Practical Health

Insight (25)

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ADG and Immunity

Immunity used to fight against any type of disease is costing energy. The way to quantify how much energy is needed is normally done by determining the reduction in average daily weight gain (ADG) and comparing this reduction to a non-affected control group.

The ADG is the result of changes in feed intake and in feed efficiency or the efficiency in converting feed into bodyweight. The healthier the pig the more efficient this conversion will be (Fig. 1). Genetics and feed quantity and quality also play their part.

When a pig is sick three independent processes will influence the ADG. At first, sick pigs eat less so part of the reduced ADG is a result of the reduced average daily feed intake (ADFI). The second factor relates to the efficiency in which the feed is converted into bodyweight and in the third place to the extra energy needed to restore the health of the pigs. These three factors can vary a lot between different situations and stress can also have a similar impact on the pigs.

This article looks at the underlying mechanism and to some examples.

Factors affecting pigs

Pastorelli et al. (Animal 2011) studied 122 peer reviewed articles involving different factors that affect pigs. The overall conclusion is that an immunological reaction is one of the underlying causative factors that has a great impact on reduced ADG. The immune system consists of many different parts of the body that fight against invading pathogens and disease and this is always done at the expense (reduction) of ADG.

Another aspect of the immune system is the reaction to stress. The outcome is an individual that is on a higher level of alert. This also requires energy which will have a reduced ADG as a result. Both these conditions can be of short or long duration. Parasitic infections and overcrowding are typical conditions that can last for a long time.

The 122 articles from different authors investigated different factors affecting pigs. For example pathogens like parasites, bacteria, viruses and fungi (mycotoxicosis) were studied. These cause an immunological reaction in pigs that have a negative relation to ADG. We knew that part so that was easy to prove. However, from the data set, it was also shown that environmental, housing, social and climatic conditions have an impact on the ADG that is regulated through different factors that are also involved in the immune system.

Stimulation of the immune system can be done in different ways and the reaction can also be different. What they have in common is that they may lead to a reduction of ADFI, to a decrease in feed efficiency and to an increase in spending energy. These are the same basic three elements that lead to a reduction in ADG.

The protein synthesis that takes place in healthy pigs to build up muscles is suddenly in competition with protein synthesis that is needed in immunological processes.

Body protein digestion increases, reducing the bodyweight and the body temperature rises, reducing the feed intake and increasing metabolism. The metabolism of nutrients, growth and the functioning of the immune system is regulated through certain hormones (for example growth hormone, glucagon and cortisone) and through cytokines. In the field of cytokines, the knowledge in the scientific community has greatly increased.

Researchers have discovered that the cytokine profile induced by the different conditions or pathogens in pigs differ greatly. Certain pathogens have a much more profound impact on ADG and ADFI than others. The wasting syndrome, well known from PCV2AD, is a classic example of a cytokine response that gives an undesired effect.

The impact of disease

Pastorelli looked at different reported challenges that pigs may face and, in particular, to respiratory and digestive bacterial diseases, parasitic infections, mycotoxicosis, poor housing conditions and LPS challenge. The impact of these factors was studied and the ADFI and the ADG parameters were determined.

With their method of analysing and based on this database it was concluded that mycotoxicosis had the highest impact on both ADFI (-23%) and on ADG (-30%), followed by the group suffering from respiratory diseases (ADFI -16%, ADG -16%). Parasitic infections had the lowest score (ADFI -3%, ADG -8%), with the others taking an intermediate position.

The variation in the results was great which, of course, is not surprising. In every situation there will be variation in, for example, the severity of the challenge and other factors applicable to that specific study environment. But this does not change the overall picture. ADG is always impacted and part of this reduction is due to ADFI.

Is there a difference in the situations under study for the reduction in ADFI and ADG? Yes and No.

For four out of six conditions the relation between the reduction in ADFI and reduction in ADG was a constant factor. For the mycotoxicosis and poor housing condition the relation between feed efficiency and ADFI was not constant. The ADG decreased faster than the ADFI.

The focus in pork production has always been on disease prevention and control because of the effect of diseases on ADFI and ADG. Often only a part on the population is suffering from the disease and the variation in bodyweight between pigs in the same group will increase.

With the data that Pastorelli studied it becomes clear that not only diseases but other factors like poor housing conditions and hygiene can have a similar effect on the pigs.

To make it even worse, as the underlying mechanism is based on the immune reaction, it is highly likely that all matters of stress will create the same kind of reaction.

Examples of stress are those incurred by overcrowding, not enough space at the drinking points, food troughs etc.

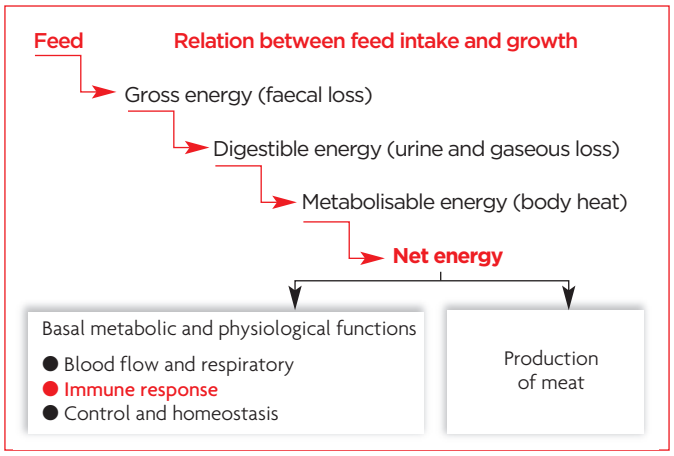
Growing pigs to the market is a complex activity. There is the fixed requirement of the slaughterhouses and food processors to receive market pigs of a certain bodyweight and standard quality only. The desire of management on a pig farm is to have a continuous flow of uniform pigs in a group ensuring that it is possible to completely empty sections of the farm for cleaning and disinfection.

However there are many different conditions that have an impact on the growth of an individual pig. These affected individual pigs will be the reason that the demands of the management of the farm and the requirements of the meat processor are not met. These two aspects will lead to a reduced income for the farmer as well as management problems.

Besides disease control, stress control in all its appearances will also need our attention. Stress is typically something that is happening in individual pigs suffering from mainly zootechnical factors, with a reduced ADG and/or ADFI as a result. Science shows that there is money to earn by paying attention to factors that have a positive influence on the well being of the pig.

The choice should be for optimal production that takes care of good conditions for raising pigs and not for maximum production that, almost by definition, leads to increased stress. ■

Fig. 1. The efficiency of converting feed into bodyweight.



Practical Health

Insight (26)

PCV2 Past, Present & Future

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In recent years, the pig industry has had two major disrupting surprises. The sudden emergence of severe disease episodes caused by PRRS virus, followed some years later by an even more devastating porcine circovirus (PCV2) disease outbreak.

These two viruses were not even on the list of possible swine diseases and had not given off any warning that they might become a danger to the industry. PRRS was an immediate surprise and PCV2 managed to cause a lot of confusion at first before it was finally recognised as an emerging pathogen.

PCV2 differs from PRRS virus by the fact that PCV2 is a DNA virus, while PRRS is a RNA virus.

The genetic changes in a DNA virus are much more limited over time compared to a RNA virus. This again has its origin in the structure of the virus.

Most RNA viruses have a single string (or strand) of nucleotides which makes replication easier but also that failures are easily made in the replication process. These 'mistakes' are called mutations. In the case of DNA viruses, most have a double and complementary strand of nucleotides and this makes the replication more complex.

Also, because the two strands are matching, there is a kind of quality control during the replication process eliminating most of the mistakes and therewith limiting the possibilities for mutations.

In both RNA and DNA cases of mutations the resulting virus should not impair the general multiplication requirements of the virus, otherwise the new virus will not survive. Also, for diagnostic techniques, it can be an issue to pick the new mutant. PCV2 virus is classified as a single stranded DNA virus.

Although the genome is expected to be much more stable because it falls in the DNA group of viruses, research has shown that the incidence of mutations is still very high in the case of PCV2 virus. In fact, much higher than in the case of double stranded DNA viruses and more in the range of single stranded RNA viruses.

In-depth studies have been done on the history of PCV2 virus and what can be expected in the future.

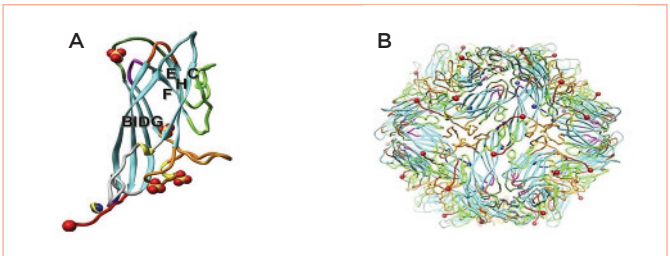
Origin of PCV2 virus

Firth and co-workers published a very interesting article on the evolution of PCV2 virus, which is a very small and simple virus. It is basically a protein clumping together and in that way forms the outside structure of the virus (see Fig. 1).

The authors conclude that both PCV2a and PCV2b have a common ancestor, which is not PCV1, and that this common ancestor appeared in the pig population over 100 years ago. PCV2a was present and detected earlier in the pig population than PCV2b. PCV2b is still regarded as more pathogenic than PCV2a and the authors suggest that PCV2b did not develop from PCV2a.

Both PCV2a and 2b spread to the different pork producing regions in the world in a pattern that reflects the global trade in live pigs. Of course the pigs traded were regarded as healthy and PCV2 diagnostics had not yet been used.

Fig. 1. On the left, the single protein (A) and on the right (B) the capsid or outside structure of the PCV2 virus. Small changes in the simple structure as seen by A may lead to escape mutants. Inside this capsid the DNA (genetic material) is present. It is also very simple with only three parts. For producing the outside protein there is one part, another part is for multiplication and there is a small third part.



PCV1 was first isolated in 1974 and is still not connected to any kind of disease. PCV2 was first isolated in 1997 and is the cause of PCV2 Associated Disease (PCVAD).

The PCV2 virus, both PCV2a and PCV2b, are mildly pathogenic. There is a metabolic cost involved in removing PCV2 virus from the body and this is translated in economic cost that can be measured in well-designed studies. When this virus is affecting the pigs, together with co-factors, this collaboration develops into the severe disease situation as we all know it. Most vaccines are based on PCV2a and confer good protection against PCV2b. It has not been possible to identify exactly where the PCV virus originates from.

Circovirus of birds is the most likely origin but much more important is that it has not been possible to identify the parts responsible for the sudden emergence of the increased pathogenicity.

Present situation

At the moment two developments are taking place at the same time. New PCV2 strains have been discovered and reported in the scientific press and in industry journals. They are classified as PCV2c,d and e.

There are publications that point out that the current PCV2a vaccines are not providing as good protection against these new strains as they do against the 'old' strains. But the evidence of this assumed lesser efficacy is not supported by all researchers.

Also, information coming from the field in Europe and the Americas indicates that sometimes a lesser efficacy of the vaccine is assumed in combination with finding a PCV2 virus that has a slight difference in its genome. However, it still is a seldom observation and adjustments in the vaccination scheme often solves the problem.

Secondly, both in Europe and in the USA, research funds are allocated to closely follow the situation in the field, which is an excellent and necessary initiative.

One of the groups working on this subject is located in Padua, Italy (Franzo, Tucciarone and co-workers). In their work they describe that when immunity induced by a vaccine is not 100%, allowing field strains to circulate in vaccinated pigs, that these viruses can escape the vaccine induced immunity or can increase in virulence or both.

Although PCV2 vaccines are highly efficacious, in veterinary practice pigs are often vaccinated under sub-optimal conditions. This will reduce the impact vaccination can have on the resulting immunity induced in the pigs and on field virus circulation after challenge.

Another research group from Iowa (Shen, Halbur and co-workers) found that after five years of mass PCV2 vaccination, the PCV2a virus had almost completely disappeared in the vaccinated herds. And even more that the prevalence in the few non-vaccinated herds was much lower than before! So, a remarkable shift in dynamics of the PCV2a virus in the area under study.

The PCV2a strains that were still found had some changes in the genetic code of their capsid, which is the base for immunity and may possibly lead to escaping immunity.

For PCV2b, the observed dynamics after the start of PCV2 vaccination are less clear.

The future of PCV2 virus

No one can predict the future, but helping to shape the future is of course something different. From studies as reported above it is clear that the massive adoption of the PCV2a vaccines has certain consequences. For now the industry is very happy with the efficacy the current vaccines are having but, due to its massive use and the related pressure on developing escape mutants, new vaccines based on new PCV2 strains might be required in the future.

The question is: how long will the current vaccines last? This is a question that cannot be answered. The only valid remark here is that when viraemia is controlled in an optimal manner, there will be less field virus that can give rise to the creation of escape mutants.

This is a new area for vaccine use but comes close to how society currently thinks on how antibiotics should be used and how that matter is addressed!

The prudent use of antibiotics will expand the period that they are efficacious. Maybe after some time the industry will also be more prudent in the use of vaccines.

Storage, handling and usage, including timing of vaccination, are critical aspects for many vaccines and certainly for PCV2 vaccines. ■

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Insight (27)

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Precision Livestock Farming

Precision Livestock Farming (PLF) is often referred to as the situation in which a computerised system continuously collects real-time-data of all the animals on the farm in any stage of production. This data is at any moment available for the manager for checking the different processes on the farm and he will use it to decide on corrective actions that are deemed necessary.

When using a computerised system, the input of validated data and intelligent analysis is essential. But where does PLF come from and what are the benefits?

Banhazi et al use a very nice descriptive definition of PLF: 'The main purpose of PLF is to improve the efficiency of production, while increasing animal and human welfare, via applying advanced information and communication technologies (ICT), targeted resources use and precise control of the production process'.

This description contains key elements. PLF comes from the desire to have more control in general and developed into a system that has more control over the individual production processes. It is a given that different farms will all be at different levels of implementing something in the line of PLF – simply because production processes encompass everything and every farmer has one or more production process that he tries to control. Buying 25kg pigs, vaccinating pigs are production processes, just like cleaning the stables after a close out.

All these 'production processes' need a certain standard of working that give the best result. In fact all processes can be individually identified and scrutinised to see if allocated resources are used in an optimal manner. It is beyond any doubt that everyone in the pork business works continuously on improving production, but often on an ad-hoc basis and not from an all processes encompassing view.

There are farms that try to identify and control individual production processes and try to do so in a systematic way. They realise that optimal use of targeted resources is crucial to stay in business. It is the task of management to structure this process of analysing processes within the concept of PLF. The different processes should be identified and prioritised.

Management have to make sure that resource use is optimised within the possibilities of internal and external factors. It is also important that they make sure that the suggested checkpoints for controlling the PLF processes are easy to implement and easy to control. It all starts with the collection of data from the individual animal.

Individual versus average

PLF makes it possible to put much more emphasis on individual data and individual pigs and this has major advantages. For example, if a batch of pigs is slaughtered and the ADG is 800, calculated from start of the finishing period to harvesting, that could look very good. But the reality is that often the variation is rather high, which means that certain pigs should have gone earlier to the slaughter house and some pigs should have stayed longer on the farm.

In PLF individual feeding and/or weighing of pigs is just one of the data collection points. When the pig reaches a certain production bench mark, for example slaughter weight or time for a pregnancy check, they are automatically separated from the rest of the batch.

Another example is the immunological response to vaccination or field infection. In both cases when the variation is high, the uniformity of the batch is at risk. This is exactly one of the advantages of implementing PLF.

The identification of risk factors that may need correction is the underlying process to avoid them happening again. The correct interpretation of more precise information generated through PLF, will ultimately lead to a lot of new benefits.

Animal health products

The handling and administration of animal health products on farms is such a production process where frequently things go wrong. It is not only an example of wrong use of allocated resources but may have far reaching consequences.

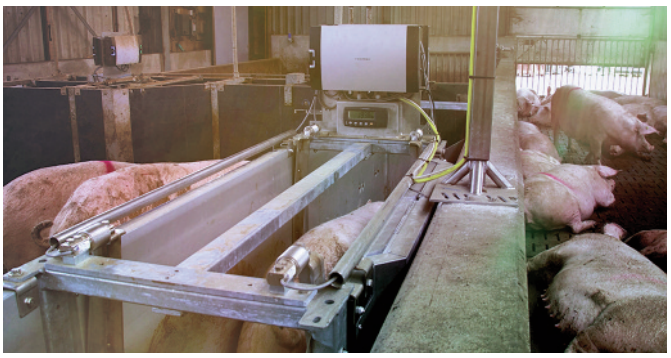
Animal health products account for an average 4-6% of the total expenditure of a farm. The amount of money involved (resource) is thus limited. However, when the purchased AH products are not correctly used the consequences can be far reaching.

It all starts with the decision that it is necessary to use a certain medicine because the underlying process, which is the correct diagnosis of a certain disease and its related economic consequences, demands that this (disease-) process is controlled. In many cases different options to control the disease are available.

They may range from using antimicrobials or vaccines but also other options should be included in the decision making process to make sure resources are used in the best manner. Actinobacillus pleuropneumoniae (APP) infection presents such a dilemma. Next to antibiotics and vaccines, improving the housing and ventilation conditions together with a reduction in kg of live pigs per m^2 is just one of the other options.

Whatever is chosen will have completely different consequences.

Individual feeding or weighing equipment with a possibility to separate the pigs when the production benchmark is reached (courtesy Nedap).



When the choice goes for treatment or prevention of the disease then the selection of a specific product within the group of antibiotics or vaccines is the next step.

When the choice goes for one of the antibiotics, a sensitivity test is essential to ensure that the chosen antibiotic will really work. When the choice goes for a vaccine, the vaccination scheme should be carefully investigated as APP vaccines are notorious for interference with maternally derived antibodies (MDA).

So when APP vaccines are used in the presence of high levels of MDA, firstly the resource utilised for buying the APP vaccine is not used in a correct manner (wastage!), secondly the protection against the APP disease will be less than what could be expected and the Return on Investment (ROI) will be lower.

Within PLF these aspects are important. Making the right selection is based on assessing the options available and using the materials purchased in the right way. In addition, there should be an easy, transparent and controllable registration system of all products entering the farm and also a good record system on what has been used on which animals etc. When, for example, 1,000 doses of a certain vaccine have been purchased the records should easily trace where these 1,000 doses have gone to.

You will not be surprised to learn that often it will show that these doses were used to vaccinate less or even far more than 1,000 pigs. Less could be possible and part of the number of vaccine doses is just wasted, but more is a matter of wrong administration techniques and needs adjustment. Within PLF it is also important to monitor the right storage conditions (a prerequisite is that inside the refrigerator there is a temperature monitoring system) and the right administration technique.

When overlooking the whole process from deciding to buy an AH product to actually using the product and finally checking for the correct use and if it delivers the ROI where hoped; many individual processes can be identified and they all should be included in this specific part of the whole PLF concept.

Optimal use of resources is the key and all-encompassing factor to be competitive. ■

Practical Health

Insight (28)

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Auditing. For what?

Auditing is used in many different types of industry that produces or delivers goods. The nature and the consequences of such an audit can be very different. There are also industries that have unrelated audits in place and their usage is often restricted to a certain production chain only or is just very regional. What is the situation in our pork producing industry?

The pork sector also has many non-related audits. Why? Often the answer is simple: there was a benefit to gain by the one that developed the audit. This could be for the sake of selling products or securing their market.

These audits are focused and product or service related. Is that good for the pork producing industry? Or is there a need for a common auditing system across the pork industry – audits that are designed to protect the interest of the pigs and the pork producing industry?

Auditing requirements

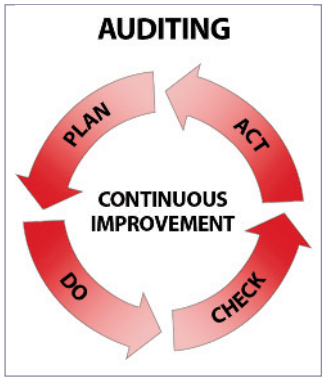
A good auditing system drives on several elements that are all supporting each other. First of all you need to have the pig producers accepting that the audit is indeed to their benefit and are actively cooperating. This means that they implement the necessary protocols on the farm that are required for the audit and that they prepare themselves before the auditor comes.

These two aspects are critical. To run a smooth and cost efficient audit on a farm, knowledge of what will be asked and preparing for the answers, throughout the period between successive audits, is important. Secondly, the meatpackers and retailers need to value the outcome of the audit as an indispensable tool to safeguard the interest of their customers.

When these two different parties acknowledge that an audit is to their interest, than it comes to choosing which production processes are involved in the audit, the organisation and finally the execution of an audit. The selection and description of which processes should be involved and what is checked, is an excellent communication tool. This part should easily be accessible by the general public so that all can see what the industry standard is. And of course this standard should be in line with what consumers accept.

If this is not the case then the production system will always be a possible target for activists that are against our industry and whose actions will always be at a cost to the industry. When the audit pass requirements are transparent this will give the consumers a kind of guarantee that the meat they buy is produced according to societal accepted standards.

Fig. 1. The auditing process should lead to continuous improvement.



Which production processes should be checked?

In the USA, pork producers and the meatpackers have installed such an auditing system already. They call it the Common Swine Industry Audit (CSIA) to indicate that it replaces, nationwide, all the audits that were in place before and were started up by different players in the market. Their all-encompassing name for their auditing process is related to animal welfare. And this is an excellent choice.

Consumers demand that a lot of focus is put on animal welfare during the meat production process and that there is a system in place that checks that the industry lives up to expectations.

Secondly, for the workers, veterinarians included, in this industry many processes that are in place relate, directly or indirectly, to animal welfare. For example, the moving of pigs from one place to another section can be done in different ways.

The handling of the pigs during this process can also differ very much. The focus should go to a group size and moving handling material that is not negatively affecting the wellbeing of the pigs in that process. The same animal welfare principle is applicable in timely euthanasia, castration, overstocking, storage and handling of medicines etc.

There are many different processes on the farm that have an impact on animal welfare. When these issues are checked and (negative-)deviations from the agreed industry standard are addressed, all will benefit and animal activists will have less to complain about.

How should such an auditing system be organised?

Here the wheel does not need to be invented again. There are many examples in place where enough experience has been accumulated over time to help in the design of an auditing system. In short, there needs to be an agreed auditing protocol. The main players here are the pork producers and the retailers. They have a strong voice in the development of the agreed protocol. Veterinarians, pork production specialists and extension workers play a key role in the design of the protocol. Veterinarians may take the lead in this process as by definition they should be the advocates of animal welfare.

For the organisation you need auditors. These persons preferably have knowledge of the pork producing industry and are trained by professionals on how to do an audit. Their knowledge and skills should be frequently tested and updated. They have to obey the rules of an agreed down time period between visiting different farms. They make an appointment with the pork producer so that the pork producer knows that they are coming and can prepare the necessary documentation of those administrative matters that are checked.

Of course this also gives the producer the possibility to correct omissions in his administration but that is not important. It is important that all the required information is available in the correct manner and the skill of the auditor here is important in order to detect possible falsifications.

There will also be auditors that check by surprise visits. In the actual execution of the audit, the tour over the facilities, next to the paper check in the office, is of course extremely important.

During this inspection the farm should be in normal operation. Dirty vaccination equipment, wrong size of needles, expired animal health products that are still ready to be used, dirty boots moving across the different sections of the farm; a skilled auditor will notice all these things. The auditor should preferably be an outside person, not connected to any of the advisors visiting the same farm already.

Of course there can be contact between the auditor and the regular advising staff visiting the farm but only for clarification purposes.

In the evaluation of the audit critical steps can be included. This means that if any of these critical steps are not in order, the farm will automatically fail the audit. Next to this there can be points that need to be addressed but do not lead to failing the audit immediately.

The consequences of failing the audit are completely decided upon by the pork producer and meatpacker/retailer. Retailers can demand a passed audit for their suppliers. Then, when a supplier fails the audit this may include that the pork producer will not serve that retailer up to the moment that he again passes the audit.

Requesting a new audit when the reason for failing is addressed, is of course possible.

Benefits

This all comes down to customers' trust. The world is demanding more and more transparency and this is especially true in the field of food production.

Transparency by itself and alone will not be the creator of trust. Independent parties that are checking and certifying the industry are an essential element.

They should assure that the industry adheres to the standards that they present to the general public as their routine and transparent way of working.

Of course this will not eliminate all risk and will not assure 100% compliance. But it helps in assuring a stable market that appreciates the effort made by the industry. That is the value of auditing! ■

Practical Health

Insight (29)

ON FARM HANDLING OF AH PRODUCTS

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The 2017 European Symposium of Porcine Health Management, held recently in Prague, the beautiful capital city of the Czech Republic, was a well attended meeting with an excellent and interesting scientific program.

On the last day of the symposium, and as the last speaker, Dr Frédéric Vangroenweghe presented data on a survey that he performed on the actual temperatures measured in refrigerators that are used to store Animal Health (AH) products on farms in Belgium and the Netherlands.

These countries might not be regarded as representative for the worldwide situation. However, when the situation in these countries is not considered optimal there is no reason to assume that the situation in other countries is much better.

In this survey the term 'AH products' was restricted to vaccines only.

Objectives of the survey

Firstly, the actual storage temperature for vaccines on pig farms in the Benelux area was measured. Of course the recorded data was analysed and the distribution of correct and incorrect refrigerator temperatures was reported.

Furthermore, an analysis for differences among seasons was made and if there were any differences in vaccine storage temperature between Belgium and The Netherlands. Next to this, all suggestions for improvement were given and financial aspects were included.

Results

For both countries the results were very similar. In around 30% of the cases (110 pig farms in total participated in this survey) the recorded temperature was not within the prescribed limits (between +2°C and +8°C).

The consequences of wrong storage

Of course there are different variables that should be identified. As a general statement it can be said that, when a product is not handled according to the manufacturer's recommendation, the manufacturer (of the AH product) cannot and does not accept any consequence and is not liable for any reported suspected adverse effect.

This counts for all the cases (30%) that Dr Vangroenweghe encountered. But there is more on the individual vaccine level.

Freeze dried vaccines, in general, can handle freezing, so storing below +2°C will not cause any problems. Inactivated oil adjuvanted vaccines will suffer from freezing to the extent that the emulsion will break rendering the vaccine immediately useless.

There are lots of variations on this question of consequences, so the simple answer here is: follow the recommendations of the (AH product) manufacturer and check the temperature of the storage refrigerator continuously. You never know when 'outside of range' temperatures do appear.

The end result is that the affected vaccines will be less efficacious or even cause adverse side effects due to degradation of vaccine components. It is a relatively low investment in a refrigerator but a much higher investment in vaccines.

To protect this high investment, it is a must that AH products are stored correctly.

The availability of a good working refrigerator with a temperature recording system is essential.

Why are vaccines often stored so poorly on farms?

This is a good question which often has a simple answer. True causes are a combination of a lack of knowledge on the consequences of a wrong storage temperature and an unfounded firm belief that the old and second hand refrigerator is in perfect condition.

Of course there are also seasonal differences. In summer the capacity of the refrigerator to cool sufficiently below ambient temperatures is a critical factor, while in winter the refrigerator situation can be very different.

The place where the refrigerator is located on the farm is also of importance.

Everywhere in the world, instructions that are given to farm staff on how to handle AH products is the responsibility of the veterinarian under whose care the animals are treated.

Who is responsible for on-farm storage?

This question is not an easy one to answer. Dr Vangroenweghe decided to call it a 'shared' responsibility between the owner of the pigs/farm manager and the farm veterinarian. Of course national legislation also comes into force so a general statement is difficult to make.

However, when this issue is taken to a higher level a judgement can be given. It all starts with the fact that a diagnosis is made by the veterinarian and that a certain intervention strategy is decided upon. Often, and just for economic reasons, the veterinarian leaves the AH products behind on the farm. He trusts the storage, handling and administration of the AH products to the local staff present on the farm. Does this release him from his responsibilities or make this a shared responsibility? No, of course not.

At first the veterinarian has to assure that the necessary hardware is in place, and in good working order and, secondly, that the staff receive proper training on aspects of storage, handling and correct administration of AH products.

Farm staff that are applying AH products that are prescribed by the veterinarian often do not have the knowledge to oversee the consequences related to wrong storage or use of AH products.

It is amazing to learn that AH products that are the result of several years of dedicated research and that are often expensive end up with end users who are often poorly instructed and seldom read leaflets.

The veterinarian is responsible for the correct storage, handling and administration of the AH products that are used on farms under his care and that are prescribed by him.

He can delegate this responsibility to properly trained staff that work under his supervision. There are veterinary practices that offer this type of training to their customers in both theoretical and practical sessions. In such cases, the veterinarian proves his responsibility and handles in good faith. Now the farmer has to live up to the responsibility given to him, on his request.

Lessons to learn

With a temperature monitoring system continuous information can be gathered, stored and accessed by any connected device. Warning systems can also be included when deviations from the set temperatures are recorded.

As an example, when products are taken out of the fridge and the door is left open too long, the cold air will drop out of the fridge and the inside temperature will rise and it might take a long time before the inside temperature comes back into the desired range.

This can be made visible by monitoring and used to train the staff on farm on how important it is to open and close doors in a quick manner.

Data collection becomes a key element in any business. In the struggle for optimal use of resources a lot can still be learned.

The contribution of Dr Vangroenweghe during the ESPHM 2017 was an excellent example of such a lesson learned by analysing the data gathered by simple monitoring. ■

Practical Health

Insight (30)

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LABOUR AND WATER

An intriguing title for a column. Why are they mentioned together? Is there a relation and, if so, what is it? To cut a long story short, in pork production these two items are rapidly developing into critical production factors. There are, of course, regional differences but more and more areas in the world are affected by one, or both, of these two factors. Let us have a closer look at water and labour and how they can be managed.

Labour

With the increasing size of farms very few pig farmers can do without personnel, but with pork prices fluctuating they are hesitant to allocate resources to invest in training and trying to keep staff with, for example, higher salaries. The consequence is that there is a high turnover of personnel in many countries, which has a negative impact on the quality of the workers.

Quality is defined by experience, knowledge and by having a sense of what a pig needs. In earlier days it was easier to get labourers who were raised on a farm themselves and who knew what a pig needs. With less people living in rural areas and with less farms, the current potential group of farm workers has less knowledge and experience with pigs than the generation before them. This is less of a problem when you need staff for driving a combine or tractor, but dealing with living animals makes a difference and the targets are becoming higher every year to stay competitive.

Targets are, for example, piglets per sow per year, or tons of meat per sow per year. To follow these constantly increasing targets you need many things but one of them is an increasing level of technical skills of the staff on the farm. So the basic capabilities of our workers are gradually eroding, while the demand for technical skills is on a steady and continuous increase.

How is this situation handled in different regions? In Europe the situation is relatively easy. From Eastern Europe many young workers originating from rural areas work on pig farms in Western Europe and often have a background in pork production. Here it is a matter of educating them and keeping them motivated, which always includes a financial component.

In Asia, a similar pattern can be seen and the shift in production from backyard to commercial farms provides labourers with a pork production background. Here education is an important factor for success. In the USA the situation is a bit different. Over 50% of all pigs are housed on the larger farms and labourers are very difficult to get. They often come from other countries on the American continent and have no or little background in pork production. This situation is not going to change for the better by itself.

The only solution is to invest in training programs to make sure that the staff on the farm will not be the restricting factor to reach the company targets. This has to be combined with other actions to keep them on the farm. Providing decent housing for staff is done in certain parts of the world but a financial incentive when company targets are reached works everywhere. In the USA web based training programs are developed in an attempt to help solve labour issues on pig farms. The Pork Avenue Training Portal is such an example.

The basis for a training program is an educational system covering all aspects that are present on pig farms and this should be common for all farm workers. This common program can be topped up with farm specific training when required.

When hiring new staff that possess these proven transparent competences, quality standards on farms are easier to maintain. Of course when skills are on a higher level, compensation should be also. There is no other choice. When in a highly technical environment the targets go up, the skills of the workers have to go up combined with the accompanying rewards. The future situation in Europe and later in Asia will be comparable to what happens currently in the USA. The next generation of pig farm workers will have less affinity with pork production and will require more on the job training. Web based training portals will be an essential part of this training. Farms in certain parts of the world have been forced to close down simply because of a lack of skilled labour.

Water

Exactly the same as with labourers, pork production increases and water becomes more scarce. Rainfall is becoming more unpredictable and this will all lead to less water and sometimes also to water of lower quality. The total amount of water required to produce 1kg of pork meat is estimated to be just below 6000 litres. This includes everything from growing the feed for the pigs, their drinking water and finally also what is needed for cleaning etc. With a growing and more demanding urban population, water consumption for cities will increase, leaving less water for growing vegetables and feed for livestock. This can be reverted by importing meat.

The famous Osler Desouzart mentions in his lectures that when a country is importing pork meat it is in fact 'importing' water! He calls it 'virtual' water import.

Take China as an example. It has a fast growing urban population, a quick transfer from backyard pork production to large scale commercial farms, less rainfall and many cases of polluted water. No wonder that the earlier concept of being self-sufficient in pork has been weakened and, as a result, China has become a major player on the international pork market, as a buyer!

Japan developed this strategy some years ago for a number of other reasons. No wonder that China also recently opened their market for beef. Beef, with an estimated requirement of 16,000 litres of water per kg of meat, is by far the largest consumer of water per kg bodyweight.

Feed can be bought and transported over large distances. Buildings and other technologies can be locally constructed or imported. This is not feasible with water. Pig farms in certain parts of the world had to close down simply because of a lack of water.

Water and labour are real critical production factors that will become even more critical in the near future.

For the labour issue, farm managers can try to influence this trend by providing high quality transparent training to their staff with an appropriate incentive scheme.

Of course, first the new staff has to be hired and here a more animal friendly housing situation might be of help for the workers to experience more joy in their work!

Secondly, managers should develop schemes that makes it attractive for staff to stay, so that the investment in personnel will be for the benefit of the farm in the long run.

For the water issue the situation is different. Little can be done to influence this natural phenomenon. Climate change is a hot debate but, without a doubt, climate change has an influence on rainfall.

China, for example, tries to manipulate rainfall and transports water over long distances. However, it still has to prove how successful these programs will be in the long term.

It is foreseeable that animal protein production will be concentrated in those regions with enough rainfall for both the human and livestock population and with enough skilled labour. ■

Fig. 1. Large parts of Western China are dry with little agricultural potential (grey area), while in the darker (brown) parts of Eastern China all urban, economic and agricultural activities are concentrated. Rainfall is mainly in the South-Eastern part.

Practical Health

Insight (31)

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Gut Health

On March 17th 2017, a full day was dedicated to discussing important matters related to Pig Gut Health at a conference hosted by International Pig Topics in Bangkok during VIV Asia 2017. Speakers from Asia, Europe and the USA covered different topics ranging from feeding strategies for lactating sows to strategies used for PED prevention, immune function and microbial activity, vaccination programs and the metabolic cost of stress and disease.

In addition, the different additives to influence gut health were discussed, including manipulating microbiotica for optimising piglet performance, feed enzymes, mycotoxins, probiotica and how to improve antibiotic treatment.

The discussion between delegates and speakers was lively and continued until the very end of the meeting. This article looks at some of the highlights of the conference.

Feeding strategies

Lactating sow feeds strategies was the title of the opening lecture but of course these strategies already start in gestation. High levels of fermentable carbohydrates in gestation feed were recommended, combined with a two phase feed scheme aiming at reducing embryonic death and increasing feed intake in the first phase and for increasing birth weight and vitality of piglets in the second phase of gestation.

The situation may differ between farms and so will the composition of the feed used. For example, when constipation is an issue more inert carbohydrates should be used. In any case a smooth transition to lactating feed should be planned. The second phase gestation feed can be continued into the first couple of days in lactation in a restricted manner or the phase one lactation feed can be introduced at an increasing quantity a couple of days before farrowing.

The second phase lactation feed given to a piglet from two weeks of age should be given ad lib with starch as the main energy source and with a higher level of crude protein. This lecture by Jannes Doppenberg from the Schothorst Feed Research institute in the Netherlands was highly appreciated by the delegates for its high level of detail and technical standard.

Corridor discussions centred on the number of feeding moments, which is a critical item in hot climates. In high temperature regions sows with large litters often have difficulties taking up the huge quantity of required feed when only two feedings per day are scheduled. Under these conditions it is better to split the total quantity over more feedings per day or keep the sows in a group and install automatic feeding stations. Providing enough water should never be forgotten and both water quality and water flow should be checked regularly.

When piglets are born and colostrum is taken up in time and in enough quantity the immune status of sows and gilts is an essential parameter. Protection of the young piglets all comes from the dam and through the first milk they ingest. Even for diseases that no longer have impact on the sows this protective mechanism can still be used. Examples are neonatal diarrhoea caused by either E. coli or clostridium.

Vaccination schemes

The vaccination schemes used in breeding stock that all have a positive impact on either the unborn piglets or the newly born piglets were handled at the conference by Dr Raul Berro from the Philippines. In his conclusions he pointed out that it is very much a matter of selecting the right gilts (enough teats) and right vaccines (inducing high levels of protective antibodies) in combination with the right timing of applying the vaccines (vaccination schemes).

This shows again how technically complex the pork producing industry has become. Everyday the farm manager has to make decisions, like what is the right time for the vaccination, and the outcome of the decision has a big impact on the next step in the production process.

Practical data on PED

Dr Pariwat Poolperm from Kasetsart University in Thailand presented practical data on PED preventive strategies showing very clearly how IgG and IgA antibody levels in colostrum increased after either PED vaccination or after feedback with PED virus containing material.

The height of the villi in the small intestine, either in the duodenum, ileum or jejunum, after a PED virus challenge was related to the amount of colostrum that the piglets received and of course the PED antibodies it contained.

The rationale on the transfer of immunity for the important pathogens through immunisation of the sow was outlined followed by a presentation on the research done by Kasetsart University dealing with a disease that causes great damage in both Asia and the USA.

Dr Pariwat had to answer many questions on how the feedback material was actually made but his team had an excellent 'home-made-video' that included all steps from the selection of the starting material, to mixing and processing this material to the actual administration to the pregnant sows. Again, this was a particular highlight of this conference.

Performance-linked microbial index

That pig gut health has become a very important subject to study became clear from the presentation of Peter van't Veld from Denkavit, the Netherlands.

An enormous amount of data was collected on bacterial flora in the hindgut of the pigs and this was linked to the performance of the pigs.

In this way a Performance-linked Microbial Index (PMI) could be defined. The goal is to define which micro-organism (microbiota) should be promoted by feed or management to get a good feed conversion ratio (FCR).

In future, faecal samples might give an indication of the expected FCR. Or, when clear differences are present in FCR, the microbial flora might give the required information on what the desired intestinal flora should be. That this flora can be influenced by feed composition was clear from several speakers.

In the lecture by Dr Jason Frank of Diamond V from the USA, he pictured the pig gut as much more important in terms of pig health than previously thought.

He referred to Lyte who even wanted to consider the microbiota in the digestive tract as an organ. The microbiota can influence the host disease susceptibility, the host nervous system can influence the microbiota and thirdly the microbiota possesses its own nervous system.

There is need for further research to reveal the function of a microbiota-gut-immune-system-brain axis in pig health.

Knowledge is constantly evolving and the audience was informed on what the near future may bring.

Metabolic cost of stress

The lecture on metabolic cost of stress and disease by Sarah Cervantes from the Philippines was a great example on this phenomenon of increasing knowledge. It was very new only yesterday, it is very much accepted and appreciated today and will have a great impact on how management activities are judged tomorrow.

Stress and disease are important factors in sub optimal performance on pig farms. Reducing the metabolic cost of stress and disease requires the removal of stressors contributed by farm mismanagement(!), microbial and viral exposures and the presence of immunogens in the feed.

Explicitly addressing farm management, it is important to take matters such as animal welfare seriously.

'High immune stimulation' was arranged by creating a nursery environment that was not hygienic (no cleaning) and by practicing continuous flow combined with co-mingling. In several parts of the world this is still 'normal' practice.

It is impossible to give detailed information from all the lectures presented at this very interesting conference. However, the last three speakers informed the audience about aspects relating to mycotoxins, on how the efficacy of an antibiotic treatment can be improved and on the mode of action and advantages of probiotics.

The audience was able to absorb a good mix of research reports looking at the near future combined with practical matters that can be implemented almost immediately when the situation on the farm is ready to accept the advice given.

This conference clearly showed the importance of good management practices. ■

Practical Health

Insight (32)

Change

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Change has always been our way and will continue to be so. However, change creates frustration, makes us angry and can take us out of our comfort zone. The pork producing industry is subject to constant change and this has three main drivers: society, technology and the interaction between the two.

The outcome of this third driver is not predictable and sometimes even in conflict (i.e. science has proven that it is better to go in a certain direction but society decides to go the opposite way).

In this interaction the stakeholders differ in their information strategies and in their objectives, often with minorities dominating. This all makes it impossible for the general public to get a clear and unbiased picture and they end up as a simple follower in this process of change.

Society will always be subject to change. New generations will have different ideas even when the impact of new technologies is taken out. But when new technologies, like, for example, Facebook, are taken up widely by a new generation, the process of change can get a strong momentum. The Kübler-Ross change curve (Fig. 1) shows the different phases that normally accompany change.

Another factor of importance is that change always includes a risk. With only a small financial buffer and a wrong decision, change might mean the end of being in business. Numerous examples are known from history about famous industries that have disappeared, simply through taking decisions that did not deliver.

Examples of the interaction between society and technology in the pork sector include:

- Feeding a larger world; leading to a higher number of pigs in a concentrated area.
- Low-cost intensive-production systems; making affordable consumer prices possible.
- Animal welfare, climate change and antibiotic resistance; all, for completely different reasons, leading to a more and more critical society demanding change.

Feeding the world with low cost products

The post World War II era has seen an enormous growth in the urban population demanding regular supplies of affordable food, including a growing share of meat.

Agriculture was booming with a steady increase in the number of farms; this later changed to a decrease in the number of farms but with a growing number of animals per farm. This had a big impact on rural populations and these changes are still occurring all over the world.

In the USA in 2017, four million out of the total of six million sows are on the premises of 40 large commercial farming enterprises only.

The sow population on these 40 farms grew by some 250,000 in only one year! This is very different from some years ago when the average farm size was much smaller, providing income to many families in rural areas. These smaller farms were essential for creating a rural economy, which is currently absent in many regions across the world.

Is it impossible for smaller sized family farms to feed the world? There are many aspects to consider when trying to answer this question.

Smaller farms have more obstacles to react quickly to successive changes and are more at risk when changes are occurring.

This is partly due to the small financial buffer they have, but also due to their management structure. To analyse a new situation and take an educated decision on where to go, managerial skills are required.

Larger farms with skilled managers are better equipped for tackling these changes. The larger farms often have easier access to capital, they have staff to analyse changes that the industry comes across and they are not committed to one region, as a family farm typically is.

The increase in farm size to large enterprises is therefore also driven by the risks that a constantly changing society is confronting the industry with, which is different from the driving force to have the capacity to feed the world.

In many European countries pig farms are still a family business. The process of consolidation is slower compared to what happens in the USA. Europe is a pork exporting area, contributing to feeding the world and, although less than before, contributing to the rural economy.

Last but not least, the large farms are not, by definition, profitable. Management pays off but only when they take the right decisions.

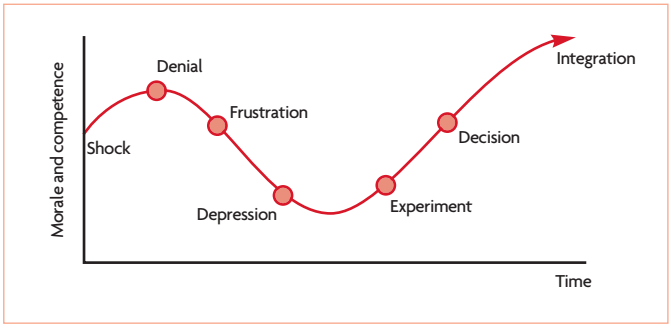

Fig. 1. The Kübler-Ross change curve.

Climate change and antibiotic resistance

In these very different conditions, awareness and agreeing to the origin of the problem is essential to execute a global program to limit the impact of these factors.

At this moment in the debate on accepting climate change some major stakeholders suddenly take a different view, which does not help. Climate change will have a big impact on certain regions that are now important in pork production.

Rainfall patterns are already changing and pork production needs a lot of water.

Also, sooner or later, the livestock industry, including pork producers, will have to contribute to the reduction in greenhouse gas emissions. The goal for every industry is to become carbon dioxide emission neutral. Solar panels on pork houses, production of biogas but also better production records producing more kg of meat with less sows or less feed, are all examples the pork industry can work on.

Antibiotic resistance is of a completely different magnitude. The whole world is contributing to this problem with a difference between regions. The increase in international (human-) migrations means, as a consequence, that these differences gradually disappear.

In Norway and Sweden the antibiotics resistance profile is getting now close to that of the Middle East. This is very different from some years ago when Norway and Sweden were standing out positively. This change happened with very little veterinary involvement.

It shows how complex the matter of antibiotic resistance is in our modern volatile society.

The predicted number of deaths due to antimicrobial resistance in 2050 is enormous, with large regional differences, but all regions are affected. This will all put pressure on how animals are reared and housed so that the necessity of antibiotic treatments will be reduced.

Veterinarians will have to contribute to this reduction. Producing pork using less antibiotics is seen as a force and opportunity to change to better production systems.

Animal welfare

The Kübler-Ross change curve shows us that humans are very inventive in turning around a threat into a positive development.

Just like the situation in the recent past when the pressure was on producing enough affordable food, the current threats of climate change and antibiotic resistance will drive the production systems to change. The pig could be the winner.

Better housing conditions combined with better management will lead to improved welfare and examples are present that these changes reduce the need for antibiotic treatments. It will also reduce the cost of production or improve on economic production parameters. Relying more on non-fossil natural energy sources has a positive effect on the cost of production systems.

During the opening session of the 7th Chinese Veterinary Conference 2017 in Chengdu, China, the President of the Association of Veterinarians in Africa, Dr Kechrid, stressed that veterinarians work for the benefit of food, health and the planet. Just think about it! ■