

Foals fighting from the front line with Sel-Plex® and Bio-Mos®

Everyone wants big, strong, healthy foals which will grow into adults able to perform to their full potential. However, it is a fact of life that foals face constant invasion by disease causing organisms. Having good disease defense in early life is essential.

Defenses against invading organisms operate at three levels. Firstly there are the outer defenses at the body surfaces which prevent the invader attaching to and entering the body. These include the lungs and the gut surface. Secondly, should the invader gain entry, there are a set of early defenses that come into play almost immediately, such as white blood cells which ‘eat’ and digest the invader. Finally there are immune defenses which are precisely targeted against each separate type of invading organism. These defenses are complex and immensely powerful!

There are two main arms of the immune defenses; cells and antibodies. When an organism invades the body, it is ‘eaten’ by cells which break it down into small proteins called peptides. The peptides are then displayed as ‘foreign’ on the cell’s surface, stimulating important cells of the immune system called T-cells. Stimulated T-cells can turn resting cells into aggressive microbe-killers (cell-mediated immunity) or cause B-cells to produce antibody. Antibodies are complementary proteins to the peptides from the invading organism, fitting together as a key fits a lock. When an antibody finds its complementary peptide on the invading organism, it sticks like glue! Once attached the antibody defends the body by a variety of methods, including preventing entry, helping the early defenses and impairing the organism’s ability to function.

Antibodies can be life-saving, and may be needed in any part of the body. There are several types of antibody. The main antibody which leaks from the blood into other parts of the body is called immunoglobulin class G (IgG). Body surfaces, such as the gut, are protected by immunoglobulin class A (IgA). Whilst immunoglobulin class M (IgM) is a large and powerful antibody found in the blood, and the first antibody made in defense of the body. There is also immunoglobulin class E (IgE) which is involved in allergy and protection against worms.

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Newborn foals are able to produce immune responses as soon as they are born. However, their newborn, 'naïve' immune system is not yet experienced, making them very vulnerable to invasion. Thankfully nature has a solution! Antibodies are donated by the mare until the foals own immune system 'catches up'. The mare's antibodies cross the placenta and are secreted into the milk. The first milk produced by the mare, called colostrum, is particularly rich in antibodies, providing the foal with protection against infection in the early days. The protection from these donated antibodies is called 'passive immunity'. Passive immunity can be extremely protective as the foal benefits from antibodies the mare has produced in response to vaccines and all the infective organisms she has fought in her lifetime. Unfortunately foals are only able to absorb the antibodies from the colostrum into their blood for about 24 hours, so it is essential that they receive plenty of good quality colostrum in the first 24 hours of life. The mare produces colostrum during her last two weeks of pregnancy and theoretically the foal should get plenty of antibodies the first time it nurses. Subsequent milk also contains antibodies which can help protect the foal's guts as they continue to nurse. Both colostrum and milk contain the three types of antibodies, IgG, IgA and IgM.

If it were possible to help the foal develop its own immune system, or to provide better passive immunity through an increase in colostrum or milk antibody concentration, it could help provide better protection for the newborn foal. This may be possible through nutritional supplementation of the pregnant and lactating mare.

Foals deficient in selenium do not thrive, and are susceptible to disease. If the mare is deficient, the foal will often also be born in a deficient status. Unfortunately gestation and the onset of lactation can be a drain on the mare's mineral reserves, which can leave her in a marginal status at foaling. Research has been conducted to determine if supplementation of influenza vaccinated, pregnant and lactating mares with selenium (Se) can improve the foal's immune function. Results showed that levels of antibodies specific for equine influenza virus were higher in foals produced from mares receiving 3mg Se/day than those from mares receiving 1 mg Se/day.

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For the mares receiving 3 mg Se/day, half were supplemented with inorganic selenium, with the remainder obtaining Sel-Plex® organic selenium produced by *Saccharomyces cerevisiae* CNCM I-3060 (Alltech Inc.). Selenium concentrations in colostrum, milk, and mare and foal serum were all higher when mares were supplemented with Sel-Plex. Further, at 12 hours of age, foals from mares receiving Sel-Plex tended to have higher serum IgG levels. Thus selenium supplementation of the mare, particularly in an organic form, improved the immune protection of foals either by providing more protective antibodies in colostrum, or enhancing their own immune function.

It has been known for many years that a form of sugar found in the cell walls of certain yeasts can stimulate the immune response. This sugar compound is called mannan oligosaccharide or MOS. Several experiments have been conducted to evaluate if feeding a MOS product (Bio-Mos®, Alltech, Inc.) would stimulate the immune system of mares and improve the health status of foals. Mares were fed 10 g MOS/day from 2 months before until 1 month after foaling. Blood samples were taken before and after foaling. Colostrum and milk samples were also taken, together with data on foal growth and fecal score (to check the foal's gut health). The blood, colostrum and milk samples from mares and foals were analyzed for three types of antibody: IgG, IgA and IgM. It was consistently found that mares fed Bio-Mos had significantly higher colostrum and milk antibody levels, in particular IgA. Foal serum antibody levels varied, but tended to be higher in foals from mares supplemented with Bio-Mos, especially the IgM levels measured on the day of foaling. A higher IgM level so soon after foaling indicates an enhanced transfer of passive immunity from the mares supplemented with Bio-Mos. Further, the high levels of IgA in colostrum and milk offer ongoing local protection in the foal's gut.

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The gut is the biggest battlefield in the foal's body. One of the first challenges to the newborn foal is diarrhea. A foal can get two types of diarrhea. The first is the common foal heat diarrhea which occurs at 7 to 12 days of age, and is considered normal, requiring little or no treatment. The second type of diarrhea is caused by infectious organisms such as *Clostridium* or *Salmonella*. The newborn foal's intestine is very vulnerable to infection. If a foal has inadequate antibodies from colostrum to help fight this type of infectious diarrhea, it can be a major health concern. The presence of high levels of antibodies, particularly IgA, in the foal can reduce or prevent infectious organisms growing in the intestine. It is possible to help control diarrhea in foals through nutritional supplementation of the mare with Bio-Mos.

None of the foals from mares fed Bio-Mos suffered from diarrhea, whereas over 80% of the foals from untreated mares suffered a bout of diarrhea requiring therapy (at about 56 days of age). This data suggests that the additional antibodies secreted in the colostrum and milk of mares supplemented with Bio-Mos may help the foals to cope with microbial challenge. Bio-Mos can therefore both improve immune function in the mare and help foals cope with pathogenic challenges to the digestive system.

In summary, from birth, foals are fighting disease-causing invading organisms. Good defenses are of utmost importance if a foal is to grow into a healthy adult and fulfill athletic potential. Nutritional supplementation of pregnant and lactating mares with Sel-Plex and Bio-Mos has been shown to enhance defenses through improving the immune status of both the mare and foal, thereby helping to breed and grow stronger, healthier foals.

References available on request.