CSAS SYMPOSIUM: **UNDERSTANDING FEEDING BEHAVIOR TO IMPROVE ANIMAL WELL-BEING AND PRODUCTIVITY**

0229 The psychology and sociology of feeding behavior. J. J. Villalba*, *Agricultural Experiment Station, Utah State University, Logan.*

Food intake (how much to eat) and preference (what to eat) dictate nutrient balance and ultimately an individual's fitness and productivity. Emerging evidence suggests that the mechanisms underlying hunger and satiety are not only governed by physiological signals associated with the homeostatic control of food intake but also by their interaction with pathways involved in the control of food reward and hedonics. The hedonic value of a food—or how pleasurable to the animal such food results—is in part motivated by the individual's previous experiences with its orosensorial and biochemical properties. Taste (as well as smell and sight) allows animals to discriminate among foods and is a source of hedonic sensations. Postingestive feedback calibrates such sensations with its homeostatic utility, influencing food preference and chemical composition of the diet. This mechanism identifies foods adequate in nutrients (or in chemicals that enhance health) and foods with nutrient deficiencies/imbalances (or in chemicals that are toxic), thereby increasing or decreasing preference, respectively. The cultural inflection is manifest through mother and peers, representing a model from which naïve observers learn new behaviors and are exposed to novel environmental experiences. These experiences begin in utero and continue after birth, priming individuals to learn from their individual orosensorial and postingestive experiences. In turn, the new knowledge created within a social group is maintained and transmitted by mothers across generations. It is proposed that a strategic management of an animal's experiences with food, i.e., a certain target food presented early in life with mother/peers, or in close temporal association with other nutritious/medicinal foods, has the potential to enhance animal health, productivity and well-being.

Key Words: food choice, behavior, preference

0230 Physiological mechanisms controlling feeding behavior. M. S. Allen* and P. Piantoni, *Michigan State University, East Lansing*.

Mechanisms controlling feed intake are dependent on the interaction between diet and physiological state of animals. Physiological state is affected by age, pregnancy, lactation, and adiposity and is characterized by differences in insulin sensitivity of tissues and plasma concentrations of insulin, growth hormone, and leptin. The interaction between diet and physiological state affects feeding behavior (e.g., meal size and frequency) depending on the type and temporal supply of absorbed fuels. These fuels (e.g., glucose, fatty acids, amino acids) derive from the diet directly or indirectly as a result of gastrointestinal fermentation and are metabolized or stored by different tissues at different rates. Other fuels (e.g., long chain fatty acids, glycerol, amino acids) originate from body reserves. Effects of fuels on endocrine response and gene expression affect energy partitioning, which in turn affects feeding behavior by altering clearance of fuels from the blood. Various signals are integrated in brain feeding centers and dominant mechanisms controlling feed intake change with physiological state. Signals that affect feeding behavior include those from gut distension, which likely dominates control of feed intake under conditions of high-energy requirements with low-energy diets, as well as those from the release of gut peptides stimulated by certain nutrients. There is a growing consensus of the importance of fuel-based sensing among tissues. Signals to brain feeding centers via hepatic vagal afferents are also affected by oxidation of fuels. While oxidation of fuels has been linked to feeding behavior, evidence suggests that the mechanism is specifically related to hepatic energy charge (degree of phosphorylation of adenine nucleotides). Synergistic effects of metabolic inhibitors have been demonstrated in rodents, which suggests an integrated mechanism with a common signal related to hepatic energy status from oxidation of a variety of fuels. Utilization of high-energy phosphate bonds vary with liver function and their production is determined by the flux of carbon through acetyl CoA and activity of the tricarboxylic acid cycle. Hepatic concentration of acetyl CoA varies diurnally and is highly variable across cows, depending on lipolytic state (e.g., early postpartum period, shipping stress). Therefore, acetyl CoA is likely a key metabolite involved in both circadian control of feeding behavior and control of feed intake across physiological states. This presentation will discuss control of feed intake in animals varying in physiological state considering the effects of diet on energy partitioning and hepatic oxidation of fuels.

Key Words: feeding behavior, hepatic oxidation, metabolic fuels

0231 Feeding behavior, productivity and welfare of dairy cows. M. A. G. von Keyserlingk* and D. M. Weary, *University of British Columbia, Vancouver, BC, Canada.*

Over the last decade there has been a growing scientific interest in feeding behavior of dairy cattle, in part because dairy nutritionists are now becoming interested in how changes in feed intake are mediated by changes in behavior and, in part, because changes in feeding behavior are increasingly recognized as a useful indicator of cow health. Feeding behavior can be described using several measures, including the number and duration of meals, as well as intake and feeding rate. However, it is now clear that changes in feeding behavior are mediated in part by changes in other primary behaviors such

as social and lying behavior. It is also well established that the delivery of fresh feed is a primary factor stimulating feeding behavior by intensively housed dairy cows. Moreover, management factors such as competition at the feed bunk and regrouping can profoundly affect feeding behavior, with subordinate animals often showing the most pronounced effects. Many types of diseases are common after calving; these include illnesses caused by infectious agents and disturbances in metabolism. Much of our work has focused on identifying links between feeding behavior and a common infectious disease of the uterus, metritis. For example, over a series of studies, we now provide solid evidence that feeding behavior is altered in cows during the period of illness, but even more interesting is that this behavior is altered in the weeks leading up to parturition, long before clinical signs are evident, compared to healthy cows. We also review the relationship between lying, social, and feeding behavior as work now indicates that each of these behaviors impacts the other and collectively they play a role in expression of sickness behavior by cattle.

Key Words: social behavior, lying behavior, disease

0232 Good eating habits lead to good growth and welfare of dairy calves. T. J. DeVries*, *University of Guelph, Kemptville, ON, Canada.*

The dairy calf needs access to milk in sufficient quantities to maintain health and high-levels of growth. In addition, solid feed consumption must also occur early in life to establish fermentation in the rumen, and initiate the process of physical and metabolic development of the rumen. There is good empirical evidence that the feeding behavior patterns of adult dairy cattle, in meal patterning and dietary selection, can impact health, productivity, and welfare. It has also been demonstrated in more recent research that the feeding behavior patterns of dairy calves may also be just as important. In particular, feeding behavior can have immediate impact by influencing nutrient consumption and growth. Further, as behavior patterns are learned early in the life of a ruminant, these may have long-term implications if and when they persist over time. Thus, there is potential for various nutritional, housing, and management factors early in the life of a dairy calf to impact both short- and long-term feeding behavior patterns. This review will provide several examples of early-life factors influencing the eating habits of dairy calves and, in turn, influencing calf growth and welfare. For example, providing continuous, ad libitum access to milk may result not only in greater growth, but also in more natural feeding patterns, both of milk and solid feed. As another example, there is new data to reinforce the idea that providing forage to calves is important for rumen development, and consequent growth and efficiency. However, the physical form and presentation of that forage may also have a significant impact on the feeding patterns of calves, in particular feed sorting, impacting both their immediate nutrient intakes as well as the development and persistence of that behavior. Housing management also has the potential to impact calf feeding behavior and growth. Housing calves in pairs (vs. individually) can promote intake and growth, particularly at weaning. However, competition for feed access for grouped calves can impact the expression and learning of less desirable feeding patterns. Continued research in this area is needed to assess how long some of these learned behaviors persist and what factors may influence their persistence or diminishment.

Key Words: calves, behavior, sorting