dam as fixed effects, and sire as a random. Allele substitution effect was also calculated using a regression model that included genotype term as a covariate. Mean S/P values for SAR were 2.26 ± 0.08 and mean values for RT were 39.0 ± 0.05°C. From the SNP previously identified, ASGA0019937, ALGA0025501 and H3GA0020133 were associated with SAR after PRRS vaccination ($P < 0.01$), and the favorable alleles increased S/P levels in 0.21 ± 0.06, 0.19 ± 0.07 and 0.46 ± 0.10, respectively. However, only ALGA0017541 was associated to RT ($P < 0.01$), and the favorable allele reduced 0.21 ± 0.01°C the rectal temperature. In conclusion, four specific genetic markers that underlie genetic variation in response of gilts to PRRS vaccination were validated using a SNP genotype to phenotype association analysis. We propose such SNP as candidates for use in a marker assisted selection program that further evaluates the immune response to PRRS vaccination in gilts of southern Sonora production systems.

Key Words: gilts, immune response, PRRS vaccination.

UNDERSTANDING INFLAMMATION AND INFLAMMATORY BIOMARKERS TO IMPROVE ANIMAL PERFORMANCE

0185 Overview of the inflammatory response and its nutritional costs.
K. C. Klasing*, *University of California, Davis.*

Innate immune cells respond quickly to a potential pathogen due to the presence of a common set of receptors on all phagocytic cells that recognize broad categories of pathogens. Thus, a very large number of cells can recognize invading microbes and respond to them quickly. A consequence of this is pathogen clearance, usually by phagocytosis, followed by the release of inflammatory cytokines and chemokines that amplify the local infiltration of additional inflammatory cells and activate them. If the challenge is large or if it is accompanied by damage to host tissue, cytokines are released in sufficient amounts that they have endocrine-like effects throughout the body. This cytokine storm induces metabolic changes, including increased protein degradation and insulin resistance in skeletal muscle, which diverts nutrients from muscle and other tissues so that they become available for the increased demands of leukocytes and for the production of protective proteins. Importantly the liver transitions from maintaining homeostasis and supporting the nutritional demands of growth or reproduction to the production of protective proteins such as complement, mannan binding protein, and C-reactive protein that aid in the detection and neutralization of pathogens. This transition is accompanied by hepatic hypertrophy. A study of the costs of a systemic inflammatory response in chickens to *Salmonella* that examined the amount of nutrients in 6 different leukocyte types in 5 different tissues (blood, spleen, bursa, thymus, bone marrow) and 12 protective proteins (acute phase proteins and immunoglobulins) found that the amount of essential amino acids in the protective proteins greatly exceed that in the cellular component of the immune system during both a normal and an inflammatory state. The ideal balance of amino acids for the acute phase of an inflammatory response differs greatly from that needed for growth and there is a critical need for additional cysteine and threonine. Ongoing research indicates that higher metabolic rate, decreased intake of food, a mismatch between the nutrient balance needed for the inflammatory response relative to that in body tissues and less efficient digestion that accompany a robust inflammatory response are, together, even more costly than the direct use of nutrients by inflammatory cells and the liver. Together, these costs result in decreased productivity that cannot be completely reversed by supplying additional nutrients.

Key Words: inflammation, cytokines, nutrients

0186 Ruminal microbes, microbial products, and systemic inflammation.
T. G. Nagaraja*, *Kansas State University, Manhattan.*

The ruminal ecosystem is inhabited by complex communities of microbes that include bacteria, archaea, protozoa, fungi and viruses. The immune system of the animal has evolved to maintain tolerance to innocuous gut commensals and induce protective responses to pathogens. Besides fermentative role, ruminal microbes do have the potential to influence the overall health of the host because of their ability to induce systemic inflammation. The ruminal epithelium-vascular interphase allows absorption of fermentation products and also serves as a selective barrier to prevent translocation and systemic dissemination of bacteria, bacterial toxins, and immunogenic factors. Ruminal dysbiosis that increases ruminal acidity and osmolarity may increase permeability and even induce a breach in the integrity of the epithelial and vascular endothelial barriers, thus facilitating entry of bacteria or bacterial antigens into the portal vein. A classic example is the delivery of ruminal bacterium, *Fusobacterium necrophorum,* into the liver to cause abscesses, which is facilitated by ruminal damage induced by excessive accumulation of lactic acid or VFA. Bacteria that manage to exit or bypass the liver can cause systemic inflammation in other organs, such as lungs, heart, joints, hoof, etc. Shifts in microbial populations associated with dysbiosis result in increased concentrations of potentially toxic and inflammatory substances, which include endotoxic lipopolysaccharide (LPS), biogenic amines, ethanol, etc. A bacterial product that has received a lot of interest is LPS, a component of all Gram negative bacteria. The entry of LPS into the systemic circulation, either from the rumen or the lower gut, could trigger release of proinflammatory cytokines, reactive oxygen and nitrogen intermediates, and bioactive lipids. The inflammatory response to the presence of ruminal LPS in the blood is evidenced by increase in acute phase proteins, such as haptoglobin and LPS binding protein.

Biogenic amines generated in the rumen that could lead to inflammation include histamine, tyramine, and ethanolamine. Histamine that is absorbed from the rumen or produced endogenously in tissues during inflammation plays a key role in the development of laminitis. Ethanolamine derived from bacterial phospholipids has the potential to enhance growth and virulence of certain gut pathogens. In conclusion, ruminal microbes and their products generate many complex interactions with the host immune system, and dysbiosis has the potential to induce systemic inflammation. Although inflammation is a protective reaction, the persistence of inflammatory mediators could have negative consequences for the host.

Key Words: ruminal microbes, dysbiosis, inflammation

0187 Usefulness (or not) of inflammatory biomarkers: The good, the bad, and ugly. C. Chase*, *South Dakota State University, Brookings.*

The innate immune system has the job of sensing the host's environment–looking for infections and tissue damage. It then does its second job, which is to recruit in the "right" cells to handle the problem. There is ample evidence that both physical and psychological distress can induce innate immune system pro- and anti-inflammatory cytokines that can cause immune dysfunction in animals, leading to an increased incidence of infectious disease. In livestock, there are several factors that will compromise immune function. There is the stress of transportation, dehydration, feed change (with the resulting negative energy balance), acidosis, and associated microbial changes in the gut. Overstimulation of the innate immune system can result in a pro-inflammatory cytokine storm, which will increase tissue damage. Both pro-inflammatory cytokines [such as tumor necrosis factor-α (TNF-α), interleukin-1, and interleukin-6] and anti-inflammatory cytokines (such as interleukin 10, transforming growth factor β and interleukin 1 receptor antagonist) can be elevated in the serum of animals experiencing a cytokine storm. These in addition to acute phase proteins are often monitored to "measure inflammation". An overview of "inflammation" and an experimental approach in cattle to study these local interactions will be discussed along with the proof of concept immunological measurements.

Key Words: innate immunity, inflammation, pro-inflammatory, anti-inflammatory

---

0188 Nutritional and management considerations in beef cattle experiencing stress-induced inflammation. R. F. Cooke*, *Oregon State University-EOARC, Burns.*

When transported to feedlots, beef cattle are exposed to several stressors within a short period of time that directly impact their performance and welfare. The main stressors associated with this "feedlot transfer phase" (FTP)—weaning, road transport, and feedlot entry—increased ($P < 0.05$) plasma concentrations of cortisol, pro-inflammatory cytokines, and acute-phase proteins (APP), while the magnitude of this response was negatively correlated ($r = -0.50$, $P < 0.01$) with feedlot receiving ADG and DMI. Further, feed and water deprivation elicited ($P < 0.01$) an APP response and reduced ($P < 0.03$) receiving performance similarly as in cattle transported for long distances. Hence, strategies to alleviate the APP response elicited during the FTP were evaluated: (1) Steers were assigned to continuous road transport for 1300 km (TRANS), or road transport for 1300 km with rest stops every 430 km (STOP). During feedlot receiving, ADG and G:F were similar ($P > 0.68$) between TRANS and STOP. Plasma concentrations of APP were greater ($P \leq 0.04$) in TRANS compared with STOP on d 1 of receiving. (2) Steers transported for 1300 km received (SUP) or not (CON) Ca soaps of soybean oil during a 28-d preconditioning. Upon transport, plasma TNF-α increased for CON but decreased for SUP steers ($P < 0.01$). Steers assigned to SUP had greater ($P = 0.02$) ADG compared with CON steers during the receiving phase. Upon slaughter, carcass yield grade and marbling were greater ($P < 0.05$) for SUP compared with CON. A subsequent trial evaluated the inclusion of camelina meal in similar research design. During feedlot receiving, SUP steers had reduced ($P < 0.01$) plasma APP concentrations and tended ($P = 0.10$) to have greater G:F compared with CON. 3) Steers were transported for 1300 km and administered flunixin meglumine (1.1 mg/kg BW) at truck loading and unloading, or meloxicam (1 mg/kg of BW) at loading and during the initial 7 d of feedlot receiving. Both anti-inflammatory drugs reduced ($P < 0.05$) the APP response elicited during the FTP compared with non-treated cohorts, but only meloxicam increased ($P < 0.04$) receiving ADG and G:F. In summary, inclusion of rest-stops during transport, preconditioning PUFA supplementation, and use of anti-inflammatory drugs are alternatives to alleviate the APP response elicited during the FTP, whereas PUFA and meloxicam administration enhanced feedlot performance of feeder cattle.

Key Words: beef cattle, inflammation, management, nutrition

CELL BIOLOGY SYMPOSIUM: MEMBRANE TRAFFICKING AND SIGNAL TRANSDUCTION

0189 Introduction: What is the relevance of this topic? J. L. Klotz*, *USDA-ARS, Forage-Animal Production Research Unit, Lexington, KY.*

Knowledge of membrane dynamics and receptor-ligand related responses are critical to a complete understanding of many of the tissue-level and whole animal level observations made in physiologic, pharmaceutical and toxicological research. The outcome of this basic research can have significant implications in animal agriculture in terms of impact