Feeding brewer's yeast derivatives for an excellent start in life

A basic requirement for high vitality, fertility and longevity in the dairy herd is a successful rearing period. Therefore, it is crucial to pay attention to this special phase. Due to their immature immune system calves are very susceptible to intestinal and respiratory diseases in the first weeks of life.

by Petra Bisesti, Product Management Livestock (Ruminants), Leiber GmbH, Germany. www.leibergmbh.de

Environmental challenges, for example humid and cold climate conditions, as well as emotional or social stress can harm the animal. Different infectious agents like E. coli, rota and coronavirus and cryptosporidia can proliferate and lead to microbiota imbalances in the gastrointestinal tract (GIT).

In addition to proper colostrum management, biosecurity and other preventive measures, young animals need to have access to high quality nutrition. It is proven that what you feed the calf in early life determines its future growth and performance.

A high proportion of highly digestible and palatable raw materials as well as gut flora stabilising ingredients like prebiotics should not be omitted in a well-balanced diet for calves. One effective tool to strengthen the body's defences and enhance gut microbiota and morphology is the use of real brewer's yeast Saccharomyces (S.) cerevisiae. Applied in milk replacers or starter diets, the risk of scours can be reduced. Fig. 1 shows the broad range of yeasts available for animal nutrition. To stabilise rumen pH and microbiota, feed for dairy cows usually contains supplements based on whole yeast cells: either live, probiotic micro-organisms or inactivated, prebiotic yeast combined with functional fibre, though so-called yeast derivatives are often supplied in calf nutrition. The mode of action and effects on animal health and performance depend on origin, manufacturing process and composition of the product.

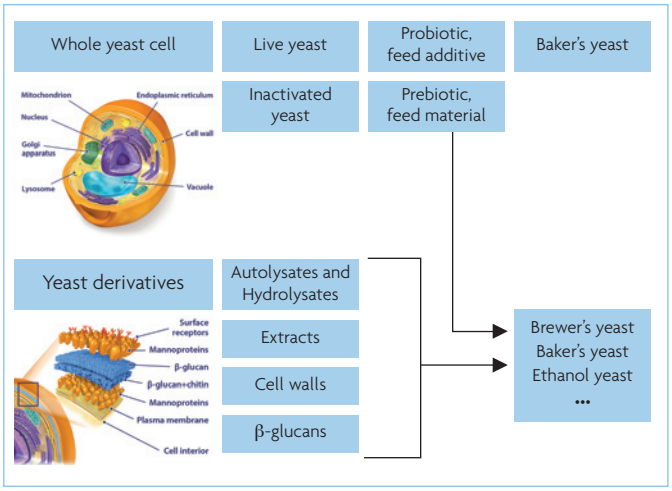


Fig. 1. Range of yeasts in animal nutrition.

Beneficial effects on gut health

In animal nutrition the most common and effective yeast products are based on S. cerevisiae. Beside other yeast derivatives consisting of, for example, baker's or ethanol yeast, the real brewer's yeast is of great interest – also in terms of sustainability. Real brewer's yeast is a by-product from breweries which is refined and processed to different feed and food specialties.

Whereas yeast cell content (yeast extract) is mainly used in food and the pet food industry, yeast cell walls or parts thereof are popular in livestock diets. In addition to other valuable ingredients like B vitamins, real brewer's yeast contains components of hops, which has been used as a medical plant for centuries. For instance, calming, bacteriostatic and antioxidative effects are described for hops. According to in vitro-studies a preventive use can result in inhibition of Gram-positive pathogens.

Furthermore, the brewer's yeast cell wall product Biolex MB 40 consists of high mannan-oligosaccharides (MOS) and (1.3)-(1.6)-β-glucan contents. It is evident that MOS serve as a growing medium for beneficial bacteria like lactobacilli in the gut.

In an in-vitro model (simulator of intestinal microbial ecosystem) the prebiotic, dose-dependent effect of Biolex MB40 could be demonstrated.

Biolex MB40 is digested moderately and selectively, in particular in the distal colon. Among other effects, a significant increase of propionate and butyrate was seen.

Additionally, with specific receptors at their surface MOS bind certain Gram-negative pathogens and (myco)toxins. An in vitro study at the University of Berlin showed that Leiber brewer's yeast significantly reduces adhesion of coliform pathogens and salmonella to intestinal epithelial cells by 30 and 50%, respectively. Positive effects on gut health of calves, lambs and piglets were confirmed in several feeding trials. For example, in a piglet trial from Thailand 0.1% Biolex MB40 reduced the incidence of diarrhoea in the rearing period by 30%.

In another trial from Iran with 75 Holstein calves 5g of Biolex MB40 in milk replacer or 0.1% in the starter feed resulted in less diarrhoea days

Continued on page 9

Fig. 2. Influence of Biolex MB40 on body mass and daily weight gain of lambs.

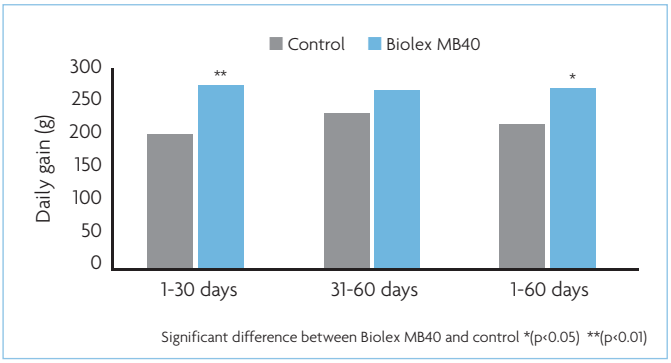
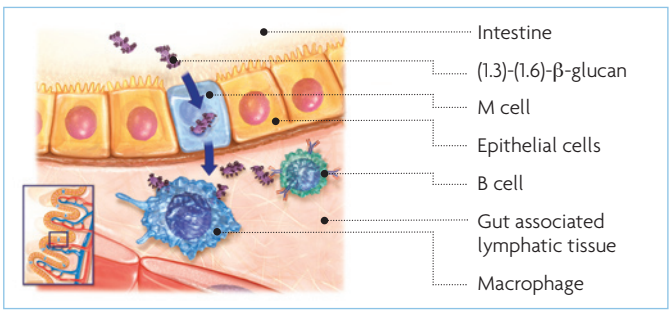


Fig. 3. Activation of macrophages by β-glucans and antigen presentation to B-cells.



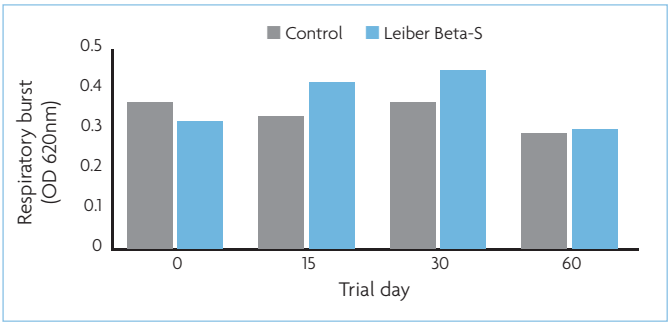


Fig. 4. Influence of Leiber Beta-S on selected parameters of cellular immunity in the blood serum of calves.

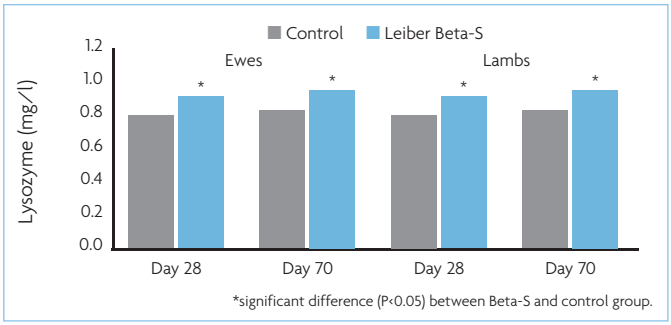


Fig. 6. Effect of Leiber Beta-S on lysozyme level (non-specific, humoral immune parameter) in ewes and lambs.

Continued from page 7

and improved the faecal score. Instead of 6.4 diarrhoea days (control), both trial groups showed scours for only 2.3 days. As a result of improved microbiota balance, higher weight gains were observed in calves fed with prebiotic-supplemented diets.

Additionally, yeast cell walls consist of (1.3)-(1.6)-β-glucans which are known to stimulate the immune-system of young or stressed animals. As shown in Table 1, Biolex MB40 improves humoral immunity in lambs. In this scientific trial from Poland the trial group showed increased lysozyme activity and γ-globulin content. The use of brewer's yeast cell walls in lambs also resulted in better growth (Fig. 2).

Parameter	Group	Investigation day 0	Investigation day 15	Investigation day 30	Investigation day 60
Lysozyme activity (mg/L)	Control	0.79 ± 0.08	0.79 ± 0.09	0.77 ± 0.08	0.81 ± 0.06
	Biolex MB40	0.79 ± 0.06	1.09 ± 0.09 **	1.14 ± 0.06 **	1.17 ± 0.04 **
γ-globulin content (g/L)	Control	30.22 ± 5.41	33.17 ± 2.83	31.61 ± 1.27	30.67 ± 3.13
	Biolex MB40	34.11 ± 6.81	36.44 ± 5.82	35.44 ± 3.87 *	39.44 ± 3.83 **

Significant difference between Biolex MB40 and control *(p<0.05) **(p<0.01)

Table 1. Influence of Biolex MB40 on parameters of humoral immunity in blood serum of lambs.

Immune-stimulating effects

Leiber Beta-S consists of a high proportion of purified (1.3)-(1.6)-β-glucans. Numerous feeding trials provide evidence about immune effects of β-glucans derived from brewer's yeast with 1.3-β-linked backbone and 1.6-β-linked side chains.

The manufacturing process and isolation method impact the structure of β-glucans and consequently effects the immune system.

Fig. 3 demonstrates macrophage activation and antigen presentation in gut associated lymphoid tissue (GALT) triggered by brewer's yeast β-glucans.

A Polish university trial demonstrated the positive effect of Leiber Beta-S in calves on unspecific and specific immune response by increasing phagocytic activity and proliferation of B and T lymphocytes. The activity of phagocytes (shown in the respiratory burst activity in Fig. 4) rose in the first 15 days of the trial.

Moreover, the proliferation of B and T lymphocytes increased over the entire trial period (Fig. 5). Results suggest that supplementation of Leiber Beta-S sets the immune system in an excited state and therefore a faster immune response occurs when pathogens enter the body.

Another university trial from Poland found that feeding ewes with 0.05% Beta-S positively impacts the offspring as well. Beta-S resulted in significantly higher γ-globulin and lysozyme levels in blood of dam and lamb (Fig. 6) and increased B and T cells (Fig. 7).

From studies in dogs and man it may be concluded that orally applied, insoluble yeast β-glucans are able to strengthen the body's defence, especially in creatures with a weakened immune system. In dogs suffering from inflammatory bowel disease (IBD) brewer's yeast β-glucans decreased the level of pro-inflammatory IL-6 and increased anti-inflammatory IL-10. Moreover, several clinical studies in man show that subjects supplemented with yeast β-glucans benefit by reduced severity of respiratory tract infections symptoms. Similar beneficial effects in young or stressed animals like calves are expected. However, further investigations are necessary.

Conclusion

The intestinal health of young animals plays an important role for their development and future performance. Since calves are born with a limited immune capacity a sufficient intake of colostrum is essential to protect newborns against pathogenic agents and environmental stressors.

The supplementation of brewer's yeast derivatives in the offspring of ruminants is a very effective tool to enhance gut health and support the immune system. The yeast cell wall product Biolex MB40 is characterised by a high MOS and β-glucan content. The use in milk replacers or starter feed results in prebiotic effects, improved gut integrity and humoral immunity. Purified β-glucans in Beta-S increase unspecific and specific immune parameters. ■

References are available from the author on request

Fig. 5. Effects of Leiber Beta-S on proliferation of B and T lymphocytes.

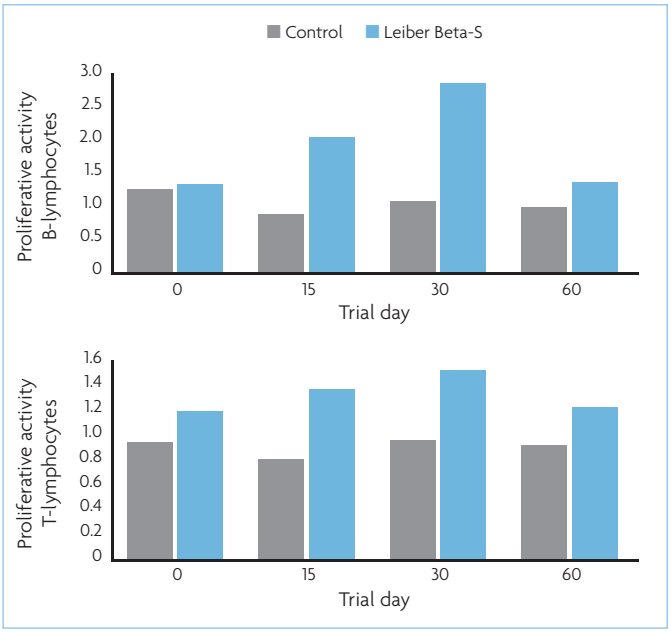


Fig. 7. Effect of Leiber Beta-S on T-cell proliferation in ewes and lambs.