Building and boosting the immunity shield of pigs

Conference report

A well-functioning immune system is vital for the survival and performance of animals. It helps piglets cope with challenging periods, such as their first days of life or weaning. Measures can be taken around farrowing to support the piglets during their first days by enhancing the quality and quantity of colostrum and helping them develop their own immune system as fast as possible.

Adequate feeding of the sow before and around farrowing

Feeding of both the sow and the piglet has an important influence on farrowing, the health of the sow, colostrum and milk production, piglets' development of immunity, and their later performance. A well-functioning immune system is crucial for the piglets to withstand upcoming challenges such as weaning.

Colostrum quality can be influenced by feeding

Newborn piglets have no functioning immunity system. They rely entirely on immunoglobulin G (IgG) absorption from colostrum within the first few hours after birth to establish their immunity shield. Dr. Megan Edwards, Animal Nutrition Consultant from Integral Nutrition (S) Pte Ltd, highlighted the payback of adequate colostrum quality and intake: Adequate colostrum intake can positively affect whole-of-life

immunity and, ultimately, growth performance. The contained IgG is essential for providing passive immunity to piglets, protecting them from infections during their early days of life when their immune systems are still developing. There is a positive correlation between the amount of IgG they absorb from colostrum and their performance. This benefit of colostrum intake is independent of birth weight.

We have a 3-week window to influence colostrogenesis. However, the fat content of colostrum is determined in the last 48 hours before farrowing. According to Dr. Edwards, influencing colostrum quality is generally easier than affecting quantity. She identified several compounds that can serve as immunomodulators, such as MCFAs, yeast extracts, and butyrate. However, by moving IgG to colostrum and milk in late gestation and lactation, the sow compromises her immunity status by depleting her own reserves for about two weeks.

Feeding at farrowing

Sow body condition has been shown to have more impact on colostrum yield than feeding level. The highest colostrum yield was achieved when sows entered the farrowing unit with a moderate body condition (3-3.25 – the ribs, spine, and hip bones can only be felt with firm pressure but are not visibly prominent). Overfeeding should be avoided to prevent sows from becoming excessively fat pre-farrowing.

Sows experience increased energy demands during farrowing due to the physical demands of parturition and the physiological changes occurring in their bodies. Dr. Edwards does not encourage withholding feed on the day of farrowing and suggests offering up to 3kg if the sow has the appetite. Feeding just below the energy requirement helps the sow to mobilize her own body fat.

Many producers mistakenly withhold feed on the day of the farrow to reduce the incidence of constipation. Feeding, however, stimulates gut motility. Withholding feed can slow down gut transit time and actually increase the likelihood of constipation.

Piglet feeding for developing intestinal tract and immune system

In piglet feeding, two strategies are decisive: the early intake of immunoglobulins via colostrum to protect the piglets against pathogens during their first days of life and the offering of creep feed to stimulate their intestinal development.

High-quality colostrum as much and as soon as possible

When the piglets are born, it is of the highest importance that they ingest colostrum as much and as soon as possible. The piglet can only absorb intact large IgG molecules, the primary source of passive immunity, before gut closure, which begins about 6–12 hours after birth and progresses rapidly to completion in about 24 hours. In any case, the sow will start producing milk by this time and no more colostrum. The concentration of colostrum IgG decreases by 50% within 6 hours after the birth of the first piglet. The target is for piglets to consume 250 g of colostrum within the first 24 hours, ideally within the first 6 hours. However, about 30% of sows produce insufficient colostrum.

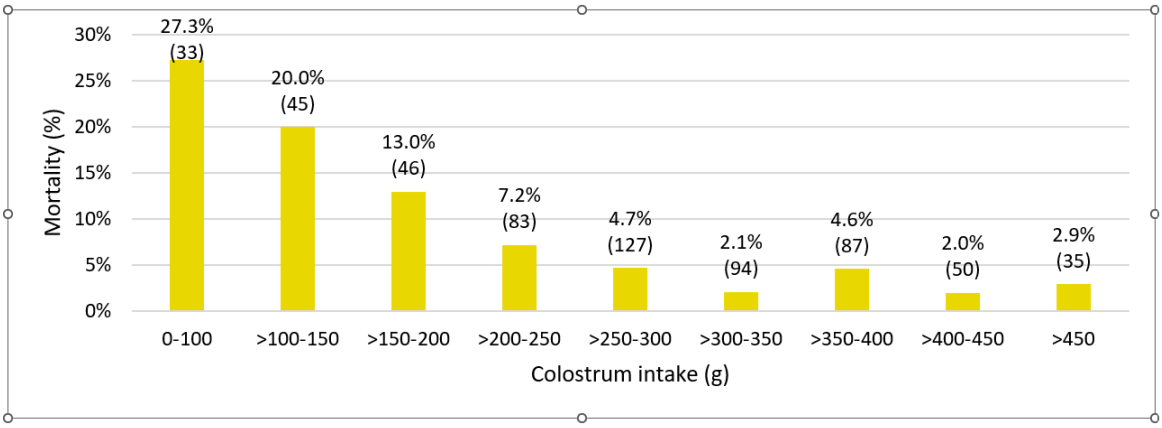


Figure 1: Mortality of piglets until 42 days of age according to intervals of birthweight and colostrum intake
(Hasan *et al*. 2019; the numbers of piglets are shown in parenthesis)

Split suckling jump-starts weak piglets

Split suckling is an effective management strategy to improve piglets' access to colostrum and milk, particularly in increasingly common situations where sows give birth to large litters. This involves temporarily separating the more vigorous piglets from the sow to allow smaller or weaker piglets better access to the teats. This method helps ensure that all piglets receive adequate nutrition during the critical early hours after birth.

Large litters provoke energy deficiency in piglets

Piglets are born with limited energy reserves (glycogen and brown fat tissue). Ingestion of colostrum is associated with a considerable increase in the metabolic rate, contributing to maintaining body temperature. About 70% of the piglets' energy requirement in the first 72 hours is provided by colostrum. "Most piglets that die within this period do so primarily due to energy deficiencies rather than immune-related issues. The trend towards larger litter sizes has exacerbated the issue of energy deficiency," stated Dr. Edwards.

Creep feeding

The primary role of creep feed is to accelerate the development of the piglets, their digestive and immune systems, and their gut microbiome, not for weight gain. Creep feeding helps evolve digestive enzymes and acid secretion necessary for breaking down complex carbohydrates and proteins. This early feeding supports piglets in adapting to solid diets, mitigating stress during weaning.
Creep feeding also helps piglets develop an oral tolerance to avoid transient hypersensitivity due to various dietary ingredients. This process is essential for preventing allergic reactions and hypersensitivity, which can occur when the immune system mistakenly identifies harmless substances as threats. It takes about two weeks for the piglet to recognize an ingredient as a nutrient, not a pathogen. To facilitate this process, she recommends that creep diets contain a broad range of ingredients at low doses. This approach gradually exposes piglets to various nutrients, allowing their immune systems to adapt without overwhelming them with high concentrations of any single ingredient.

Mycotoxins must be managed – even in piglets

The significance of mycotoxins in piglets is often underestimated due to their relatively small feed intake. However, there is substantial evidence that mycotoxins can be transferred from sows to piglets through colostrum and milk, which can have profound health implications.

Dr. Edwards is convinced that managing mycotoxins is managing immunity. Mycotoxins are transferrable

via the placenta, colostrum, and milk. There is a positive correlation between the mycotoxin levels in feed and colostrum. For example, adverse effects seen in piglets consuming colostrum with low doses of deoxynivalenol (DON) include:
• Decreased villus height
• Reduced mucosal integrity
• Increased inflammation
• Alternated immune response
The bottom line is that mycotoxins are a real and everyday risk to the immune quality of your piglets.

Nutrition influences piglets' immune development

Dr. Edwards summarized that adequate nutrition is fundamental for developing a strong immune system in pigs, which is the basis for high performance. By focusing on the appropriate nutrition of the sow, ensuring an adequate intake of high-quality colostrum intake in piglets, and implementing creep feeding strategies, producers can significantly enhance the lifetime health and productivity of their piglets from an early age.

EW Nutrition's Swine Academy took place in Ho Chi Minh City and Bangkok in October 2024. Dr. Megan Edwards, an Australian animal nutrition consultant with global research and praxis experience and a keen interest in immuno-nutrition and functional nutrients, was an esteemed guest speaker at this event.

Fewer pathogens with egg immunoglobulins

For newborn pigs there are often a host of different challenges – think of crushing or contamination of the farrowing pen.
For the last problem, solutions exist. A dietary approach can help to relieve pathogenic pressure through sow manure.

The main objective of a piglet producer is to maximise the number of healthy weaned piglets per animal per year. Nowadays, it is not difficult to find production systems delivering more than 30 piglets weaned/sow/year. Combining strategies on management, feeding, and health of both piglets and sows, is crucial for increasing sow's productivity. A unique environment that can determine the success of a piglet farm is the farrowing unit. It is important to reduce as much as possible losses during this period. Pre-weaning mortality must always be monitored and targets must be set. In European conditions, it ranges between 8-10%.

One important driver in reducing pre-weaning mortality is understanding the fragility of newborn piglets. At birth, the resources of a piglet are very scarce: low energy reserves and practically no immune defence against existing pathogens in their new environment. Problems are prone to happen and will be mostly caused by pathogens present in the environment, in the feed, in the water and most important, in the faeces of the sow. The main contamination source for newborn piglets is their mother's manure. And this first contamination can be quite severe causing diarrhoea and increasing piglet mortality.

Together with crushing, diarrhoea definitely causes a high percentage of total losses during the first days of life. In most of the cases, the disease is caused not only by one agent but by a combination of enteric infections from different pathogens or at least different strains of a pathogenic species. *E. coli* and clostridia are two of the most important diarrhoea causing pathogens during the first weeks after birth.

Pathogens during the first days

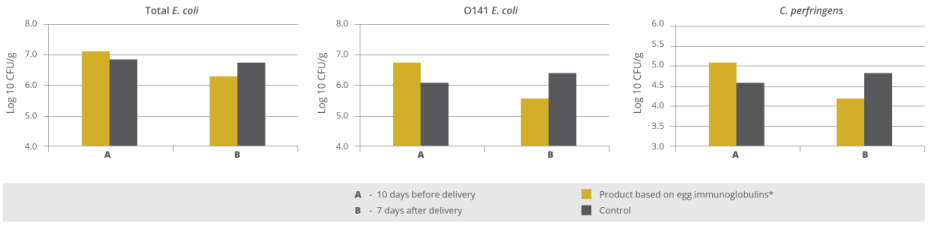
E. coli is well known as one of the main responsible pathogens for pre-weaning diarrhoea. And although it belongs to the normal intestinal flora of pigs, part of the different *E. coli* strains are pathogenic. *E. coli* cause about 80% of diarrhoeas in piglets and 50% of losses in piglet production. The factors making *E. coli* pathogenic, the so-called virulence factors include e.g. fimbria to attach to the intestinal wall and the capacity to produce toxins.

The *Clostridium* species are another important pathogen class. During the suckling phase, piglets are quite susceptible to *Clostridium perfringens* type C. This bacteria causes necrotic enteritis in piglets and the clinical symptoms appear during the first days of life. This disease provokes serious disturbances in the organism with a mortality up to 100%. It causes significant decrease in daily gain and in weaning weight.

Strategy to protect the piglets

In order to maximise the sow's performance – measured in piglets weaned per year – it is crucial to provide the best possible conditions to the piglets. Therefore the reduction of the pathogenic pressure in the farrowing unit ranks first. Cleaning of the pen is a way to get rid of germs like *E. coli* and *Clostridium* species, the most important pathogens during the first days. This should be completed by an effective gut health management in sow and piglets. For this purpose natural ingredients can be used. Supplying natural and active immune cells, the so called antibodies, has been proven to be quite efficient in supporting gut health. Applied to piglets, immunoglobulins from the egg bind to pathogens within the intestinal tract. They show efficiency in supporting piglets' performance, decreasing the incidence of diarrhoea, mortality and increasing daily gain.

The idea was to check if these immunoglobulins from the egg could also bind pathogens in the sow's gut and generate harmless complexes. That way pathogenic pressure for the piglets could be reduced. Thus a trial was conducted in Japan to check this thesis.



*[Globigen Sow]

Trial
In the trial two groups contained eight sows each. The sows of the control group received standard lactation feed, the trial group was also fed standard feed with a supplement containing egg immunoglobulins (Globigen Sow, EW Nutrition, at a dosage of 5 g/sow twice daily) on top during the last ten days before and the first seven days after delivery. The faeces of the sows were obtained by rectal stimulation (in order to get no contamination from the environment) on day 10 before and day 7 after delivery. The amount of colony forming units (CFU) of total *E. coli*, *E. coli* O141 and *Clostridium perfringens* were determined.

Results are shown in *Figure 1*. At the beginning of the trial, before the application of the immunoglobulin supplement, both groups showed nearly the same level of the evaluated pathogens with a slight disadvantage for the supplement group. After 17 days of applying the product based on egg immunoglobulins, a reduction of the colony forming units of total *E. coli*, *E. coli* O141 and of *Clostridium perfringens* could be seen. The sows of the supplement-fed group showed a lower level of pathogens in their excrements than the sows of the control group.

Conclusion
It is important for swine producers to understand what adversely influences the results on the farm. One consideration is to improve farrowing unit conditions of the piglets, aiming to reduce pre-weaning mortality. The results of the trial showed that a supplement based on egg immunoglobulins supplied on top of standard sow diets substantially reduced the amount of pathogenic colonies in sow manure. The reduction on pathogenic pressure and therefore the incidence of diarrhoea may be an alternative for increasing the profitability of piglet producers by increasing the number of healthier piglets weaned/sow/year.

**References are available on request.*

By Dr Inge Heinzl.
Published on PigProgress | 20th July, 2018.

Using egg immunoglobulins to

enhance piglet survival

The number of healthy piglets weaned is the most important factor for the calculation of profit in piglet production.

Losses in the farrowing unit normally occur during the first seven days of life as piglets are born with very little protection in the form of immunity. The intake of immunoglobulins from colostrum is therefore of vital importance. Besides cleanliness and special feeding, piglets can be additionally supported by two strategies that mimick the effect of colostrum:
– a direct one, meaning the feeding of immunoglobulins (IgY from eggs) to piglets that would support the immune system in the gut or
– an indirect one, meaning a supply of IgY to the sow to keep the pathogenic pressure in the farrowing unit as low as possible.

Piglets are born with no immune protection and very low energy reserves
It is well known that piglets are physiologically immature at birth. Their energy reserves are very low with only 1 – 2% body fat comprising mainly of structural and subcutaneous fat. Therefore, in the first hours of life they rely on the glucose supply from glycogen from the liver as their main energy source. However, this will only cover their needs for a few hours.
Due to the construction of the sow's placenta, a transfer of immunoglobulins (antibodies) within the uterus is not possible. This means that piglets are born with practically no immune protection and depend on the immediate intake of immunoglobulins from colostrum. The immunoglobulins can be absorbed in the gastrointestinal tract and immediately transferred into the bloodstream – but also only for a short time. The absorption ability of the piglets starts to decrease soon after birth and ends after 24 to 36 hours.

Strategy 1: Making the farrowing unit as safe as possible
The piglets' environment should be warm to prevent hypoglycaemia. Piglets looking for heat close to the sow can also get crushed. Since the temperature needs of the sow and piglets are different, a piglet nest with a special heat lamp is recommended. Furthermore, the farrowing unit should be clean. Due to their low immune status, piglets are susceptible to common pathogens such as *E. coli, Clostridium perfringens*, and rotavirus that can all lead to diarrhoea.

Most pathogens can be traced to those found in the sow's faeces. To keep this amount as low as possible, different measures can be taken:
– A vaccination increases the immune defences of the sow. The antibodies fight against the pathogens so that less "functioning" pathogens are excreted.
– Feeding of probiotics increases the number of good bacteria like Lactobacilli and Bifidobacteria competing with the pathogens for binding sites and nutrients.
– Administration of egg immunoglobulins, which bind to the pathogens within the gastrointestinal tract and make them harmless. These pathogen-immunoglobulin-complexes can be ingested by the piglets without any danger.

Strategy 2: Supporting the piglets with immunoglobulins
The aim here is to strengthen the local immunity in the gastrointestinal tract by increasing the amount of immunoglobulins (Ig). As already mentioned, the intake of sow colostrum is of vital importance. With the vaccination of the sow, the content of antibodies in the colostrum can even be enhanced.
An additional measure would be to orally supply the piglets with egg immunoglobulins (IgY). Both classes of immunoglobulins (IgG from mammals, and IgY from birds) can bind to pathogens in the gut, preventing them from binding to the intestinal wall and reducing the incidence of diarrhoea. The difference is in the degree of effectiveness and specificity.

Conclusion
To maximize the number of piglets weaned, it is necessary to support their immune system during the first days of life. Besides good hygiene management, the administration of egg antibodies to the sow will also help reduce the amount of shed pathogens keeping the pathogenic pressure low. The application of egg antibodies directly to the piglets supports their immune system by binding the pathogens in the gut, minimizing the risk of diarrhoea.