Immunoglobulins – Novel solutions for swine health

Conference Report

Unlike humans and most mammals, piglets do not receive any maternal immunoglobulins (antibodies) via the placenta. Therefore, it is vital for piglets to receive maternal antibodies via the colostrum within 24 hours of birth. Otherwise, they are more vulnerable to illnesses in their early stages of life. In situations where piglets do not receive enough colostrum, such as due to large litter sizes or weak sows following a prolonged farrowing — supplemental colostrum or IgY products can provide essential immune protection.

In the following, Dr. Shofiqur Rahman describes the innovative role of IgY – yolk immunoglobulins in enhancing swine health.

IgY – modes of action

IgY is an antibody found in egg yolk. It is an entirely natural product; each egg contains approximately 100 mg of IgY. These egg-derived antibodies primarily function in the gut through several mechanisms:

- Adherence inhibition – IgY antibodies bind to specific structures on the surface of pathogens (such as fimbriae, flagella, and lipopolysaccharides), preventing them from adhering to the intestinal mucosa and blocking the initial stages of infection. This is particularly significant for enterotoxigenic *E. coli* (ETEC), which causes piglet diarrhea by attaching to intestinal cells.
- Neutralization – IgY can neutralize toxins produced by pathogens, preventing them from exerting harmful effects on host cells.

- Agglutination – IgY promotes the clumping of pathogens by binding them together, effectively immobilizing them, and facilitating their removal from the animal's gut.
- Cell damage – IgY can damage the integrity of bacterial cell walls leading to cell lysis and reduced bacterial viability.

Furthermore, because these pathogens are bound in complexes with IgY and eliminated through feces in an inactivated form, IgY helps prevent environmental re-infection through manure.

IgY and IgG – functional differences

Both IgY and Immunoglobulin G (IgG) (IgG, the most abundant immunoglobulin in mammals) are antibodies. They, however, exhibit significant differences due to their distinct structural characteristics. "IgY, for instance, does not activate the complement system, a key function of IgG that enhances immune responses against infections. Additionally, IgY promotes more rapid phagocytosis and reduces inflammation compared to IgG. These effects contribute to energy conservation, thereby facilitating improved animal growth performance," he explained.

IgY is more hydrophobic than IgG, which increases its stability and resistance to proteolytic degradation. This property is beneficial for maintaining its functionality in the gastrointestinal tract.

Production and quality control

IgY develops in hens in response to the pathogens they encounter, regardless of their relevance to the hens themselves. For instance, hens immunized with an infectious pathogen affecting pigs can produce IgY, effectively preventing the disease caused by that pathogen.

There are different methods of IgY production. One possibility is to hyperimmunize the hens simultaneously with multiple antigens. This method seems convenient, but it does not produce products with standardized levels of immunoglobulins for each antigen.

Another approach involves immunizing different groups of hens, each with a single antigen (e.g., transmissible gastroenteritis virus, rotavirus, *E. coli*) that commonly challenges piglets during the first weeks of life. The immunoglobulin content is then quantified, and the resulting egg powders are spray-dried, pasteurized, and mixed. This process yields an IgY product with standardized amounts of specific immunoglobulins that exhibit high affinity for the target pathogens.

One health application in swine

“The benefits of IgY have been demonstrated through extensive trials and commercial experiences, highlighting its potential for various applications not only in swine but also in other animals and humans,” said Dr. Rahman.

Due to concerns about antibiotic resistance, regulatory and consumer scrutiny increased over the use of in-feed antibiotics. IgY can serve as an effective and natural alternative for improving overall gut health, reducing the incidence and severity of diarrhea, reducing morbidity during the critical pre- and post-weaning periods, and, thereby, increasing performance.

Unlike antibiotics, which can indiscriminately kill both harmful and beneficial bacteria, IgY selectively targets specific pathogens. This selective action helps maintain a balanced gut microbiome, which is crucial for overall health and digestion in piglets. Disruption of the gut microbiota by antibiotics can lead to issues such as antibiotic-associated diarrhea and increased susceptibility to opportunistic infections due to the loss of beneficial microbes.

In contrast to antibiotics, IgY targets multiple antigenic sites on pathogens, requiring various genes for their protection, thereby avoiding resistance issues among pathogenic microorganisms. Additionally, IgY is effective not only against bacteria but also demonstrates significant efficacy against viruses and coccidia.

Conclusion

Dr. Rahman concluded that “the use of IgY as a passive immunization strategy, incorporated into a holistic approach to reducing piglet diarrhea, offers a safe and natural alternative to traditional antibiotics, particularly in the light of rising antibiotic resistance and the need for effective treatments also for viral diseases.”

EW Nutrition’s Swine Academy took place in Ho Chi Minh City and Bangkok in October 2024. Dr. Shofiqur Rahman, Senior Researcher at the Immunology Research Institute Gifu (IRIG) in Japan was one of the highly experienced speakers of EW Nutrition. Originally a microbiologist, Dr. Rahman focuses on researching and developing IgY products for Human, Animal, Pet, Fish, Plant, and Environmental health.

Optimising Weaner Performance

Conference report

To optimize weaner performance, it is helpful to understand the stressful situation the piglets are facing. In contrast to weaning in nature, which occurs gradually until completion at approximately 4-5 months, weaning in intensive pig operations is an acute process, typically occurring at 3-4 weeks of age. This critical phase subjects piglets to multiple stressors, which can have cumulative effects on their health and development.

Furthermore, the weaning process usually coincides with a decline in the levels of maternally derived antibodies. As these antibody levels decrease, piglets become increasingly susceptible to infections, particularly during the stressful transition to solid food and movement from the sow to the new nursery environment. Managing the weaning process carefully is crucial to minimize stress and support immune function.

Weaning factors that influence a successful weaning

Several aspects must be considered to provide the weaning piglets with the best conditions, and diverse measures must be taken. These measures range from the social environment to nutrition, hygiene, and the people dealing with the pigs.

Social dynamics

When forming nursery groups, aim to keep pigs in these groups as long as possible. Moving all pigs to their new environment at the same time can promote a more rapid establishment of social stability. If possible, once weaning groups are selected and placed in the nursery, keep these groups together to harvest. Any change in the pig group will again result in the need for a new hierarchy to be established, along with fighting and disrupting the group. “Allow newly selected nursery groups to establish their hierarchy by avoiding interventions during the first 48 hours, except to treat sick or injured pigs”, recommends Dr. Parke. “A well-enriched environment, such as chewable ropes and toys, can help reduce stress levels and

may reduce the frequency of abnormal behaviors such as tail biting and aggression.”

Environmental management

The piglets should be kept at an optimal temperature between 27-30°C – depending on floor type, weight, and age of piglets. Adding a heat lamp/floor mat warm area for just-weaned piglets will further assist thermoregulation and minimize stress through the weaning transition.

Proper ventilation is crucial for maintaining air quality and preventing the buildup of harmful gases like ammonia. Good airflow helps regulate temperature and humidity, reducing stress on the pigs. However, care must be taken to avoid drafts that can chill young pigs. For example, a draft of 0.5 m/second can ‘feel’ like an 8°C drop for the piglet.

Targets for gas, dust, and bacteria levels

Risk factor	Gas			Total dust	Respirable dust	Bacteria
	Ammonia	Hydrogen sulphide	Carbon dioxide			
Target levels	<10ppm (20ppm max.)	<5ppm	<3,000ppm (aim for <1,500ppm)	2.4mg/m^3	0.23mg/m^3	100,000 CFU/m^3

Flooring and pen materials should be robust, in good condition, and easily cleaned to reduce the risk of skin abrasions and subsequent infections.

Provide sufficient space (recommended 0.19 m^2/8 kg pig on slat/solid floor) in pens to minimize competition for feed and water and to reduce social stress among piglets.

Weaner pigs benefit from using the same type of feeder in the nursery as in the farrowing room. This consistency can help to reduce stress and anxiety during the transition to the nursery and increase the feed intake during the first few days post-weaning.

Nutritional support

Weaning stress and poor feed intake post-weaning commonly result in dysbiosis and a decrease in villus height in the small intestine of piglets. Associated digestive impairment and altered gut morphology can lead to decreased nutrient absorption, as well as enteric and systemic health issues. A palatable transition diet, from 7 days pre- to 7 days post-weaning, is recommended to keep piglets eating. The composition or form of the transition diet should remain the same during this period. Consider using functional feed additives, such as phytomolecules or egg immunoglobulins, to support microbial modulation and gut integrity.

Ensure piglets have access to fresh, cool, and clean water (minimum water flow of 0.5-0.7L/minute), with enough drinking space (maximum of ten piglets per drinker). Consider providing additional water supply points (e.g., bowls) in the first week.

Hygiene and biosecurity

All-in, all-out management avoids the mixing of different age groups. It is particularly beneficial for weaner pigs, as it helps minimize disease transmission. After removing each batch of weaners, the nursery must be thoroughly cleaned, disinfected, and dried. This includes not just the floors but also feeders, waterers, and any equipment used in the room.

There should be strict rules for everything that comes through the external perimeter fence. Internal biosecurity is also essential, e.g., changing into clean, disinfected boots and thoroughly washing hands when moving between rooms/buildings.

Routine monitoring

Regular and proactive monitoring of weaner pigs, including carefully observing their behavior, is essential for ensuring their health and optimizing growth performance. By implementing effective monitoring strategies, producers can identify potential challenges early and take timely interventions to minimize negative impacts.

Pig positive people

Dr. Parke emphasized that the attitude and skills of stockpersons play a significant role in reducing stress during this vulnerable weaning transition period. Positive handling can improve piglet welfare and their future response to human contact, which is crucial for their short and long-term production performance.

Piglets that receive positive handling are likelier to demonstrate affiliative behaviors towards humans, facilitating smoother transitions during weaning and enhancing their overall development. Stockpersons should be trained to recognize signs of stress or discomfort in pigs.

Collaborative approach

“Collaboration is critical for successful weaning; we can’t have silos in pig production unless it’s to store feed,” joked Dr. Parke. “By adopting a proactive approach that emphasizes collaboration and comprehensive management strategies across the production system, pig welfare and long-term productivity of the herd will be enhanced,” she concluded.

EW Nutrition’s Swine Academy took place in Ho Chi Minh City and Bangkok in October 2024. Dr. Merideth Parke, Global Application Manager, Swine, was one of the highly experienced speakers of EW Nutrition. She is a veterinarian who strongly focuses on swine health and preventive medicine.

Piglet rearing – there is still room for improvement!

*By **I. Heinzl**, Editor, and **Predrag Persak**, Regional Technical Manager North Europe*

Optimal rearing conditions for piglets are crucial for ensuring their healthy growth, reducing mortality, and enhancing productivity. These conditions include proper temperature, nutrition, housing, hygiene, and care. Here are the key aspects:

1. Temperature and ventilation

Piglets are sensitive to cold because they cannot regulate their body temperature effectively in the first few days after birth. Proper temperature control is essential to prevent chilling, possibly leading to illness and death. Additionally, regulating the temperature would cost energy, which otherwise could be spent for growth.
Signs of a too-cold environmental temperature are piling on top of one another, tucking the legs under the body, being unable to get up, laying near a corner or wall, or shivering, which may stop if the conditions worsen. Measuring the body temperature shows less than 35°C in the case of chilling.

The following temperatures are recommended for successful piglet rearing:

Farrowing unit (for newborns)	32 – 35°C (90–95°F) during the first few days
After the first week	The temperature can gradually decrease by about 1.5-2.0°C per week until it reaches 25°C (77°F)

For supplemental heating, heat lamps, heated floors, or creep areas (a designated warm spot) can be used to maintain the ideal temperature, especially in cooler climates.

Temperature is often closely related to ventilation. Ventilation is essential to reduce dust, humidity, ammonia, and other harmful substances occurring in the air. However, if fresh/cold air enters the pigsty, the temperature decreases, which can get dangerous for the piglets. Suitable ventilation means finding a good balance between providing fresh air and maintaining temperature to prevent energy losses and chilling of the piglets.

Comfort zones can be a solution. They are an effective way to keep the piglets warm and ventilation rates

where needed to maintain proper air exchange and humidity levels.

2. Nutrition

Nutrition is critical for piglet growth and immune system development. Most important after birth is the access to colostrum. Piglets are born with an immature immune system, and the maternal antibodies ingested with the colostrum are vital for their survival. They should consume colostrum within the first 6 hours after birth.

It will take 5 to 7 days for piglets to stabilize and get regular on suckling schedule.

At around seven days of age, it is recommended to introduce a highly digestible, nutrient-dense creep feed that helps transition piglets from milk to solid food. Fresh and clean water of the best quality must always be available.

Never forget most important nutrient, beside sow´s love and care – water. Allow piglets free access to the excellent quality water.

3. Housing and Space

A well-designed, clean, and dry environment is critical for reducing stress and promoting health. Farrowing crates help prevent sows from accidentally crushing the piglets during the first few weeks. However, these farrowing crates should provide enough space for the sow to nurse the piglets while allowing piglets to move freely.

Separate warm and clean areas (creep spaces) for the piglets within the farrowing pen are helpful to help the piglets escape from cooler or potentially dangerous parts of the crate. Straw, sawdust, or rubber mats should be provided to keep the piglets warm and comfortable, and good drainage is essential to maintain dryness.

4. Hygiene and Health

Hygiene is crucial to prevent disease and promote the health of piglets. For this purpose, pens and farrowing units should be thoroughly cleaned. Regular removal of waste and keeping bedding dry helps control pathogens. It is essential to clean and disinfect the farrowing unit from one farrowing to the other to reduce disease risks.

Health: After birth, the piglets' umbilical cord stump should be disinfected to prevent infections. A further essential precautionary measure to prevent anemia is an oral supplementation or an iron injection within the first three days of life, as piglets are born with low iron levels.

For further health monitoring and management, it should be ensured that the piglets are vaccinated against common diseases, such as E. coli, Mycoplasma, and Porcine Circovirus. Additionally, deworming protocols and monitoring for signs of parasites should be implemented for parasite control.

5. Weaning Practices

Piglets are typically weaned between 3 and 4 weeks of age, but early weaning (around 21 days) can be practiced in intensive systems. Optimal weaning requires gradual adaptation to solid feed and a stress-free environment.

If the piglets are weaned at 21 to 28 days, a high-quality starter diet after weaning is essential to maintain growth rates and minimize post-weaning stress.

6. Minimizing Stress

Stress management is essential to prevent disease and poor growth. For this purpose, minimize handling to the minimum during the first few days and, if necessary, handle the piglets gently to reduce stress.

A new environment also means strain for the piglets, so keep the litter groups together during weaning to reduce fighting and social stress.

7. Supportive functional feed ingredients

Depending on veterinary and managing practices, the availability of feed, and the possible use of antimicrobials or other medicals as prophylactics, there can be high variability in rearing conditions in diverse areas of the world. In the following, two functional feed ingredients with entirely different modes of action are presented that support piglets at different rearing conditions.

7.1 Egg immunoglobulins (IgY) support piglets under poor rearing conditions

Egg immunoglobulins are beneficial if piglets are not raised under the best conditions, meaning lower hygienic standards and higher pathogenic pressure. With egg immunoglobulins coming from hens having been in contact with pathogens relevant to piglets, it is possible to support the young animals. What is the background? Hens are able to transfer maternal antibodies against diseases that they are confronted with to the egg. With this mechanism, they can provide their progeny with a starter kit for the first time after hatching. However, the best thing is that these antibodies are also helpful for mammals.

A trial conducted on a commercial farm in Spain shows the weight development of piglets fed an IgY-containing egg powder product (EP) compared to a negative control. The weaned piglets were fed a two-phase feeding (15 days prestarter, 22 days starter). The control (n=51) received no additional functional feed ingredient, whereas the EP group was fed 2 kg of the product/t of feed during the prestarter phase. The animals were weighed individually on days 16 and 37.

The results are shown in Figures 1 and 2.

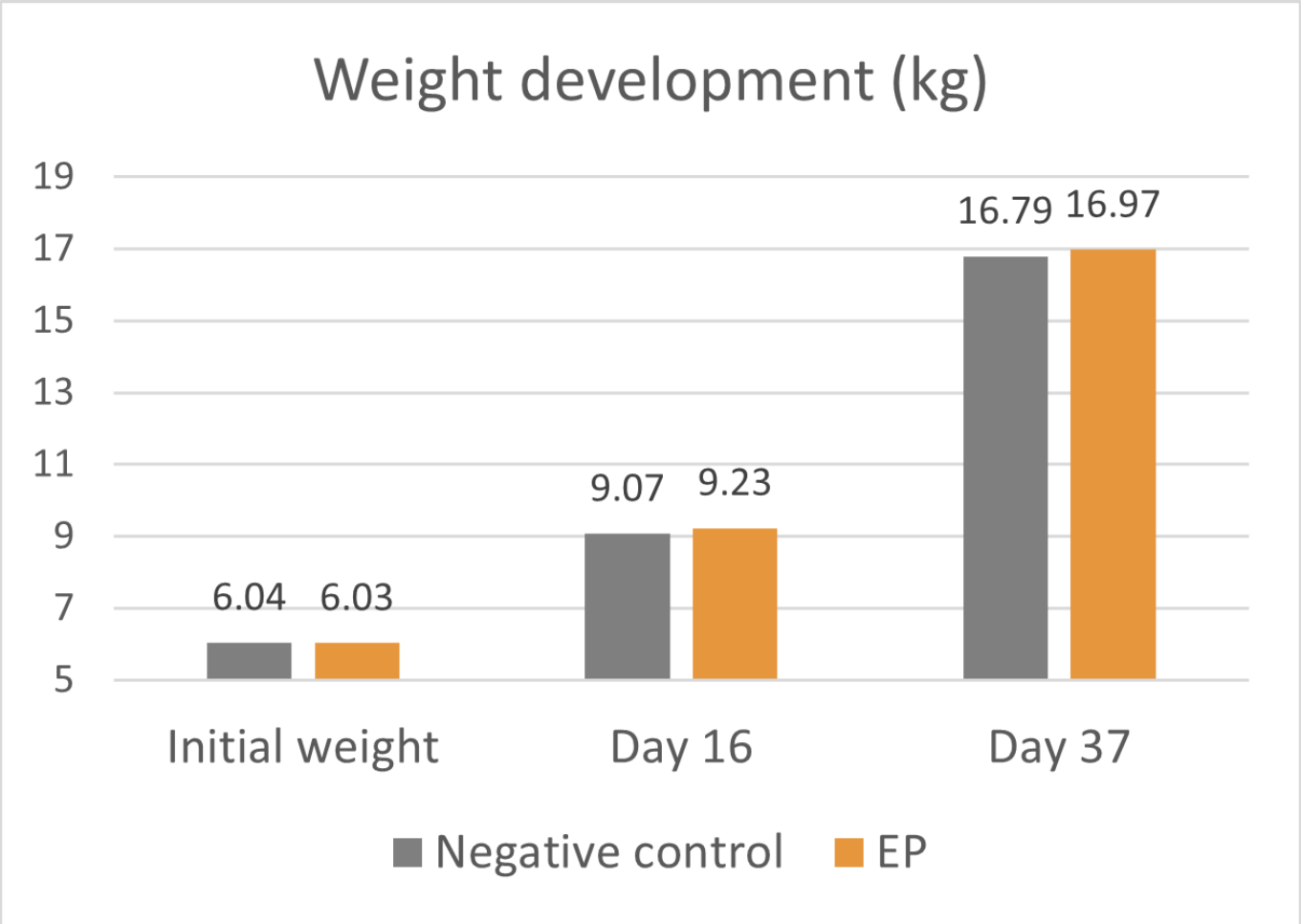

Figure 1: Weight development of piglets receiving an IgY-containing egg powder product compared to a negative control

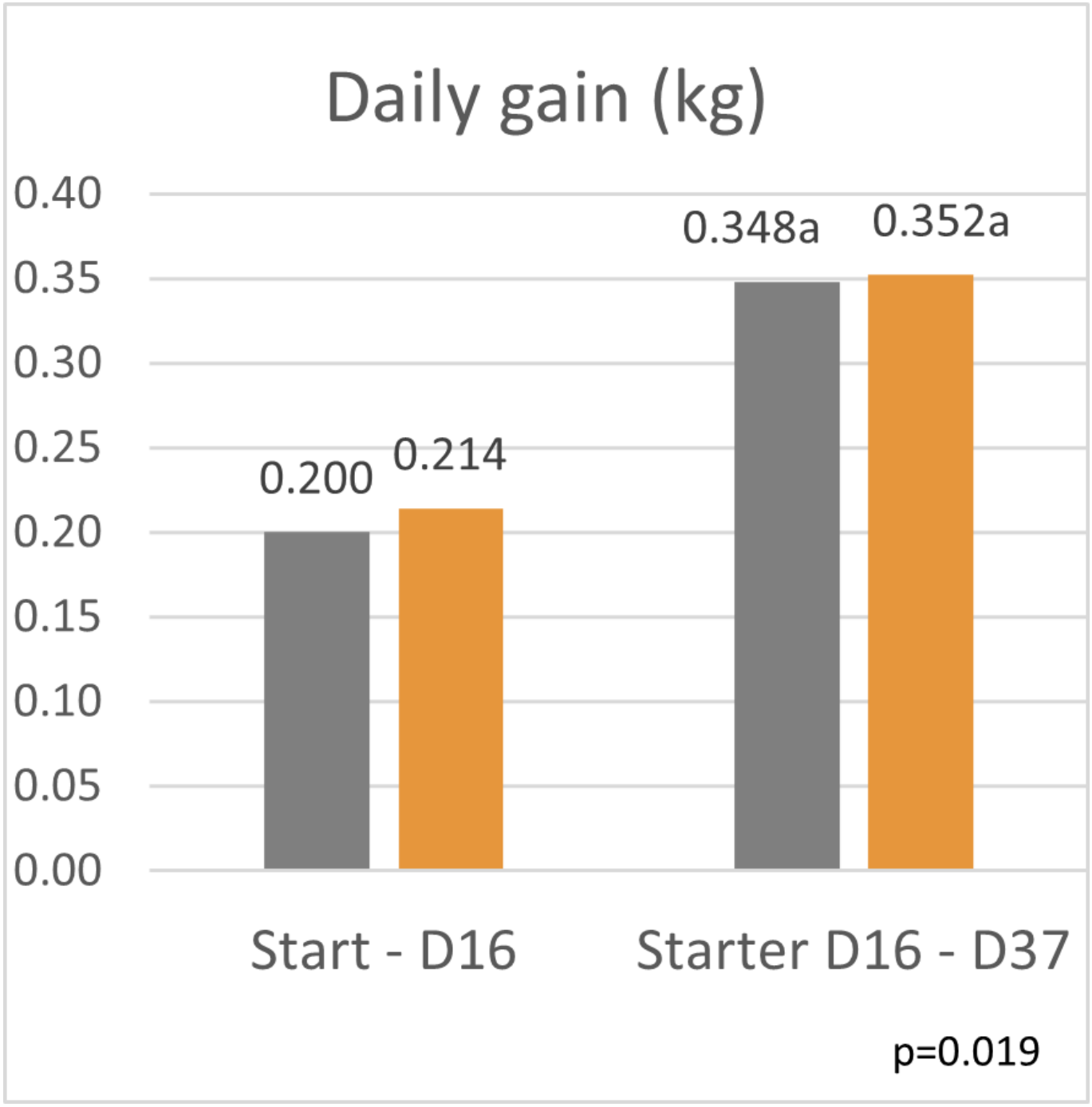

Figure 2: Daily gain of piglets receiving an IgY-containing egg powder product compared to a negative control

Explanation of the results: Under poor hygienic conditions, the pathogenic pressure is relatively high, and everything lowering this pressure helps to improve gut health, the utilization of nutrients, and performance. Egg immunoglobulins positively influence the gut microbiome, thus helping reduce diarrhea. By lowering the pathogenic pressure, the organism's energy can be used for growth and must not be employed for the body's defense.

7.2 Phytomolecules can even show improvement under optimum conditions

Phytomolecules generally show diverse gut health-promoting effects, from driving the intestinal microbiome in the right direction and strengthening the intestinal barrier to acting as antioxidants or anti-

inflammatories or increasing the secretion of digestive juices and, therefore, improving digestion. Which mode of action is relevant if the piglets are raised under already optimal conditions (best hygiene, no prophylactic antibiotics or zinc oxide) and show the highest growth? Is there still room for improvement? Yes, it is. A trial conducted in Germany adduces evidence.

In this trial, 220 piglets weaned on average at 26 days and weighing around 8 kg were housed in 20 pens of 11 castrated males or gilts each. Piglets were blocked by body weight and fed a two-phase feeding program (phase 1 from day 1 to day 13 and phase 2 from day 17 to day 40; pelleted diet). Neither feed or water medication nor therapeutic levels of ZnO were used.

The results of this piglet trial can be seen in Figures 3 and 4.

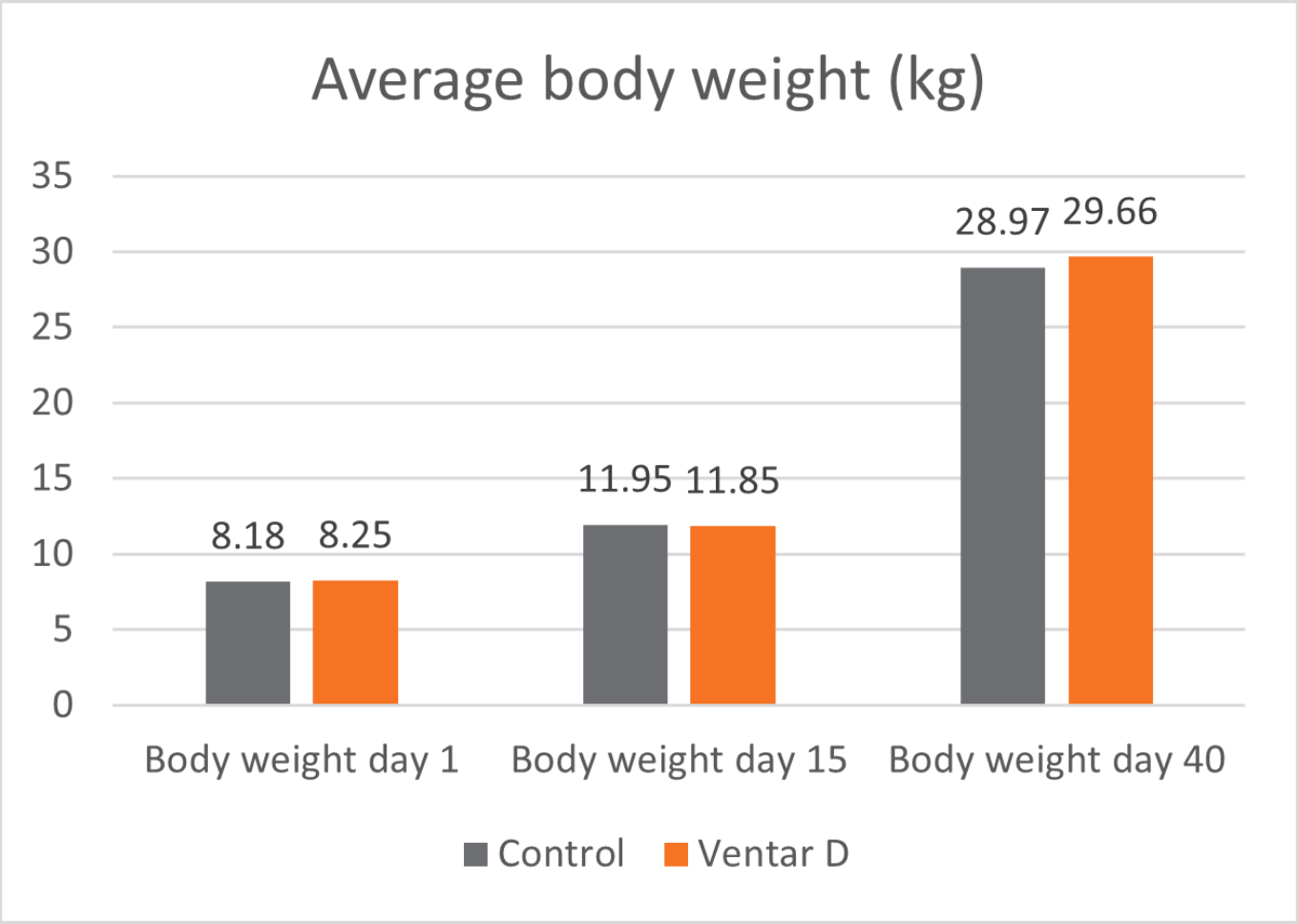

Figure 3: Weight development of piglets fed Ventar D compared to a negative control

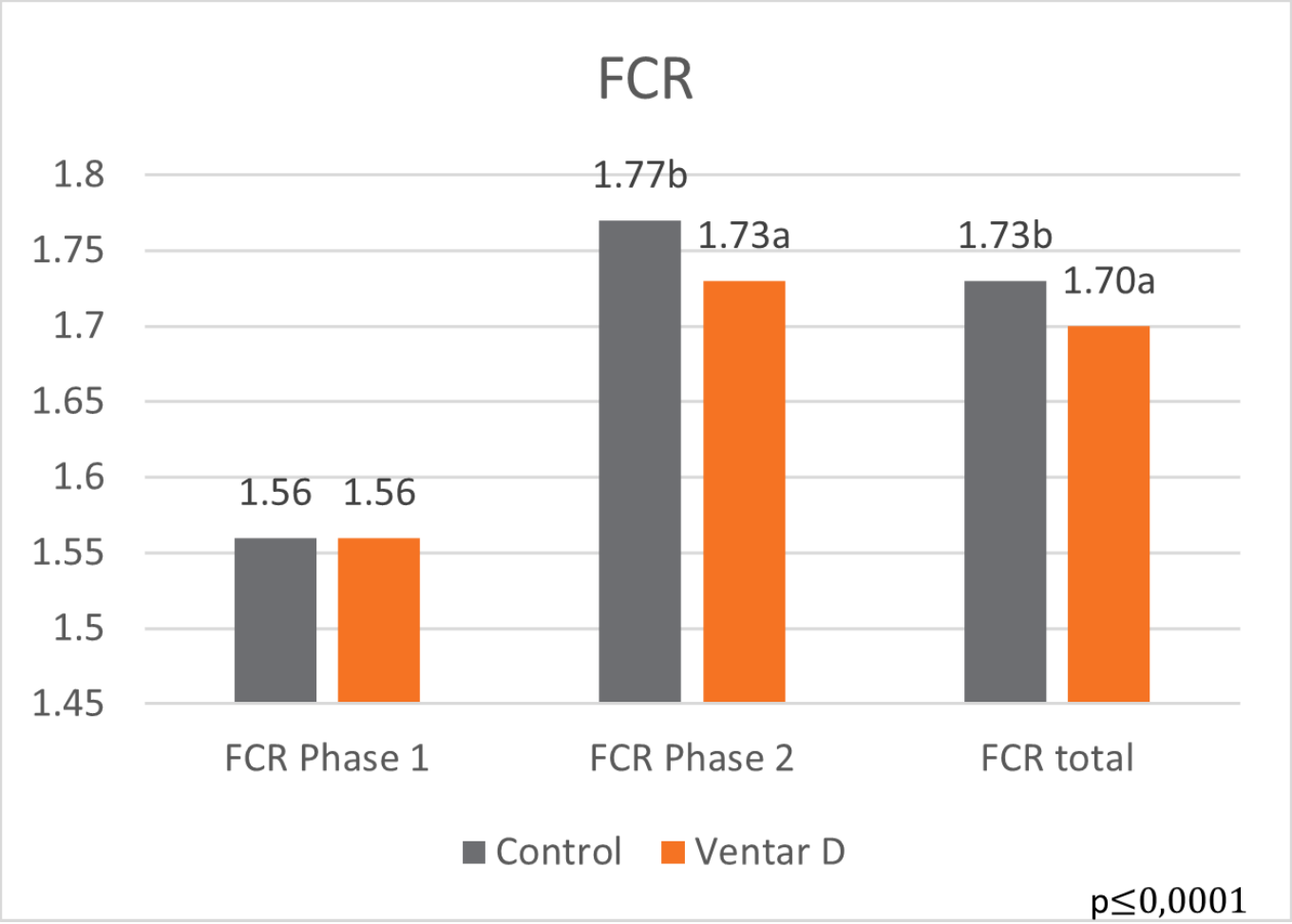

Figure 4: Feed conversion rate in piglets fed Ventar D compared to a negative control

Explanation of the results: The figures show that the piglets in the control already have an extremely high weight compared to those of a similar age in the previous trial, indicating the best rearing conditions in this trial. But, even here, Ventar D has the capacity to improve performance. Why? High-performing animals stress their body more than low-performing ones. Anabolic processes increase oxidative stress and non-infectious inflammation and burden the immune system. The relevant mode of action of Ventar D is not the gut health-promoting or the antimicrobial one because there is no issue. The relevant modes of action in this case are antioxidant and anti-inflammatory. With these two characteristics, Ventar D still has the capacity to improve the performance of piglets that are already at the top level.

8. Conclusion

For high piglet performance, providing the best possible rearing conditions is essential. However, there are differences concerning these conditions in different areas of the world. Depending on them, different feed strategies can be used. Egg immunoglobulins show the best effects if there is a certain pathogenic pressure. Phytomolecules, however, due to their various modes of action, can be beneficial under different levels in rearing conditions. In a low standard, the antimicrobial and gut health-promoting effect is more relevant; in the case of best conditions, the anti-oxidant and anti-inflammatory effects are decisive.

In summary, it could be said that functional feed ingredients have significant advantages in piglet rearing, but the right choice must be made depending on the prevailing conditions.