



Animal plasma has been widely used in piglet feeding, not only as a protein source, but also as a tool to reduce gastrointestinal disorders after weaning. Drs FELLIPE BARBOSA and INGE HEINZL consider a safe alternative in order to keep animals healthy and to avoid loss of performance.*

The recent developments surrounding the health risks associated with using animal plasma as a piglet feed ingredient is growing serious concerns in China. After the reported cases of African swine fever (ASF) commencing in August 2018, the Chinese government decided to ban the use of pig blood (and its by-products) in animal feed for some time.

The reason for the temporary ban of pig blood ingredients: African swine fever.

ASF is a viral disease of pigs and wild boars. The virus causes a lethal hemorrhagic disease in pigs. In some

cases, the death of infected animals can occur during one week after the infection. There are no vaccines against the ASF Virus. When it hits the herd it is virtually impossible to stop its spread contaminating all animals.

Spreading of the virus occurs as follows:

- contact with contagious pigs from infected areas,
- contact with contaminated materials, being fed with kitchen waste and
- non-trusted animal origin feed ingredients.

Table 1: Performance of pigs weaned at 19 days of age fed for 15 days post-weaning a diet containing different plasma or fractions.

	Casein	Plasma	Albumin	IgG [*]	LMW ^{**}
Weight gain (g/day)	19 ^a	134 ^b	78 ^{ab}	158 ^c	50 ^a
Feed intake (g/day)	181 ^a	262 ^b	244 ^{ab}	273 ^b	191 ^a

Gatnau et al., 1995

^{*}Immunoglobulins; ^{**}Low molecular weight

rows with different superscripts are significantly different p<0.05

There is a risk of pig blood carrying different types of viruses like ASF virus. Therefore, from time to time the use of ingredients based on blood is questioned by pig producers. To minimise this risk, the use of ingredients derived from pig slaughterhouses (including animal plasma) in pig feed is no longer allowed in China. This measure will cause not only a protein deficit in piglet feeds but also reduced protection of weaned piglets when intestinal disorders are concerned.

Immunoglobulins from animal plasma and its benefits on reducing post-weaning diarrhea (PWD)

The use of animal plasma has a positive effect on post-weaning performance of piglets. It is generally known that as a palatable ingredient, animal plasma stimulates feed intake. This results in better growth and a higher post-weaning performance in piglets. However, a closer inspection on the mode of action of spray dried plasma reveals its properties as an immune-ingredient and shows its supporting effect on the overall health status of the animals. Scientific publications showed that the positive influence on growth when feeding plasma to piglets is mainly due to its “immunoglobulin fraction”. This assigns to plasma a specific role in nutrition of weaned pigs to prevent PWD and to reduce the need for antibiotics.

Egg immunoglobulins: a natural way of protecting weaned piglets

Globigen® Jump Start (EW Nutrition GmbH) is a functional and standardized product based on whole egg powder. It contains natural immunoglobulins (IgY – “immunoglobulins from yolk”) mixed with a carrier. IgY are cells of the immune system from birds similar to the IgG in mammals. They have the main function of identifying and neutralizing harmful substances in the body. IgYs are obtained through a non-invasive process and are natural ingredients from eggs. There is no connection with blood and slaughter by-products and therefore no risk of carrying animal diseases.

Globigen® Jump Start is used to support piglets during critical stages of life, as long as their natural immunity is not completely developed. Scientific data confirmed that the IgY present in egg powder are capable of supporting intestinal health and growth performance of newly weaned piglets. More recently, also the possibility of using immunoglobulins as alternatives to zinc oxide (ZnO) and in-feed antibiotics (Hedegaard et al., 2017; Li et al. 2015) were evaluated with promising results.

Table 2: Effect of IgY against diarrhea caused by bacterial pathogens in piglets.

Items			%		Outcome measured considered mortality (M) or diarrhea (D)
			Intervention	Control	
Reference	Pathogens	Piglet age			
Imberechts et al.	F18 + ETEC	Weaned (21-28d old)	33	66	D
			25	75	D
			0	25	M
Marquardt et al.	K88 + ETEC	Neonatal (3d old)	12.5	62.5	M
		Weaned (21-28 d old)	0	30	M
		Weaning (14-18 d old)	1.9	3.9	D

Adapted from Li et al., 2015

Better results than plasma IgG: understanding the antigens causing post-weaning diarrhea

Animal plasma is a by-product of the meat industry. The animals slaughtered were possibly exposed to various diseases over their whole life. It cannot be considered as a standardized product in terms of immunoglobulins (either quantity nor quality). The Ig contained could be useful but also totally useless, depending on the pathogens the animals have been confronted with. As a source of immunoglobulins Globigen Jump Start is a costefficient and effective alternative to replace plasma in piglets' diets. Its IgY content will have the same protection effect in the gut as IgG, but the nutritionist will have the possibility of choosing different protein sources in the market, either because of price or availability of raw materials. Our recommendation is that 40kg of plasma can be replaced by 2kg of Globigen Jump Start supplied with different high digestible protein sources.

A piglet trial was conducted with the objective of evaluate the efficacy of egg immunoglobulins on performance parameters of weaned piglets and to evaluate it as a substitute for animal plasma. Piglets were challenged with F4 and F18 enterotoxigenic E. coli (ETEC) strains and feed either 2kg of Globigen Jump Start (GJS) or 40kg of spray dried plasma (SDP) in the weaner diet. The comparison was also done to a negative group (NG – microbiological challenge and no protection in the diet); and a positive group (PG – no microbiological challenge and antibiotics + ZnO in the diet).

Piglets from NG had lower feed intake, weight gain, and feed efficiency than animals from PG. The same was observed for piglets from GJS and SDP group. However, the impact of bacterial challenge on weight gain was lower for GJS piglets than for SDP (-14% and -52% when compared to PG); whereas feed intake was similar for both groups (-13% and -14% when compared to PG). The results showed that piglets receiving GJS were more efficient on converting feed into growth even when challenged when compared to SDP animals.

Table 3: Effect of IgY compared to plasma on performance of challenged piglets.

Parameters	1 to 7 days after adaption period								
	NG	GJS	SDP	PG	NG ↔ PG	NG ↔ GJS	SDP ↔ GJS	SDP ↔ GJS	SDP ↔ PG
Feed intake (kg)	1.46 ^a	2.16 ^{ab}	1.93 ^{ab}	2.47 ^b	-41%	-32%	-13%	-11%	-14%
Weight gain (kg)	0.78 ^a	1.88 ^{bc}	1.04 ^{ab}	2.19 ^c	-64%	-58%	-14%	-44%	-52%
Feed efficiency (kg weight gain / kg of feed)	0.39 ^a	0.80 ^{ab}	0.45 ^{ab}	0.89 ^b	-56%	-52%	-10%	-44%	-49%

different superscripts within the row are significantly different p<0.05

Trial conclusion

In this trial, the product based on egg immunoglobulins showed better influence on the performance of piglets than blood plasma. This may be due to the fact that the quality of the plasma depends on the animals slaughtered and on their contact with diseases, determining how much and which antibodies are available in this feed.

Additionally, blood plasma includes the danger of infectious diseases.

Safe and standard: free of swine related diseases and ruminant material

EW Nutrition clearly understands the importance of maintaining standardisation. It is a key factor for the customers to have a product that they can depend on every day.

Therefore, through specific steps during the production of Globigen products, EW Nutrition ensures product quality. During production, all eggs are pasteurised and dried to a whole egg powder. In between steps include microbiological analysis, Salmonella, and avian disease controls to ensure the final product is free of the mentioned threats. Furthermore, as Globigen products are originated from laying hen farms there is no risk of contamination with any swine disease, like the devastating ASF. Finally, Globigen products do not contain any raw materials produced from, or substances derived from ruminants nor do the products come in contact with risk materials during the whole process (not be at risk for carrying transmissible spongiform encephalopathy or bovine spongiform encephalopathy – BSE).



Breeding hens are a valuable asset for the poultry industry, as they produce the hatching eggs and day-old chicks. It is therefore important to manage contamination as well as possible. Mycotoxin management is part of that.

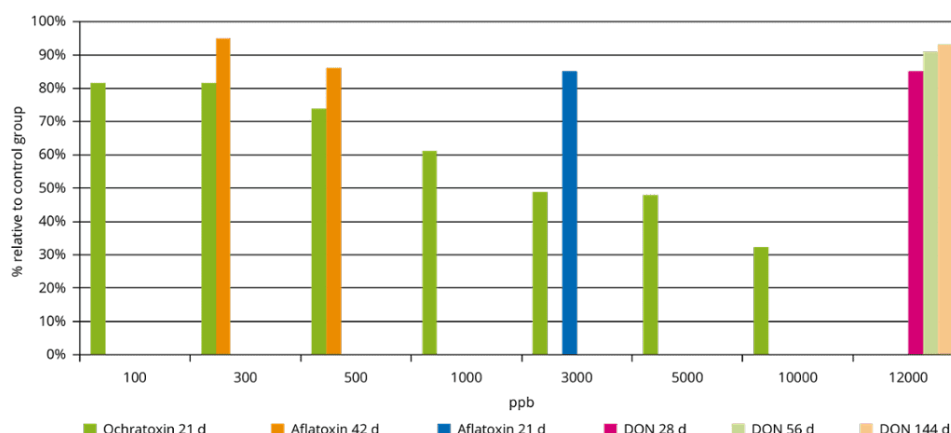
In the production of hatching eggs and day-old chicks, the selection of raw materials with high nutritional quality and safety is the common practice. [Mycotoxins](#) are an undesired factor in any feed formulated for animals in production and reproduction, but often, it is inevitable to have certain levels of contamination. The presence of [mycotoxins](#) in breeding bird rations does not always lead to visible symptoms, such as trichothecenes causing oral lesions. However, it may influence productivity, egg quality, hatchery performance, as well as chick quality and immunity. Mycotoxins exert toxic effects mainly on the gastrointestinal tract, liver, and kidneys and can accumulate in some tissues but also in the eggs.

Egg production

Mycotoxicosis in hens can cause reduced egg production. As can be seen in *Figure 1*, the levels at which these effects can be observed are as low as 100ppb in feed, for example with a 21 day exposure to ochratoxin. By increasing the level of the toxin, production further decreases. A similar effect is obtained by exposing birds to aflatoxin. In contrast, DON levels that affect productivity in breeding hens are high and infrequent in grains and by-products. Under experimental conditions, more than 10,000ppb of DON and a 28-day exposure are needed to adversely affect productivity. By increasing the exposure time (DON – from 56 to 144 days) a recovery of egg production can be observed. This recovery can be explained by feed intake behaviour of the animals: low at the beginning of the DON exposure and increasing afterwards. The most likely mechanism for the reduction of egg production is the decrease in protein synthesis. A lower synthesis of albumin is the result of a degeneration of the liver tissue caused by ochratoxin, T2, and

DON. The livers then may look pale, friable and occasionally with superficial haemorrhages. Egg production is not the first parameter affected by mycotoxins in breeding hens. Parameters such as embryonic mortality and hatchability can be influenced before and even more than egg production and also without it being affected.

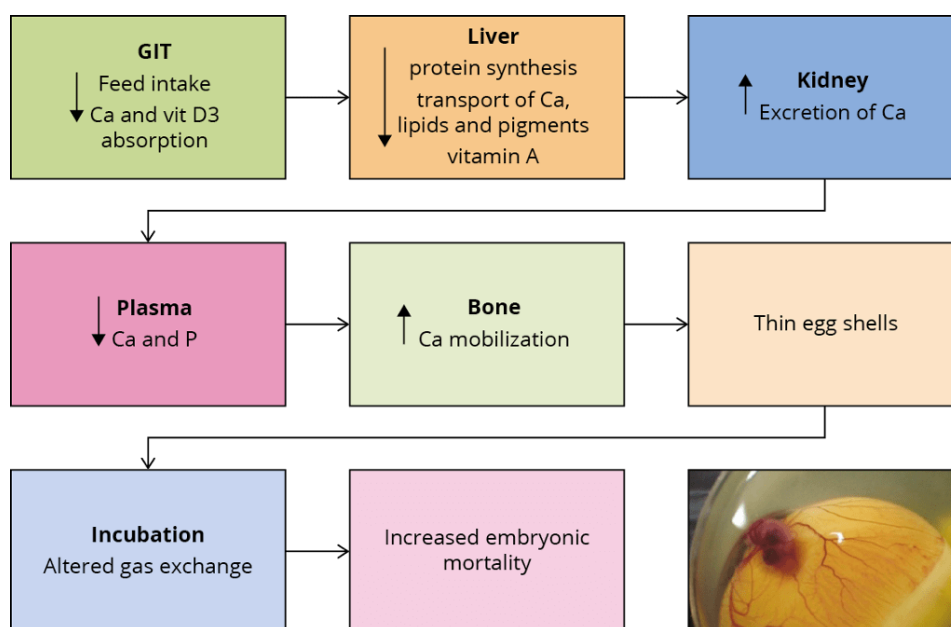
Figure 1 – Egg production influenced by mycotoxins compared to negative control (=100 %).



Eggshell quality and embryonic mortality

The eggshell is important to protect the progeny. Thin and fragile shells can increase embryonic mortality and decrease hatchability as well as weight gain of the embryo. Calcium is important for the construction of the eggshell. An impaired calcium metabolism leads to bad eggshell quality. Its bio-availability as well as vitamin D3, also important for this purpose, depends on intestinal integrity and on the production of enzymes and transporters that aid in feed digestion and nutrient absorption. These processes can be affected by aflatoxins, DON, T2, and Fumonisin. Also further metabolism can be affected by mycotoxins like aflatoxins and ochratoxins due to their nephrotoxic effect. By favouring the excretion of calcium they unbalance its metabolism. The metabolism of another element needed for egg shell formation, vitamin D3, also takes place in the liver. Furthermore, this organ provides most of the lipids that make up the yolk but also lipoproteins, that are necessary for the transport of calcium and carotenoids to the egg. Carotenoids are important for egg quality as well as chick immunity.

Figure 2 – Effects of mycotoxins on eggshell quality and embryonic mortality.



When the liver function is impaired, the internal and external quality of the egg declines, which, in the end, affects the production of day old chicks. Figure 2 illustrates the possible ways how mycotoxins can negatively affect eggshell quality and as a consequence embryonic mortality. If intestinal integrity is

compromised, the utilisation of nutrients decreases. Liver and kidney damage leads to a less availability of calcium and other nutrients necessary for egg formation. Birds' calcium levels in plasma then are lower and a greater mobilisation of calcium from the bones is the possible response from the organism. However, this response cannot be maintained and the eggs have a thinner shell. The thickness of the eggshell influences moisture loss and exchange with the environment during the incubation period. An optimal egg-shell quality will not allow the loss of nutrients and will also prevent bacterial contamination as well as embryo mortality. *Figure 3* shows the effect of different mycotoxins on embryonic mortality. Incremental levels of ochratoxin or aflatoxin heighten embryonic mortality in a range from 1.5 to 7.5 times the embryonic mortality of a control group. In some cases, embryos are affected even when the hens have received feed contaminated with mycotoxins within the guidelines suggested by the EFSA. For example, 4,900ppb of DON for ten weeks increase the number of embryos with abnormalities. The causes are not clear, as only traces of DON can be found in the egg. However, this mycotoxin can affect protein synthesis at the liver level and with this the deposition of nutrients into the egg.

Effects on the progeny

Ochratoxin and aflatoxin can be transferred into the egg, where they exert toxicity on the embryos. But this not necessarily results in mortality. However, the chicks can suffer from a compromised immune function due to two reasons: lower transmission of antibodies from the hen and lower viability of the chickens' immune cells accompanied with a lower relative weight of the bursa of Fabricio and the thymus. When both aflatoxin and ochratoxin, are present in the feed, the effect on these parameters is synergistic. The final result could be an increased early chick mortality due to a higher incidence of bacterial and viral infections. The transmission of other mycotoxins into the egg is minimal. Therefore the existence of a direct effect on the progeny is unlikely, but an indirect effect via a lower deposition of nutrients must be considered.

Risk management

The best approach to manage [mycotoxin](#) risk is to implement an integrated strategy that includes good crop and grain storing practices, regular sampling and mycotoxin analysis. Tools (such as [MasterRisk](#)) can help in providing evaluation of mycotoxin interactions and helps in choosing the best strategy to deal with specific mycotoxin challenges. The results of mycotoxin analysis can hence be used to take decisions regarding the inclusion levels of raw materials and choosing products with anti-mycotoxin action. Such products can prevent the passage of mycotoxins into the bloodstream and their contact with the gastrointestinal tract. The additional use of phytomolecules that support the liver function is highly advisable for long living animals as they have additional effects to keep welfare, health and performance. In mycotoxin risk management, prevention is the key for success.

Read [Mycotoxins: Their effect in breeder hens](#) the full article
ALL ABOUT FEED, Mycotoxins, Background, 31.October.2018