MMA complex and endotoxins – what does this mean for the colostrum?

by Simone Schaumberger, Product Manager Mycofix, Biomin Holding GmbH.

Endotoxin related diseases have received much attention and debate. As these toxins may lead to endotoxaemia, shock and death, it is of great importance to understand where they come from and how they could harm the animal.

A healthy sow with suckling piglets.

Endotoxins are everywhere

Endotoxins are parts of the cell wall of Gram negative bacteria (for example E. coli, salmonella). They act as pyrogens (induce fever) and have a potent immunomodulatory effect. If the animal is healthy, gut-derived endotoxins are transported via the portal vein to the liver and are eliminated there.

An overwhelming release of endotoxins activates further cascades, which in the worst cases may lead to an endotoxic shock and even death. Because of their chemical structure, endotoxins are also called lipopolysaccharides (LPS).

Endotoxins are released by bacteria after death or during proliferation. Administration of special kinds of antibiotics (for example Beta-lactam) can increase the liberation of endotoxins because of their bactericidal activity.

This fact should be taken into consideration when treating Mastitis Metritis Agalactia (MMA) complex and the additional use of NSAID (non-steroidal anti-inflammatory drug) is recommended. In comparison, antibiotics like polymyxin B (polypeptide antibiotic) are known to bind endotoxins.

Their use is limited because of nephrotoxic (kidney damage) and neurotoxic (effect on nervous system) effects.

Fig. 1. Comparison of Gram positive and Gram negative bacterial cell wall. Location of lipopolysaccharide in the cell wall is circled.

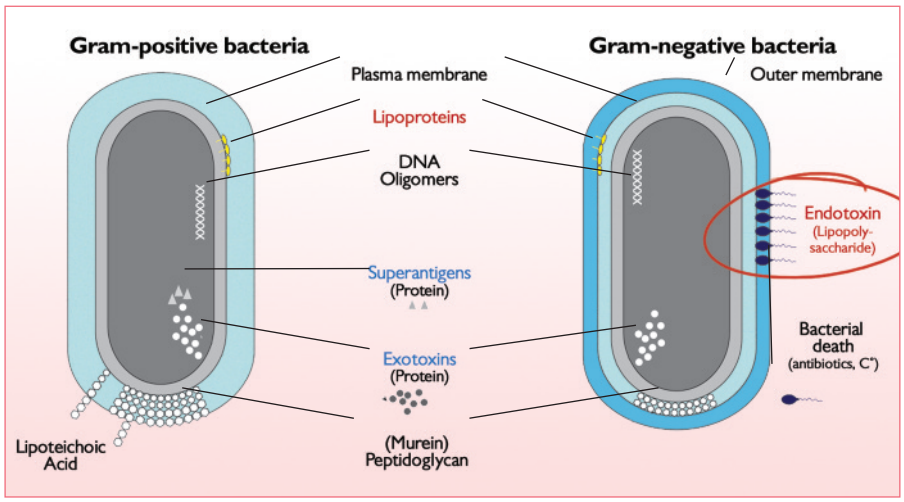
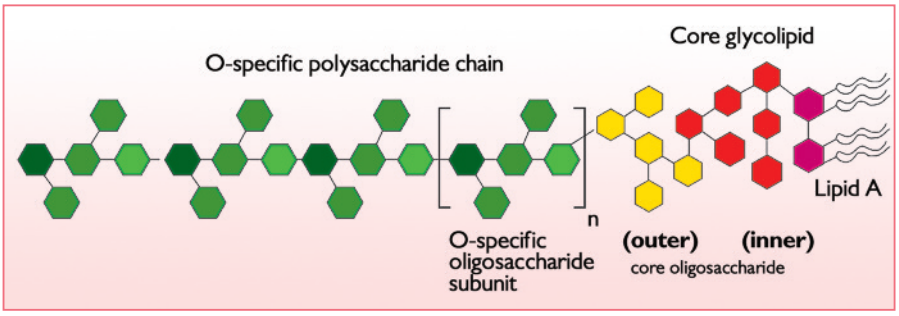


Fig. 2. Structure of LPS (endotoxin).



The MMA complex

MMA complex is a multi-factorial disease. In general, there is no single specific cause. The interaction of several factors leads to a dis-

Continued on page 16

Continued from page 15
ease outbreak. Kemper (2007) listed a few factors, such as water intake, feeding regime, lack of exercise and farm management, which may lead to MMA.

She also mentioned three disposing factors which support the occurrence of MMA: colonic inertia, urinary tract infections and prolonged birth. It has also been pointed out that endotoxins may worsen the problem.

Waldmann (2000) went a step further, proposing that endotoxins are disease triggers for uterine infections and mastitis.

Consequently, endotoxins seem to play a significant role in the MMA complex, although not in the initial stage of the disease. Due to stress, re-housing and lack of exercise, intestinal activity is reduced. This is followed by obstipation, which is the point when endotoxins may start to cause problems.

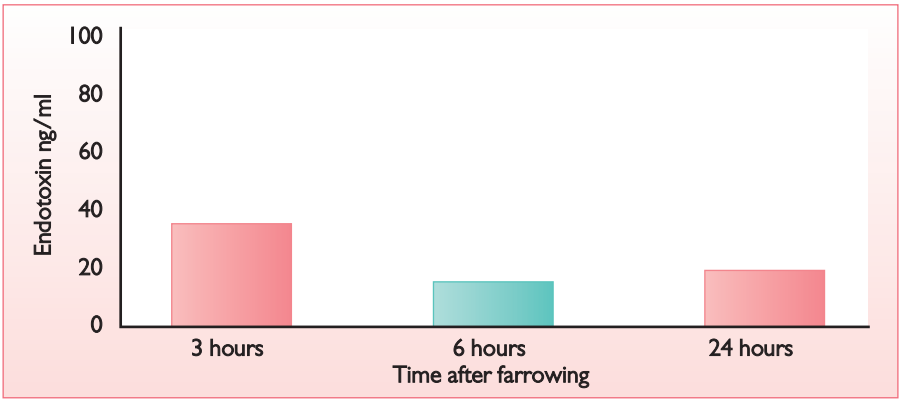


Fig. 3. Endotoxin values measured in the colostrum of healthy sows at 3, 6 and 24 hours after birth (Biomin Research Center, 2013).

The load of endotoxins exposure in the near birth period depends on the blockages as mentioned and fat loss, which may happen at this time. At first, endotoxins lead to a deterioration of the general condition of the sow. Thereafter, fever or circulatory disorders may result from endotoxins circulating in the blood.

There are several explanations for an increase in endotoxins in the blood of the animals.

Kruger et al (2000) and Kamphues (2000) stated that the feeding regime before and after birth has the greatest impact on the MMA complex. Special attention should be paid to the sow during this period.

Sow condition

The primary goal is to keep intestinal motility up and to boost the appetite of the animal.

Especially before birth, obstipation should be avoided as faeces remaining in the intestine for prolonged periods increase the number of bacteria. In addition, the blockage may lead to increased intestinal wall permeability. The so-called 'leaky-gut' increases the permeability of the gut wall, allowing bacteria and endotoxins into the organism.

The second main goal is to avoid an over conditioning of the sows. Appropriate feeding during pregnancy should not result in increased lipolysis after birth. An overwhelming mobilisation of fat may flood the organism with endotoxins and impair the metabolism of energy and fat.

This impairment during the peripartum can be caused by missing energy from the feed or because energy is lost during milk production.

Such energy loss also leads to increased intestinal wall permeability, which in turn increases the amounts of endotoxins entering the organism. It is also proposed that high levels of endotoxins in the uterus dur-

ing the prenatal phase have an impact on growing piglets.

A consequence of this may be poor viable piglets or whole litters having a high portion of low-weight piglets or even stillbirths.

Endotoxins and colostrum/milk

Endotoxins have an effect on the disease complex MMA. It has been shown that endotoxins suppress the production of prolactin (hormone for milk production), which leads to a depletion of milk. Endotoxin contamination of the sow colostrum may have a negative impact on piglets and result in diarrhoea.

To test the incidence of endotoxins in the sow colostrum, 102 colostrum samples from 42 sows were tested for their endotoxin activity at the Biomin Research Center. Samples were taken at 3, 6 and 24 hours after birth.

It was shown that endotoxins were excreted via the colostrum and milk of sows. But further research is necessary to assess the impact of endotoxin values on piglets.

Another study by Ratzinger (2010) showed the difference in the endotoxin values in the milk of healthy and treated sows due to MMA.

Average endotoxin values of 16 farms tested can be seen in Fig. 4.

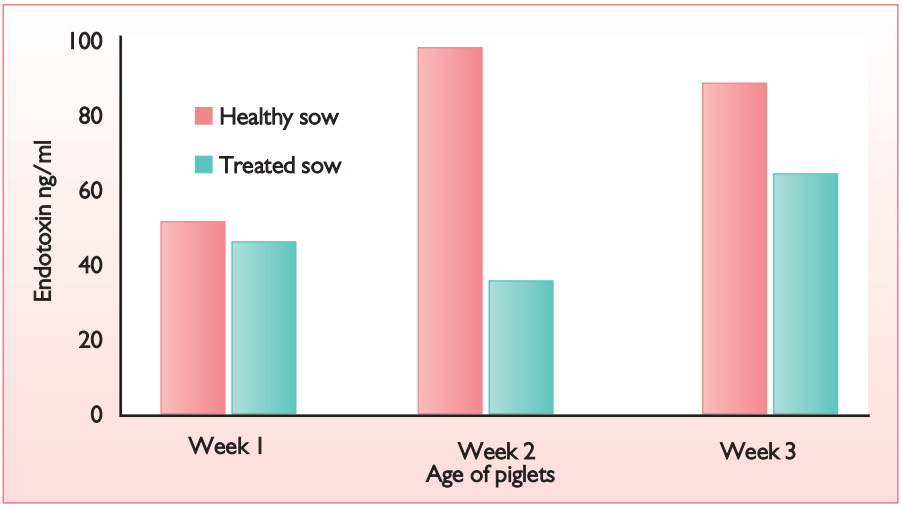


Fig. 4. Endotoxin values in milk of healthy and MMA treated sows at 1, 2 and 3 weeks after farrowing (Ratzinger 2010).

Values were higher compared to the colostrum study and differences between treated and non-treated sows were observed.

The highest deviation between the healthy and the treated sows was seen in week two.

Conclusion

It is widely accepted that endotoxins play a role in the MMA complex. Studies have shown the presence of endotoxins in colostrum and milk, but the direct effects of contaminated milk in piglets have to be further investigated.

As endotoxins cannot be avoided in the environment of pigs, controlling their proliferation to prevent MMA disease in sows is essential, and recommended. ■

References are available from the author on request.