Stress and Disease

By: Lark Burnham, PhD

From the previous series on comparative digestion, it should have been clear that ruminants, pseudo-ruminants and equines are dependent on microorganisms for their very survival. Although this dependency is greatest in herbivores, it also exists to some degree in all mammals. Symbiosis with microorganisms (bacteria, yeasts, fungi, and protozoa) is not limited to roughage degradation or as a source of protein. They are, in fact, an extension of the immune system.

Approximately 400 species of microorganisms inhabit the gastrointestinal tracts of healthy mammals. They are the mother's first gift to her young as they travel down the birth canal. Other beneficial microbes are collected from the environment. They line the GIT from stem to stern and exist in the lumen of the stomach and large intestine. Passage through the small intestine is usually too rapid to encourage microbial proliferation.

The microorganisms that dominate the healthy gut (indigenous microflora) are the first line of defense against infection. These microbes use a variety of mechanisms to protect their turf, including competition for nutrients and living space, as well as both chemical and biological weapons. As long as the nutrient flow continues and the pH remains constant, the indigenous microflora can maintain their advantage. There are two types of infection where they may be overcome under these conditions: Infection by 1) an overwhelming number of pathogens; or 2) one that is especially virulent.

An animal experiences stress when something in their existence changes. This can be variation in environmental temperature, change of ownership and/or residence, or biological events such as birth or weaning. The response to stress is known as the "flight or fight mechanism".

This mechanism is a series of very rapid hormone secretions that prepare the animal to fight or flee. One of the first results of this cascade is the diversion of energy from the GIT to the muscles. The GIT is an energy hog, it uses one-third of all the energy in the body. This means that contractions that normally move digesta along the tract stop. Non-passive nutrient absorption is also curtailed. Indigenous microflora starve and die, which leaves gaps in the protective barrier they normally present. The animal is now vulnerable to opportunistic pathogens which always exist in the GIT, but in small numbers.

The physiological response is the same, whatever the exigency. However, the duration and magnitude of response will vary with the extremity and/or and duration of the stress. Short-lived stress such as shearing or vaccination does minor damage compared to chronic pain or overcrowding.

Stress is part of normal life. However, farm animals are exposed to conditions they would never experience in the wild. Causes of stress in animal agriculture include:

- Mixing with strange animals and being forced to live in close proximity
- Fastidious animals such as alpacas forced to sleep and eat near their dung piles
- Procedures such as castration and shearing
- Restrictions on natural behavior such as mating, or ability to separate from the herd at birth
- Association with humans

Commercial animal agriculture is just becoming aware of the role of stress in disease. Humane handling and facilitation of natural behaviors have been scientifically shown to significantly improve animal health and productivity. Although most exotic livestock species are not bred for meat or milk, they are just as susceptible to stress.

If stress is chronic and/or severe, exotic species can suffer reduced reproductive ability and fiber quality, in addition to susceptibility to disease. Design or reorganize farm layout to minimize crowding and provide adequate shelter. Thoughtful layout can also promote livestock handling that minimizes stress for both the animals and their owners.

There is only so much that can be done with handling and physical plant to minimize stress. Microbial feed additives known as probiotics or direct-fed microbials (DFM) can temporarily fill the gaps left by stress-killed indigenous microflora. These will be discussed in the next issue.

About the author:

Lark Burnham received a B.S. in Animal Science (1979), from Kansas State University and a M.S. in non-ruminant nutrition (1995) from Kansas State Universtity, Manhattan, and a Ph.D. Doctorate in ruminant nutrition (2004) from Texas Tech University, Lubbock. Her special interests are comparative nutrition, the role of the micro flora in all mammals, fiber digestion, and probiotics. Lark currently works for Natur's Way. Inc., Horton, KS, which produces MSE probiotics.