Calf diarrhea: types, causes, solutions

By Dr. Inge Heinzl, Editor, EW Nutrition

Diarrhea causes a higher workload, increased costs for treatment, losses, and, of course, lower benefits for the farmer. But not all diarrheas are equal. How do they differ, where do differences come from, and what can you do to protect your animals?

Diarrhea is a protective measure of the organism

In general, diarrhea is characterized by more liquid being secreted than being resorbed. However, diarrhea is not a disease but only a symptom. Diarrhea has a protective function for the organism: the higher liquid volume in the gut increases motility, and pathogens and toxins are more readily excreted.

Diarrhea can occur for several reasons. It can result from inadequate nutrition but also the reaction to an infection by pathogens such as bacteria, viruses, and protozoa.

Where does the fluid come from?

Depending on how the accumulation of fluid in the gut is generated, there are different kinds of diarrhea:

- In the case of secretory diarrhea, as the name says, the fluid accumulation comes from an increased secretion into the gut caused by toxins activating enzyme systems. The gut mucosa can no longer resorb this higher amount of liquid.
- When the animals suffer from malabsorptive diarrhea due to destroyed enterocytes and shortened villi, the enzyme activity and absorption capacity are reduced. Less liquid can be absorbed and has to be excreted via the gut.
- When inflammatory diarrhea occurs, the gut mucosa is damaged. Higher amounts of mucus, protein, and blood are released into the gut lumen.

Due to multiple infections, diarrhea often is a mixture of different forms.

Multiple causes can be responsible

For the occurrence of diarrhea, different causers can be a possibility. Besides infectious pathogens, also the feed must be considered.

1. Bacteria often produce toxins

E. coli is a common agent of the gut microflora and in general it is harmless. However, *E. coli* can also be the cause of different types of diarrhea, depending on the virulence factors. Virulence factors of *E.coli* are, e.g., fimbria for the attachment to intestinal receptors or the ability to produce toxins influencing the secretion of ions and liquids. Example: enterotoxic *E. coli* (ETEC) F5 and F41 occurring during the first days of life.

In general, *Salmonella* plays a secondary role in calf diarrhea. Of the *Salmonella serovars*, mainly *S. Typhimurium* and *S. Dublin* are found in calves. *Salmonella* produces enterotoxins that attack the intestinal wall.

Clostridia infections belong to the most expensive ones in cattle farming globally. In herbivores, *clostridia* are part of the normal flora of the gastrointestinal tract; only a few types can cause severe disease. In calves, the necrotizing toxin-producing *Clostridium perfringens* can lead to enterotoxaemia manifesting in acute bloody diarrhea.

2. Viruses cause lesions in the gut

Rotavirus, which occurs mainly during the 5th -15th day of life, is the most common viral pathogen causing diarrhea in calves and lambs. If more enterocytes are destroyed than regenerated by the organism, the resorption surface in the gut decreases. With increasing age, animals develop immunity against this pathogen.

Coronavirus usually attacks calves at the age of 5 – 21 days (mainly correlated with the decreasing concentration of antibodies in maternal milk). They cause similar lesions in the intestine as rotavirus but additionally lead to necrosis of the crypts in the large intestine. The digestive and absorptive function is lost, resulting in reduced reabsorption of fluids. 3 to 20 % of diarrhea arising in calves is caused by Coronavirus.

3. Protozoa can lead to malabsorptive diarrhea

Cryptosporidium parvum (mainly 1-2 weeks after birth) belongs to the coccidia and is presumed to be the most common pathogen to cause diarrhea (prevalence up to more than 60 %) in calves. Cryptosporidium is transmitted via oocysts found in feces and on the farm equipment. Cryptosporidia destroy the microvilli in the gut, the function of the gut mucosa is reduced, the resorption area decreases. Consequence: loss of enzyme activity and, therefore, an insufficient breakdown of sugar and protein, resulting in malabsorption.

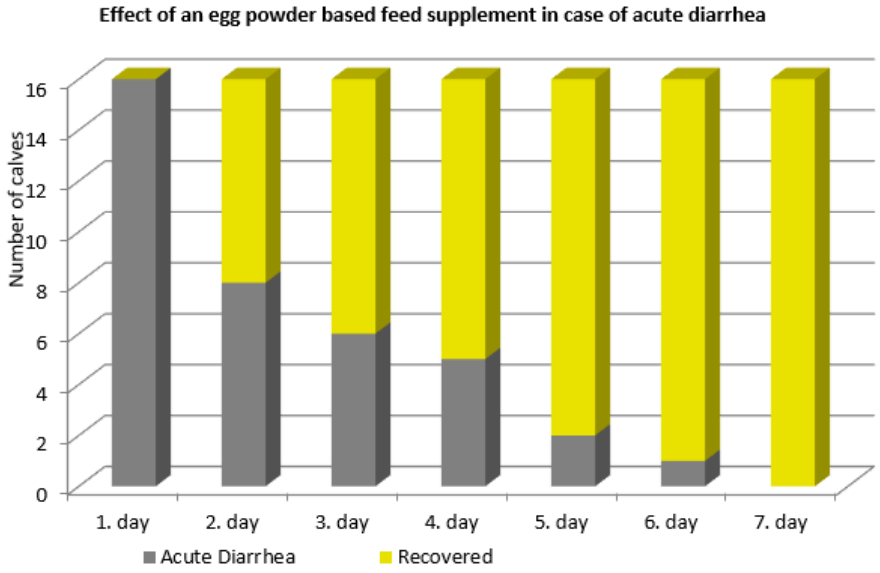
4. Calves need their special feed

In general, raw materials which cannot be well digested by the calf (mainly soya products, often used in milk replacers) or which cause allergy can cause diarrhea in calves. Also, antibiotics can lead to an imbalance of the intestinal flora, destruction of the villi, and malabsorptive diarrhea.

Trial shows promising results in the field

A field study with the egg powder-based product Globigen Dia Stop was conducted with 16 calves suffering from diarrhea. They were fed twice daily 50 g of Globigen Dia Stop stirred into the milk replacer.

Result (fig. 1): already one day after the first application of Globigen Dia Stop, 50 % of the calves recovered. After seven days, all calves overcame diarrhea. On average, one calf needed 2,4 treatments to show a full recovery from diarrhea (≙ 1,25 treatment days).



Egg immunoglobulins support against diarrhea

Egg immunoglobulins can effectively support calves in their fight against diarrhea. Immunoglobulins can act against bacteria, parasites, and viruses, not only against bacteria as antibiotics do. With egg immunoglobulin-based products, the farmer has a tool at his disposal that is easy to handle and does not require a withdrawal period. As there is no danger of the generation of resistance, these products are ideal for reducing the use of antibiotics in animal production.

Article initially published in NutriNews

IgYs support calves in case of diarrhea

By Lea Poppe, Technical Manager – Europe, EW Nutrition

Humans and animals protect themselves against diseases with specific antibodies (immunoglobulins). They receive antibodies from their mother or a vaccination (passive immunity) or produce them themselves after contact with a pathogen (active immunity). To be protected by a high passive immunity during the first weeks of life, a calf must receive high-quality colostrum with a sufficient amount of farm-specific antibodies as early as possible after birth.

Undersupply with immunoglobulins lowers later performance

In 2015, the Ludwig Maximilian University of Munich examined the immunoglobulin supply of 1,242 newborn calves. This study showed that more than half of the calves were undersupplied: 23% severely (<5mg IgG / ml blood serum) and 36% slightly undersupplied (5-10mg IgG/ml). The supply situation was only satisfactory in 41% of the calves (> 10 mg IgG/ml).

Undersupply results in higher susceptibility to disease, higher mortality, and lower daily weight gain. This entails increased rearing costs. Besides, only healthy calves can achieve their full potential as adult animals. For example, when a calf experiences even mild diarrhea, it is expected to produce 344 kg less milk the first lactation (Welsch, 2016). Possible causes of diarrhea are infectious factors such as viruses (rota, coronaviruses), bacteria (*E. coli*) and parasites (cryptosporidia), but also non-infectious factors such as poor husbandry and feeding errors.

Survey confirms: Calves lack sufficient amounts of immunoglobulins

In December 2020, EW Nutrition conducted a telephone survey among 55 dairy cattle consultants and veterinarians from Spain, Germany, France, Poland, and Great Britain to review calves' passive immunity.

This survey confirmed that calves lack sufficient amounts of immunoglobulins: 69.1% of respondents thought that calves were undersupplied. 76.4% of them saw a clear connection between early-occurring diarrheal diseases and calves' insufficient passive immunity. Respondents came to these conclusions even though more than half of them thought that colostrum quality had not deteriorated during the last years

(56.4%).

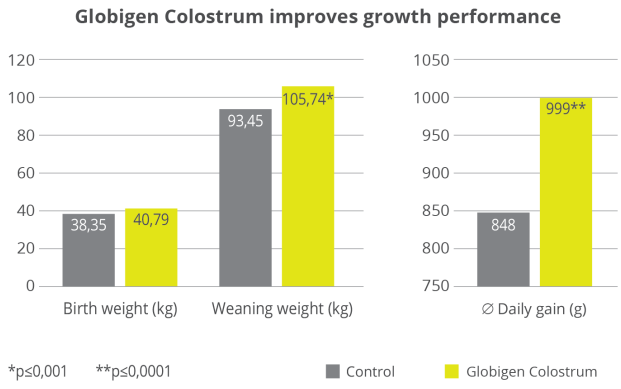
Immunoglobulins from the egg help calves against diarrhea

Egg immunoglobulins offer one way to support calves in case of diarrhea. Chickens form antibodies (IgY from “**I**mmuno**g**lobulins in **Y**olk”) against all disease pathogens they encounter and release them into the egg as an immunological starting aid for the chick. It does not matter whether the disease is relevant to poultry or cattle.

These antibodies can be used to improve poor-quality colostrum or to support the calf during acute diarrhea. Studies show that egg immunoglobulins act in calves’ intestines, where they can bind and block diarrhea pathogens (Ikemori et al., 1992).

IgY add value to colostrum

A feeding study with 39 female newborn calves took place on an 800-cow dairy farm in Brandenburg, Eastern Germany. The objective was to examine whether the IgY-containing complementary feed Globigen Colostrum effectively supports calves during the first critical period. For the experiment, all calves were given high-quality colostrum (4L within 2 hours after birth). During the first 5 days of life, the 19 calves in the test group additionally received 100g of the complimentary feed stirred into the colostrum (day 1) or the mixed colostrum (days 2 – 5).



Result: The daily weight gain for the test group was 18% higher than in the control group (+ 151g). This resulted in 13% higher weaning weights (see above).

Three calves in the control group had mild diarrhea; in the test group, only one calf. However, antibiotics did not have to be used to treat the diarrhea.

IgY to reduce neonatal diarrhea

The IgY-based product Globigen Calf Paste was tested on two dairy farms in Russia. These trials focused on reducing neonatal diarrhea, which occurs in the first 2 to 3 weeks of life. The product, a 30ml oral syringe with a dosing ring, was administered at a rate of 10ml per day for the first three days of life. On the first farm in the Belgorod region, the trial and control groups consisted of 11 calves each. On the 10th day of life, the diarrhea incidence per group was checked: while 73% of the calves in the control group had diarrhea, requiring antibiotics, only 1 calf of the trial group had diarrhea, and no antibiotic treatment was

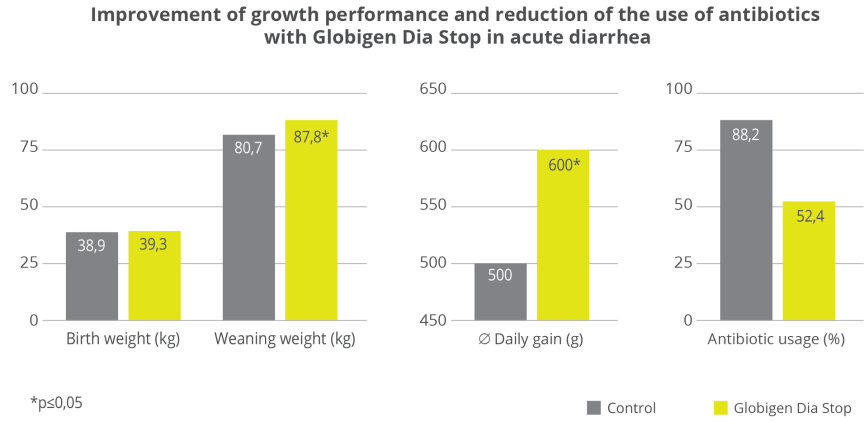
needed. On the second farm in the Moscow region, where the groups encompassed 20 calves each and observations took place on the 5th day of life, results were similar: 75% of the control animals suffered from diarrhea, but just 3 calves in the trial group showed signs of diarrhea.

IgY support calves with acute diarrhea

In another trial, carried out with 38 calves on a dairy farm with 550 cows in North Rhine-Westphalia, Western Germany, the dietetic feed supplement Globigen Dia Stop was tested. This product is also based on egg immunoglobulins.

Only calves showing newborn diarrhea were used for this experiment. When diarrhea occurred, the 21 calves in the test group received 50g Globigen Dia Stop twice a day in addition to their milk drink. The diseased calves in the control group (17 calves) were given a rehydration solution, stirred into water, twice a day.

If the diarrhea could not be stopped after four days in the calves of either group, the animals were treated by a veterinarian.



Result: In the test group, 100g (+ 20%) and thus significantly higher daily gains were achieved, which led to a 9% higher weaning weight. Furthermore, over 40% fewer calves had to be treated with antibiotics in the Globigen Dia Stop group than in the control group. (see above)

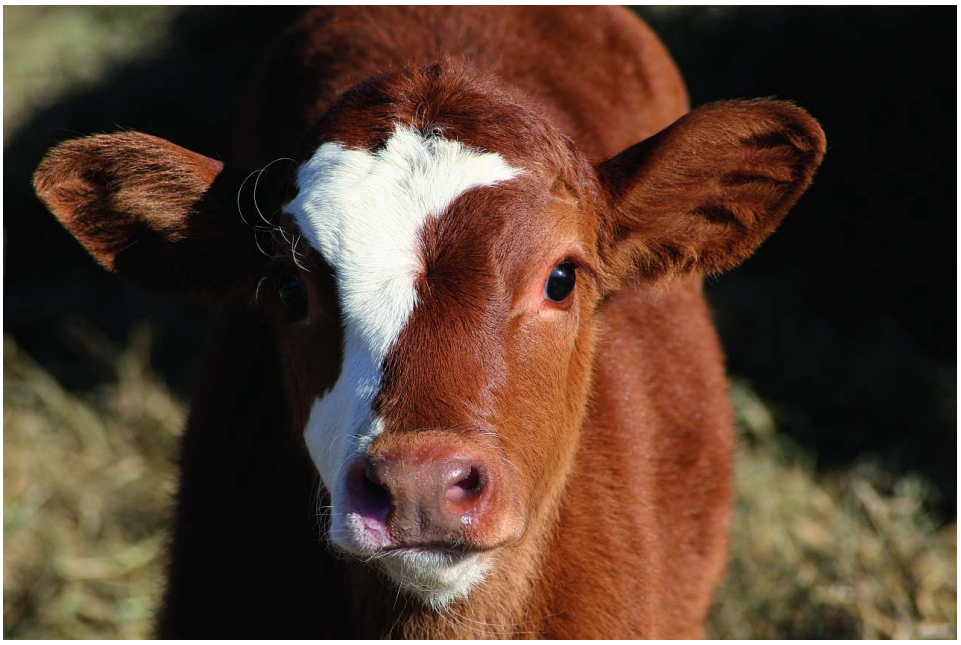
Conclusion: Egg immunoglobulins support gut health

The results of these studies indicate that the administration of egg antibodies (IgY) to calves supports intestinal health and has a positive effect on calves' performance. Globigen supplementation can likely reduce diarrhea incidence and severity, especially in the critical first phase of the calves' life – thus ensuring high performance in the long term.

Diarrhea in calves: Causes, consequences, prevention

by Judith Schmidt, ProductManager On Farm Solutions, EW Nutrition

Although diarrhea is called a factor disease, strictly speaking, it is not a disease but a symptom. Diarrhea can be a protective function of the body. With the higher fluid volume in the intestine and its increased peristalsis, pathogens and toxins are excreted.



Common causes of diarrhea

Despite various electrolyte drinks available from the veterinarian or in stores, too many calves still die as a consequence of diarrhea. The economic damage for the farms is immense.

The causes of the occurrence of diarrhea are diverse. Infectious causes such as viruses, parasites, bacteria, fungi, and non-infectious causes such as insufficient colostrum supply, feeding, and housing have a significant influence.

The diet of the newborn calf has a significant influence on scours. The following factors are decisive:

- The immune status of the calves
- Inadequate/incorrect preparation of the liquids
- Inadequate drinking hygiene

The development of diarrhea

In the first three weeks of life, diarrheal diseases are the most common and economically impactful diseases in newborn calves. In the first weeks of life, 75 to 85 % of calf diseases are related to diarrhea. The reason for this is that calves are born without immune protection. Their immunity is primarily built up in the first twelve hours by the supply of colostrum. After that, the intestinal barrier is barely passable for the antibodies.

The four most important pathogens are Rotavirus and Coronavirus, Cryptosporidium, and E.coli. These pathogens damage the intestinal lining, leading to water and minerals not being absorbed from the intestine into the blood. The minerals, instead of being assimilated, are lost and eliminated through feces.

Bacteria such as E.coli attach to the intestinal wall and produce toxins. Viruses, on the other hand, penetrate the intestinal wall in order to multiply. Both of them result in damages to the intestinal wall, which can allow fluids to leak out. The result is diarrhea.

Symptoms of diarrhea

The most important symptoms are:

- Sunken eyes as an expression of dehydration
- Reduced intake of fluids
- Lying down
- Low temperature
- Cold body surface
- Apathy or even coma

Types of diarrhea

There are different types of diarrhea, mainly the secretory and the malabsorptive form. Because of frequent mixed infections, the two forms of scours are often mixed.

Secretory diarrhea

The binding of toxins to the enterocytes' cell surface receptors activates enzyme systems that lead to increased fluid secretion in the intestine. The intestinal lining can no longer absorb this increased fluid influx. The trigger for this can be, for example, an E.coli infection.

Malabsorptive diarrhea

The erythrocytes are destroyed and the villi are reduced in size. There is a loss of the microvilli. The result is a lower enzyme activity and resorption capacity. By this reduction in villi length, less fluid can be absorbed and has to be excreted through the intestine.

Importance of the colostrum supply

Low colostrum intake or a low quality of colostrum at birth results in the failure of passive transfer (FPT) due to the inadequate ingestion of colostral immunoglobulins. FPT is associated with an increased risk of mortality and decreased health status.

Adequate transfer of maternal immunoglobulins is associated with short- and long-term health advantages. These advantages are created by reducing pre- and post-weaning mortality due to infectious diseases, as well as by increasing daily weight gain, feed efficiency, fertility, and milk production in first and second lactation.

Colostrum is the elixir of life for newborn calves. As already mentioned, calves are born without their own active immune protection. Their immune system develops slowly. In order to obtain a first passive immunization, early administration of high-quality colostrum (≥ 50 mg IgG/ml) is of the highest importance.

The colostrum should be administered to calves as early as possible, but latest 4 to 6 hours after birth. The reason for early administration of colostrum is that the amount of immunoglobulins decreases with the passage of time after birth and with an increased milking number.

By the twelfth week, the calf has fully developed its own stable immune system and is therefore able to produce its own antibodies.

Economic consequences of diarrhea

The consequences of diarrhea and the associated costs should not be underestimated. Even a mild form of diarrhea costs the farmer money:

	Course of diarrhea			
	Heavy diarrhea		Light diarrhea	
	In €	In %	In €	In %
Costs for Vet Costs for drugs, electrolytes	75 € 72 €	56	45 € 30 €	69
Additional rearing days Additional rearing costs	9 days 30,60 €	12	4 days 13,60 €	13
Mortality rate Costs for mortality	13 % 48 €	18	2 % 7,40 €	7
Additional labor farmer Additional costs for labour	2,5 h 37,50 €	14	0,8 h 12 €	11
Overall costs	**263,10 €**		**108,00 €**	

How to avoid diarrhea in calves

It is primarily essential that the calf is protected from fluid losses and that active diarrhea is avoided. Measures can be taken in advance to prevent the newborn calves from diarrhea:

- Cleaning the calving pen after each calving
- Bringing the calves into cleaned and disinfected boxes
- Regularly checking the quality of colostrum

But the most important basic requirement for a healthy start into life is to give 2 to 4 liters of colostrum within the first six hours of life. In addition to the timing, the quality of the colostrum is crucial. To that end, EW Nutrition developed a colostrum enhancer that improves colostrum management.

IgY can bind foreign substances like bacteria or viruses in the gut, which improves gut health and increases weight gain. The natural egg immunoglobulins act like maternal colostrum and bind to the pathogen epitopes. After that, the blocked pathogens cannot bind to the intestinal wall, preventing damage to the intestinal wall. Field studies prove the product's efficacy, showing an 18 % higher daily weight gain and a 13 % higher weaning weight compared to the control group. Additionally, the IgG contained in Globigen Colostrum help you avoid a failure of passive transfer (FPT).

The application of Globigen Colostrum is very user-friendly and simple, as it can be mixed directly into the colostrum of the mother cow.

Higher profit through improved calf performance

The benefits of Globigen Colostrum are:

- Improved calf performance
- Lower incidence of diarrhea
- Improved weight gain
- Higher profit

The timely and adequate supply of colostrum is the most important factor in preventing infection-related calf diseases. Therefore, it is necessary to ensure that calves receive sufficient antibodies from the cow's colostrum in the first days after birth.

References available upon request