiltration water using various acidification agents affects the composition and rennet coagulation properties of the resulting microfiltration casein concentrate. *By Gaber et al., page 7927.* Using concentrated milk with increased protein content is becoming common in the cheese industry for its economic sustainability. However, an increased protein concentration in milk is associated with an increased colloidal mineral content. This relative excess in minerals may cause textural defects in the produced cheese. The objective of this study was to examine a possible method to slightly reduce the mineral content by pH adjustments during the processing of high-protein milk. Different types of acidifying agents were used during processing, and their influence on the content of protein, minerals, and coagulation properties of the high-protein milk was assessed. <https://doi.org/10.3168/jds.2020-18237>.

Production of highly purified fractions of α -lactalbumin and β -lactoglobulin from cheese whey using high hydrostatic pressure. *By Marciniak et al., page 7939.* Cheese whey contains the valuable proteins α -lactalbumin and β -lactoglobulin, but selective fractionation of these 2 proteins into pure fractions is challenging because of their similar molecular weights. High hydrostatic pressure has been suggested as a means to specifically induce changes in β -lactoglobulin conformation in acidified cheese whey that allows production of highly purified fractions of α -lactalbumin and β -lactoglobulin. <https://doi.org/10.3168/jds.2019-17817>.

Short communication: Dietary protein restriction and conjugated linoleic acid supplementation in dairy cows affect milk composition, the cheese-making process, and cheese quality. *By Bittante et al., page 7951.* Lowering dietary crude protein, with the aim of reducing the environmental impact of dairy farming, causes a modest decrease in milk protein and casein content, a correlated increase in the cheese fat:protein ratio, and especially a reduction in the cheese maturation index, raising questions about its causes and the final sensory profile of the cheese. The addition of conjugated linoleic acid to the cows' diet, which can be done to improve the nutritional quality of the final dairy products, causes much greater and unfavorable modifications to milk composition, cheese-making ability, and cheese quality and needs to be carefully evaluated. <https://doi.org/10.3168/jds.2019-17847>.

Evaluation of the synergistic olfactory effects of diacetyl, acetaldehyde, and acetoin in a yogurt matrix using odor threshold, aroma intensity, and electronic nose analyses. *By Tian et al., page 7957.* Diacetyl, acetaldehyde, and acetoin have been widely recognized as the key aroma compounds in yogurt, but their synergistic effects and optimum concentration ranges remain unclear. In this study, the odor threshold values and optimum concentration ranges of diacetyl, acetaldehyde, and acetoin were determined in a yogurt matrix. Furthermore, the synergistic effects of these 3 compounds were evaluated using Feller's additive model and the σ - τ plot method and verified by electronic nose analysis. The phenomenon of synergism among these 3 compounds provides theoretical support for the improvement of flavor in yogurt. <https://doi.org/10.3168/jds.2019-17495>.

Between-cow variation in the components of feed efficiency. *By Guinguina et al., page 7968.* Data from respiration chamber studies were used to evaluate between-cow variations in the components of feed efficiency as well as the associations among these components. The between-cow coefficient of variation in gross energy intake was the greatest and the most repeatable. Between-cow variations in methane yield, energy digestibility, and metabolizability were rather small and only moderately repeatable. Genetic selection of cows emitting low levels of methane could lead to the unintended selection of animals with lower digestibility. However, the selection of dairy cows with high efficiency of metabolizable energy use for lactation may be an effective approach to lowering enteric methane emissions. <https://doi.org/10.3168/jds.2020-18257>.

The effects of energy metabolism variables on feed efficiency in respiration chamber studies with lactating dairy cows. *By Guinguina et al., page 7983.* This study provided evidence from respiration chambers showing the mechanisms that contribute to differences in feed efficiency of lactating dairy cows. Our results indicate that differences in metabolizability and the efficiency of metabolizable energy use for lactation are responsible for a major part of the variation in feed efficiency among cows. Improved feed efficiency contributed to most of the differences among methane intensity (g/kg of energy-corrected milk) in cows but had little or no effect on methane yield (g/kg of dry matter intake). These findings suggest that improving feed efficiency is a sustainable way to reduce methane emission per unit of product and to enhance dairy profitability. <https://doi.org/10.3168/jds.2020-18259>.

Effect of heat-treated canola meal and glycerol inclusion on performance and gastrointestinal development of Holstein calves. *By Burakowska et al., page 7998.* Canola meal is a protein source that is not commonly fed to dairy calves. Twenty-eight bull calves were fed a pelleted starter mixture containing either untreated or heat-treated canola meal, with or without inclusion of glycerol until weaning. We observed that feeding calves starters with heat-treated canola meal may negatively affect growth and the development of the gastrointestinal tract and that starter mixture with glycerol may promote growth and stimulate the development of the gastrointestinal tract.
<https://doi.org/10.3168/jds.2019-18133>.

Evaluation of fecal fermentation profile and bacterial community in organically fed dairy cows consuming forage-rich diets with different particle sizes. *By Castillo-Lopez et al., page 8020.* Organically fed lactating Holstein cows were used to evaluate the effects of reducing conventional particle size of hay and clover-grass silage in a TMR on both the fecal fermentation profile and the fecal microbiota. The concentration of total short-chain fatty acids was not affected. However, propionate, a key glucogenic precursor, tended to increase with particle size reduction. Bacterial α -diversity remained unaffected by forage particle size reduction, but relative abundance of *Lachnospiraceae* and *Ruminobacter* increased when particle size was reduced. Reducing forage particle size may contribute to optimization of forages without negatively affecting fecal fermentation and bacterial diversity.
<https://doi.org/10.3168/jds.2019-18036>.

Substitution of wheat straw with sugarcane bagasse in low-forage diets fed to mid-lactation dairy cows: Milk production, digestibility, and chewing behavior. *By Molavian et al., page 8034.* The effects of replacing increasing proportions of wheat straw with sugarcane bagasse on the performance of mid-lactation Holstein dairy cows fed low-forage diets were investigated. Feeding sugarcane bagasse decreased nutrient digestibility, but across all treatments cows had similar dry matter intake and milk yield. Sugarcane bagasse can be used as an alternative fiber source to partially replace wheat straw in dairy cow diets without negative effects on milk production.
<https://doi.org/10.3168/jds.2020-18499>.

Milk production, methane emissions, nitrogen, and energy balance of cows fed diets based on different forage systems. *By Gison et al., page 8048.* This study determined the milk production, digestibility, and methane emissions of cows fed diets characterized by different forages. The dietary forage did not affect milk production or methane production

per kilogram of milk or per kilogram of dry matter intake. Digestibility was lower for a hay-based diet, which was characterized by a lower energy value. The use of high-quality grass silages can reduce the amount of purchased feeds, such as soybean meal, and can increase the overall environmental sustainability of dairy farms.
<https://doi.org/10.3168/jds.2019-18134>.

Tall fescue as an alternative to timothy fed with or without alfalfa to dairy cows. *By Richard et al., page 8062.* We assessed the effects on the lactation performance of dairy cows of (1) feeding tall fescue or timothy silage, in combination or not with alfalfa silage, and (2) feeding tall fescue as silage or haylage. Feeding tall fescue or timothy silage, either as the sole forage in the diet or in combination with alfalfa, did not influence the milking performance of cows. Adding alfalfa to either tall fescue or timothy silage in the diet increased dry matter intake and milk yield and reduced milk fat concentration. Feeding tall fescue as silage resulted in higher dry matter intake but similar milk yield compared with when it was fed as haylage.
<https://doi.org/10.3168/jds.2019-18120>.

3-Nitrooxypropanol decreases methane emissions and increases hydrogen emissions of early lactation dairy cows, with associated changes in nutrient digestibility and energy metabolism. *By van Gastelen et al., page 8074.* Methane emissions from dairy cattle contribute to global warming. This study investigated the methane-mitigation potential of the feed additive 3-nitrooxypropanol and its persistence when fed to dairy cows in early lactation. Results showed that 3-nitrooxypropanol decreased methane emissions, increased apparent total-tract digestibility of nutrients, and decreased body weight loss. These results indicate that 3-nitrooxypropanol is an effective strategy to decrease methane emissions with energetically positive effects on Holstein-Friesian cows in early lactation.
<https://doi.org/10.3168/jds.2019-17936>.

Relationships between milk fat and rumination time recorded by commercial rumination sensing systems. *By Andreen et al., page 8094.* Highly fermentable diets make cows vulnerable to hard-to-detect digestive conditions that decrease milk fat, a major contributor to milk value in many regions. Rumination or cud-chewing is an important part of ruminal digestive processes, and changes in the time spent ruminating could indicate a cow is experiencing altered rumen fermentation. In the present study, rumination and milk fat data were collected from 2 dairy farms over a 1-yr period. A weak, negative linear relationship was found between time spent ruminating and milk fat in 1 of the 2 farms. However, the relationship does not

appear to be strong enough to accurately identify cows experiencing low milk fat due to digestive issues.
<https://doi.org/10.3168/jds.2019-17900>.

Effect of toasting and decortication of oat on rumen biohydrogenation and intestinal digestibility of fatty acids in dairy cows. *By Lashkari et al., page 8105.* Decortication of oat was tested to increase fatty acid supply in dairy cows, and toasting was tested to increase the supply of unsaturated fatty acids to the small intestine. The daily intake of fatty acids increased from decortication, mainly because it removes the diluting effect of the hull, but toasting reduced fatty acid intake as a consequence of the decreased concentrations of C18:2n-6 and C18:3n-3 fatty acids. Toasting increased the proportion of unsaturated fatty acids in the duodenal fatty acid flow due to a protection of unsaturated fatty acids from ruminal biohydrogenation, but the observed significant decline in total fatty acid concentration makes toasting inapplicable as a processing tool for oat.
<https://doi.org/10.3168/jds.2019-18125>.

Dietary supplementation with oregano essential oil and monensin in combination is antagonistic to growth performance of yearling Holstein bulls. *By Wu et al., page 8119.* Oregano essential oil extract exhibits antimicrobial activities that can be used as an alternative to antibiotics and growth promoters. Young Holstein bulls were fed a ration supplemented without or with oregano or monensin separately or in combination for 8 mo. Substituting oregano for monensin resulted in similar body weight gains and average daily gains compared with control-fed bulls; however, oregano and monensin fed in combination were antagonistic to growth performance. Oregano and monensin should not be fed in combination.
<https://doi.org/10.3168/jds.2020-18211>.

Extended colostrum feeding for 2 weeks improves growth performance and reduces the susceptibility to diarrhea and pneumonia in neonatal Holstein dairy calves. *By Kargar et al., page 8130.* The objective of this study was to determine the effects of partial replacement of pasteurized whole milk (5 kg/d) with pasteurized colostrum at 0, 350, or 700 g/d for an extended 2 wk on the growth performance and health status of Holstein dairy calves (n = 144). Subsequently, the calves were fed 5 kg/d of pasteurized whole milk. Feeding pasteurized colostrum to calves at 700 g/d potentially improved the growth performance and health status.
<https://doi.org/10.3168/jds.2020-18355>.

Postweaning response on growth and nutrient digestion to using different weaning strategies

when feeding moderate and high amounts of milk replacer to Holstein calves. *By Klopp et al., page 8143.* Weaned dairy calves not adequately adapted to solid feed intake undergo slower postweaning growth. Thus, we evaluated postweaning responses to milk replacer (MR) amount and weaning strategies to enhance the transition from fluid to solid diet. Gradual weaning over 21 d proved effective when used to transition calves from a high (up to 1.1 kg) level of MR but was not different from a single-step 7-d weaning for calves weaned using a moderate (0.66 kg) MR regimen. Calves fed a high-MR diet benefit from a gradual weaning process that ensures successful growth and development.
<https://doi.org/10.3168/jds.2019-17704>.

Effects of supplementing Holstein cows with soybean oil compared with palmitic acid-enriched triglycerides on milk production and nutrient partitioning. *By Liu et al., page 8151.* Conjugated linoleic acids and insulin have been well recognized as key mediators in nutrient partitioning during lactation; however, the effects of the 2 have not been clearly separated. In this study, mid-lactation Holstein cows were included in a crossover experiment and fed diets supplemented with palmitic acid-enriched triglycerides or soybean oil. Production performance and energy partitioning were determined for individual cows. The diet containing soybean oil partitioned more energy toward body tissue gain instead of milk synthesis compared with the diet with palmitic acid-enriched triglycerides, suggesting that this diet decreased the efficiency of nutrient utilization in lactating dairy cows.
<https://doi.org/10.3168/jds.2019-18100>.

Distribution of seasonality of calving patterns and milk production in dairy herds across the United States. *By Ferreira et al., page 8161.* Calving and milk production follow seasonal patterns throughout the United States, but the distribution of seasonality among dairy herds is not known. Summer-to-winter ratios can be biased measures of seasonality because the dates of peak and nadir of the number of calvings and milk production do not always occur during summer and winter. Using low-to-peak ratios from sine and cosine models, we captured maximum seasonality of the calving and milk production patterns among dairy farms in 41 US states. Small herds and herds with lower milk production per cow were generally the most seasonal.
<https://doi.org/10.3168/jds.2019-18138>.

Evaluating the cost-effectiveness of diagnosing and treating phantom cows in seasonal-calving dairy herds. *By Chambers et al., page 8174.* Phantom cows are defined as cows that have been artificially inseminated, not subsequently detected in estrus, and

then diagnosed as nonpregnant on pregnancy examination. Using decision-tree analysis, we demonstrated that identifying and treating phantom cows with a progesterone-based synchrony program was economically viable under specific conditions but highly influenced by the accuracy of cow selection by the farmer and pregnancy diagnosis and the expected prevalence of phantom cows. Farmers, veterinarians, and animal health advisors can use this information to determine whether intervention is economically feasible on a given dairy farm.

<https://doi.org/10.3168/jds.2019-17352>.

Modeling variability of the lactation curves of cows in automated milking systems. *By Masía et al., page 8189.* Dairy cows milked in automatic milking systems with high daily yield and long milking intervals were identified and their frequency quantified. Lactation curves were modeled using several mixed models to include fixed effect parameters and random cow effects. A new phenotype for automatic milking systems, a combination of relatively higher milk yield with relatively longer milking interval, could allow an increase in the volumes of milk harvested through an increased number of cows milked per robot.

<https://doi.org/10.3168/jds.2019-17962>.

Net benefits of smallholder dairy cattle farms in Senegal can be significantly increased through the use of better dairy cattle breeds and improved management practices. *By Marshall et al., page 8197.* Keeping dairy cattle is important to the livelihoods of the rural poor in Senegal. Here, we compared the net benefit of different types of smallholder dairy enterprises in Senegal, which varied in terms of the breed or cross-breed type kept and the level of animal management. A key result was that the keeping of crossbred (indigenous zebu \times *Bos taurus*) dairy cattle under improved animal management was 7.4 times more net beneficial and had a 1.4-fold more favorable cost:benefit ratio than the traditional system of keeping indigenous zebu under low levels of animal management.

<https://doi.org/10.3168/jds.2019-17334>.

Economic opportunities of using crossbreeding and sexing in Holstein dairy herds. *By Pahmeyer and Britz, page 8218.* This study highlighted the possible economic gain of optimal sexed semen and sexed beef semen usage for the production of purebred and crossbred animals in German dairy herds. The results of our simulation suggest that farms could increase their profits by an average of €79.42 per cow per year by using sexed semen on heifers and beef semen on cows under current market conditions in the Federal State of North Rhine-Westphalia, Germany.

<https://doi.org/10.3168/jds.2019-17354>.

Physical and economic comparison of pasture-based automatic and conventional milking systems. *By Gargiulo et al., page 8231.* Automatic milking systems (AMS) have the potential to improve productivity and profitability in dairy farming. This study evaluated the physical and economic performance of pasture-based AMS and conventional milking system using commercial farm data. We found that the overall physical and economic performance of farms with pasture-based AMS was relatively similar to that of farms with conventional milking systems. Potential for improving labor efficiency, robot utilization, and pasture utilization on farms using AMS has been identified.

<https://doi.org/10.3168/jds.2020-18317>.

Short communication: The beef merit of the sire mated to a dairy female affects her subsequent performance. *By Berry and Ring, page 8241.* Although the proportion of dairy cow matings to beef bulls is increasing in many populations, much of the research to date has focused on the greater revenue attainable from these beef-cross calves. What has not been fully explored is the association between sire beef merit and the subsequent lactation performance of the mated dairy cow. Results for the present study highlight a small but unfavorable association of sire beef merit with both the milk production and reproductive performance of its mate.

<https://doi.org/10.3168/jds.2020-18521>.

Survival analyses in Holstein cows considering direct disease diagnoses and specific SNP marker effects. *By Shabalina et al., page 8257.* Accurate genetic longevity evaluations for young animals strongly depend on proper early available indicator traits. In this regard, we applied survival analyses for a censored–uncensored data structure and considered disease diagnoses from different lactation stages as explanatory variables for the length of productive life. For all modeling approaches, clinical mastitis was the best longevity predictor. Single single nucleotide polymorphism markers were weak longevity predictors. Genetic parameters for the length of productive life differed when including or ignoring health diagnoses from different lactation stages in statistical modeling approaches.

<https://doi.org/10.3168/jds.2020-18174>.

Nonparametric analysis of casein complex genes' epistasis and their effects on phenotypic expression of milk yield and composition in Murciano-Granadina goats. *By Pizarro et al., page 8274.* Rather than acting as single units, goat casein complex genes interact, and their interactions condition the phenotypic results that are expressed in each animal. Understanding this relationship is always challenging given the great number of additional effects

that can potentially be involved. Still, the economic value of the traits considered promotes the need to study this relationship in order to maximize goat milk profitability and satisfactorily meet market demands. Contextually, this study aimed to use a nonparametric biostatistical procedure to link genes' relationships with their phenotypic effects in order to overcome the difficulty of predicting individual mutation effects and the interactions between such mutations.
<https://doi.org/10.3168/jds.2019-17833>.

Time- and population-dependent genetic patterns underlie bovine milk somatic cell count.

By Miles and Huson, page 8292. Milk somatic cell count (SCC) is a common mastitis indicator that has historically been evaluated as a lactation-average score. Considering SCC at specific stages in lactation reflective of physiological changes in the cow reveals different genetic patterns than does a lactation-average score. In this study, by tracking SCC throughout lactation, cows were categorized as having chronic mastitis problems, being of average udder health, or being robustly healthy, and genomic regions were identified that differentiated chronic cows from all others. Variation in SCC across lactation must be considered in genomic selection strategies given the nonpathological causes of udder inflammation and the differing etiologies of mastitis.

<https://doi.org/10.3168/jds.2020-18322>.

Application of multivariate single-step SNP best linear unbiased predictor model and revised SNP list for genomic evaluation of dairy cattle in Australia.

By Konstantinov and Goddard, page 8305. The current study examined the computational feasibility and predictive ability of a multivariate single-step single nucleotide polymorphism (SNP)–best linear unbiased predictor (BLUP) model used for genetic evaluation of dairy cattle from 3 major breeds in Australia. The results showed that the model is computationally feasible, but more work is needed to improve the efficiency of the computations before practical implementation. The model increased the reliability and reduced the bias of the breeding values compared with the parent average from the traditional BLUP in all breeds studied. Two quite different genotype sets were used in this study: the 50K chip (BovineSNP50 Bead-Chip; Illumina, San Diego, CA) with 40,080 SNP and a Custom-XT SNP list with 46,516 variants expected to be enriched for causative mutations or markers in strong linkage disequilibrium with causal variants for 1 or more of the most important dairy traits. The use of the Custom-XT SNP list resulted in better predictive ability compared with the validation results with the 50K chip.

<https://doi.org/10.3168/jds.2020-18242>.

Structural and functional analysis of the signaling lymphocytic activation molecule family 7 (SLAMF7) gene in response to infection with coagulase-negative and coagulase-positive staphylococci.

By Korwin-Kossakowska et al., page 8317. We studied the potential relationship between the molecular mechanisms of alternative splicing and DNA methylation and the occurrence of mastitis—a disease with important economic and social consequences—in dairy cows. The specificity of the signaling lymphocytic activation molecule family 7 (SLAMF7) gene was especially interesting. In addition, an analysis was performed to assess the relationship between an indel polymorphism of this gene and certain production traits. The results of the analysis showed that health status is associated with the expression levels of individual variants.

<https://doi.org/10.3168/jds.2019-17398>.

Genetic parameters for noncoagulating milk, milk coagulation properties, and detailed milk composition in Swedish Red Dairy Cattle.

By Duchemin et al., page 8330. This study explored the coagulation ability of milk from Swedish Red Dairy Cattle, especially noncoagulating milk. Noncoagulating milk has a negative effect on cheese production and may reduce cheese yield. We determined the heritability of noncoagulating milk and how this trait correlates phenotypically and genetically with milk coagulation properties, milk composition, and physical traits. The aim was to increase our understanding of how noncoagulating milk could be reduced by breeding practices and thus increase the economic output for the dairy industry.

<https://doi.org/10.3168/jds.2020-18315>.

Short communication: Animal-level factors associated with whether a dairy female is mated to a dairy or beef bull.

By Berry and Ring, page 8343. The growing use of mating beef bulls to dairy females necessitates tools to guide herd-level mating programs. One decision within such tools is whether the female in question should be mated to a dairy or a beef bull. Animal-level factors associated with this decision such as cow parity, breed, genetic merit, and previous lactation yield were detected in the present study and can thus be used as default parameters in decision support tools.

<https://doi.org/10.3168/jds.2020-18179>.

Staphylococcal enterotoxin M induced inflammation and impairment of bovine mammary epithelial cells.

By Zhao et al., page 8350. *Staphylococcus aureus* is a common causative agent of bovine mastitis in dairy herds worldwide, and its invasion into mammary epithelial cells is critical in the pathogenesis

of mastitis. However, the specific pathogenic factors in *S. aureus* causing mastitis have not been clearly identified. Virulence gene profile analysis revealed the frequent occurrence of staphylococcal enterotoxin M gene in *S. aureus* isolates from subclinical or clinical mastitis in cows. In the present study, staphylococcal enterotoxin M induced inflammation and impairment of bovine mammary epithelial cells. These results suggested that staphylococcal enterotoxin M may be associated with mastitis.

<https://doi.org/10.3168/jds.2019-17444>.

Measuring behavior patterns and evaluating time-sampling methodology to characterize brush use in weaned beef cattle. *By Horvath et al., page 8360.* We characterized daily brush use patterns of weaned cattle and asked questions about how to best quantify these behaviors. Brush use varied among individuals and was more common during daylight hours than at night. We found that taking snapshots of the animals' behaviors every 1 to 3 min captured overall time spent using brushes, but continuous observation of each stop and start was the only valid approach to capture the details of brush use, including number of uses per day. The methodology used to characterize brush use in future research should be tailored to research objectives and validated.

<https://doi.org/10.3168/jds.2020-18419>.

Passive immunity and colostrum management practices on Ontario dairy farms and auction facilities: A cross-sectional study. *By Renaud et al., page 8369.* The objectives of this cross-sectional study were to determine the level of failed transfer of passive immunity (FTPI) in dairy calves across the province of Ontario and to determine colostrum management practices. Of calves sampled at auction facilities and dairy farms, 24% of had FTPI. The prevalence of FTPI on Ontario dairy farms appears to have improved since previous estimates; however, there remains substantial room for improvement.

<https://doi.org/10.3168/jds.2020-18572>.

Sodium butyrate reduces bovine mammary epithelial cell inflammatory responses induced by exogenous lipopolysaccharide, by inactivating NF- κ B signaling. *By Sun et al., page 8388.* To evaluate whether sodium butyrate alleviates lipopolysaccharide (LPS)-induced inflammatory responses in bovine mammary epithelial cells and the underlying molecular mechanisms, we studied gene expression of proinflammatory cytokines and protein expression of key molecules in the NF- κ B pathway in bovine mammary epithelial cell line MAC-T cells. We learned that sodium butyrate alleviated the inflammatory responses in MAC-T cells triggered by LPS by decreasing the abundance of proinflammatory cytokines and inactivat-

ing the NF- κ B pathway. Our results suggest potential cytoprotective effects of sodium butyrate against LPS-induced inflammatory responses in MAC-T cells.

<https://doi.org/10.3168/jds.2020-18189>.

Development and implementation of a risk assessment and management program for enzootic bovine leukosis in Atlantic Canada. *By John et al., page 8398.* In this study, we determined the current state of bovine leukemia virus (BLV) infection in dairy herds in Atlantic Canada and developed an initial risk assessment and management program workbook for dairy producers and veterinarians to help identify management practices associated with increasing numbers of BLV-positive cows within the herd. Currently, about 90% of dairy herds in Atlantic Canada are BLV-positive, and about 70% of herds have at least 25% BLV-positive cows.

<https://doi.org/10.3168/jds.2019-17434>.

Development and evaluation of 4 loop-mediated isothermal amplification assays to detect mastitis-causing bacteria in bovine milk samples. *By Griffioen et al., page 8407.* On-site tests to detect mastitis-causing bacteria in bovine milk within 24 h are limited. In this study we developed and evaluated 4 loop-mediated isothermal amplification (LAMP) assays targeting 4 mastitis-causing bacteria. Furthermore, as a step toward on-site use, we evaluated a generic nucleic acid lateral flow immunoassay for readout of LAMP assays. Compared with bacteriological culture with identification by mass spectrometry, these assays had an agreement of ≥ 0.80 on field samples, except for the *Streptococcus* spp. assay, which had moderate agreement. The evaluated LAMP assays have the potential to enable fast and reliable on-site testing of clinical mastitis milk samples.

<https://doi.org/10.3168/jds.2019-18035>.

Effects of access to stationary brushes and chopped hay on behavior and performance of individually housed dairy calves. *By Horvath et al., page 8421.* We examined the effects of providing combinations of hay and manual brushes to individually housed dairy calves on their performance and time engaged in feeding, grooming, and nonnutritive oral behaviors. Provision of brushes did not affect performance, but hay supported intake and growth during weaning. Access to a brush reduced pen-directed sucking, particularly around the time of milk delivery, and both brush and hay access reduced nonnutritive sucking on a teat. Calves provided hay used the brush less, but self-grooming was not affected by hay or brush access. These findings support benefits of increasing environmental complexity for dairy calves.

<https://doi.org/10.3168/jds.2019-18042>.

Comparison of methods for predicting cow composite somatic cell counts. *By Anglart et al., page 8433.* Somatic cells in dairy cow milk can be used to identify animals with udder health problems and reflect the quality of the milk, but it is expensive to analyze somatic cells as frequently as is desirable. We evaluated machine learning methods that could predict cow composite somatic cell counts by using data regularly recorded by automatic milking systems. We found 2 promising machine learning methods to predict the somatic cell count of individual cows' milk that could be used to facilitate udder health management in dairy farms.
<https://doi.org/10.3168/jds.2020-18320>.

Effects of postpartum acetylsalicylic acid on metabolic status, health, and production in lactating dairy cattle. *By Barragan et al., page 8443.* The first weeks before and after calving are one of the most challenging periods for dairy cows. Anti-inflammatory treatment may improve animal welfare and productivity. The objective was to assess the effects of a preventive strategy with acetylsalicylic acid (ASA) on biomarkers of metabolic stress, milk production, and rumination in dairy cows after calving. Cows treated with ASA had lower metabolic stress compared with untreated cows, and cows in second or greater lactation tended to produce more milk during the first 60 d after calving. Results suggest that an applied ASA treatment after calving may improve production and metabolic status of cows.
<https://doi.org/10.3168/jds.2019-17966>.

Clinical presentation and immune characteristics in first-lactation Holstein-Friesian cows following intramammary infection with genotypically distinct *Staphylococcus aureus* strains. *By Niedziela et al., page 8453.* This study demonstrates the influence of different strains of *Staphylococcus aureus* on the outcome of intramammary infection. *Staphylococcus aureus* is one of the main causes of mastitis in Ireland and worldwide. Two distinct strains of *Staph. aureus* were used to infect first-lactation Holstein-Friesian cows. One strain was found to induce predominantly clinical mastitis, whereas the other induced mild and subclinical mastitis. Information regarding the infecting *Staph. aureus* strain or genotype may thus influence treatment and culling decisions in the future.
<https://doi.org/10.3168/jds.2019-17433>.

Distinct responses in feed sorting, chewing behavior, and ruminal acidosis risk between primiparous and multiparous Simmental cows fed diets differing in forage and starch levels. *By Stauder et al., page 8467.* Feeding cows diets low in forages and high in starch has negative effects on rumen health. This study showed that primiparous cows were

more responsive than multiparous cows to such diets, as they increased the sorting for longer and against fine particles and increased chewing indices. Despite these adaptations, primiparous cows had a higher incidence of subacute ruminal acidosis compared with multiparous cows. The study suggests higher forage fiber requirements for primiparous cows to maintain ruminal health and lower the risk of ruminal acidosis.
<https://doi.org/10.3168/jds.2019-17760>.

Effects of employer management on employee recruitment, satisfaction, engagement, and retention on large US dairy farms. *By Moore et al., page 8482.* Adoption of human resource management practices varies widely across dairy farms. Previous research characterizing nonagricultural employment revealed that employee motivation can be affected by management. Similarly, our findings indicate that employee satisfaction, intention to remain in their current employment, and willingness to recommend their place of work to other workers are highly related to employees' perception of how well farm employers have adopted basic human resource management principles. Management practices that affect employee-employer relationships and employee teamwork on the farm are especially important. Ethnicity and gender affect how frequently employees are willing to share ideas with farm employers.
<https://doi.org/10.3168/jds.2019-18025>.

The effect of milk feeding strategy and restriction of meal patterning on behavior, solid feed intake, and growth performance of male dairy calves fed via computer-controlled milk feeders. *By Jensen et al., page 8494.* A high milk allowance followed by a subsequent reduction is recommended, whereas relaxed restriction of meal frequency on computer-controlled milk feeders allows milk meal patterning resembling natural suckling, which may stimulate solid food intake. We investigated the effects of step-down milk feeding and relaxed restriction on milk meal frequency in male dairy calves on computer-controlled milk feeders. Only among flat-rate-fed calves did a relaxed milk meal frequency restriction stimulate feeding and increase average daily gain postweaning. Although both step-down and relaxed restriction may help calves transition from milk to solids before weaning, they should not be combined when the total milk allowance is low.
<https://doi.org/10.3168/jds.2020-18166>.

Youth and adult public views of dairy calf housing options. *By Perttu et al., page 8507.* The general public influences livestock production through consumer purchasing decisions and legislation; hence, public concerns about animal welfare are of increasing interest. A mixed-method survey was used to

investigate preferences for, and acceptance of, dairy calf housing options in youth and adults, respectively. Youth overwhelmingly preferred group housing of dairy calves, and adults likewise showed highest acceptance for group calf housing compared with individual or pair housing. Preferences and acceptance were driven by perceptions of increased space allowance and opportunity for calves to socialize, suggesting that public desire for naturalness in dairy farming may start at an early age.

<https://doi.org/10.3168/jds.2019-17727>.

Behavioral changes in calves 11 days after caudary disbudding: Effect of local anesthesia. *By Adcock et al., page 8518.* It is well understood that hot-iron disbudding is painful for calves, but less is known about how long this pain lasts. To test whether calves experience pain 11 d after the procedure, we compared the behavior of calves administered cornual nerve injections with lidocaine or saline. Calves with no pain relief shook their head and flicked their ears more than those with lidocaine and were less likely to rub their heads on other surfaces for the first 50 min after the injections. We conclude that lidocaine reduced head movements and made calves less protective of their wounds, suggesting that calves experience ongoing pain in the weeks after disbudding.

<https://doi.org/10.3168/jds.2020-18337>.

Short communication: Condition of male dairy calves at auction markets. *By Wilson et al., page 8530.* Young male calves that are marketed from dairy farms are vulnerable to health and welfare problems. We found that 20% of male dairy calves at a Canadian auction had at least 1 health abnormality, and 10.5% were of little or no commercial value. Calves with a bright and alert attitude, beef genetics, and a heavier body weight sold for higher prices. These results underline the need for solutions to prevent the marketing of male dairy calves that are in poor condition.

<https://doi.org/10.3168/jds.2019-17860>.

Technical note: Calving prediction in dairy cattle based on continuous measurements of ventral tail base skin temperature using supervised machine learning. *By Higaki et al., page 8535.* A calving prediction model was developed based on 15 features extracted from sensing data of ventral tail base skin temperature and 1 non-sensor-based variable (days to expected calving date) through a support vector machine. The model predicted calving within the next 24 h with a sensitivity of ~80% and precision of ~70% in 2 dairy farms with distinct cattle management practices, indicating that this methodology has the potential to effectively and robustly predict calving in dairy cattle.

<https://doi.org/10.3168/jds.2019-17689>.

Estimation of maximum thermo-hygrometric index thresholds affecting milk production in Italian Brown Swiss cattle. *By Maggiolino et al., page 8541.* This paper shows the daily maximum temperature-humidity index (THI) thresholds and weighted average THI thresholds for each parity class, beyond which milk production patterns tend to decline in Italian Brown Swiss cows. Results revealed that normalized milk yield patterns, as well as milk components and cheese yield predictive values, are affected by THI values 2 to 3 points higher than what is reported in Holstein cattle. Protein yield proved to be the trait most sensitive to heat stress, with a lower THI threshold relative to other traits. This is a relevant aspect for a breed that produces milk with high cheese-making utility.

<https://doi.org/10.3168/jds.2020-18622>.

In vitro effects of conjugated linoleic acid (CLA) on inflammatory functions of bovine monocytes. *By Ávila et al., page 8554.* We provide a demonstration that conjugated linoleic acid (CLA) may have important roles in modulating some in vitro monocyte immune functions. Only CLA mixture (50:50) exerts antiapoptotic activity and can increase production of reactive oxygen species in an inflammatory in vitro model, suggesting that the effects of each CLA isomer are different, and in combination, synergic effects are induced.

<https://doi.org/10.3168/jds.2020-18659>.

The effect of parity number on the metabolism, inflammation, and oxidative status of dairy sheep during the transition period. *By Cabiddu et al., page 8564.* Just as in dairy cows, the transition period in dairy sheep is a critical phase. Therefore, the aim of this study was to evaluate the effects of parity on the performance, metabolic profile, and inflammation and stress biomarkers of periparturient dairy sheep. Higher body weights, standard milk yields, and levels of milk protein, fat, and casein were detected in multiparous sheep. At the same time, multiparous sheep had lower levels of energy metabolism biomarkers and inflammation parameters compared with primiparous sheep. Overall, these findings point to a different metabolic adaptation response after lambing between primiparous and multiparous ewes.

<https://doi.org/10.3168/jds.2019-18114>.

Effect of heat stress during the early and late dry period on mammary gland development of Holstein dairy cattle. *By Fabris et al., page 8576.* Cows exposed to high temperature and humidity have increased rectal temperature and respiration rate. It is well known that heat stress during the dry period reduces milk yield in the next lactation and affects

profitability of dairy farmers. A recent study reported that if cows are exposed to heat stress at any point during the dry period, milk yield is compromised in the subsequent lactation. The mechanism through which heat stress reduces milk yield during either the early or late dry period is unknown. Here we provide evidence on the effect of heat stress during the early and late dry period on mammary gland development of Holstein dairy cows.
<https://doi.org/10.3168/jds.2019-17911>.

Methods for assessing heat stress in preweaned dairy calves exposed to chronic heat stress or continuous cooling. *By Dado-Senn et al., page 8587.* Dairy calves are more thermotolerant than mature cows but can still experience heat stress. Literature on methods to assess chronic heat stress in calves is scarce. Herein, we demonstrate that skin temperature measurements at the ear, neck, or rump are appropriate methods of estimating heat stress and that temperature-humidity index is the best environmental indicator of heat stress in dairy calves exposed to chronic hyperthermia. Further, we demonstrate that heat abatement should be initiated when the temperature-humidity index reaches values ranging from 65 to 69 to prevent heat stress-related impairments in calves raised in a shaded subtropical environment.
<https://doi.org/10.3168/jds.2020-18381>.

The effect of chronic, mild heat stress on metabolic changes of nutrition and adaptations in rumen papillae of lactating dairy cows. *By Eslamizad et al., page 8601.* Heat stress affects feed intake, intestinal integrity, and absorption, but its effects on the rumen have not yet been investigated. We studied the feeding behavior and the mRNA expression of ruminal tight junction proteins and analyzed the rumen papillae proteome of heat-stressed and pair-fed dairy cows. Results indicate that heat stress does not compromise barrier function and inflammatory responses in the rumen epithelium, likely due to adaptations in feed intake behavior and defense mechanisms at the tissue level.
<https://doi.org/10.3168/jds.2020-18417>.

Early supplementation of *Saccharomyces cerevisiae boulardii* CNCM I-1079 in newborn dairy calves increases IgA production in the intestine at 1 week of age. *By Villot et al., page 8615.* The growing pressure to limit the use of prophylactic antimicrobials has encouraged multidisciplinary approaches to improve gut health in calves and enhance options available to the dairy industry. This study demonstrated that 1-wk-old calves are already capable of developing immunity and that supplementation from birth with live yeast *Saccharomyces cerevisiae boulardii* CNCM I-1079 could contribute to enhanced immune function by stimulating intestinal production of immu-

noglobulin A and shape microbiota colonization toward a beneficial microbial ecosystem for gut health.
<https://doi.org/10.3168/jds.2020-18274>.

Effect of colostrum feeding strategies on the expression of neuroendocrine genes and active gut mucosa-attached bacterial populations in neonatal calves. *By Hromádková et al., page 8629.* The neuroendocrine system is important in the systemic regulation of metabolism and immunity. However, our understanding of the effect of colostrum feeding on the neuroendocrine system in dairy calves is limited. This study revealed that extended colostrum feeding during 72 h after birth upregulated the expression of α -adrenergic and serotonin receptor genes and increased the abundance of *Lactobacillus* spp. and *Escherichia coli* in the gut. Additionally, there were positive correlations between gut bacteria abundance and expression of serotonin receptors, suggesting that colostrum feeding strategies may affect the interaction between gut microbiota and neuroendocrine functions in calves.
<https://doi.org/10.3168/jds.2019-17710>.

Effects of fatty acids on inducing endoplasmic reticulum stress in bovine mammary epithelial cells. *By Sharmin et al., page 8643.* The present study evaluated the ability of fatty acids to induce endoplasmic reticulum stress in bovine mammary epithelial cells. Saturated long-chain fatty acids increase C/EBP homologous protein (CHOP; proapoptotic marker) expression compared with unsaturated ones. Among short- and medium-chain fatty acids, acetic and propionic acids in particular reduce CHOP expression in bovine mammary epithelial cells. These results indicate that more than the beneficial effect exerted by acetic and propionic acids, saturated fatty acids can cause severe endoplasmic reticulum stress compared with unsaturated fatty acids.
<https://doi.org/10.3168/jds.2019-18080>.

Technical note: Evaluation of a colorimetric point-of-care test for measuring urine ammonium concentration in periparturient dairy cattle. *By Megahed and Constable et al., page 8655.* The main objective of this study was to evaluate the analytical performance of a colorimetric point-of-care test (MCol-ortest, Merck KGaA, Billerica, MA) for measuring urine ammonium ion concentration ($[\text{NH}_4^+]$) in periparturient dairy cattle. We found that the colorimetric test provided an accurate, low-cost, and practical method for measuring urine $[\text{NH}_4^+]$ in dairy cattle.
<https://doi.org/10.3168/jds.2020-18534>.

Fertility and 305-day production of Viking Red-, Montbéliarde-, and Holstein-sired crossbred cows compared with Holstein cows during their first 3 lactations in Minnesota dairy

herds. *By Hazel et al., page 8683.* The first 3 generations of crossbreds from a 3-breed rotation of Viking Red, Montbéliarde, and Holstein were compared with Holstein herdmates in a designed phenotypic study in 7 high-performance dairy herds. The 2-breed and 3-breed crossbreds had superior fertility compared with their Holstein herdmates. Age at calving was lower for 3-breed crossbreds in their first 3 lactations and lower for Holstein-sired crossbreds during first lactation. The 2-breed crossbreds had higher fat plus protein production (kg) than Holstein herdmates during first lactation. The 3-breed crossbreds had lower fat plus protein production (kg) compared with Holstein herdmates during their first 3 lactations.

<https://doi.org/10.3168/jds.2020-18196>.

Symposium review: Progesterone effects on early embryo development in cattle. *By Lonergan and Sánchez, page 8698.* Progesterone (P4) plays a key role in reproductive events associated with establishment and maintenance of pregnancy through its effects on oocyte quality and its action on the uterine endometrium. Reduced P4 concentrations during growth of the ovulatory follicle are associated with lower fertility, and low concentrations of circulating P4 after ovulation have been associated with reductions in conceptus growth and elongation, decreased interferon- τ production, and lower pregnancy rates in cattle. Despite the potential beneficial effects of exogenous P4 supplementation on fertility, results of supplementation studies have been inconsistent.

<https://doi.org/10.3168/jds.2020-18583>.