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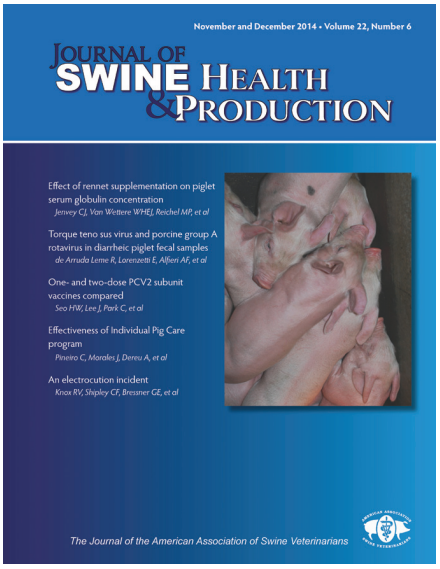

A litter of Minnesota piglets

Photo courtesy of Tina Smith

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quoted from the Executive Editor's message, page 281

swine influenza

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The changing role of the veterinarian

It was 4 years ago this month (November) that the AVMA Executive Board approved a recommendation to amend the Veterinarian's Oath to add four words, denoted in boldface below:

"Being admitted to the profession of veterinary medicine, I solemnly swear to use my scientific knowledge and skills for the benefit of society through the protection of animal health **and welfare**, the **prevention and** relief of animal suffering, the conservation of animal resources, the promotion of public health, and the advancement of medical knowledge.

I will practice my profession conscientiously, with dignity, and in keeping with the principles of veterinary medical ethics.

I accept as a lifelong obligation the continual improvement of my professional knowledge and competence."

While I will not go into the specifics of the process that took place to amend our oath, nor my thoughts on that process, the end result was that our oath now has a stronger commitment to animal welfare than it did prior to the amendment, and I think that is a good thing. However, it is important to make it clear that I believe that is a positive change when considered within the context of our oath, in which we solemnly swear to use our *scientific* knowledge and skills to honor that commitment to animal welfare.

It is critical that valid scientific data is the driver of the animal welfare field, not public opinion or agenda-driven activists. We have a sworn duty to protect the health and welfare of the animals under our care. As veterinarians, we are not in a popularity contest, and even if we were, it is against the principles of veterinary medical ethics (which we have also sworn to uphold) to make recommendations based on anything other than "the needs of the patient, the welfare of the client, and the safety of the public."

"… I believe that is a positive change when considered within the context of our oath, in which we solemnly swear to use our scientific knowledge and skills to honor that commitment to animal welfare."

In addition to upholding our sworn duty to protect animal welfare throughout our day-to-day practice, there are many ways we can be more formally involved in animal welfare. Veterinarians can (and I would argue should) be involved in writing company- and farm-specific animal-welfare policies, protocols, and audits. Veterinarians can also play a key role in creating training programs for new employees that encompass topics such as animal handling, antibiotic use, and euthanasia methods, all of which are important components of ensuring appropriate animal welfare on-farm. Furthermore, most professional and industry associations have an animal welfare committee and many of them welcome new members routinely.

I briefly mentioned animal welfare audits, and I would like to expound on that topic just a bit. As most of you know, any producer that markets to multiple packers is currently subject to multiple third-party audits. Unfortunately, today, those audits are variable in breadth and depth of scope. I think it is critical that producers know what is expected of them by establishing one set of animal-welfare criteria that is based on science and accepted industry-wide. True animal welfare should not be a marketing tool, but should be adequately provided for all pigs, regardless of phase, scale, or type of production. I have been honored to serve on the Industry Audit Task Force, a group that was brought together to establish such a set of animal-welfare standards and a common audit tool for use across the industry, regardless of production phase or packer affiliation. My hope is that this new set of animal-welfare standards and the common audit tool will be widely adopted, supported, and endorsed by producers, veterinarians, and packers. This program has the potential to ensure that we continue to build and maintain trust and confidence by bringing consistency, efficiency, and transparency to our third-party audit system.

In keeping with the emphasis on the importance of basing animal-welfare protocols and principles on science, the AASV Foundation (AASVF) recently announced its plan to fund scholarships for AASV members interested in pursuing board certification in animal welfare, available through the American College of Animal Welfare. The AASVF has committed to award up to five $5000 scholarships, each renewable for up to 3 years. This is a demonstration of AASV's commitment to animal welfare and the importance of our members taking an active role in the future of animal welfare. I would love nothing more than for the foundation to be able to award all five scholarships to AASV members working toward board certification in animal welfare. Will you be one of the recipients?

Michelle Sprague, DVM
AASV President

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Leveraging time and talent

Non-profit associations, both large and small, depend on volunteers for achieving the mission of the organization. Part of the reason for this dependence is that associations often operate in an environment of limited resources, which in turn limits the number of paid staff. The other reason is that very often the best person to fulfill a role for an association is a volunteer with the right combination of talent, knowledge, and motivation. This is true in veterinary medicine and especially true for the AASV. The AASV has a long history going back to its origins of using volunteers for the various functions and tasks of the organization.

The governance and administration of the AASV is in the hands of the board of directors, which includes the elected district directors and the elected officers on the executive committee. These members are all volunteers and freely donate their time and talents to the AASV. The district directors represent their respective geographical districts and the officers represent the entirety of the association members. The decisions faced by the board range from budgetary issues, programming, committee activity, official positions, staffing, and other strategic matters. In between the biennial board meetings, the executive committee is tasked to act on behalf of the board.

Other AASV volunteers serve on committees that are usually issue-based. These committees always meet during the AASV Annual Meeting. Every committee is also approved for an additional meeting at another time during the year as needed. As issues arise, they are referred to the appropriate committee. Occasionally a new committee may be created to deal with a specific issue. Committees need to be challenged to stay active and engaged. Part of this can be accomplished by motivated leadership and active scanning of the profession and industry for potential needs. Committees can also be rejuvenated by allowing members to retire and bringing on new members.

Another area of volunteerism for the AASV is the sending of representatives to other organizations and regulatory agencies. Some examples of this are the American Veterinary Medical Association, National Pork Board, National Pork Producers Council, US Food and Drug Administration, and US Department of Agriculture. Contact, communication, and collaboration with other organizations and agencies play a large part in advocating on behalf of the interests of our members. Alliances with like-minded groups are essential as we leverage resources and find synergy in positioning and representation.

"The best volunteer is a member who is self-motivated, knowledgeable, and fearless."

One area of AASV volunteer representation is with the American Veterinary Medical Association. The AVMA is the parent organization for all of the allied species groups, including AASV. As such, AVMA provides numerous opportunities for AASV members to participate in the committees, task forces, and councils of the AVMA. The food-animal sector of AVMA membership is shrinking, while the majority sector of companion-animal medicine is increasing. This fact makes AVMA representation all the more important for AASV, albeit more difficult at times. Not only are we a minority, but our industry is often misunderstood and sometimes even misrepresented by our opponents. Our representative may be the only contact with food-animal medicine for many of the other AVMA members. It may be this contact and representation that facilitates AVMA to adopt positions and policies beneficial to the AASV and the swine industry.

An essential part of any association is providing volunteer opportunities for young members. I won't bore you with the cliché of "our youth are our future." This statement is way too limiting, because I believe that while the future is indeed a concern, our younger members are our present! They can contribute in the here and now without waiting for years to serve the association. The AASV can't afford to build barriers to volunteers; rather, we need to enable the participation of motivated and talented members who are willing to give talents and time.

When dealing with practice and production issues, it is a strategic advantage to leverage the time and talents of those veterinarians closest to the issue at hand. No one can provide a better perspective or more accurate view of an issue than someone who lives that issue on a daily basis and is impacted by the decisions arising from the issue at hand. Practical experience and having "skin in the game" offer a first-hand experience that cannot be equaled by merely studying an issue. Offering informed opinions and fact-based deliberation is a cornerstone of policy-making for the AASV.

The breadth of volunteerism within the AASV is amazing. From committee membership to elected offices to representation to other organizations, agencies, and groups, AASV volunteers stay active and involved. The best volunteer is a member who is self-motivated, knowledgeable, and fearless. The attribute of fearlessness comes into play when a volunteer must assert and/or defend an AASV position that may not be popular with everyone involved. The best volunteer is a member who is driven to do their best for the AASV regardless of the lack of compensation, accolades, and recognition and even, perhaps, in the presence of controversy and opposition.

Thank you to each and every volunteer serving the AASV!

Tom Burkgren, DVM
Executive Director

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Thank you!

This has been a successful year for the *Journal of Swine Health and Production* (*JSHAP*). It feels like just yesterday I was writing my Welcome 2014[1] message, and now here I am sitting writing my message for the final issue of 2014. My mother warned me that as I got older time would seem to go by faster – and she was correct – again! In the November-December issue, *JSHAP* publishes a list of the reviewers who have graciously reviewed manuscripts for the journal. This year the list is composed of 87 names of reviewers and editorial board members who have reviewed manuscripts. I ask everyone to have a look at that list and recognize those individuals. I would like to personally thank all of the 2013-2014 reviewers and editorial board members for their hard work and contributions to the journal and our successful year.

In a previous message, I described the peer-review process for a manuscript submission with *JSHAP*. If you have not read that message yet I encourage you to read it.[2] What I didn't mention in that message in great detail was how much work the review process is for the reviewers specifically. *JSHAP* asks a reviewer to return a manuscript to the office within 3 weeks of accepting it. This is to help *JSHAP* keep the review process moving along in a timely manner. Any revisions requested of the author will need to be re-reviewed and so typically a reviewer will need to re-evaluate these revisions, perhaps 8 weeks after seeing the manuscript for the first time. This timeline depends on how long it takes for an author to respond to any queries raised. And so the commitment to review a manuscript can span a few months. What I am trying to say is that a reviewer may see a manuscript anywhere from one to three times before their work is done. This requires a considerable time commitment on behalf of the reviewer, and I feel it is often an overlooked and perhaps under-appreciated job. I myself have been guilty of grumbling in the office lunch room about certain comments a reviewer may have provided on my own work submitted to journals over the years. What you don't know, however, is who that reviewer is. I was in a situation once where an author was discussing (AKA, complaining about) a reviewer, and about half way through the conversation I realized that I was that reviewer. I fear my face may have gone beet red and given away my secret. I had spent a great deal of time crafting thoughtful comments that I felt were fair, courteous, and helpful. At the time, I was a new reviewer and I felt terrible that the author was so upset. Now I really aspire to not grumble about my own reviews, as I have an even greater appreciation as to how much work they are and how important they are for the development of our body of scientific knowledge.

"…JSHAP has had a nice increase in our impact factor…and this is attributed to the hard work of our reviewers, authors, and staff."

It never ceases to amaze me how willing the scientific community and our AASV membership are to help with the review process. In this time of busy schedules and increased work demands on everyone, everywhere, I recognize it is often difficult to take on additional work (I hope you can now appreciate that reviewing a paper thoroughly is a ton of work). Our journal manuscript submissions have been very healthy this year. At the time of writing this message, we have already surpassed our 2012-2013 count for manuscript submissions and we still have many weeks left in the year to go. While this is terrific for on-going contributions to the scientific literature, it does make recruiting reviewers challenging. And so, once again, thank you to those who take on extra work in this era of busy schedules.

One more item of good news in the continued development of the journal is the increase in our impact factor this year. I have mentioned in a previous message how impact factors are determined and what they represent.[3] I don't like to dwell on impact factors too much, but I would like to recognize that *JSHAP* has had a nice increase in our impact factor, the highest recorded in several years, and this is attributed to all the hard work of our reviewers, authors, and staff. Thank you all for your contributions to a successful 2014 for *JSHAP*!

References

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Terri O'Sullivan, DVM, PhD
Executive Editor

ORIGINAL RESEARCH PEER REVIEWED

Investigation of the impact of oral rennet supplementation on serum globulin concentration in neonatal piglets

Caitlin J. Jenvey, BSc; William H. E. J. Van Wettere, PhD; Michael P. Reichel, DVPH, DVTM, MVSc, MBA, Dr Med Vet, PhD, FACVSc, Diplomate ECVPH; Peter D. Cockcroft, MA, MSc, Vet MB, DVM&S, Diplomate ECBHM

Summary

Objective: The objective of this study was to determine whether oral supplementation of piglets with rennet increases immunoglobulin absorption and thereby piglet serum globulin concentrations. Serum immunoglobulin concentrations in piglets derived from induced farrowing and non-induced farrowing multiparous (MP) and primiparous (PP) sows were compared.

Materials and methods: A total of 20 MP and 20 PP sows were used in this trial, with half of the MP and PP sows induced to farrow using prostaglandin F2α by injection. Each piglet from induced and non-induced MP and PP sows was conveniently assigned to one of three treatment groups: no supplementation, oral supplementation with rennet, or oral supplementation with saline. Rennet and saline treatments were administered to piglets twice during their first 12 hours of life. A blood sample was collected from each piglet 48 to 72 hours post farrowing.

Results: Serum globulin concentrations did not differ with rennet supplementation in piglets derived from either induced or non-induced PP or MP sows.

Implication: Within the power of this study, oral rennet supplementation does not increase piglet serum globulin concentrations.

Keywords: swine, piglets, rennet, serum globulin

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Resumen - Investigación del impacto de la suplementación con cuajo oral en la concentración de globulina sérica en lechones neonatos

Objetivo: El objetivo de este estudio fue determinar si el suplemento oral de lechones con cuajo incrementa la absorción de inmunoglobulina y por consiguiente las concentraciones de globulina sérica del lechón. Se compararon las concentraciones de inmunoglobulina sérica en lechones nacidos de partos inducidos y partos no inducidos de hembras multíparas (MP por sus siglas en inglés) y primíparas (PP por sus siglas en inglés).

Materiales y métodos: Se utilizaron un total de 20 hembras MP y 20 hembras PP en este estudio, con la mitad de las hembras MP y PP inducidas al parto utilizando prostaglandina F2α inyectada. Cada lechón de hembra MP y PP inducida o no inducida fue apropiadamente asignado a uno de tres grupos: sin suplemento, suplemento oral con cuajo, o suplemento oral con solución salina. Se administraron tratamientos con cuajo y solución salina a lechones dos veces durante sus primeras 12 horas de vida. Se recolectó una muestra de sangre de cada lechón 48 a 72 horas post parto.

Resultados: Las concentraciones de globulina sérica no difirieron con el suplemento de cuajo en lechones provenientes de hembras PP o MP inducidas o no inducidas.

Implicación: Dentro del poder de este estudio, el suplemento oral de cuajo no incrementa las concentraciones de globulina sérica del lechón.

Résumé - Étude de l'impact d'un ajout oral de présure dans l'alimentation de porcelets nouveau-nés sur la concentration de globulines sériques

Objectif: La présente étude visait à déterminer chez des porcelets si une supplémentation orale en présure augmentait l'absorption des immunoglobulines et par conséquent les concentrations de globulines sériques. Les concentrations d'immunoglobulines sériques chez des porcelets obtenus par mises-bas induites et non-induites chez des truies multipares (MP) et primipares (PP) ont été comparées.

Matériels et méthodes: Un total de 20 truies MP et 20 truies PP ont fait partie de l'étude, la mise-bas chez la moitié des truies de chacun de ces deux groupes étant induite par injection de prostaglandine F2α. Chaque porcelet provenant des truies MP et PP induites et non-induites était assigné à un des trois groupes de traitement: aucun supplément, supplément oral de présure, ou supplément oral de saline. La présure et la saline furent administrées aux porcelets deux fois durant les 12 premières heures de vie. Un échantillon sanguin fut prélevé de chaque porcelet 48 à 72 heures suivant la mise-bas.

Résultats: Les concentrations de globulines sériques ne différaient pas suivant une supplémentation en présure chez des porcelets provenant de truies MP ou PP et que la mise-bas soit provoquée ou non.

Implication: En tenant compte des limites de la présente étude, on peut conclure qu'une supplémentation orale en présure n'augmente pas les concentrations des globulines sériques.

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This article is available online at http://www.aasv.org/shap.html.

Jenvey CJ, Van Wettere WHEJ, Reichel MP, et al. Investigation of the impact of oral rennet supplementation on serum globulin concentration in neonatal piglets. *J Swine Health Prod.* 2014;22(6):282–286.

Piglets are born hypogammaglobulinemic and therefore require ingestion of maternal immunoglobulins (Igs) via colostrum immediately after birth to provide protection against infections. Immunoglobulins are absorbed in the small intestine and pass directly into the bloodstream. However, this process is time dependent, with gut closure in piglets occurring 24 to 36 hours after birth.[1]

Rennet is composed of a group of enzymes that occur in the stomach of the newborn mammal. The active enzyme, chymosin (also referred to as rennin), assists in release of Igs from the colostrum and milk ingested by coagulating the casein, resulting in formation of a solid curd and immunoglobulin-rich (Ig-rich) whey. Curd formation is thought to be important for maintaining the health of newborn dairy calves.[2] The absorption of Igs from colostrum by the neonate can be indirectly measured by an assay of serum gamma-glutamyl transferase (GGT),[3,4] an enzyme produced by the ductile cells in the mammary gland. In a study by Gregory,[5] feeding calves colostrum that had previously been incubated with rennet resulted in 20% fewer calves with suboptimal GGT activity (< 500 U per L). Additionally, the proportion of calves that still had suboptimal GGT activity was also 60% lower.[5] To the authors' knowledge, supplementation of piglets with rennet to improve piglet Ig absorption has not been investigated. The objective of this study was to determine whether oral supplementation of piglets with rennet increases Ig absorption, thereby improving piglet serum globulin concentrations. Serum globulin concentrations were compared in piglets derived from induced farrowing and non-induced farrowing multiparous (MP) and primiparous (PP) sows.

Materials and methods

All experimental procedures were conducted at the University of Adelaide's Roseworthy Piggery, South Australia, with approval of the University of Adelaide Animal Ethics Committee.

Sow selection

The study was performed on an intensive commercial pig farm in South Australia from May to November 2012. Twenty MP and 20 PP sows from this herd were sampled (Figure 1). Half of each group (10 MP and 10 PP sows; the first 10 sows on the farrowing list in each category) were selected for induction of parturition. Induction was performed the day before the estimated due date, which was based upon an assumed gestation length of 115 days. Each sow was injected with 1 mL of prostaglandin F2α (Lutalyse; Pfizer, West Ryde, New South Wales), administered into the stroma of the vulval lips on two occasions. The first injection was given in the morning and the second 6 hours later in the afternoon.

Piglet allocation to treatments

Either three or six or nine piglets from each litter were included in the trial. This number was maximised according to the size of the litter. For example, if there were five piglets in the litter, three piglets were conveniently selected and assigned to the trial. The remaining two piglets were excluded from the trial but remained with the litter. Sows were housed in individual crates and cross-fostering was allowed.

The piglets to be included in the trial within each litter were weighed within 6 hours of birth and were ranked according to their birth weights. The ranked list of piglets was sequentially divided into groups of three, starting with the heaviest piglet. Each piglet within each weight-rank group was conveniently assigned to either the rennet treatment group (Rennet) or one of two control groups. The control groups consisted of no oral supplementation (None) and oral 0.9% saline supplementation (Saline). Saline supplementation was included as a control treatment as it was used as the carrier for the vegetable rennet administered to the Rennet group. Piglets assigned to the Saline or Rennet groups were fed 4 mL of their designated oral supplement via stomach tube twice during the first 12 hours post parturition. The rennet supplement consisted of vegetable rennet (Cheeselinks, Little River, Victoria, Australia) diluted 1:100 with saline to achieve a final concentration of 2.02 international milk-clotting units per mL.

Piglet blood-sample collection, weaning, and serum testing

A blood sample was collected from each piglet by venipuncture of the anterior vena cava 48 to 72 hours post parturition. All piglets were weighed at weaning (21 ± 0.14 days; mean ± standard error) and all deaths between birth and weaning were recorded. Blood samples were centrifuged and the serum tested using mass spectrometry (Beckman Coulter AU480, Lane Cove, New South Wales) for total protein and albumin concentrations to determine globulin concentration (globulin concentration = total protein - albumin).

Statistical analysis

Descriptive statistics to determine normal distribution were performed. Mean, standard error, and 95% confidence intervals (CI) were calculated for parity, induction, and treatment groups (Rennet, Saline, or None). All 18 variables (Box 1) measured in this study were assessed for significance using multivariable linear regression analysis with an automated backwards stepwise elimination of nonsignificant factors ($P \geq .05$). The interactions between the treatment groups and five other variables were also assessed (Box 1). Model diagnostics were performed to assess the assumptions of normality, linearity and homoscedasticity. The statistical package "R" was used for all analyses (R version 3.0.2; **www.r-project.org/**).

Results

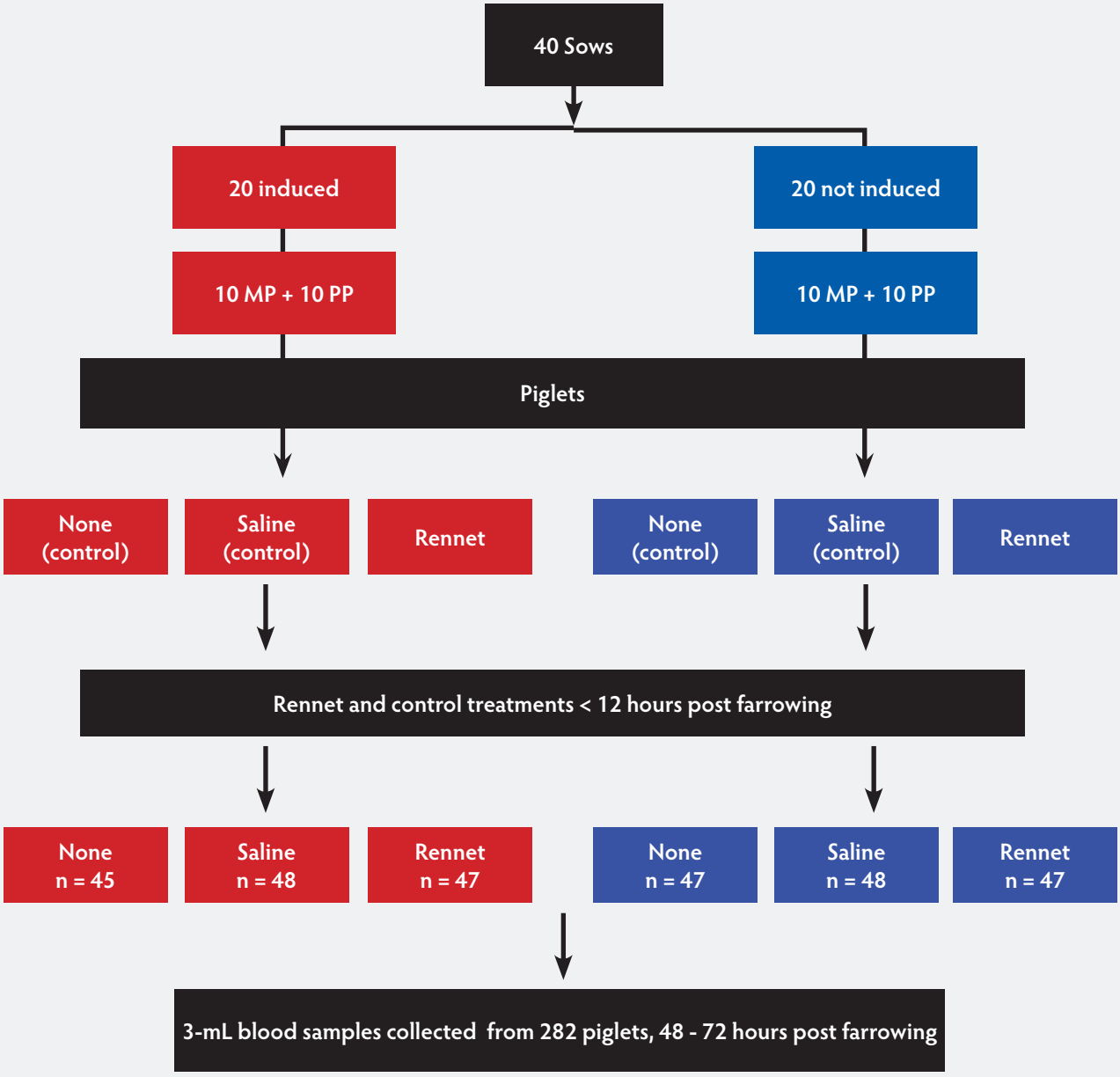
A total of 312 piglets were recruited for the study. Forty-five piglets were cross-fostered. Twenty-one piglets died during the study (6.7% mortality) and data were incomplete for nine piglets: these 30 animals were removed from the statistical analysis.

Mean piglet serum globulin concentrations did not differ ($P > .05$) among the None (n = 92), Saline (n = 96), and Rennet (n = 94) groups (38.31 ± 0.92, 39.07 ± 0.92, and 39.20 ± 0.78 g per L, respectively).

Mean serum globulin concentrations of piglets derived from non-induced dams did not differ ($P > .05$) among the None (n = 47), Saline (n = 48), and Rennet (n = 47) groups (39.86 ± 1.42, 39.94 ± 1.15, and 38.43 ± 1.39 g per L, respectively). Mean serum globulin concentrations of piglets derived from dams induced to farrow did not differ ($P > .05$) among the None (n = 45), Saline (n = 48), and Rennet (n = 47) treatment groups (36.78 ± 1.14, 38.44 ± 1.04, and 39.75 ± 1.30 g L, respectively).

Mean serum globulin concentrations of piglets derived from PP sows did not differ ($P > .05$) among the None (n = 46), Saline (n = 48), and Rennet (n = 45) groups (34.74 ± 1.12, 36.06 ± 1.11, and 36.14 ± 1.40 g per L, respectively). Mean serum globulin concentrations of piglets derived from MP sows did not differ ($P > 0.5$) among the None (n = 46), Saline (n = 48), and Rennet

Figure 1: Experimental design of a study to determine whether oral supplementation of piglets with rennet increases immunoglobulin absorption and thereby piglet serum globulin concentrations. Among 40 sows in the breeding herd (20 Multiparous, MP; 20 Primiparous, PP), the first 10 sows on the farrowing list in each category (10 MP and 10 PP sows) were selected for induction of parturition. Half of the sows in each group were induced to farrow by injection of prostaglandin into the vulvar lips. A maximum of nine piglets per sow were each assigned to one of three treatments: None (control), Saline (control), or Rennet (treatment). Administration of the saline or rennet was performed twice within the first 12 hours of life.



(n = 49) groups (42.04 ± 1.27, 42.27 ± 0.90, and 41.94 ± 1.17 g per L, respectively).

Mean serum globulin concentrations of piglets derived from induced PP sows did not differ ($P > 0.5$) among the None (n = 24), Saline (n = 28), and Rennet (n = 25) groups (34.52 ± 1.48, 36.11 ± 1.21, and 38.12 ± 1.94 g per L, respectively). Mean serum globulin concentration of piglets derived from induced MP sows did not differ ($P > 0.5$) among the None (n = 21), Saline (n = 20), and Rennet (n = 22) groups (39.55 ± 1.62, 41.41 ± 1.60, and 41.68 ± 1.64 g per L, respectively). Mean serum globulin concentrations of piglets derived from non-induced PP sows did not differ ($P > .05$) among the None (n = 22), Saline (n = 20), and Rennet (n = 20) groups (35.00 ± 1.73, 36.00 ± 2.04, and 33.91 ± 1.98 g per L, respectively). Mean serum globulin concentration of piglets derived from non-induced MP sows did not differ ($P > 0.5$) among the None (n = 25), Saline (n = 28), and Rennet (n = 27) groups (44.15 ± 1.84, 42.93 ± 1.04 and 42.13 ± 1.67 g per L, respectively).

Multivariable linear regression analysis

The model met the assumptions for normality, linearity, and homoscedasticity. A total of 18 variables were assessed for significance in relation to piglet serum globulin concentrations using a multivariable linear regression model. Of the assessed variables, four were deemed to be significant by regression

Box 1: Variables assessed for significance in relation to piglet serum globulin concentrations in a multivariable linear regression model*

Gender (Male or Female)
Treatment group (None, Saline, Rennet)
Time of day when born (AM or PM)
Birth date
Birth weight
Weaning date
Weaning weight
Weaning age
Growth rate
Fostered (Yes or No)
Primiparous/Multiparous
Induce (Yes or No)
Litter size
Interactions:
Treatment + Induce
Treatment + Parity
Treatment + Birth weight
Treatment + Litter size
Treatment + Fostered

* Study described in Figure 1.

analysis (Table 1). These variables were time of day when born ($P < .001$), birth weight ($P < .01$), weaning weight ($P < .001$), and parity ($P < .001$). The multiple R^2 and P value for the model were 0.20 and $P < .001$, respectively. There were no significant differences in serum globulin concentrations among the treatment groups ($P = .07$).

Discussion

Oral supplementation of piglets with rennet during their first 12 hours of life did not increase piglet serum globulin concentrations. In contrast with the current study, Gregory[5] added calf rennet directly to colostrum before bottle feeding each calf. It is possible that combining rennet with the colostrum prior to feeding may have promoted better rennet activity than administering rennet directly into the stomach in the current study. Gregory[5] also measured GGT activity rather than serum globulin. However, the positive association between GGT activity and IgG has previously been documented.[4,6]

Both piglets and calves are born hypogammaglobulinemic and therefore rely upon ingestion and absorption of maternal antibodies derived from colostrum to provide protection against infections. In both species, macromolecules (such as Igs) are readily absorbed in the small intestine during the neonatal period. Transmission of macromolecules across the gut epithelium declines post partum and ends within 24 to 36 hours of birth in both calves and piglets.[1] This process, termed gut closure, is accelerated by ingestion of colostrum.[1]

It is possible that the physiological differences in digestive processes between calves and piglets may explain why the hypothesis was rejected in this study. Following ingestion of colostrum, chymosin, a proteolytic enzyme present in the stomach of newborn calves, causes a curd to form within 10 minutes of the colostrum reaching the abomasum.[7] A study by Pang and Ernstrom[8] demonstrated milk-clotting activity in bovine fetal cells removed from calves at 6 months of development. Curd formation slows down the digestive processes and allows the whey produced to be passed into the small intestine where absorption of immunoglobulins occurs.[2] A study by Foltmann et al[9] demonstrated that chymosin is present in the stomachs of newborn piglets. The study also found that the relative milk-clotting activity of the extract taken from newborn piglet stomachs was greater than the activity demonstrated by calf chymosin.[9] However, curd formation may be reduced if the pH of the stomach is elevated.[10] The normal abomasal pH of calves was 1.6 ± 0.21[11] two hours before their first feed and 2.77 ± 0.08 twenty-four hours after birth.[7] Abomasal pH increases with continued feeding, but decreases to normal ranges within 7[11] to 12[7] hours. This increase in abomasal pH following feeding is thought to be due to two factors: the ability of the calf to produce hydrochloric acid in the abomasum, which is stimulated by feeding; and production of low-pH whey during curd formation. Acid secretion has also been demonstrated in piglets. Lecce and Morgan[1] showed that 1-day-old piglets had the ability to acidify their stomachs to a pH of 2, while Cranwell and Titchen,[12] using a fundic pouch, were able to demonstrate acid secretion as early as 17 hours after birth and observed milk clots in the stomachs of the piglets in the study during the pouch operation. Stomach pH of piglets in these studies ranged from 2.1 to 3.9[1] and 1.25 to 1.90.[12] Although chymosin concentration and pH were not measured in the current study, it is apparent from previous research that newborn piglets have the necessary physiological processes to allow for adequate curd formation after colostrum ingestion, not unlike the processes found in the calf. It is possible that the concentration of chymosin present within the newborn piglet stomach is already sufficient, thus supplementation with rennet will not promote further curd formation and whey production.

Within the power of this study, there was no observed relationship between treatment group and piglet serum globulin concentration. However, our results did show a positive relationship between piglet serum globulin concentrations and parity, time of day when born, and birth weight. Our study also found a negative relationship between piglet serum globulin concentrations and

Table 1: Final model evaluating factors influencing piglet serum globulin concentrations*

Variable	Estimate	Standard error	*P*
Intercept	3.47	2.81	< .001
Time of day when born (PM)†	3.17	1.01	.002
Birth weight (kg)	4.79	1.88	.01
Weaning weight (kg)	-0.72	0.25	.005
Parity (MP)†	6.15	1.03	< .001

* Study described in Figure 1. Multivariable linear regression model, variables as follows: time of day when born (PM = born between 12 PM and 6 PM); birth weight (kg); weaning weight (kg) (mean age 21 ± 0.14 days); parity of sow (MP = multiparous). Multiple $R^2 = 0.20$, adjusted $R^2 = 0.18$.

† Value in parentheses is the significant variable of two variable options.

weaning weight. A study by Hendrix et al[13] aimed to determine the effect certain dam factors had on the serum gamma globulin concentrations of piglets. They found a positive correlation between piglet serum gamma globulin concentration and parity, and with birth weight.[13] However, studies by Carney-Hinkle et al[14] and Nguyen et al[15] could not find a relationship between piglet serum globulin concentration and parity.

Implications

- Within the power of this study, oral rennet supplementation of piglets does not increase serum globulin concentration beyond that in piglets not supplemented.
- Sow parity, time of day when born, and birth weight are positively related to piglet serum globulin concentration.
- Weaning weight is negatively related to piglet serum globulin concentration.

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Conflict of interest

None reported.

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Peer reviewed

Brief communication

Detection of Torque teno sus virus in diarrheic piglet fecal samples positive or negative for porcine group A rotavirus

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Summary

Association of Torque teno sus virus (TTSuV) and porcine group A rotavirus (PoRVA) was evaluated in PoRVA-positive or PoRVA-negative diarrheic piglet fecal samples. Molecular TTSuV detection was 40.4% (21/52) and 53.3% (49/92) in PoRVA-positive and -negative fecal samples, respectively. No association ($P = .19$) was observed between TTSuV and PoRVA diarrhea.

Keywords: swine, intestinal health, diarrhea, porcine enteric viruses, Torque teno sus virus

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Resumen - Detección del Torque teno sus virus en muestras fecales de lechones diarreicos positivas o negativas al rotavirus porcino grupo A

Se evaluó la asociación del Torque teno sus virus (TTSuV) y el rotavirus porcino grupo A (PoRVA por sus siglas en inglés) en muestras fecales de lechones diarreicos negativos o positivos al PoRVA. La detección molecular del TTSuV fue 40.4% (21/52) y 53.3% (49/92) en muestras fecales positivas y negativas al PoRVA, respectivamente. No se observó asociación ($P = .19$) entre TTSuV y PoRVA en las diarreas.

Résumé - Détection du Torque teno sus virus à partir d'échantillons fécaux provenant de porcs diarrhéiques positifs ou négatifs pour le rotavirus porcin du groupe A

L'association du Torque teno sus virus (TTSuV) et du rotavirus porcin de groupe A (PoRVA) fut évaluée dans des échantillons fécaux provenant de porcs diarrhéiques PoRVA-positifs ou PoRVA-négatifs. La détection moléculaire de TTSuV était de 40,4% (21/52) et 53,3% (49/92) dans les échantillons PoRVA-positifs et PoRVA-négatifs, respectivement. Aucune association ($P = 0,19$) ne fut notée entre TTSuV et PoRVA dans les diarrées.

Torque teno virus (TTV), a member of the family *Anelloviridae*, is a non-enveloped virus with a single-stranded, negative-sense, circular DNA genome. Infection has been demonstrated in multiple species, including humans and swine.[1] The virus genome can be detected in various organs, secretions, and excretions from both humans and animals.[1,2]

In pigs, the virus is named *Torque teno sus virus* (TTSuV) and is categorized into two genera. Genus *Iotatorquevirus* includes the species *Torque teno sus virus 1a* and *Torque teno sus virus 1b* (TTSuV1), and the genus *Kappatorquevirus* includes the species *Torque teno sus virus k2* (TTSuV2).[3]

Torque teno sus virus has not been associated with specific clinical pathology or gross or histological lesions, and infection is common in both healthy and diseased pigs.[1] Studies have evaluated TTSuV infection as a contributor to the emergence or worsening of other important viral diseases of economic and public health impact. It is believed that TTSuV may contribute to these clinical syndromes as a co-infection associated with porcine circovirus 2 (PCV2) and hepatitis E virus (HEV) infections.[1,4] Studies have evaluated TTSuV infection in association with porcine reproductive and respiratory syndrome virus (PRRSV) and classical swine fever virus (CSFV); however, no correlation between TTSuV, PRRSV, and CSFV clinical signs or diseases has been identified.[1,5] In contrast, when loads of TTSuV DNA were evaluated by means of a real-time quantitative polymerase chain reaction (PCR) assay in pigs experimentally infected with CSFV, the TTSuV2 serum load was significantly larger in pigs with clinical signs of disease than in the healthy controls.[6]

Torque teno sus virus has been reported in bone marrow and peripheral blood mononuclear cells from clinically healthy pigs and in various fetal tissue samples.[7] The presence of TTSuV DNA in intestinal samples[8-10] and the high rates of TTSuV detection in fecal samples[11-13] suggests that enterocytes might be targets for virus replication.

Maintenance of intestinal health is essential to ensure pig productivity. Neonatal diarrhea is one of the most economically important syndromes affecting piglets worldwide.[14] Occurrence of diarrhea depends on several factors, including host immunity, management procedures, and infectious agents (bacteria, protozoa, and viruses). Microorganisms in single or mixed infections may be the determining factor for occurrence of neonatal diarrhea. The health or immunological status of individual animals, environmental conditions, and management procedures associated with concurrent infections may enhance the severity of clinical disease.[14-16]

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de Arruda Leme R, Lorenzetti E, Alfieri AF, et al. Detection of Torque teno sus virus in diarrheic piglet fecal samples positive or negative for porcine group A rotavirus. *J Swine Health Prod.* 2014;22(6): 287–290.

Although TTSuV is excreted in diarrheic feces, to the knowledge of the authors, no studies have sought association of TTSuV with important enteric virus infections.

Porcine group A rotavirus (PoRVA) is implicated in enteric diseases of pigs. It causes a common health problem and is the most frequent viral etiological agent involved in the pig neonatal diarrhea complex throughout the world.[16] Most studies on TTSuV infection in association with other viruses have focused on hepatic, respiratory, reproductive, or multisystemic diseases. The aim of this study was to determine the frequency of TTSuV DNA detection in feces of diarrheic piglets previously identified as PoRVA-positive or PoRVA-negative by polyacrylamide gel electrophoresis (PAGE).

Materials and methods

This study is in agreement with the ethical principles determined by the Brazilian College of Animal Experimentation (COBEA) and was approved by the Ethics Committee on Animal Experimentation of the Universidade Estadual de Londrina.

In total, 144 piglet diarrheic fecal samples were included in this study. The samples were derived from a collection of feces (2004 to 2012) that had been stored at 4°C. Fecal samples were selected on the basis of the Brazilian state of origin (specifically, South, Midwest, and Southeast areas of Brazil where commercial swine production is concentrated), age of the animals, fecal consistency, and previous conclusive results for PoRVA diarrhea by the PAGE technique. Samples with doubtful PAGE results (eg, polyacrylamide gel bands of low intensity or in anomalous positions, extra bands or undefined electropherotype or both) were not selected for analysis. Fecal samples previously evaluated for TTSuV[12] (n = 97) and 47 other samples meeting the terms of the inclusion criteria were selected.

Fecal samples from diarrheic piglets originated from a total of 43 pig herds located in the South (n = 61), Midwest (n = 38), and Southeast (n = 45) Brazilian regions. Fifty-two PoRVA-positive and 92 PoRVA-negative diarrheic fecal samples were included from piglets in their first week of life (0 to 7 days of age, n = 43), second week of life (8 to 14 days of age, n = 48), and third week of life (15 to 21 days of age, n = 53). The distribution of samples by their date of collection was 16 for 2004, 10 for 2005, 13 for 2006, 20 for 2007, six for 2008, three for 2009, four for 2010, 46 for 2011, and 26 for 2012.

Fecal suspensions were prepared and the supernatants were used for nucleic acid extraction.[17] Polymerase chain reaction assays were performed using specific primers for TTSuV1 and TTSuV2 in a previously described technique.[12,18] Two positive samples for each TTSuV genus were randomly selected by drawing lots for sequence analysis to confirm the specificity of the amplicons obtained.

Statistical analysis was performed with Epi Info (`http://wwwn.cdc.gov/epiinfo/`) using chi-square (χ^2) analysis to compare the percentages of positive samples for each TTSuV genus between and within both groups of fecal samples analyzed (PoRVA-positive and PoRVA-negative), and to determine whether detection of TTSuV was associated with PoRVA diarrhea. The confidence limit for the statistical tests was set at 95% ($P < .05$).

Results

Of the 144 diarrheic suckling piglet fecal samples included in this study, 48.6% (70) were positive for TTSuV. The specificity of the amplicons obtained for each TTSuV genus was confirmed during sequence analysis. The detection rate for TTSuV1 was higher ($P < .05$) than that for either TTSuV2 or a combination of both genera in both groups evaluated (PoRVA-positive and PoRVA-negative samples). However, TTSuV1, TTSuV2, or co-infection detection rates did not differ between the PoRVA-positive and PoRVA-negative groups ($P > .05$). The TTSuV was most frequently detected in samples from piglets during their first week of life (55.8%; 24 of 43), followed by animals at the second (47.9%; 23 of 48) and third weeks of life (43.4%; 23 of 53) (Table 1).

Of the PoRVA-positive diarrheic piglets, 40.4% (21 of 52) tested positive for TTSuV and 59.6% (31 of 52) tested negative. Of the PoRVA-negative diarrheic piglets, 53.3% (49 of 92) tested positive for TTSuV and 46.7% (43 of 92) tested negative. Overall TTSuV detection did not differ between PoRVA-positive and PoRVA-negative samples ($P = .19$).

Discussion

This study was drafted to evaluate TTSuV infection in association with an enteric viral pathogen. Porcine group A rotavirus was used as the model enteropathogen because it is the most common viral agent involved in piglet neonatal diarrhea. While all fecal samples included in this analysis were diarrheic, the study did not intend to evaluate TTSuV as a causative agent of diarrhea. For this, the presence of other enteric pathogens (bacteria, protozoa, and various viruses) should be investigated.

Results based on each TTSuV genus in piglets aged 1 to 3 weeks are in agreement with a Brazilian study[13] that evaluated TTSuV infection at various stages of the pig production cycle. The TTSuV1 genus was detected in fecal samples from suckling piglets more frequently ($P < .05$) than the TTSuV2 genus or mixed infections of both genera.

Piglet fecal samples included in this study were tested for PoRVA immediately after collection. In acute infections, high loads of PoRVA are shed in feces ($10^{10\text{-}12}$ virus particles per gram of feces).[9] This facilitates diagnosis by the PAGE technique, which is considered of high specificity for PoRVA detection. The same does not apply, for example, to the atypical rotaviruses, which are eliminated in feces in smaller loads[19] and cannot always be detected by the PAGE technique. For this reason, and to maintain consistency since 2004, the PAGE technique is considered a useful tool to screen fecal samples for PoRVA.

Fecal samples included in this study were stored for diagnostic purposes at 4°C to avoid repeated freezing and thawing, which would accelerate degradation of nucleic acid in the samples.[20] Molecular assays targeting small fragments of the most conserved region of enteric virus genomes have successfully been performed using fecal samples stored at 4°C (data not shown). However, the authors cannot exclude the possibility of some degree of degradation of virus nucleic acid in samples stored at 4°C. Consequently, occurrence of TTSuV may be underestimated due to false-negative findings in both the PoRVA-positive and PoRVA-negative piglet samples.

The role of TTSuV as a triggering factor or an opportunistic pathogen has been extensively investigated, primarily in multifactorial diseases.[1] Porcine group A rotavirus is sufficiently pathogenic to independently cause clinical signs of disease. However, one study[14] reported multiple pathogens involved in 30% of piglet diarrhea cases, with rotavirus the most frequently detected agent, alone or in combination with other agents. Our results revealed that TTSuV shedding in the feces of diarrheic suckling piglets did not differ significantly between

Table 1: Detection of TTSuV1 and TTSuV2 in single or mixed infections using PCR assays in piglet diarrheic fecal samples previously diagnosed as positive or negative for PoRVA by the PAGE technique*

	Piglet age (week)	TTSuV-positive (%)			Total (%)
		TTSuV1	TTSuV2	TTSuV1 + TTSuV2	
PoRVA-positive (n = 52)					
	1st (n = 19)	9 (47.4)	0	2 (10.5)	11 (57.9)
	2nd (n = 16)	7 (43.8)	1 (6.3)	0	8 (50.0)
	3rd (n = 17)	2 (11.8)	0	0	2 (11.8)
Subtotal	NA	18 (34.6)^{A,a}	1 (1.9)^{A,b}	2 (3.8)^{A,b}	21 (40.4)
PoRVA-negative (n = 92)					
	1st (n = 24)	8 (33.3)	1 (4.2)	4 (16.7)	13 (54.2)
	2nd (n = 32)	10 (31.3)	0	5 (15.6)	15 (46.9)
	3rd (n = 36)	16 (44.4)	2 (5.6)	3 (8.3)	21 (58.3)
Subtotal	NA	34 (37)^{A,a}	3 (3.3)^{A,b}	12 (13)^{A,c}	49 (53.3)
Total (n = 144)	**NA**	**52 (36.1)^{A,a}**	**4 (2.8)^{A,b}**	**14 (9.7)^{A,c}**	**70 (48.6)**

* 144 fecal samples from a collection of pig feces (2004 to 2012) were selected according to the Brazilian state of origin, age of piglet, fecal consistency, and previously conclusive results for PoRVA diarrhea by the PAGE technique. Fifty-two PoRVA-positive and 92 PoRVA-negative diarrheic fecal samples from suckling piglets during their first week of life (0 to 7 days of age, n = 43), second week of life (8 to 14 days of age, n = 48), and third week of life (15 to 21 days of age, n = 53) were evaluated for TTSuV. Specific PCR assays were performed to detect and differentiate TTSuV1 (genus *Iotatorquevirus*) and TTSuV2 (genus *Kappatorquevirus*).

A Within a column, values with the superscript "A" do not differ significantly ($P > .05$; chi-square).

a,b,c Within a row, values with different lowercase superscript letters differ significantly ($P < .05$; chi-square).

TTSuV = Torque teno sus virus; PoRVA = porcine group A rotavirus; PCR = polymerase chain reaction; PAGE = polyacrylamide gel electrophoresis; NA = not applicable.

PoRVA-positive and PoRVA-negative animals, and no association between PoRVA and TTSuV infection was identified. It has been suggested that the biological behavior of TTSuV may vary with conditions of co-infection and that variation in the immunological status of the host due to mixed infections may regulate TTSuV replication.[6]

To the best of our knowledge, this is the first study conducted to detect TTSuV in association with a specific enteric viral pathogen (PoRVA). The potential pathogenic role of TTSuV infections has been previously investigated.[1] The neonatal diarrhea complex in pigs depends on many factors. Interaction between viruses may enhance the severity of clinical signs and, consequently, may impact productivity. Further studies seeking associations among emerging and classic enteric viral agents are needed to provide tools that enable prophylactic procedures and strategies to improve pig intestinal health.

Implications

- Under the conditions of this study, fecal shedding of TTSuV is independent of PoRVA infection in diarrheic piglets aged 1 to 3 weeks.
- Considering that porcine enteric viral agents are common throughout the pork industry and that the maintenance of pig intestinal health is essential to ensure productivity, continued surveillance for viral enteric infections and their potential associations cannot be ignored.

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Conflict of interest

None reported.

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Conversion tables

Weights and measures conversions

Weights and measures

Common (US)	Metric	To convert	Multiply by
1 oz	28.35 g	oz to g	28.4
1 lb (16 oz)	453.59 g	lb to kg	0.45
2.2 lb	1 kg	kg to lb	2.2
1 in	2.54 cm	in to cm	2.54
0.39 in	1 cm	cm to in	0.39
1 ft (12 in)	0.31 m	ft to m	0.3
3.28 ft	1 m	m to ft	3.28
1 mi	1.6 km	mi to km	1.6
0.62 mi	1 km	km to mi	0.62
1 in^2	6.45 cm^2	in^2 to cm^2	6.45
0.16 in^2	1 cm^2	cm^2 to in^2	0.16
1 ft^2	0.09 m^2	ft^2 to m^2	0.09
10.76 ft^2	1 m^2	m^2 to ft^2	10.8
1 ft^3	0.03 m^3	ft^3 to m^3	0.03
35.3 ft^3	1 m^3	m^3 to ft^3	35
1 gal (128 fl oz)	3.8 L	gal to L	3.8
0.264 gal	1 L	L to gal	0.26
1 qt (32 fl oz)	946.36 mL	qt to L	0.95
33.815 fl oz	1 L	L to qt	1.1

Temperature equivalents (approx)

°C	°F
0	32
10	50
15.5	60
16	61
18.3	65
21.1	70
23.8	75
26.6	80
28	82
29.4	85
32.2	90
38.8	102
39.4	103
40.0	104
40.5	105
41.1	106
100	212

°F = (°C × 9/5) + 32

°C = (°F - 32) × 5/9

Conversion chart, kg to lb (approx)

Pig size	Kg	Lb
Birth	1.5-2.0	3.3-4.4
Weaning	3.5	7.7
	5	11
	10	22
Nursery	15	33
	20	44
	25	55
	30	66
Grower	45	99
	50	110
	60	132
Finisher	90	198
	100	220
	105	231
	110	242
	115	253
Sow	135	300
	300	661
Boar	360	794
	363	800

1 tonne = 1000 kg

1 ppm = 0.0001% = 1 mg/kg = 1 g/tonne

1 ppm = 1 mg/L

Peer reviewed

Brief communication

Comparison of commercial one-dose and two-dose baculovirus-expressed porcine circovirus type 2 subunit vaccines

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Summary

One- and two-dose recombinant porcine circovirus type 2 (PCV2) vaccines did not differ significantly in terms of immunological testing (neutralizing antibody titers, number of interferon-γ-secreting cells), virological testing (number of PCV2 genomic copies per mL serum), and pathological evidence of infection (lymphoid lesions scores and PCV2 antigen-positive cells).

Keywords: swine, porcine circovirus type 2, porcine circovirus type 2 vaccine

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Resumen - Comparación de las vacunas comerciales de subunidades de una dosis y dos dosis contra circovirus porcino tipo 2 expresado en baculovirus

Las vacunas de una y dos dosis del circovirus porcino tipo 2 recombinante (PCV2 por sus siglas en inglés) no difirieron significativamente en términos de pruebas inmunológicas (títulos de anticuerpos neutralizantes, número de células secretoras de interferón-γ), pruebas virológicas (número de copias genómicas del PCV2 por mL de suero), y evidencia patológica de infección (puntajes de lesiones linfoides y células positivas al antígeno de PCV2).

Résumé - Comparaison de vaccins sous-unitaires commerciaux une-dose et deux-doses contre le circovirus de type 2 exprimé dans un baculovirus

Des vaccins recombinants une- et deux-doses contre le circovirus porcin de type 2 (PCV2) ne différaient pas significativement en terme de réponse immunologique (titres d'anticorps neutralisant, nombre de cellules secrétant de l'interféron-γ), d'analyses virologiques (nombre de copies du génome de PCV2 par mL de sérum), et d'évidence pathologique de l'infection (pointage des lésions lymphoïdes et cellules positives pour l'antigène PCV2).

Porcine circovirus type 2 (PCV2) is a small, non-enveloped, single-stranded DNA virus in the genus *Circovirus* within the family *Circoviridae*.[1] It has been incriminated as a major causative agent of postweaning multisystemic wasting syndrome (PMWS), which is known as PCV2-associated diseases (PCVAD);[2,3] PCVAD is considered to be an economically important global issue. Most Korean swine farms (95.5%) use a PCV2 vaccine for control of PCVAD because the vaccine is highly efficacious.[4]

Currently, five commercial PCV2 vaccines are available in Korea.[5] These include three subunit vaccines that are based on the capsid protein expressed in a baculovirus system, and two inactivated vaccines based on PCV2 or on chimeric PCV1–2.[4,6] The baculovirus-expressed subunit vaccines, requiring one- or two-dose administration, are most commonly used in Korean herds.[5] Among them, Porcilis PCV (one dose; MSD Animal Health, Summit, New Jersey) and Circumvent PCV (two doses; MSD Animal Health) are different preparations of the same core antigen.[4] Both vaccines are available in Korea, but in other countries, only one or the other is available.[4] For example, Circumvent PCV alone is available in North America, while Porcilis PCV alone is available in Europe.[4]

Under field conditions, some swine producers prefer a one-dose PCV2 vaccine because of less labor and stress to animals, while others prefer a two-dose vaccine that generates an immunological booster response. To the knowledge of the authors, there are no reports comparing commercial one- and two-dose recombinant PCV2 vaccines having the same core PCV2 antigen. Hence, the objective of this study was to compare the immune response, virus levels, and lesions in pigs vaccinated with one- and two-dose PCV2 subunit vaccines.

Materials and methods

All animal protocols were approved by the Seoul National University Institutional Animal Care and Use Committee.

Thirty colostrum-fed, cross-bred, conventional piglets were purchased at 14 days of age from a commercial farm. At arrival, all piglets were negative for porcine reproductive and respiratory syndrome virus (PRRSV) and *Mycoplasma hyopneumoniae* when tested with the PRRS X3 Ab test (Idexx Laboratories Inc, Westbrook, Maine) and the Idexx M. hyo. Ab test (Idexx Laboratories, Inc), respectively. All piglets were negative for PCV2 viremia when tested by real-time polymerase chain reaction (PCR), and all were seronegative against PCV2 when blood samples collected when

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the pigs were 3 weeks old and again on the day of challenge were tested using a commercial enzyme-linked immunosorbent assay (ELISA; SERELISA PCV2 Ab Mono Blocking, Synbiotics, Lyon, France).

A total of 30 piglets were randomly assigned to six groups (five pigs per group) using the random number generation function in Excel (Microsoft Corporation, Redmond, Washington) (Table 1). Sample size was calculated assuming a 90% power (1- β = .90) of detecting a difference at the 5% level of significance (α = .05).[7] The treatment timeline is shown in Table 1. In Group 1 and Group 2 pigs, one 2.0-mL dose of Porcilis PCV was administered intramuscularly (IM) at 3 weeks of age in the right side of the neck. In Group 3 and Group 4 pigs, two 2-mL doses of Circumvent PCV were administered IM at 3 and 6 weeks of age, one on each side of the neck. At 28 days post vaccination, each pig in Group 1 (49 days of age), Group 3 (70 days of age), and Group 5 (70 days of age) was inoculated intranasally with 2 mL of PCV2b (strain SNUVR000463; 5th passage; 1.0×10^5 median tissue culture infectious doses per mL). Group 5 pigs served as the positive control group (challenged but not vaccinated). Group 6 pigs were unchallenged and unvaccinated (no product administration) and served as the negative control group. Groups were housed in separate rooms within the facility. Blood samples were collected at study days -28, 0 (day of challenge), 7, 14, 21, and 42.

Extraction of DNA from serum samples was performed using the QIAamp DNA Mini Kit (Qiagen Inc, Valencia, California). The DNA extracts were used to quantify PCV2 DNA copy numbers by real-time PCR as previously described.[8] The number of genomic copies of PCV2 genomic DNA per mL of serum was transformed to $\log_{10}$ for analysis.

All pigs were euthanized for necropsy at Day 42. Superficial inguinal lymph nodes were collected for histopathology and immunohistochemistry.

Serum samples were tested using a commercial PCV2 ELISA IgG (Synbiotics) and virus neutralization.[9] Serum samples were considered positive for PCV2 IgG antibody if the titer was greater than 350, according to the manufacturer's instructions. The neutralizing antibody (NA) data were transformed to $\log_2$ for analysis. The numbers of PCV2-specific interferon-γ-secreting cells (IFN-γ-SCs) were determined in peripheral blood mononuclear cells (PBMCs) as previously described.[10] Whole PCV2b (the same strain used for challenge) at a multiplicity of infection of 0.01 was used as stimulant of PBMCs. Phytohemagglutinin (10 µg per mL; Roche Diagnostics GmbH, Mannheim, Germany) and phosphate buffered saline were used as a positive and negative control, respectively.

For the morphometric analysis of histopathological lesion score and number of PCV2-positive cells in lymph nodes, three superficial inguinal lymph-node sections were examined blindly as previously described.[11,12] Lymphoid lesions were scored on a scale from 0 to 3: 0, no lymphoid depletion or granulomatous replacement; 1, mild lymphoid depletion; 2, moderate lymphoid depletion; and 3, severe lymphoid depletion and histiocytic replacement.[11] The number of lymphoid PCV2 antigen-positive cells per unit area (0.25 mm^2) were counted using an NIH Image J 1.45s program (`http://imagej.nih.gov/ij/download.html`).[12]

Continuous data (PCV2 DNA, PCV2 serological results, PCV2-specific IFN-γ-SCs, and lymphoid PCV2 antigen-positive cells) were analyzed using a one-way analysis of variance (ANOVA). If the ANOVA showed a significant effect, Tukey's test for multiple comparisons was performed at each time point. Discrete data (lymphoid lesion score) were analyzed by Fisher's exact test. A value of $P < .05$ was considered significant.

Table 1: Means (standard deviation) of lymphoid lesion score and numbers of lymphoid porcine circovirus type 2 (PCV2) antigen-positive cells in pigs vaccinated with a one-dose or a two-dose PCV2 vaccine and challenged with PCV2*

Group	Vaccine	Vaccination		Challenge		Lymphoid lesion score†	No. of PCV2$^+$ lymphoid cells‡
		3 weeks	6 weeks	7 weeks	10 weeks		
1	Porcilis PCV	2 mL	None	Yes	No	0.8 (0.44)^a	7.6 (4.22)^a
2	Porcilis PCV	2 mL	None	No	No	0 (0)^b	0 (0)^b
3	Circumvent PCV	2 mL	2 mL	No	Yes	0.6 (0.45)^a	6.0 (5.29)^a
4	Circumvent PCV	2 mL	2 mL	No	No	0 (0)^b	0 (0)^b
5	None	NA	NA	No	Yes	1.2 (0.54)^a	18.0 (6.82)^c
6	None	NA	NA	No	No	0 (0)^b	0 (0)^b

* Group 1 and 2 pigs were vaccinated with a one-dose PCV2 vaccine (Porcilis PCV; MSD Animal Health, Summit, New Jersey) at 3 weeks of age, and Group 3 and 4 pigs were vaccinated with a two-dose PCV2 vaccine (Circumvent PCV; MSD Animal Health) at 3 and 6 weeks of age. Group 1 pigs were inoculated with PCV2b strain SNUVR000463 at 7 weeks of age and Group 3 and Group 5 pigs were inoculated with the same PCV2b strain at 10 weeks of age. For each group, n = 5 pigs.

† Pigs in all six groups were euthanized for necropsy at 42 days post challenge. Superficial inguinal lymph nodes were collected for histopathology and immunohistochemistry. Lymphoid lesion score ranged from 0 to 3: 0 = no lymphoid depletion or granulomatous replacement; 1 = mild lymphoid depletion; 2 = moderate lymphoid depletion; and 3 = severe lymphoid depletion and histiocytic replacement. Scores were compared among groups using Fisher's exact test.

‡ The number of lymphoid PCV2 antigen-positive cells per unit area (0.25 mm^2) was counted using an NIH Image J 1.45s program (`http://imagej.nih.gov/ij/download.html`). Numbers of positive cells were compared among groups using Tukey's test.

^{abc} Within a column, different letters indicate a significant difference among groups ($P < .05$).

PCV2$^+$ = PCV2 antigen-positive; NA = not applicable.

Results

At Day 0, PCV2 DNA was not detected in the serum of any pigs. In Group 1 and Group 3 (vaccinated challenged animals), the number of genomic copies of PCV2 in serum was significantly lower ($P < .05$) on days 7 to 42 than in the unvaccinated challenged animals in Group 5. However, number of genomic copies of PCV2 in serum did not differ between Group 1 (immunized with one-dose PCV2 vaccine) and Group 3 (immunized with two-dose PCV2 vaccine) (Figure 1). No PCV2 DNA was detected in serum of pigs in groups 2, 4, and 6 throughout the experiment.

In vaccinated animals (Group 1, 2, 3, and 4), anti-PCV2 IgG antibody titers and geometric mean NA titers were significantly higher ($P < .05$) on days 0 to 21 than in unvaccinated challenged animals (Group 5) (Figure 2A and 2B). In vaccinated animals (Group 1, 2, 3, and 4), numbers of PCV2-specific IFN-γ-SCs, were significantly higher ($P < .05$) than in unvaccinated challenged animals (Group 5) at days 0 and 7 (Figure 2C). In animals vaccinated with the two-dose PCV2 vaccine (Group 3 and 4), titers of anti-PCV2 IgG antibodies were significantly higher ($P < .05$) on Day 0 than in animals immunized with the one-dose PCV2 vaccine (Group 1 and 2) (Figure 2A). Anti-PCV2 IgG antibody titers, geometric mean NA titers, and numbers of PCV2-specific IFN-γ-SCs did not differ on days 7 to 42 between the vaccinated challenged animals in Group 1 (one-dose vaccine) and Group 3 (two-dose vaccine) or between the vaccinated unchallenged animals in Group 2 (one-dose vaccine) and Group 4 (two-dose vaccine) (Figure 2). No anti-PCV2 IgG antibodies or PCV2-specific NA or IFN-γ-SCs were detected in Group 6, the negative control animals.

The number of lymphoid PCV2 antigen-positive cells was significantly lower ($P < .05$) in the vaccinated groups (Group 1, 2, 3, and 4) than in the positive control group (Group 5) (Table 1). However, lymphoid lesion scores and the number of lymphoid PCV2 antigen-positive cells did not differ between one-dose (Group 1) and two-dose (Group 3) vaccinated challenged animals.

Discussion

It is reasonable to determine the parameters for PCV2 vaccine efficacy on the basis of induction of protective immunity, the number of copies of PCV2 genomic DNA per mL of serum, and the presence of PCV2-associated lesions and PCV2 antigen within

Figure 1: Means (with standard deviation) of the $\log_{10}$ transformed number of genomic copies of PCV2 DNA in serum of pigs in the study described in Table 1. Different letters indicate significant differences among groups ($P < .05$: one-way ANOVA).

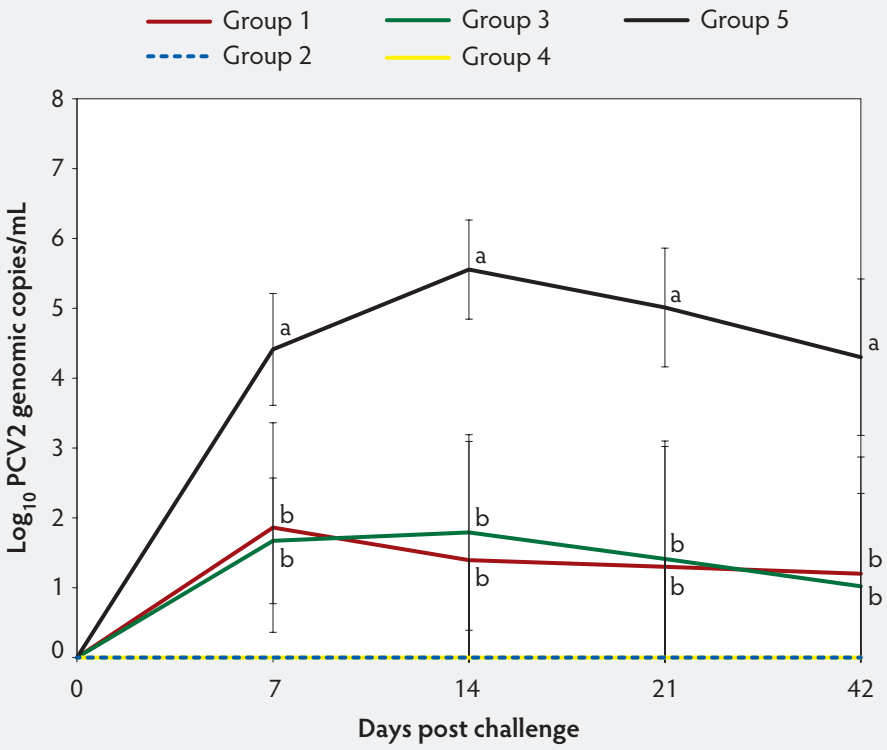


Figure 2A: Means (with standard deviation) for anti-PCV2-IgG antibody titers in the study described in Table 1. Different letters indicate significant differences among groups ($P < .05$; one-way ANOVA).

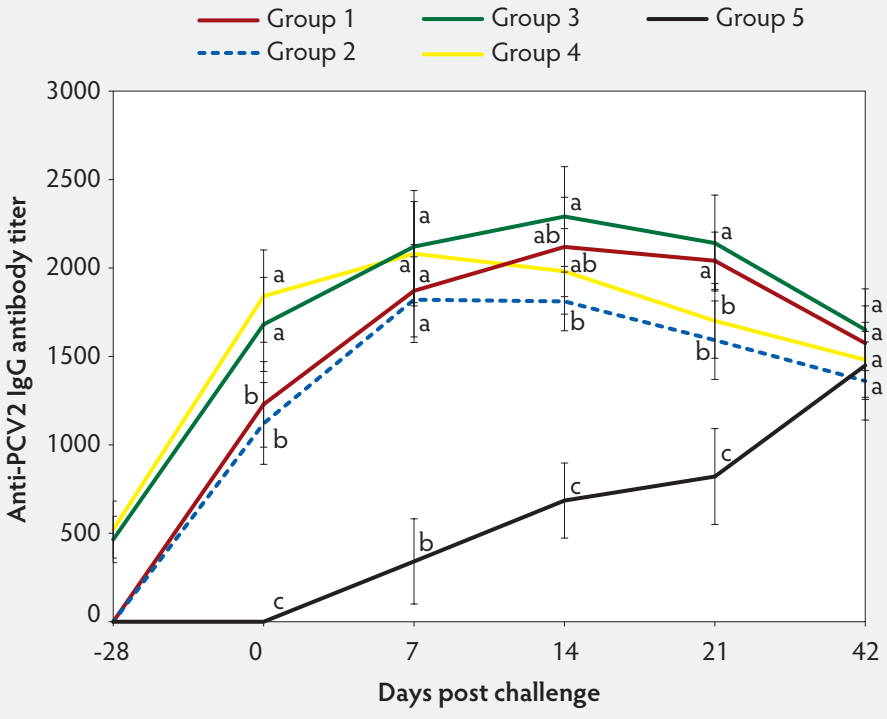


Figure 2B: Log_2 transformed group means (with standard deviation) for neutralizing antibody (NA) titers. Treatments described in Table 1. Different letters indicate significant differences among groups ($P < .05$; one-way ANOVA).

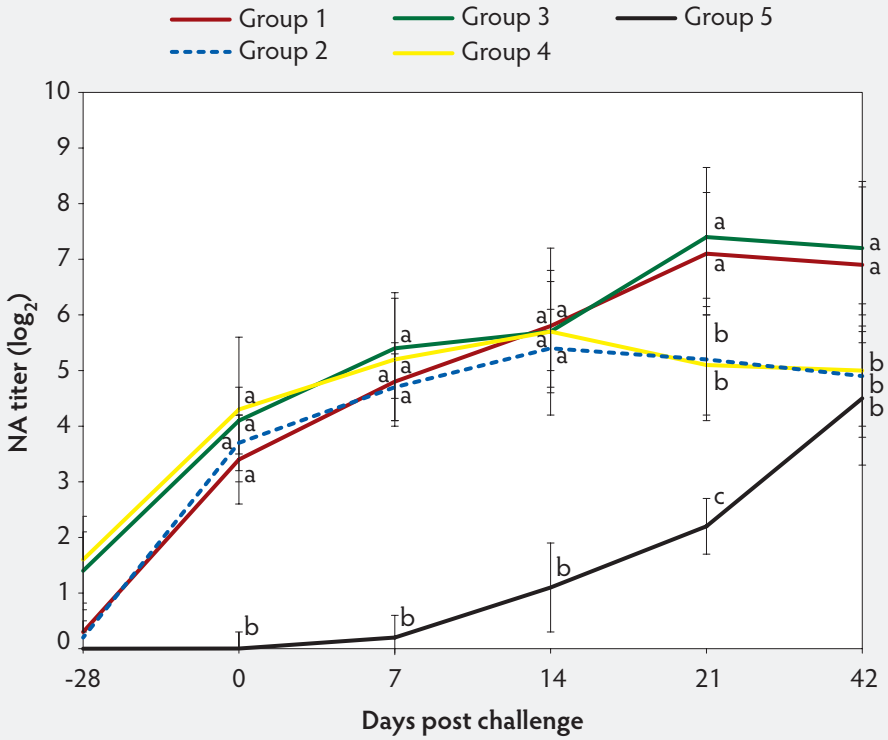
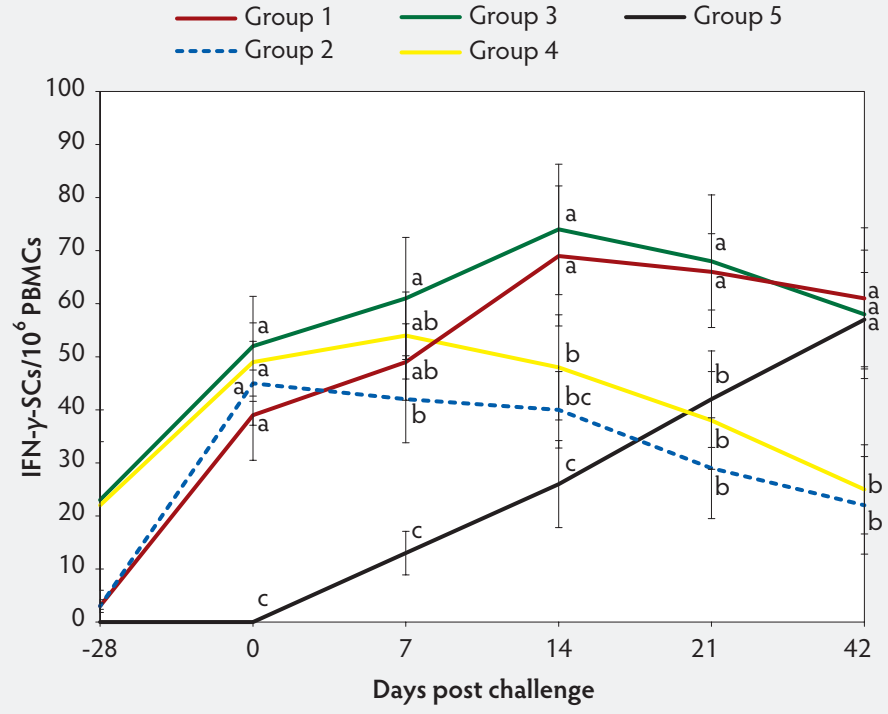


Figure 2C: Mean numbers (with standard deviation) of PCV2-specific interferon-γ-secreting cells (IFN-γ-SCs) in peripheral blood mononuclear cells (PBMCs). Treatments described in Table 1. Different letters indicate significant differences among groups ($P < .05$; one-way ANOVA).



these lesions.[4] Induction by the vaccine of protective immunity such as PCV2-specific neutralizing antibody and IFN-γ-SCs plays a critical role in reducing the PCV2 load in the blood.[13,14] Although differences in serological parameters were apparent between two-dose and one-dose products at the time of challenge, this did not result in significant differences in PCV2 viremia or PCV2-associated lesions after challenge. These observations are further supported by a study[15] in which the reduction of PCV2 DNA in the serum did not differ between pigs given a one-dose chimeric PCV1-2 vaccine (2 mL) and a two-dose vaccine (ie, the same one-dose product administered twice, 1 mL per dose).

In the current study, in pigs vaccinated with either the one- or two-dose product, the number of copies of PCV2 genomic DNA per mL of serum was lower than the number observed in the unvaccinated, unchallenged group. However, mean lymphoid lesion scores did not differ between vaccinated groups of pigs and the group that was not challenged. These data suggest that PCV2-associated microscopic lesions were not prominent in the present study, as the pigs were challenged with PCV2 alone. Co-infections may be necessary and crucial for the full development of typical pathological lesions related to PCVAD.[15,16]

Single-dose PCV2 vaccines are more popular because less labor is required of the workers and there is less stress to the animals. Swine producers are more likely to be compliant with a one-dose vaccine than with a two-dose regimen. Compliance cannot be monitored as easily with one-dose baculovirus-expressed PCV2 vaccines because there is no reliable baculovirus antibody ELISA test.[17,18] Although the small number of animals tested is a limitation of this study, there is no serological evidence that it makes any difference whether one or two doses of PCV2 vaccine are administered. These results will greatly facilitate swine practitioners in providing information to producers on whether to use a one-dose or two-dose PCV2 vaccine.

Implications

- Under the conditions of this study, it makes no difference to protection whether a one-dose or two-dose PCV2 vaccine is used.
- Using a one-dose instead of a two-dose PCV2 vaccine creates less stress for both the pigs and animal-care workers.

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Conflict of interest

None reported.

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* Non-refereed reference.

Brief communication

Peer reviewed

Individual Pig Care program improves productive performance and animal health in nursery-growing pigs

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Summary

Individual Pig Care (IPC; Zoetis, Paris, France) is a new management tool for swine farmers, based on daily keen observation of pigs, early detection of health problems, and prompt reaction to them. In this study, IPC improved production and promoted more effective management with more targeted use of medication.

Keywords: swine, Individual Pig Care, health, management, antibiotic judicious use

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Resumen - El programa Individual Pig Care mejora el desempeño productivo y la salud animal en cerdos de destete-crecimiento

El programa Individual Pig Care (IPC; Zoetis, Paris, Francia) es una nueva herramienta de manejo para los productores porcinos, basada en la aguda observación de cerdos, detección temprana de problemas de salud, y la pronta respuesta a los mismos. En este estudio, el IPC mejoró la producción y promovió un manejo más efectivo con una utilización más enfocada de la medicación.

Résumé - Le programme Individual Pig Care améliore les performances de production et la santé des animaux chez les porcs en pouponnière-croissance

Le programme Individual Pig Care (IPC; Zoetis, Paris, France) est un nouvel outil de gestion pour les producteurs porcins, basé sur une observation quotidienne attentive des porcs, une détection précoce des problèmes de santé, et une réaction prompte à ces problèmes. Dans la présente étude, le programme IPC a permis d'améliorer la production et a favorisé une gestion plus efficace avec une utilisation ciblée de la médication.

Antimicrobial-resistant zoonotic bacteria may be transmitted from pigs to the human population, potentially resulting in human disease that may not respond efficiently to antimicrobial treatment.[1,2] In an attempt to reduce antimicrobial resistance in zoonotic pathogens, the current pig-production industry is aiming to promote a more judicious use of antibiotics either under national regulations (The Netherlands, France, and Germany are the latest countries involved in this initiative) or the demands of the final customer (retailers and supermarkets). However, animal health and welfare require a highly efficient and economically sustainable system for disease control, including a need for both vaccination and antibiotics.

To fulfill those objectives, a new management tool for swine farmers in Europe has been developed. It is called Individual Pig Care (IPC; Zoetis, Paris, France) and is based on daily individual observation of the pigs, early detection of husbandry and health problems, and prompt and accurate reaction to these problems, enabled by rapid and effective data collection and processing.

The IPC program is a commercial service delivered by coaches called husbandry educators. To determine if IPC positively affects swine productivity in nursery-growing pigs, a study was conducted at a commercial swine-production facility. Productive performance and health status outcomes for a group monitored by a dedicated on-site IPC educator (IPC group) were compared to outcomes for a group raised according to the standard care protocol in place prior to the trial (Control group).

Materials and methods

Animal care and experimental procedures used in this study followed the regulations and guidelines of the Spanish government for the protection of animals under scientific research (Real Decreto Español 223/88 BOE 67: 8509-8511).

Study facilities

The study was conducted on a commercial, 700-sow, farrow-to-finish farm in Segovia, Spain. The health status of the farm was medium-low; the herd was positive for porcine reproductive and respiratory syndrome (PRRS) and there was a high incidence of colibacillosis in the nursery phase.

A total of 24 pens (2.5 m × 2.8 m) distributed in four nursery rooms were used for the study. Environmental conditions during the trial (temperature and ventilation rate) were automatically controlled and assessed as appropriate for the age of the pigs. Each pen was equipped with one six-hole self-feeder and two nipple waterers, allowing ad libitum access to feed and water.

Study animals and housing

A total of 368 pigs, with equal numbers of females and entire males, were selected for the study at 23 days of age (weaning day) and were observed until they were 90 days of age. Pigs were randomly assigned (by random number generator) to the four nursery rooms, with four pens per room and

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23 pigs per pen. Two pens housed males and two pens housed females. Two additional pens per room, initially empty, were used as hospital pens.

Experimental design

The main effect assessed was management of the pigs in the standard (Control) and IPC models. Animals and pens were equally distributed in both treatment groups. Each hospital pen accommodated pigs from only one IPC pen in order to maintain pen integrity. The control group was managed according to the traditional methodology used on this farm, which provided one observation of the pigs per day. Sick pigs were marked with a spray and treated according to the standard operating practices on the farm. Briefly, clinical signs were treated according to the preexisting treatment protocols at the site. When clinical signs affected several pigs in a pen, treatment was applied in feed or via drinking water to the entire pen. In addition, severely ill pigs were treated, removed from the pen, and left in the corridor, with feed and water available, until they died naturally or their health status improved and they were returned to their pens.

In the IPC group, the IPC guidelines were followed for health and husbandry management of pigs.[3] A different caregiver, previously trained in the IPC guidelines by an IPC veterinarian educator, also monitored the IPC-trained farmer during the study. Management consisted of one daily visit to the pigs by the caregiver, treating sick pigs according to clinical signs and the preexisting treatment protocols at the site, but individual pig treatment was emphasized in this group. The same intramuscular (IM) antibiotics were used in both groups.

All data was recorded using paper forms and a digital pen paired with the SIM card of a commercial smartphone. These devices sent data to a database prepared to automatically process data, delivering a Web-based dashboard or control panel to check and monitor data and information generated immediately after collection. Sick pigs were scored and clinical signs were quantified according to severity (A, mild signs of disease; B, medium; C, serious; and D, very serious or near death) and type of disease (digestive, respiratory, lameness, neurological, bite wounds, or other). Pigs with disease described as category B or C were placed in hospital pens, with males and females accommodated in separate pens in each room. Pigs that did not recover within 3 to 4 days remained in the hospital pen for the duration of the study. Dying pigs (category D) were immediately euthanized.

Measurements and observations

Pigs were individually weighed and feed intake was measured by pen at day 0 (23 days of age); at day 40, the end of the nursery period (63 days of age); and at day 67, the end of the growing period (90 days of age). Parameters calculated were average daily gain (ADG), average daily feed intake (ADFI), and feed conversion ratio (FCR) in each phase. Body weight (BW) homogeneity within pen was also calculated, using the equation "100 minus the coefficient of variation" in each pen. Deaths and incidence of diseases were recorded daily in forms traditionally used in the site (Control) or in digitalized paper forms and using a digital pen (IPC).

Statistical analyses

Data were analyzed as a randomized complete-bock design using SAS 9.2 (SAS, Cary, North Carolina). Productive performance data were analyzed by ANOVA (PROC GLM), and mortality and incidences of diseases were analyzed as binary variables using the chi-square test. The pen of 23 pigs was the experimental unit. The model included treatment and gender as fixed effects and room as a random effect. Least-squares means were calculated for each treatment, and the effect of treatment was considered significant when $P < .05$ and as a trend when $P < .10$.

Results

Growth performance is presented in Table 1. Both in the nursery and in the growing periods, ADG and ADFI were higher and FCR was lower in IPC pigs than the control group ($P < .05$). Body weight homogeneity tended to be higher in IPC than in the control group at days 40 and 67. Final BW was higher in IPC group than in the control group.

Mortality did not differ between treatments in the nursery period (Table 1). Three pigs died in total, one in the control group and two in the IPC group. Both deaths in the IPC group were D pigs which were humanely euthanized. In the growing phase, pigs were clinically affected by PRRS at approximately 80 days of age, when typical signs were observed (lack of appetite, lethargy, respiratory signs, and blue discoloration of the skin on the ears). Mortality increased above the average in this phase in this farm (which was approximately 1%) and tended to be higher in the control group than in the IPC group (Table 1). One of the seven pigs that died in the control group was placed in the corridor with neurological signs and died approximately 24 hours later.

In the nursery period, morbidity did not differ between treatments: high immediately after weaning (43.4% and 52.7% of Control and IPC pigs, respectively, presented some type of clinical sign) and then decreasing progressively up to the first week after weaning when incidence was < 10% in each group. In the 7-day period after weaning, all clinical signs observed were digestive disorders. In the IPC group, sick pigs (52.7%) were individually treated by IM injection of antimicrobials. In this group, 78 sick pigs were scored as A pigs (42.4%), 17 as B pigs (9.2%), and two as C pigs (1.1%). All B pigs were moved to the hospital pen within the first week after weaning, and were treated and returned to their pen in 2 to 3 days, after showing signs of recovery. Both C pigs were moved to the hospital pen and remained there until they died during the growing period. In the Control group, mass antibiotic treatment was the treatment of choice when 20% to 30% of pigs per pen showed clinical signs of a digestive disorder. Within the first 7 days after weaning, all pens in the Control group received colistin sulphate via drinking water (100,000 IU colistin per kg BW daily for 3 consecutive days) and zinc oxide in the feed (2500 g per tonne for 14 days). In addition, more seriously affected pigs (43.4%) received individual IM antibiotic treatment.

In the growing phase, no mass treatments were used and the percentage of pigs individually treated with antibiotic did not differ between treatments (4.5%).

Discussion

The present study demonstrated that use of the husbandry- and health-management program proposed in this study (the IPC program) improved productive performance (both ADG and FCR).

In the UK, the Responsible Use of Medicines in Agriculture (RUMA) Alliance of farming, animal-health industry, food-retailing, and associated groups have as their goal promotion of a coordinated and integrated approach to best practice in the use of medicines. The Pig Working Group of the RUMA Alliance has published guidelines

Table 1: Mean (standard deviation) of growth performance in pigs managed under the Individual Pig Care (IPC) program or a standard care system (Control)*

	Control (n = 8 pens)	IPC (n = 8 pens)	*P*†
Nursery period (23 to 63 days of age)‡			
Initial BW (kg)	6.78 (1.122)	6.73 (0.867)	.91
ADG (kg/day)	0.326 (0.030)	0.368 (0.031)	.01
ADFI (kg/day)	0.467 (0.041)	0.511 (0.042)	.048
FCR (kg/kg)	1.434 (0.032)	1.392 (0.033)	.047
BW at 63 days (kg)	19.42 (1.333)	20.85 (2.303)	.07
Homogeneity at 63 days (%)	82.9 (4.142)	87.1 (3.142)	.06
Mortality (%)	0.54	1.09	.56
Growing period (64 to 90 days of age)			
ADG (kg/day)	0.391 (0.017)	0.439 (0.044)	.03
ADFI (kg/day)	0.637 (0.036)	0.696 (0.042)	.04
FCR (kg/kg)	1.634 (0.058)	1.590 (0.047)	.04
BW at 90 days (kg)	29.97 (1.304)	32.71 (2.448)	.04
Homogeneity at 90 days (%)	82.6 (3.879)	85.9 (3.003)	.07
Mortality (%)	3.83	1.10	.09
Total nursery-growing period (23 to 90 days of age)			
ADG (kg/day)	0.348 (0.011)	0.399 (0.031)	.004
ADFI (kg/day)	0.532 (0.032)	0.595 (0.048)	.049
FCR (kg/kg)	1.529 (0.029)	1.486 (0.032)	.049
Mortality (%)	4.35	2.17	.24

* A total of 368 pigs weaned at 23 days of age were used for the experiment, randomly allotted to 16 pens (23 pigs per pen), resulting in eight pens and 184 pigs per treatment group.

† One-way ANOVA for productive performance comparisons (ADG, ADFI, FCR, BW and BW homogeneity) and chi-square test for mortality comparisons.

‡ In the IPC group, 19 pigs were moved to the hospital pens within the first week after weaning: 17 returned to their pens in 2 to 3 days; two pigs remained in the hospital pen and died during the growing period. Average daily feed intake was controlled in the hospital pen and included in final calculations.

BW = body weight; ADG = average daily gain; ADFI = average daily feed intake; FCR = feed conversion ratio.

for responsible use of antimicrobials in pig production.[4] In this document, the importance of early recognition and treatment of disease is considered essential to protect animal welfare and also is a cornerstone of responsible medicine use, which is completely in line with IPC principles. The IPC program trains the caregiver to identify sick pigs at an early stage of disease (categorized as "A"). As a result, the IPC pigs in this study received individual treatment early in the disease process, which may have allowed them to recover quickly with minimal treatment. While they did not receive mass medication, their productive performance was better than that of the control pigs, and, in the growing phase, mortality tended to be lower than that of the control pigs, which had all received mass medication. Injectable antibiotics provide the most effective treatment in outbreak infections, mainly because they do not depend on water or feed consumption, which are usually reduced in sick pigs.[5] As a result, pigs treated individually have the best chance of recovery, with the least amount of antibiotic needed and with the medication given at the correct dosage. Availability of hospital pens may also contribute to a faster recovery in more seriously ill pigs (ie, categorized as B and C). Pigs in hospital pens are able to recuperate without competing with healthy pen mates for food, water, and comfortable lying areas. However, the effects on health status and productive performance obtained in the present study when the IPC guidelines were followed may be greater because of the relatively poor health status of the commercial herd.

It is increasingly necessary to adopt new approaches to food safety and pork quality. One way to describe the quality of pork production might be to collect information about medications used, proportion of pigs needing treatment, and management of herd health. In two studies, antimicrobials used in the different phases of swine production were registered and associated with production, sales, and trade information.[6,7] However, this kind of data gives little information about how, where, when, and why antimicrobials are used.[8] The current study proposes a new protocol, the IPC program, to generate these records properly,

accurately, and quickly. Health and growth performance might improve considerably with more comprehensive control of disease. In addition, records obtained with this program provide evidence of the timing and amount of medications used and the results of treatment.

Implications

- Under the conditions of this study, on farms with low health status, IPC training enables the caregiver to identify and treat sick pigs at an early stage of disease, which may contribute to better growth and productivity during the nursery and growing periods.
- Emphasizing individual treatment of sick animals through the IPC program, rather than mass medication, may result in less overall antibiotic usage and improved productivity.

Conflict of interest

Drs Andre Dereu, Niels Wuyts, and Paolo Doncecchi, and Olivia Azlor are employees of Zoetis, and IPC is a protocol management program service offered by Zoetis. Drs Carlos Pineiro, Joaquin Morales, and Elena Vizcaino were employed by the research organization PigCHAMP.

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Mortality, morbidity, and fertility after accidental electrical shock in a swine breeding and gestation barn

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Summary

Accidental electrocution occurred in a swine breeding barn, resulting in the immediate death of two sows and requiring euthanasia of four sows in the subsequent hours and days due to injury and hind-limb paralysis. The incident occurred on December 18, 2012, while transrectal ultrasound was being performed on a group of postweaned sows (Group 1, n = 23; average parity 1.7, range 0 to 6) to be inseminated December 18 and 19, and a second group (Group 2a, n = 15; average parity 2.3, range 0 to 7) that had been inseminated December 4 to 6 (13 to 15 days post breeding). An additional group of replacement gilts (Group 2b, n = 7), also bred December 4 to 6 with the same semen, were located in another room of the barn and not exposed to the electrical discharge. Among surviving Group 1 and Group 2a animals and the unexposed Group 2b sows, electric shock, breeding group, and parity had no detectable effects on farrowing rate or number of liveborn pigs ($P > .10$; ANOVA). Electrical safety for animals and humans should be evaluated in swine barns and steps taken to minimize risk of electrocution and electric shock.

Keywords: swine, electrocution, fertility, stress, safety

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Resumen - Mortalidad, morbilidad, y fertilidad después de un choque eléctrico accidental en una granja porcina de cargas y gestación

La electrocución accidental ocurrió en una granja de hembras de cargas y gestación, repercutiendo en la muerte inmediata de dos hembras y se requirió la eutanasia de cuatro hembras en los días y horas subsecuentes debido a lesión y parálisis del cuarto trasero. El incidente ocurrió en diciembre 18, 2012, mientras se estaba realizando el ultrasonido transrectal en un grupo de hembras post destete (Grupo 1, n = 23; paridad promedio 1.7, rango 0 a 6) para ser inseminadas en diciembre 18 y 19, y un segundo grupo (Grupo 2a, n = 15; paridad promedio 2.3, rango 0 a 7) que había sido inseminado en diciembre 4 al 6 (13 a 15 días post inseminación). Un grupo adicional de hembras de reemplazo (Grupo 2b, n = 7), también se inseminaron en diciembre 4 al 6 con el mismo semen; este grupo estaba localizado en otra sala de la granja y las hembras no fueron expuestas a la descarga eléctrica. Entre los animales sobrevivientes del Grupo 1 y 2a y las hembras que no fueron expuestas del Grupo 2b, el choque eléctrico, grupo de inseminación, y la paridad no tuvieron efectos perceptibles en el porcentaje de fertilidad o número de cerdos nacidos vivos ($P > .10$; ANOVA). La seguridad eléctrica para animales y humanos debe evaluarse en estas granjas porcinas y deben tomarse medidas para minimizar el riesgo de electrocución y choque eléctrico.

Résumé - Mortalité, morbidité, et fertilité suite à un choc électrique accidentel dans une bâtisse de saillie et de gestation de porcs

Une électrocution accidentelle est survenue dans une bâtisse de reproduction d'un élevage de porcs, causant la mort immédiate de deux truies et entraînant l'euthanasie de quatre truies dans les heures et jours subséquents à cause de blessures et paralysie des membres postérieurs. L'incident est survenu le 18 décembre 2012 alors qu'un examen échographique transrectal était effectué sur un groupe de truies en période post-sevrage (Groupe 1, n = 23; parité moyenne de 1,7 avec un écart de 0 à 6) devant être inséminées les 18 et 19 décembre, et un second groupe de truies (Groupe 2a, n = 15; parité moyenne de 2,3 avec un écart de 0 à 7) ayant été inséminées entre le 4 et 6 décembre (13 à 15 jours post-saillie). Un groupe additionnel de cochettes de remplacement (Groupe 2b, n = 7), également saillies entre le 4 et 6 décembre avec la même semence, était situé dans une autre chambre à l'intérieur de la bâtisse et non exposé à la décharge électrique. Parmi les animaux des Groupes 1 et 2a qui ont survécu et les truies du groupe non-exposé 2b, le choc électrique, le groupe de reproduction, et la parité n'avaient aucun effet détectable sur le taux de mise-bas ou le nombre de porcelets nés vivant ($P > 0,10$; ANOVA). La sécurité électrique pour les animaux et les humains devrait être évaluée dans les bâtisses d'élevage de porcs et des mesures prises pour minimiser les risques d'électrocution et de choc électrique.

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Livestock production, whether indoors or outside, involves risks of accidental electrocution and shock for animals and humans.[1,2] Animals are particularly susceptible, since they not only lack any form of electrical insulation on their feet, which are often wet, but also have more contact than humans with surface materials.[3] Cases of electrocution and shock have been reported in a variety of animals outdoors as

a result of lightning strike[4-6] and exposure to accidental electrical discharge from damaged power lines.[7] Indoor livestock facilities also pose serious risk of electrocution and shock as result of lightning strike[8,9] and exposure to accidental electrical discharge.[10-12]
For animals housed indoors, accidental electrocution or shock has resulted[11] from catastrophic failure in the building's electrical supply, structure, and operating systems, and from faulty or improper use of electrical equipment. However, the greatest risk of accidental electric shock in a livestock facility would appear to be from non-catastrophic events involving the inability of electrical switches, connections, and outlets to function properly because they are loose, corroded, broken, moist, or dirty. Further, livestock buildings, especially swine confinement facilities, are likely to show damage to electric wire or electric cord insulation as a result of exposure to caustic gases, moisture, temperature, and rodents. Damage to the outer plastic cover may eliminate any electrical insulation or may expose the underlying electrical insulation to fray, crack, or break away. Regardless of the cause of the electrical failure, in each case, there is an opportunity for electric current to follow an alternative path of least resistance which could lead to accidental electrocution or shock.[13] In swine confinement buildings, the risks of electrocution and shock appear to be compounded by the presence of large amounts of water and moisture, metal, corrosion, rodents, and dust and dirt.

There are also numerous reports of low voltage shock (defined by the United States Department of Agriculture as < 10 V) in livestock facilities.[13] The term for low voltage shock is stray voltage, which has been reported in dairy[13] and swine[14] facilities and is associated with minor forms of stress in animals in contact with the flow of low current through conducting materials. However, stray voltage is often difficult to detect, and although not lethal, can result in reduced comfort, and in a few instances reduced performance and health.[15,16] Serious electric shock or electrocution, on the other hand, most often involves exposure to a discharge of electricity from an electrical source above 80 V and more frequently in the 110 to 380 V range, which are commonly used throughout the world in home and industrial settings.[17] The available data suggest that the electrical current reported as perceptible by humans as an unpleasant tingling at the 1- to 4- mA level[18] is the same current associated with a proportion of animals beginning to change their behavior.[15] The severity of the electrical shock is associated with increasing voltage, amperage, and duration of exposure, as well as lowered electrical resistance (Ω) of the animal and the pathway of the current through the body.[17,18] Depending upon the conditions of electrical exposure, organ system damage may be minor and transient, severe with multi-system involvement over a lifetime, or lethal. Survival of humans following electric shock or lightning strike that results in cardio-pulmonary arrest is possible if victims receive immediate medical life-support.[18] It has been reported that exposure of humans to currents of 10 to 20 mA results in skeletal muscle tetany, and at 30 to 50 mA, thoracic muscle tetany leading to respiratory distress. At levels of 50 to 100 mA, ventricular fibrillation can occur and may be associated with cardiopulmonary arrest, whereas exposure to currents above 100 mA are generally considered lethal. It is interesting to note that in most cases involving swine, and a few involving humans, severe electric shock from exposure to electric discharge or lightning strike results in posterior paralysis associated with fractures to vertebrae and long bones. These skeletal injuries are thought to occur as a result of violent muscle contractions that create excessive force on the bones and joints.[6,8-12,18]

Although there are existing data on the occurrence of electric shock and electrocution in swine, there are no available data on subsequent fertility performance in a group of sows or gilts after electric shock. The intent of this case report is to share information on how and why an electrocution incident in a group of sows occurred and the mortality, morbidity, and fertility outcomes for the animals in the affected groups, and to report changes made in the animal facilities and how personnel were educated to help prevent another occurrence.

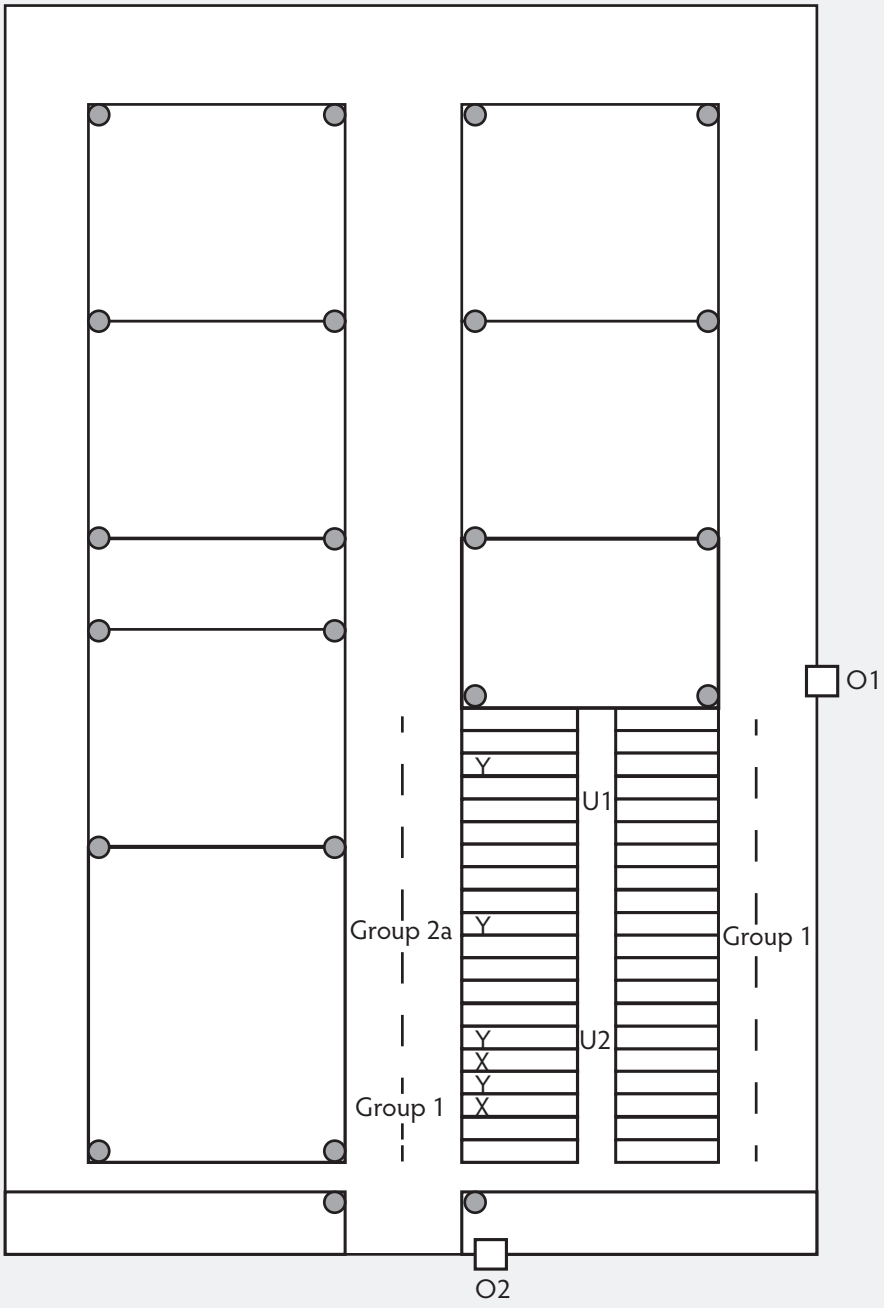
Animal shock and electrocution

On the morning of December 18, 2012, an accidental electrical shock and electrocution incident occurred, involving a group of post-weaned sows that were to be inseminated later that same day and in the subsequent days (Group 1: n = 23; average parity 1.7, range 0 to 6) and another group of sows that had been bred 13 to 15 days earlier (December 4 to 6; Group 2a: n = 15; average parity 2.3, range 0 to 7). An additional group of replacement gilts (Group 2b: n = 7), also bred 13 to 15 days earlier with the same semen as Group 2a, were located in another room of the same barn and were not exposed to the electrical discharge.

On the morning of the incident, transrectal ultrasound training was being conducted for two technicians in a 250-sow breeding and gestation facility at the University of Illinois. The animals and protocol used for the training were approved by the Institutional Care and Use Committee of the University of Illinois. The building, a confinement facility with environmental control systems, included three rooms (East, Center, and West). Approximately 60 mature sows, gilts, and boars were located in the East room where scanning was being performed (Figure 1). The 10 pens and 40 gestation stalls in the East room (36.6 × 13.4 m) were made of steel and were located over partially slatted concrete floors with steel water lines.

The ultrasound machines were located on separate carts. One machine was attached to a surge protector connected to a 16-gauge, 100-foot (30.5-m) extension cord that was plugged into the building electrical wall outlet. The other ultrasound machine was connected directly to a 16-gauge, 50-foot (15.2-m) extension cord that was plugged into a separate wall outlet. The extension cords were positioned to remain away from the sows so they could not pull or chew on them. The building had a general electric panel with 120-volt outlets and 20-amp breakers. The ultrasound machines were located in a narrow alleyway (0.46 m) behind the two rows of opposing gestation crates. The trainer was located between the two trainees and their machines. After scanning 15 animals during a 90-minute period, it was necessary to move one of the machines and adjust the extension cord to allow movement of the machine. The 100-foot cord was anchored away from the sows by a loop around one steel corner post. After resuming scanning, the machine attached to the 100-foot cord flickered and went black and then came back on and went black again. At that time, the entire room of sows jumped up simultaneously and began screaming. Until then, it had been very quiet in the facility, with most of the sows lying down and only a few drinking, eating, or standing. The noise in the room became so loud communication was impossible, and was estimated to have

Figure 1: An accidental electrocution incident occurred in two groups of sows in a 250-sow breeding and gestation barn at the University of Illinois, resulting in the immediate death of two sows (December 18, 2012). An additional four sows were euthanized in the subsequent hours and days due to injury and hind-limb paralysis. On the morning of the incident, transrectal ultrasound training was being conducted for two technicians. Each technician had an ultrasound console unit that required an electrical supply. The figure shows the general layout of the pens and stalls. The outlet boxes (O1 and O2) and ultrasound units (U1 and U2) are marked. The U1 was connected to a 100-foot (30-m) extension cord and plugged into O1; U2 was plugged into O2 with the 50-foot (15-m) cord. The electrocution incident occurred when a damaged section of the 100-foot cord contacted the steel corner post of a pen. Corner posts are indicated by solid circles. The approximate positions of the electrocuted sows (X) and those that were euthanized (Y) are marked; the locations of all Group 1 sows (bred December 18-22) and Group 2a sows (bred December 4-6) are marked with dashed lines.



exceeded 125 dB. The sows in the stalls were frantically moving while those in pens were also screaming. After approximately 10 seconds, one of the trainees unplugged the 50-foot electrical cord. However, the sows continued their behavior and the trainee ran to the outlet for the 100-foot cord, about 12.2 m away, and unplugged it. All the sows stopped screaming and moving at once. The three technicians noted that two sows (each approximately 227 kg) were unconscious and another sow appeared unable to get up and was paralyzed. Several sows had minor abrasions from the frantic movement in the stalls. The farm manager and staff were immediately alerted and the institutional veterinarian was notified.

Mortality, morbidity, and fertility report

The outcomes for the animals involved in the incident are shown in Table 1. Two sows died immediately by electrocution, and two others were euthanized later that same day due to hind-limb paralysis. Two additional animals were euthanized because of injuries and hind-limb paralysis, 1 day and 3 days after the incident, respectively. The locations of the animals in Group 1 and Group 2a and those that died and were euthanized are shown in Figure 1. All of the animals that died or were euthanized were located in the row behind those being evaluated by ultrasound.

In the weeks and months after the incident, fertility of the sows in the breeding groups was monitored. Data were analyzed by ANOVA procedures in SAS (SAS Institute Inc, Cary, North Carolina) with continuous response measures analyzed using PROC GLM and differences between least square means identified using the *t* test. Binary response measures were analyzed using PROC GENMOD and significant effects of treatment identified using the chi-square test.

Farrowing rate and liveborn data were analyzed for the main effects of electric shock, group (1, 2a, and 2b), and parity (0 to 7) using GENMOD and GLM procedures of SAS for binary and continuous response variables, respectively. Significant differences were identified at $P < .05$ and nonsignificant differences at $P > .10$.

Fertility results are shown in Table 2. The majority of the Group 1 sows were expected to be in estrus and receive their first service later the day of the electrical shock or the day after the shock. The standard farm

Table 1: Breeding dates, morbidity and mortality data, and numbers of sows housed in a breeding and gestation barn where an accidental electrocution incident occurred on December 18*

Breed group	East room	Center room	Breeding dates†	Died	Euthanized
Group 1	23	0	December 18-22	1	0
Group 2a	15	0	December 4-6	1	4
Group 2b‡	0	7	December 4-6	0	0

* The electrocution incident (described in Figure 1) involved groups of sows located in the East room of the barn and scheduled to be inseminated later that day (Group 1) or in the following days, or sows (Group 2a) and replacement gilts (Group 2b) that had been inseminated 13-15 days previously.

† All sows were inseminated twice: once at the onset of estrus (day 1) and again 24 hours later.

‡ Group 2b, a group of replacement gilts for Group 2a, were not exposed to the electrical shock.

Table 2: Fertility data from the breeding groups in a breeding and gestation barn relative to an electrocution incident*

Breed group†	Days relative to estrus‡	Sows remaining	Parity	Pregnant	Open	Farrowed	Farrowing rate (%)	Liveborn	Stillborn	Mummies
1	-4 to 1	22	1.7 ± 0.5	20	2	20	90.9	11.9 ± 0.9	0.2 ± 0.1	0.9 ± 0.2
2a	13 to 15	10	2.3 ± 0.7	9	1	8	80.0	13.3 ± 1.1	0.4 ± 0.2	1.5 ± 0.6
2b	13 to 15	7	0	6	1	6	85.7	11.2 ± 1.3	0.2 ± 0.2	0.8 ± 0.4

* Electrocution incident described in Figure 1. Breeding data described in Table 1. Mean and standard error reported for parity and numbers of liveborn and stillborn piglets and mummies.

† Group 1 and Group 2a were housed in the East room and were involved in the electrical shock incident. Group 2b were replacement gilts for Group 2a, housed in the Center room of the same building and not affected by the electrical shock incident. Farrowing rate and liveborn data were analyzed by ANOVA for the main effects of electric shock, group (1, 2a, and 2b), and parity (0 to 7). There were no effects of exposure to electric shock, group, or parity on measures of farrowing rate or liveborn pigs ($P > .10$). Significant differences were identified at $P < .05$ and nonsignificant differences at $P > .10$.

‡ All sows were inseminated twice, once at the onset of estrus (day 1) and again 24 hours later.

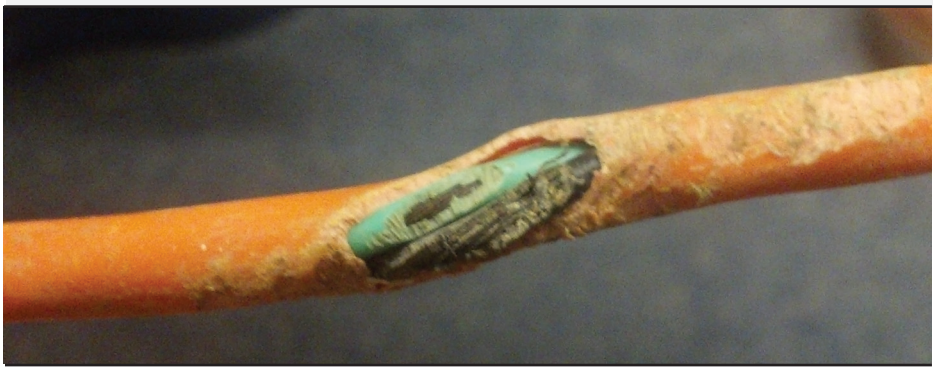
breeding protocol was to inseminate all females twice, once on the first day of estrus (day 1) and again the next day if still standing. All Group 1 animals were located in the East room. Of the surviving animals in Group 1, 90.9% of bred sows farrowed, producing an average of 11.7 pigs born alive. Breeding Group 2a sows, also located in the East room, were at day 13 to 15 of gestation, the time of embryo signaling and start of implantation. Of the surviving Group 2a females, 80.0% farrowed, producing an average of 13.3 pigs born alive. The replacement gilts for Group 2b, housed in the Center room and not exposed to the electrical discharge, had an 85.7% farrowing rate with an average of 11.2 pigs born alive. The structure of the groups and location within the facility allowed some comparison among groups for fertility, since the replacement gilts for Group 2b were housed in the Center room, which was unaffected by the electrical surge. Group 2b gilts were mated at the same time, at same location, and with the same semen as the Group 2a females, but were relocated in the next week due to the need for space in the breeding row. For the same reason, three Group 1 sows were moved into the center row. There were no effects of electric shock, group, or parity on any measure of reproductive performance ($P > .10$). Data from 23 groups that farrowed during January through November 2012 were not included in the analysis but were obtained for use in qualitative comparison. The overall farrowing rate during the 11 months before the incident was 80.1%, with 11.7 born alive for sows, and 78.6%, with 11.9 born alive for the replacement gilts.

Investigation into the incident

Inspection of the electrical cords by a farm staff member revealed a 1.3-cm section of exposed wire on the 100-foot cord where it had been looped around the steel post, and investigation into the incident identified this as the cause of the electrocution incident. An image of the cord (Figure 2) revealed that the damage likely resulted when a rodent chewed on the extension cord at that single location. There were no other areas of damage. The surge of electricity occurred when the damaged cord was re-adjusted to allow movement of the ultrasound machine, and the exposed wires directly contacted the steel corner post. The flow of current appeared to have followed the path of the conducting metal in the room. The behavior of the sows suggested that most of those in the stalls were affected and perhaps many of those in the pens as well. It is possible that the more severely affected sows had been drinking or in contact with water on the concrete floor at the time of the incident. This would have resulted in electrocution for some and painful shocks for the others. None of the trainees in contact with the stalls or concrete noted any shock, which was likely due to grounding by rubber boots and rubber-soled shoes.

A subsequent investigation was initiated by the Institutional Animal Care and Use Committee of the University of Illinois, and reports were submitted to the committee. Committee review identified the incident

Figure 2: An electrocution incident and layout of the breeding and gestation barn where the incident occurred are described in Figure 1. The damaged area of the 100-foot extension cord is shown. This type of damage suggested that rodents had chewed the cord's outer insulation, allowing the flow of current through the metal of the pens and stalls.



as an accident. However, from this incident, concerns arose about the safety issues involving electricity in the livestock facilities and within the departmental laboratories.

A mandatory educational session was held for all departmental employees to inform faculty, staff, and students who worked at the farms or within the departmental laboratories about the incident and electrical safety. The education session relayed the sequence of events that resulted in the deaths and euthanasia of the sows at the farm. It also identified the risks posed by extension-cord damage when cords are stored unprotected on the floor. For safety reasons, all extension cords were required to be protected from potential rodent damage and inspected before use. In the initial period after the incident, the Department of Animal Sciences required that all extension cords at the farms be 12-gauge and attached to a plug-in ground fault interrupter (GFI) adapter until the electrical systems could be evaluated. In the interim period before the mandatory training session, the training staff visited farm facilities and laboratories in the department and documented various potentially dangerous electrical conditions using digital pictures that were shared during the training session. In several cases, entire electrical cords or just sections of electrical cords were found lying unprotected on the ground, whether in or out of use. There were also several instances where excessive numbers of plugs were used per outlet, and electrical outlets and plugs were too close to a water supply. In the subsequent month, wired-in GFI units were installed in all receptacles at the farms.

Discussion

The results of this incident, although limited in observations, indicated that electrical shock at the time of breeding and at the time of implantation had no discernable effects on pregnancy establishment, farrowing rate, or litter size. This may not be surprising, since other studies have also shown that exposure of pigs to short-term stressors appears to have limited effects on reproduction,[7] even when induced by mild electric shock during estrus.[8] Although, to the knowledge of the authors, there are no published reports of the effects of electrical shock to swine at the time of implantation, most studies have failed to show any obvious negative effects of stress on fertility in response to mixing sows or gilts in groups.[10]

Much of what is known about electric shock and electrocution comes from human forensic and emergency-medicine reports, as well as veterinary reports involving postmortem examination of animals that were dead or euthanized due to paralysis. In humans, currents greater than 10 mA are capable of causing painful to severe shock, while those between 100 and 200 mA are lethal. With currents in the 10-mA to 20-mA range, muscular contractions can be strong enough to make breathing difficult. If the electrical current approaches 100 mA, ventricular fibrillation of the heart occurs, resulting in death. The resistance of the body may vary depending upon the points of electrical contact and whether the skin is wet or dry and may be ≤ 1000 Ω for wet skin to > 500,000 Ω for dry skin.[11] Neither the current the animals in the present report were exposed to nor their electrical resistance is known. It is likely that both the current and resistance varied from animal to animal, depending upon their location and contact with water. However, we do know that the outlet voltage was 120 V and it is likely the total duration of electrical shock was 15 to 20 seconds. If we estimate the conditions for exposure to the electrical current on the basis of animal electrical resistance to a fixed voltage using the equation I = 120 V ÷ R (where I is current in amps, V is voltage in volts, and R is resistance in ohms [Ω]), then animals with dry skin (250,000 Ω) would have been exposed to a current of < 1 mA. However, exposure of sows in contact with some moisture (10,000 Ω) may have been 12 mA or more, resulting in painful shocks as they touched metal surfaces on the sides, front, and back of the crates and pens. For animals that were wet or in contact with water, electrical resistance was lower (1000 Ω). Their exposure may have been ≥ 120 mA for 20 seconds and would have been severe enough to cause electrocution. The conditions that resulted in severe electric shock in four sows with posterior paralysis are uncertain, but may have resulted from a current flow at or just below that identified as lethal for a shorter period of time than in the sows that were electrocuted. Similar to the causes of death by electrocution noted for humans, previous reports in cases of electrocution in swine have indicated that death occurs primarily from cardiac or respiratory disruption. In cases where electric shock results in immobility and hind-leg paralysis, lesions were identified with fractures of the lumbosacral vertebrae, pelvis, and neck of the femur.[5,6]

The use of electrical cords and extension cords is common in livestock facilities, and with the risk of cord damage by any number of causes, it may be prudent to limit the length of the cord used when possible, to evaluate the cords often, and to protect the cords as much as possible. The use of heavier gauge extension cords may help to reduce the risk of damage in some cases, but damage to extension cords of any size can occur. The issue of a working GFI is important, and while re-wiring entire facilities can be expensive, plug-in GFI adapters can be used in line with extension cords. It should be noted that in this case, the personnel in the barn were also likely susceptible to shock, but were protected because all were wearing rubber-soled shoes or boots.

Implications

- Electrical cords are subject to damage and should be protected and inspected regularly.
- GFI systems should be checked for operation periodically.
- Personnel in barns should wear rubber-soled boots or shoes to aid in prevention of electrical shock and electrocution.
- Recognizing exposure to a dangerous electrical discharge in a swine facility can be characterized by unexpected loud vocalization of sows with frantic movement in stalls.

Conflict of interest

None reported.

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Sow PIN tags deadline January 1, 2015

In an effort to improve pre-harvest traceability and improve national disease surveillance in the pork industry, many major US packers and processors will require a United States Department of Agriculture- (USDA-) approved, official premises identification number (PIN) swine tag as a condition of sale for breeding stock beginning January 1, 2015.

According to Dr Patrick Webb, Pork Checkoff's director of swine health, the USDA-approved, official PIN tags for breeding swine are customizable with or without a management number and can be purchased in multiple colors. This will allow producers to use the official tag in any color as a management tag or wait to apply the tag to sows or boars prior to leaving the production site to enter harvest channels. All records documenting the identification and movement of breeding stock should be kept for 3 years.

The following companies, Allflex USA, Inc (DFW Airport, Texas), Destron Fearing (South St Paul, Minnesota), and Y-Tex Corporation (Cody, Wyoming), have been approved by USDA to manufacture official PIN swine tags. When ordering tags from one of these companies, producers must provide the nationally standardized PIN for the breeding farm. If the site does not have a PIN, producers can learn how to register for one by going to **www.pork.org/PINtag**.

The following packers will require PIN tags as of January 2015: Johnsonville, Hillshire Brands, Calihan Pork Processors, Bob Evans Farms, Wampler's Farm Sausage, Pine Ridge Farms, Pioneer Packing Co, Pork King Packing, and Abbyland Pork Pack.

For more information, contact Patrick Webb at **PWebb@pork.org** or 515-223-3441.

2014 Environmental Stewards announced

The Pork Checkoff, along with its co-sponsor, *National Hog Farmer* magazine, has selected two pork farms to be honored as the 2014 Pork Industry Environmental Stewards. The award, now in its 20th year, recognizes producers who are dedicated to safeguarding the environment and contributing to their local communities.

The 2014 award recipients are Bruce and Jenny Wessling, Grand Junction, Iowa; and David and Sharon Stephens, Malta Bend, Missouri. The judges for the 2014 award represented pork producers and environmental organizations from across the country. The committee reviewed applications from pig farmers who are committed to upholding the ideal relationship between pork production and the environment. Videos of these farms may be viewed on **www.pork.org**.

For more information, contact Mike King at **MKing@pork.org** or 515-223-3532.

2014 Pork Industry Environmental Stewards award recipients: Bruce and Jenny Wessling (left) and David and Sharon Stephens (right)

Johnson named interim CEO of National Pork Board

John Johnson, interim CEO of the National Pork Board

John Johnson, who has been the chief operating officer of the National Pork Board, is serving as the interim CEO of the organization until a replacement can be found by the group's search firm and approved by the board. Chris Novak, the previous National Pork Board CEO, stepped down after 6 years of service to the pork industry and the Pork Checkoff to take leadership of the National Corn Growers Association.

For more information, contact Kevin Waetke at **KWaetke@pork.org** or 515-223-2638.

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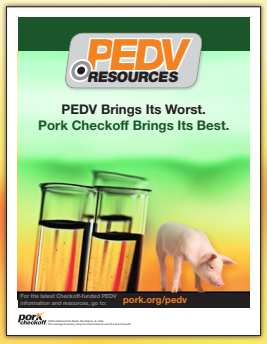
Thanks to Checkoff-funded research already conducted, some practical on-farm solutions to PEDV have been delivered to U.S. pork producers.

For the latest Checkoff-funded PEDV information and resources, go to **pork.org/pedv**.



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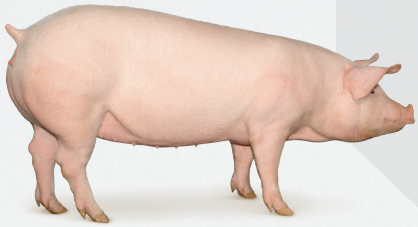

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AASV NEWS

AASV hosts Vietnamese veterinarians, government officials

Due to its off-the-beaten-path location, the AASV office does not often receive visitors, so it was an eventful day on September 10 when a large tour bus delivered a dozen veterinarians, government officials, and translators from Vietnam to the AASV front door in Perry, Iowa. The delegation was accompanied by Richard Fritz, the Executive Director of the Food and Agriculture Export Alliance (FAEA), the US organization that arranged the visit.

The visitors included high-level officials of Vietnam's National Assembly and its Ministry of Agriculture and Rural Development, in addition to a representative from the United States Department of Agriculture's (USDA's) Foreign Agricultural Service in Hanoi. Their purpose was to gather information to assist in the drafting of an Animal Veterinary Law to be submitted to the Vietnam National Assembly later this year.

The group's stop in Perry was one of several made during a 5-day tour of the United States to learn more about veterinary drug use, animal-health issues, and the various roles of government agencies and organizations like AASV. In bringing the delegation to the United States, the FAEA hoped to support Vietnamese efforts to pass a veterinary law that will strengthen the use and control of veterinary drugs, establish animal quarantine procedures, enhance food safety, and maintain and expand trade.

Dr Tom Burkgren (back row, left) and Richard Fritz (back row, right) pose with a delegation of Vietnamese veterinarians, government officials, and translators during their visit to the AASV office in Perry, Iowa

With the assistance of translators, AASV Executive Director Dr Tom Burkgren made a presentation describing the AASV, its role in addressing animal-health issues, and its interaction with other organizations and government agencies. The delegation members posed a number of questions and were particularly interested in the US process for veterinary licensure and continuing education. At the conclusion of the visit, the group expressed their appreciation and posed for a group photo before departing for the next stop on their trip.

AASV releases salary survey results

The AASV's fifth salary survey of veterinary members in the United States and Canada is complete, and a summary of the results is available for members to access on the AASV Web site at **www.aasv.org/members/only/SalarySurvey2014.pdf**. The summary has also been printed and mailed to US and Canadian members. The 2014 survey gathered salary and employment details for the year 2013.

The AASV salary survey is intended to benefit the members of the AASV by allowing greater insight into the value of professional services provided by swine veterinarians. In addition, it functions as a tool to encourage veterinary students to pursue careers as swine veterinarians.

There were 920 US and Canadian members eligible to participate in the 2014 survey, a slight increase from the most recent survey conducted in 2011. However, the response rate was somewhat lower than in past years: 35%, compared to earlier response rates of 40% or more.

As in previous survey efforts, the AASV membership was classified into two categories, with members in each category receiving a different survey: Practitioners, defined as veterinarians working in private practice and veterinarians working within production systems; and Public/Corporate Veterinarians, defined as veterinarians working within the allied pork industry and academia. The 35% response rate was consistent across both categories.

The survey results are presented in a series of tables and figures comparing salary levels with other surveyed parameters, including age, gender, hours worked, number of employees supervised, employer/practice type, and position. The survey also includes a comprehensive list of fringe benefits that indicates the percentage of respondents who reported receiving each benefit.

The AASV is indebted to IT Specialist David Brown for his management of the online survey instrument, as well as his expertise in compiling the survey results and preparing them for publication.

AASV news continued on page 313

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Reference: 1. Buhr BL, Hurley T, Tonsor G, Zering K, DiPietre D. Comprehensive economic analysis of Improvest adoption by the US pork industry. *Am Assoc Swine Vet.* 2014;201-206.

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AASV news continued from page 311

Dr James Bailey honored by South Dakota Veterinary Medical Association

The South Dakota Veterinary Medical Association (SDVMA) recently recognized AASV Charter and Life Member Dr James Bailey with the Distinguished Service Award, presented during the SDVMA 123rd Annual Meeting in Sioux Falls, South Dakota. The award honors an individual who has brought distinction to the veterinary profession through his or her devotion to the care and well-being of animals, support for the profession, and contributions to the community. The individual exemplifies the profession, both personally and professionally, through support of veterinary medicine, research, colleagues, and/or students and through civic participation. The individual's contributions have advanced the profession and serve as an inspiration to veterinarians and the clients he serves.

Dr James H. Bailey, recipient of the South Dakota VMA Distinguished Service Award.

Dr Bailey's imprint and impact on veterinary medicine span decades. He received his veterinary education from Iowa State University. In 1968, Dr Bailey joined the South Dakota State University (SDSU) faculty as the Extension Veterinarian. He retired in 1985 and was granted the status of Extension Veterinarian Emeritus. He served as the SDVMA Secretary/Treasurer from 1972 to 1985, and was the Executive Director of the SDVMA from 1985 to 1996.

Dr Bailey was a charter member of the American Association of Swine Practitioners in 1969. He served as the organization's first secretary in 1972 and as the president in 1980-1981. He was granted the Howard Dunne Memorial Award in 1986 for extraordinary service to veterinary medicine and the swine industry. In a "Heritage Video" recorded for AASV and available for members to view at **https://www.aasv.org/members/only/video/Bailey/**, Dr Bailey shared recollections of his background and career.

Dr Bailey's distinguished career includes numerous accomplishments. In 1969, Bailey was one of the original extension personnel to compile the fact sheets that became the Pork Industry Handbook. He contributed information on respiratory diseases and arthritis in swine. He was honored by the American Association of Extension Veterinarians as the Veterinarian of the Year, and also received the SDVMA Veterinarian of the Year award.

He served on the South Dakota Hog Cholera and Pseudorabies Eradication Committees.

He was a member of the South Dakota Livestock Foundation from 1970 to 1996. He served on the Livestock Conservation Institute's Parasite Committee from 1970 to 1981. Dr Bailey received the South Dakota Pork Producers Council Distinguished Service Award in 1976 and was named an Honorary Pork Producer.

Dr Bailey served as a member of the American Veterinary Medical Association's House of Delegates through the 1970s and on the Council on Biologics and Therapeutic Agents during the 1980s. Iowa State University College of Veterinary Medicine presented Dr Bailey with the prestigious Stange Memorial Award for distinguished alumni in 1984.

He was an instrumental part of the beginning of the annual Herd Health Conference at SDSU, which was first held in 1988. In 1997, the conference was renamed the James Bailey Herd Health Conference in recognition of Dr Bailey's contributions to veterinary medicine in South Dakota.

Dr Bailey and his wife Roberta live in Brookings. They have five children, 10 grandchildren, and eight great-grandchildren.

Applicants sought for alternate student delegate on AASV Board of Directors

The AASV Student Recruitment Committee is accepting applications from veterinary students interested in serving as the alternate student delegate on the AASV Board of Directors. This student will represent student interests and serve as a non-voting member of the AASV board. This experience will provide the student with a unique perspective of the inner workings of the AASV. The term of service is 2 years: the first year as alternate student delegate and the second year as the student delegate.

The alternate student delegate and student delegate are required to attend the AASV board's two meetings each year: the spring meeting held during the AASV Annual Meeting, and the fall meeting, which is usually held in October. The student delegate presents a summary of board activities to the student membership at the student breakfast during the AASV Annual Meeting, and outlines student opportunities in AASV to the AASV student members at that time. In addition, the delegate and alternate delegate are voting members of the AASV Student Recruitment Committee, and are invited to participate in committee conference calls and meetings. The delegates receive reimbursement to cover travel and lodging expenses for the fall board meeting and transportation expenses for the spring meeting.

Interested students must be members of AASV in their freshman or sophomore year. Applicants are required to submit the following documentation to the AASV (830 26th Street, Perry, IA 50220-2328; E-mail: **aasv@aasv.org**):

1. An introductory letter, not to exceed one page, describing why they want to serve as the alternate student delegate for AASV, their level of interest or background in swine medicine, and their future career goals.

2. A one- or two-page resume featuring the student's interest and experience in production medicine, particularly swine medicine.

3. A statement of recommendation from a faculty member.

The deadline for submission of necessary documentation is **November 10, 2014**. The delegate will be chosen by members of the AASV Student Recruitment Committee following review of the submitted materials. Applicants will be notified of the committee's decision by December 15.

The term of service is 2 years, beginning at the AASV Annual Meeting. During the first year, the student will serve as the alternate student delegate. The alternate delegate will automatically succeed as student delegate, beginning at the annual meeting the following year. The alternate delegate will serve in the capacity of delegate if the student delegate is unable to carry out his or her duties. Each year, a new alternate delegate is selected by the AASV Student Recruitment Committee.

Questions may be directed to the chair of the AASV Student Recruitment Committee, Dr Nathan Schaefer, **nathan.schaefer@boehringer-ingelheim.com**.

Nominate exceptional colleagues for AASV awards

Do you know an AASV member whose dedication to the association and the swine industry is worthy of recognition? The AASV Awards Committee requests nominations for the following five awards to be presented at the upcoming AASV annual meeting in Orlando.

Howard Dunne Memorial Award – Given annually to an AASV member who has made a significant contribution and rendered outstanding service to the AASV and the swine industry.

Meritorious Service Award – Given annually to an individual who has consistently given time and effort to the association in the area of service to the AASV members, AASV officers, and the AASV staff.

Swine Practitioner of the Year – Given annually to the swine practitioner (AASV member) who has demonstrated an unusual degree of proficiency in the delivery of veterinary service to his or her clients.

Technical Services/Allied Industry Veterinarian of the Year – Given annually to the technical services or allied industry veterinarian who has demonstrated an unusual degree of proficiency and effectiveness in the delivery of veterinary service to his or her company and its clients, as well as given tirelessly in service to the AASV and the swine industry.

Young Swine Veterinarian of the Year – Given annually to a swine veterinarian who is an AASV member, 5 years or less post graduation, who has demonstrated the ideals of exemplary service and proficiency early in his or her career.

Nominations are due December 15. The nomination letter should specify the award and cite the qualifications of the candidate for the award. Submit to AASV, 830 26th Street, Perry, IA 50220-2328; Fax: 515-465-3832; E-mail: **aasv@aasv.org**.

AASV 2015 Annual Meeting

February 28 - March 3, 2015

Buena Vista Palace Hotel & Spa – Orlando, Florida

AASV Annual Meeting Program

"Beyond our oath: Integrity, intensity, professionalism"

SATURDAY, FEBRUARY 28

7:30 AM – 12:30 PM

Web-based PRRS risk assessment training for the breeding herd

8:00 AM

Entrance examination: American Board of Veterinary Practitioners, Swine Health Management

Pre-conference seminars

1:00 PM – 5:00 PM

Seminar #1	Beyond our oath: *Primum non nocere* and other excellent tips, tricks and shortcuts *John Waddell, chair*
Seminar #2	Coronavirus diagnostics and surveillance *Alex Ramirez, chair*
Seminar #3	Sow reproduction: Achieving and expanding the high-producing heat *Nathan Winkelman, chair*
Seminar #4	Practical interventions that impact swine housing *Michelle Michalak, chair*
Seminar #5	Growing pig lameness: An emerging syndrome *Matthew Turner, chair*
Seminar #6	Public policy, pigs, and FDA: Why you should care *Jennifer Stevens, chair*

SUNDAY, MARCH 1

Canadian Swine Veterinarians

8:00 AM – 12:00 noon

Pre-conference seminars

8:00 AM – 12:00 noon

Seminar #7	Piglet diarrhea *Andrew Bents, chair*
Seminar #8	Biosecurity: Bridging the gap between science and compliance *Adam Schelkopf, chair*
Seminar #9	Nutrition and feeding in the era of PED virus *Joel Spencer, chair*
Seminar #10	Swine medicine for students *Angela Supple and Jeremy Pittman, co-chairs*
Seminar #11	Boar stud health, biosecurity, and technology *Joe Fent, chair*

Research topics

8:00 AM – 12:00 noon

Session chair: Chris Rademacher

8:00 AM	Viremia and tissue distribution of porcine epidemic diarrhea virus in weaned pigs after experimental infection *Mahesh Bhandari*
8:15 AM	Evaluation of porcine epidemic diarrhea virus transmission and the immune response in growing pigs *Kimberly Crawford*
8:30 AM	Defining PEDV maternal immunity and correlates of neonatal protection *Korakrit Poonsuk*
8:45 AM	Comparison of the pathogenesis differences of the US PEDV original and variant strains in neonatal piglets *Jianqiang Zhang*
9:00 AM	In vitro evaluation of serological cross-reactivity and cross-neutralization between the US PEDV original and variant strains *Qi Chen*
9:15 AM	Does previous infection of sows with a "mild" (variant) strain of PED virus confer significant protection against infection with a "severe" (prototype) strain? *Dane Goede*
9:30 AM	Airborne transmission of PED virus and effect of the electrostatic particle ionization technology on decreasing airborne swine viruses *Carmen Alonso*
9:45 AM	BREAK

Current program information is online at https://www.aasv.org/annmtg

10:15 AM	Risk assessment of feed ingredients of porcine origin as vehicles for transmission of porcine epidemic diarrhea virus (PEDV) *Fernando Sampedro*
10:30 AM	Development and validation of an indirect PDCoV anti-IgG ELISA based on the S1 portion of the spike protein and confirmation that PDCoV infection in US pigs is low and has been present since 2010 *Tanja Opriessnig*
10:45 AM	Histopathological and immunohistochemical characterization of pigs experimentally infected with porcine deltacoronavirus *Sarah Vitosh-Sillman*
11:00 AM	Effects of porcine reproductive and respiratory syndrome (PRRS) modified live virus vaccine on the host response of nursery pigs to co-infection with PRRS virus and porcine circovirus type 2b *Megan Niederwerder*
11:15 AM	Dynamics of co-circulating H1N1 and H3N2 influenza A viruses in a cohort of pigs after weaning *Andres Diaz*
11:30 AM	Effect of timing of gilt relocation from group pens to individual stalls on measures of fertility and well-being *Junye Shen*
11:45 AM	The timing of estrus and ovulation in gilts synchronized using Matrix and the effects of synchronizing ovulation using OvuGel on fertility *Rob Knox*
12:00 noon	Session concludes

Poster session: Veterinary Students, Research Topics, and Industrial Partners

12:00 noon – 5:00 PM

Poster authors present from 12:00 noon to 1:00 PM
Poster session continues on Monday, 9:00 AM to 5:00 PM

Concurrent sessions

1:00 PM – 5:15 PM

Session #1	**Student Seminar** *Alex Ramirez and Peter Davies, co-chairs*
Session #2	**Industrial Partners**
Session #3	**Industrial Partners**
Session #4	**Industrial Partners**

MONDAY, MARCH 2

General session: Beyond our oath: Integrity, intensity, professionalism

8:00 AM – 12:30 PM

Program chair: Ron Brodersen

8:00 AM	**Howard Dunne Memorial Lecture** Because it's the right thing to do *Greg Stevenson*
9:00 AM	**Alex Hogg Memorial Lecture** Influence and advocacy: Opportunities for swine veterinarians *Scanlon Daniels*
10:00 AM	BREAK
10:30 AM	Coronavirus overview and maternal vaccines to induce lactogenic immunity to PEDV in swine *Linda Saif*
11:10 AM	Gut immunity: What are the keys to protection? *Chris Chase*
11:50 AM	Coronavirus clinical presentation *Dick Hesse*
12:30 PM	LUNCHEON

Concurrent session #1: Managing enteric coronaviruses at the farm level

2:00 PM – 5:30 PM

Session chair: Jeff Harker

2:00 PM	Managing the initial break *Elissa Schlueter*
2:25 PM	Intentional exposure techniques *Matthew Turner*
2:50 PM	PED rebreaks *Matt Ackerman*
3:15 PM	BREAK
3:45 PM	Managing chronic farms *Luc Dufresne*
4:10 PM	Risk factors for chronic farms *Chris Rademacher*
4:35 PM	Time to stability/negative *Dane Goede*
5:00 PM	Roundtable discussion *All speakers*
5:30 PM	Session concludes

Concurrent session #2: Animal welfare

2:00 PM – 5:30 PM

Session chair: George Charbonneau

2:00 PM	What's coming down the pipe? *Donald Lay*
2:30 PM	Canada's new pig code *Blaine Tully*
2:45 PM	AMDUCA and pain mitigation; What tools are available to veterinarians? *Mike Apley*
3:15 PM	Meloxicam use in pain management *Locke Karriker*
3:30 PM	BREAK
4:00 PM	Feeding sows in pens: Keeping it simple *Chad Smith*
4:15 PM	Advantages and challenges of implementing electronic sow feeding (ESF) *Thomas Parsons*
4:30 PM	Beta-agonists and animal welfare *Jeremy Marchant-Forde*
4:45 PM	Feeding/nutrition interactions affecting aggression *Jeremy Marchant-Forde*
5:00 PM	B.E.S.T.: Identifying the sick or compromised pig *Madonna Benjamin*
5:15 PM	Caring for pigs in hospital pens *Suzanne Millman*
5:30 PM	Session concludes

Concurrent session #3: Significant swine disease topics

2:00 PM – 5:30 PM

Session chair: Mitch Christensen

2:00 PM	PCV2: Tools for assessing the subclinical impact *Kent Schwartz*
2:30 PM	Influenza A viruses in swine: Diversity, diagnostics, and interpretation *Phil Gauger*
3:00 PM	Parainfluenza: Influenza-like syndromes *Kyoung-Jin Yoon*
3:30 PM	BREAK
4:00 PM	*Mycoplasma hyopneumoniae* elimination: Swine Vet Center experience *Paul Yeske*
4:30 PM	PRRS diagnostic trends: What changed with PRRS behavior? *Albert Rovira*
5:00 PM	PRRS update from North Carolina: Regional spread of 1-7-4 virus *Ashley Johnson*
5:30 PM	Session concludes

TUESDAY, MARCH 3

General session: Transboundary or FAD: What difference does it make?

8:00 AM – 12:00 noon

Session chair: Ron Brodersen

8:00 AM	Global effects of disease on world pork production *Patrick Webb*
9:00 AM	Emerging diseases: The past and the future *Robert Desrosiers*
10:00 AM	BREAK
10:30 AM	Building on the Swine Futures Project: Detecting and responding to an emerging animal disease *Beth Lautner*
11:00 AM	Protecting ourselves: Feed Modernization Safety Act *Henry Turlington*
11:30 AM	What veterinarians will do differently in the future *Max Rodibaugh*
12:00 noon	Meeting concludes

Beyond our oath: Integrity, intensity, professionalism

46th AASV Annual Meeting

February 28 - March 3, 2015
Orlando, Florida

Howard Dunne Memorial Lecture:
Dr Greg Stevenson

Alex Hogg Memorial Lecture:
Dr C. Scanlon Daniels

Buena Vista Palace Hotel & Spa
1900 E Buena Vista Drive
Lake Buena Vista, FL 32830
Tel: 866-397-6516

For more information:
https://www.aasv.org/annmtg

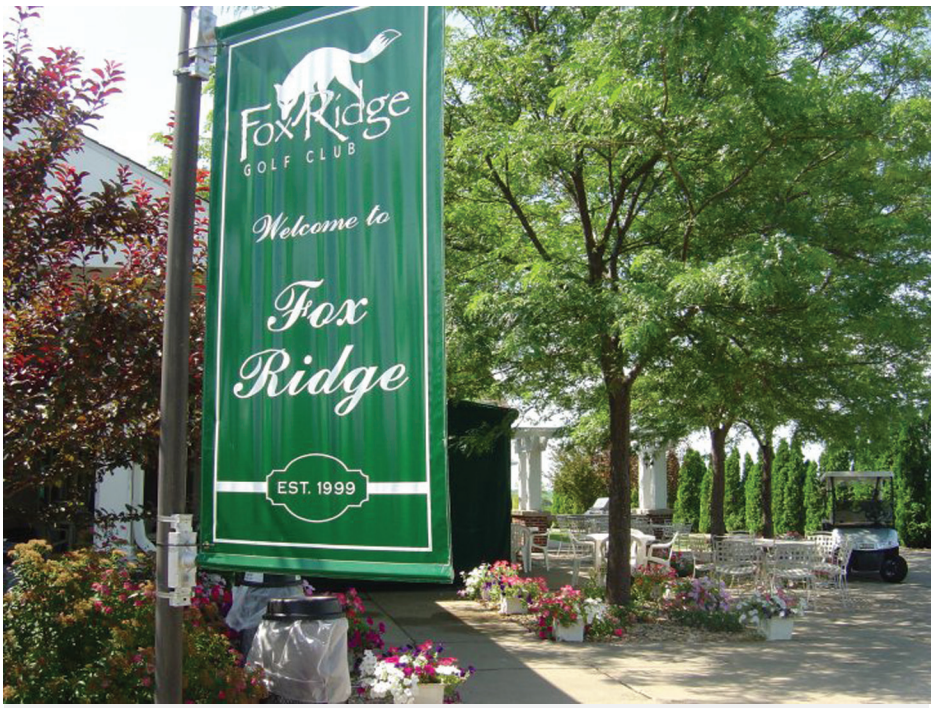
FOUNDATION NEWS

Sun shines on AASV Foundation golf outing

The AASV Foundation hosted another successful golf outing fundraiser on August 21, with 48 golfers on 12 teams participating in the modified best-ball tournament. Several teams encountered heavy rains as they traveled to the course in the morning, wondering if the event would be cancelled upon their arrival. But shortly before the noon tee-off, the clouds parted and the rain stopped, allowing the sun to shine on a fine afternoon for golf at Fox Ridge Golf Club in Dike, Iowa.

In addition to the good weather, participants enjoyed the hospitality of generous event sponsors. Aivlosin provided a box lunch for each golfer, and beverage sponsor Harrisvaccines kept the golfers hydrated with a variety of liquid refreshments. Golf-hole sponsors Alltech, Insight Wealth Group, Pivot Wealth Strategies, Topigs Norsvin USA, and Zoetis spiced up the course with additional games, giveaways, and team photos. At the conclusion of the golfing, Uniferon sponsored the awards dinner to recognize the individual and team winners.

Regardless of the golf scores, the real winner of the day was the AASV Foundation. The event raised $8500, which will help fund swine research, travel stipends for veterinary students to attend the AASV Annual Meeting, swine externship grants, scholarships, and more. The foundation is grateful to the companies who provided sponsorship support and hosted teams for the outing. In addition, the foundation expresses sincere thanks to Dr Steve Menke and his son Mike for making it possible to hold the outing at Fox Ridge Golf Club, and especially to Dr Ron White, who is stepping down after coordinating the foundation's golf fundraisers for the past 7 years – thank you, Ron!



The sky cleared just in time for the AASV Foundation golf outing at Fox Ridge Golf Club in Dike, Iowa. The club is owned by AASV member Dr Steve Menke.

Photo courtesy of Fox Ridge Golf Club

"Following your passion" key to success

Are you wondering what to donate for the AASV Foundation fundraising auction this year? "Follow your passion!" says auction committee chairman Dr Daryl Olsen, setting the theme for the 2015 fundraising activity. He points to the Swine Vet Center's donation of their clients' pork products last year as just one example of this precept in action. The Swine Vet Center's passion for their clients and the pork they produce was evident in this very popular contribution to the auction. Similarly, other auction contributions reflected members' passions for photography, quilting, knitting, hunting, fishing, sporting events, local artisans, antiques, and – of course – pigs.

So what is YOUR passion? Whatever it is, let it guide and inspire you to make a contribution to the AASV Foundation Auction this year! Dr Olsen and his committee are confident this will be the key to a successful fundraising activity in 2015.

Donate your auction item(s) by December 1

Download the donation form at **https://www.aasv.org/foundation** and submit a description of your item(s) by December 1. Your contribution will be recognized in the printed auction catalog as well as on the auction Web site, and your name will appear in the *JSHAP* full-page spread recognizing

Foundation news continued on page 321

One injection of EXCEDE® for Swine (ceftiofur crystalline free acid) treats and controls swine respiratory disease for 7 days. It continuously attacks a broad range of pathogens.* And EXCEDE is proven effective for both weaning and nursery—the 2 critical stages in a young pig's development. So you can have a healthy pig—and a healthy herd—for the long term.

IMPORTANT SAFETY INFORMATION: People with known hypersensitivity to penicillin or cephalosporins should avoid exposure to EXCEDE. Do not use in swine found to be hypersensitive to the product. Pre-slaughter withdrawal time is 14 days following the last dose. See Brief Summary of Prescribing Information on the next page.

**A pleuropneumoniae, H parasuis, P multocida, S suis.*

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(Ceftiofur Crystalline Free Acid)
Sterile Suspension

zoetis™

Foundation news continued from page 319

all of our auction item donors. If that's not enough, there's a good chance Dr Harry Snelson will say something witty about your donation in the AASV e-Letter, too!

The AASV Foundation is passionate about ensuring the future of the swine veterinary profession. Proceeds from the auction enable funding for AASV Foundation programs, including

- Administering endowments for the Howard Dunne and Alex Hogg Memorial Lectures,
- Administering the Hogg Scholarship for a swine veterinarian pursuing an MS or PhD,
- Administering funding for Veterinary Student Scholarships,
- Co-sponsoring travel stipends for veterinary students attending the AASV Annual Meeting,
- Providing swine externship grants to veterinary students,
- Funding swine research with direct application to the profession,
- Administering funding for the National Pork Industry Foundation Internship Stipends,
- Providing support for Heritage Videos, and
- Funding AASV student interns.

AASV Foundation issues call for research proposals: $60,000 available

As part of its mission to fund research with direct application to the profession, the American Association of Swine Veterinarians Foundation seeks research proposals for funding in 2015. Proposals are **due January 30, 2015**, and may request a maximum of $30,000 (US$) per project. A maximum of $60,000 will be awarded across two or more projects. The announcement of projects selected for funding will take place at the AASV Foundation Luncheon in Orlando, Florida, on Sunday, March 1, 2015 (awardees may be notified in advance).

Proposed research should fit one of the five action areas stated in the AASV Foundation mission statement (see sidebar).

The instructions for submitting proposals are available on the AASV Foundation Web site at **https://www.aasv.org/foundation/2015/research.php**. Proposals may be submitted by mail or e-mail (preferred).

A panel of AASV members will evaluate and select proposals for funding, based on the following scoring system:

- Potential benefit to swine veterinarians/swine industry (40 points)
- Probability of success within timeline (35 points)
- Scientific/investigative quality (15 points)
- Budget justification (5 points)
- Originality (5 points)

For more information, or to submit a proposal:

AASV Foundation, 830 26th Street, Perry, IA 50220-2328; Tel: 515-465-5255; Fax: 515-465-3832; E-mail: **aasv@aasv.org**.

AASV Foundation Mission Statement

The mission of the AASV Foundation is to empower swine veterinarians to achieve a higher level of personal and professional effectiveness by

- Enhancing the image of the swine veterinary profession,
- Supporting the development and scholarship of students and veterinarians interested in the swine industry,
- Addressing long-range issues of the profession,
- Supporting faculty and promoting excellence in the teaching of swine health and production, and
- Funding research with direct application to the profession.

Are your feed ingredients PEDv TESTED?

betaGRO Lot	PRRS-US	PRRS-EU	PED-n	PDCv
G0054025	NEGATIVE	NEGATIVE	NEGATIVE	NEGATIVE
G0064026	NEGATIVE	NEGATIVE	NEGATIVE	NEGATIVE
G0074037	NEGATIVE	NEGATIVE	NEGATIVE	NEGATIVE
G0084038	NEGATIVE	NEGATIVE	NEGATIVE	NEGATIVE
G0094051	NEGATIVE	NEGATIVE	NEGATIVE	NEGATIVE
G0104052	NEGATIVE	NEGATIVE	NEGATIVE	NEGATIVE
G0114054	NEGATIVE	NEGATIVE	NEGATIVE	NEGATIVE
G0124055	NEGATIVE	NEGATIVE	NEGATIVE	NEGATIVE
G0134056	NEGATIVE	NEGATIVE	NEGATIVE	NEGATIVE
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G0424079	NEGATIVE	NEGATIVE	NEGATIVE	NEGATIVE
G0434080	NEGATIVE	NEGATIVE	NEGATIVE	NEGATIVE
G0444084	NEGATIVE	NEGATIVE	NEGATIVE	NEGATIVE

betaGRO Lot	PRRS-US	PRRS-EU	PED-n	PDCv
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G0864126B	NEGATIVE	NEGATIVE	NEGATIVE	NEGATIVE
G0874132A	NEGATIVE	NEGATIVE	NEGATIVE	NEGATIVE

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On-farm antimicrobial use data – what's our position?

Growth promotant antimicrobials – gone. Over-the-counter feed-grade antimicrobials – going away. What's next? On-farm antimicrobial data collection if Congress and the Food and Drug Administration (FDA) have their way. All this just to satisfy political whims. There have been no peer-reviewed scientific studies proving any harmful effects in humans associated with increased antimicrobial resistance resulting from the judicious use of antimicrobials in food-producing animals.

The FDA recently released the Executive Summary of the 2011 National Antimicrobial Resistance Monitoring System (NARMS) Report. Since its inception in 1996, NARMS has collected samples from people, animals at harvest, and retail meats from the grocery store. These samples have been analyzed for a series of foodborne pathogens, including non-typhoidal *Salmonella*, *Enterococcus*, *Escherichia coli,* and *Campylobacter,* to monitor for resistance to classes of antimicrobials important in human medicine. As they are the only national scientific studies of antimicrobial resistance patterns in foodborne bacteria, the livestock and poultry industries watch those reports carefully. As is usually the case, the 2011 report contained positive and negative findings.[1] Here are some of the major conclusions:

During its 16-year history, NARMS has found *Salmonella* resistance to ciprofloxacin to be < 0.5% among human isolates, < 3% among retail meat isolates, and < 1% among animals at slaughter.

Continued rise in ceftriaxone resistance led to the April 2012 cephalosporin order of prohibition, which prohibits certain unapproved uses of cephalosporin drugs in cattle, swine, chickens, and turkeys.

In 2011, one human-source *Salmonella* isolate was resistant to both imipenem and cefepime and had a carbapenemase gene. No *Salmonella* isolates tested for imipenem resistance from any domestic animal source showed resistance or carbapenemase production.

Multiple drug resistant (MDR) *Salmonella* among human (9%), slaughtered chicken (8%), and slaughtered swine (16%) isolates in 2011 were the lowest since testing began.

Multiple drug resistant *Salmonella* increased from 6% in 2007 to 27% in 2011 among serotype I 4,[5],12:i:- isolates from humans, and among serotype Heidelberg isolates, MDR increased from 13% in 2006 to 34% in 2010, declining slightly to 30% in 2011. NARMS observed a decline in ampicillin, chloramphenicol, streptomycin, sulfisoxazole, and tetracycline (ACSSuT) resistance among *Salmonella* isolates from humans, swine, and cattle, and continued resistance levels of < 5% among isolates from retail poultry and poultry at slaughter.

ACSSuTAuCx resistance has remained below 5% among isolates from humans, retail poultry, poultry at slaughter, and swine since testing began. ACSSuTAuCx resistance is generally higher among cattle isolates at slaughter.

In 2011, 45% of *Campylobacter jejuni* and 36% of *Campylobacter coli* from human isolates had no resistance to any antibiotics tested in NARMS. There are no clear upward or downward trends observed among the human and poultry isolates.

In 2011, erythromycin resistance in *C coli* from human, retail chicken, and slaughtered chicken was at the lowest levels in several years (3%, 5%, and 3%, respectively). *Campylobacter jejuni* from humans and chicken sources has exhibited an erythromycin resistance rate of < 4% since NARMS testing began.

Since 2005, NARMS has observed no consistent decreases in ciprofloxacin resistance among *C jejuni* and *C coli* isolates from humans or chicken sources.

Gentamicin resistance among *C jejuni* isolates from humans, retail chicken, and chickens at slaughter was < 1% in 2011. However, between 2007 and 2011, gentamicin resistance among *C coli* increased from 0% to 12% among human isolates, 1% to 18% among isolates from retail chicken, and 1% to 6% among isolates from chickens at slaughter.

Ceftriaxone resistance among *E coli* isolates from retail chicken increased from 8% in 2002 to 13% in 2011; ground turkey isolates showed a larger increase (from 1% to 10%) during the same time period. This trend was similar in *Salmonella*. Resistance among isolates from slaughtered chicken also increased from 6% in 2000 to 12% in 2010, but dropped slightly to 9% in 2011. This was the first decline seen in the last 3 years.

All in all, I think it was a pretty positive report. However, one gap in this sampling strategy has been the inability to compare antimicrobial use on the farm to bacterial resistance patterns in animals pre-harvest. The results seen in harvest and retail meat samples may not accurately reflect actual on-farm exposure, hence the calls for on-farm data collection. The FDA is exploring ways to collect this antimicrobial use data. The US Department of Agriculture (USDA) has conducted a series of pilot studies to evaluate possible routes of collection as well. Congress, FDA, activists, and some retail establishments keep pressuring, and USDA seems willing to facilitate collection. The time has come for the industry to decide its position on providing government with access to on-farm records regarding the judicious use of antimicrobials in food-producing animals. We have an opportunity to participate in designing the program before it is designed for us.

Reference

1. 2011 NARMS Executive Report Summary. Available at: http://www.fda.gov/downloads/AnimalVeterinary/SafetyHealth/AntimicrobialResistance/NationalAntimicrobialResistanceMonitoringSystem/UCM407964.pdf. Accessed 16 September 2014.

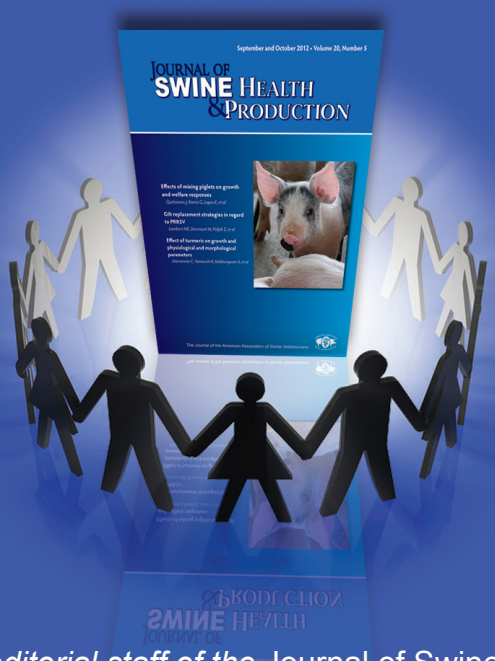
Harry Snelson, DVM
Director of Communications

Cumulative index

The *Journal of Swine Health and Production* cumulative index is updated online throughout the year as issues go to press. Articles can be accessed via the "Search" function and from the Abstracts page, **http://www.aasv.org/shap/abstracts/**.

Index by title 2014

Index by author 2014



Thank you, reviewers

Working together and creating a journal to be proud of!

The editorial staff of the Journal of Swine Health and Production *would like to acknowledge the invaluable assistance of the following individuals for their service as referees for the manuscripts that were reviewed between September 23, 2013 and September 22, 2014.*

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Nathan Winkelman
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Paul Yeske
Beth Young
Jeff Zimmerman

We apologize if we have inadvertently left a reviewer's name off the list.

Upcoming meetings

Swine Disease Conference for Swine Practitioners

November 13-14, 2014 (Thu-Fri)
Ames, Iowa

Hosted by Iowa State University

For more information:
Conference Planning and Management
Iowa State University
1601 Golden Aspen Drive #110, Ames, IA 50010
Tel: 515-294-6222; Fax: 515-294-6223
E-mail: registrations@iastate.edu
Web: http://www.extension.iastate.edu/registration/events/conferences/swine/index.html

2014 North American PRRS Symposium and PED Update

December 5-6, 2014 (Fri-Sat)
Intercontinental Chicago Magnificent Mile
505 N Michigan Ave, Chicago, Illinois

For more information:
Megan Kilgore
Kansas State University
Tel: 785-532-4528
E-mail: vmce@vet.k-state.edu
Web: http://ksvma.site-ym.com/?NAPRRS

2015 Pig-Group Ski Seminar

February 4-6, 2015 (Wed-Fri)
Copper Mountain, Colorado

Copper Mountain Group Reservations: 866-837-2996
Refer to your group code: The Pig Group or 1923

For more information:
Lori Yeske
Pig Group
39109 375th Avenue, St Peter, MH 56082
Tel: 507-381-1647
E-mail: pyeske@swinevetcenter.com
Web: http://www.pigski.net

American Association of Swine Veterinarians 46th Annual Meeting

February 28-March 3, 2015 (Sat-Tue)
Buena Vista Palace Hotel & Spa, Orlando, Florida
Reservations: 866-397-6516 or
https://www.aasv.org/annmtg/2015/lodging.htm

For more information:
American Association of Swine Veterinarians
830 26th Street, Perry, IA 50220-2328
Tel: 515-465-5255; Fax: 515-465-3832
E-mail: aasv@aasv.org
Web: https://www.aasv.org/annmtg

World Pork Expo

June 3-5, 2015 (Wed-Fri)
Iowa State Fairgrounds, Des Moines, Iowa

Hosted by the National Pork Producers Council

For more information:
Alicia Newman
National Pork Producers Council
10676 Justin Drive, Urbandale, IA 50322
Tel: 515-864-7989; Fax: 515-278-8014
E-mail: irlbecka@nppc.org
Web: http://www.worldpork.org

7th International Symposium on Emerging and Re-emerging Pig Diseases

June 21-24, 2015 (Sun-Wed)
Kyoto International Conference Center, Kyoto, Japan

For more information:
E-mail: iserpd2015@ics-inc.co.jp
Web: http://emerging2015.com

24th International Pig Veterinary Society Congress

June 6-10, 2016 (Mon-Fri)
Dublin, Ireland

For more information:
Web: http://www.ipvs2016.com

For additional information on upcoming meetings: https://www.aasv.org/meetings/

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830 26th Street
Perry, IA 50220-2328

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Photo Corner

Inquisitive pigs in an Iowa nursery

Photo courtesy of Ashley Schwartz

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