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When should we feed sows in farrowing?

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It is sometimes necessary to provide assistance to sows and piglets during farrowing in order to improve piglet survival, which can result in increased labour costs. There is evidence in cattle and ewes that feeding at night increases the incidence of calving during the day. In commercial farms, sows are typically fed during daytime hours, with a high percentage of farrowing events occurring unassisted overnight. The objective of this study was to determine the effect of feeding time (morning vs evening) on farrowing time in sows. A total of 278 sows were used in groups of 12 sows/block and 11 blocks/treatment. Sows were assigned to either morning (0700 h) or evening (1900 h) initiation of feeding upon entry to farrowing room (~d110 of gestation).

All sows were placed on a common lactation diet and fed according to established sow feeding curves, with feed intake controlled and monitored automatically (Gestal Solo, Jyga Technologies). All sows were switched to a 0700 h feeding time post-farrow. Cameras were placed in each crate to allow for recording of all farrowing events. There was no difference in born alive, stillborn and mummies ($P > 0.10$). However, there was an increase in the total number of piglets weaned and a decrease in pre-weaning mortality in sows that received PM feeding. Initiating sow feeding in the morning increased the frequency of farrowing during the day (7:00 am to 3:00 pm) compared to evening fed sows ($P < 0.001$; 51.43% vs 21.95%, respectively). There was no difference in farrowing duration between treatments ($P > 0.10$).

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Amino Acids as Functional Nutrients for Pig Health

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Currently, diets are formulated to optimize growth performance and profitability of pork production, however, with societal and legislative pressure to reduce antibiotic use in livestock agriculture, including in swine, there is an increased need to consider how diet impacts animal health as well as performance. This includes an evaluation of nutrient requirements during disease challenge in order to formulate diets that support proper gastrointestinal development and function and immune response during disease challenge in addition to growth performance. Pigs are continuously exposed to microbial pathogens and immune-stimulatory antigens that negatively impact animal productivity, with the impact on immune status likely a major factor in the observed gap between performance potential and observed performance under commercial conditions. This decrease in performance can have a substantial impact on profitability of producers. The continued sustainability of pork production will necessarily involve a re-evaluation of nutrient requirements and adjustment of diet formulation.

Impact of immune challenge on performance and nutrient utilization

The reduction in performance observed during disease challenge has largely been attributed to the observed drop in feed intake, however, recent meta-analyses have demonstrated that both reduction in nutrient supply (i.e., feed intake) and nutrient utilization (i.e., maintenance requirements) both contribute to reduced growth. The proportion with which feed intake and nutrient utilization impact performance is dependent on the specific immune challenge, with enteric bacterial infections having a greater impact on nutrient utilization while the negative effects of mycotoxins and respiratory disease are more due to decreased feed intake (Pastorelli et al., 2012; Rodrigues et al., 2021a).

In general, immune stimulation alters protein and amino acid metabolism and utilization, with amino acids redirected from growth towards supporting the immune response. This limits amino acid availability for growth which is further exacerbated by reduced feed intake. As a result, amino acid supply for the immune response is partially met through a catabolism

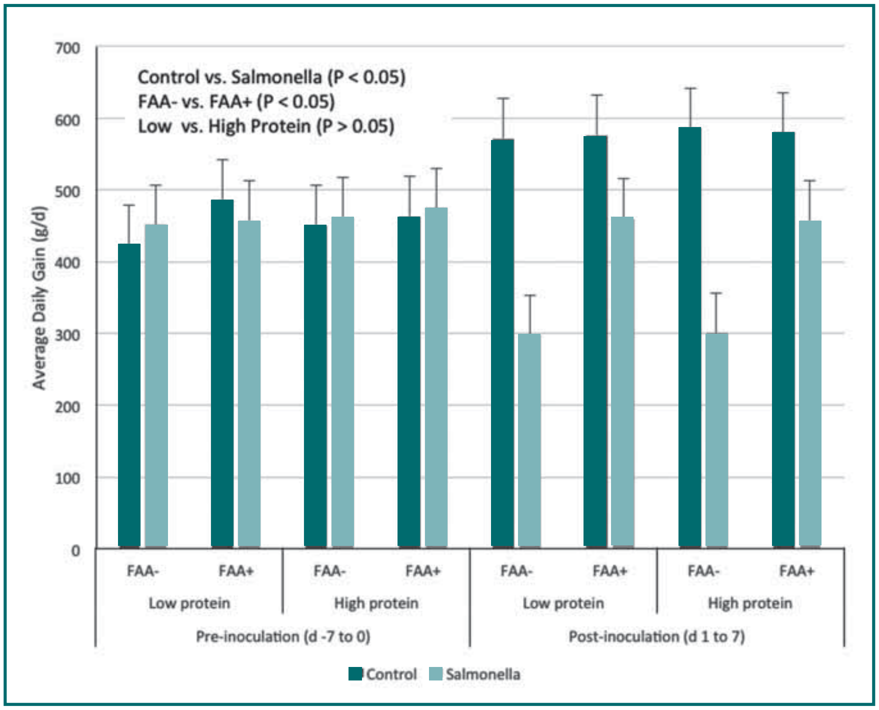

Figure 1. Growth performance of weaned pigs pre- and post-inoculation with saline (Control) or Salmonella and fed diets containing low or high protein (16.6 vs. 19.5%) with (FAA+) or without (FAA-) a functional amino acid blend supplying methionine, threonine, and tryptophan at 120% of NRC (2012) requirements for growth (n=8 pigs/treatment) Adapted from Rodrigues et al. (2021b).

of muscle protein. However, the amino acid profile of muscle protein differs significantly from that of protein involved in the immune response (Reeds et al., 1994). Overall, while it is true that immune challenge will result in a reduction in feed intake and, therefore, reduce growth and nutrient requirements for growth, it is likely that amino acid requirements (i.e., amino acid ratios to lysine) need to be adjusted during times of immune challenge based on determination of requirements in pigs during immune stimulation.

Functional amino acids and pig health

Based on the amino acid profile of immune system components, glutamine, arginine, threonine, and the aromatic and sulfur amino acids would appear to play key roles in the immune response (Reeds and Jahoor, 2001). Therefore, supplementation with these amino acids during immune challenge, above the requirements for growth during, may be of benefit in mitigating the negative effects of immune challenge. Indeed, previous studies have demonstrated an increased requirement for growth for methionine and cysteine (Rakhshandeh et al., 2010; Litvak et al., 2013), threonine (Jayaraman et al., 2015; Wellington et al., 2018; McGilvray et al., 2019), and tryptophan (De Ridder et al., 2012) in response to immune stimulation. It is important to note, however, that amino acid requirements to maximize growth, with or without immune challenge, may differ from those required to maximize other outcomes, such as components of the immune response. This was demonstrated in a recent meta-analysis where it was demonstrated that dietary amino acid content above those for maximum growth result in improvements in key physiological responses, such as milk yield, litter size, immune response, and intestinal permeability (Ramirez-Camba and Levesque, 2023). So while we tend to base our diet decisions on growth performance, and the majority of immune stimulation requirements studies focus on growth, this may not be an appropriate outcome if optimizing pig health is the goal. The term 'functional amino acids' has been used to describe those amino acids supplemented in the diet for their roles beyond those for protein synthesis (i.e., lean gain). In the context of health, these include amino acids with significant roles in gastrointestinal health (e.g., barrier function) and immune response (e.g., antioxidant balance, acute phase response).

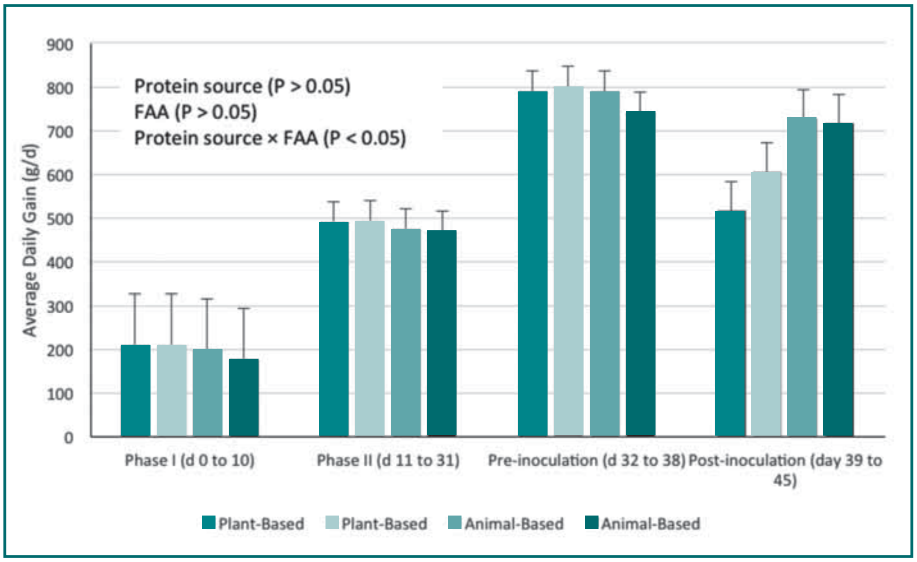

Figure 2. Growth performance of weaned pigs fed nursery diets containing either plant-based or animal-based protein sources and with (FAA+ or without (FAA-) a functional amino acid blend supplying methionine, threonine, and tryptophan at 120% of NRC (2012) requirements for growth. On d 32, piglets were placed on a common grower diet and inoculated with Salmonella Typhimurium on d 39 (n=8 pigs/treatment) (Rodrigues et al., 2022b).

As indicated above, while past research has indicated alterations in nutrient metabolism, specifically of amino acids, the effect of supplementation of amino acids for pig robustness has only recently received significant attention. Supplementation of individual functional amino acids has been shown to improve growth performance of pigs under immune challenge. Wellington et al. (2018) demonstrated an increase in the threonine requirement in immune stimulated pigs and then further demonstrated (Wellington et al., 2019) that threonine supplementation resulted in improved growth performance of growing pigs fed high fibre diets during Salmonella challenge, most likely through support of improved gut barrier function (i.e., mucin production). Likewise, Koo et al. (2020) observed that increasing threonine content resulted in improved gut integrity (i.e., goblet cell density, tight junction gene expression) in pigs with induced intestinal inflammation as a result of being fed a 'simple' diet. Koo et al. (2021) also demonstrated improved immune status in pigs housed in unsanitary conditions when fed valine-supplemented diets. An improvement in growth performance was also observed by Jayaraman et al. (2015) and Trevisi et al. (2015) in pigs housed in unsanitary conditions or challenged with E. coli, respectively, when fed diets containing supplemental threonine and Le Floc'h et al. (2009) observed improved growth performance in weaned pigs provided supplemental tryptophan when housed in unsanitary conditions.

> "There are a number of dietary strategies that can be used to improve pig robustness."

More recent work has examined the use of a blend of functional amino acids on growth performance and immune status in weaned and growing pigs. For example, Rodrigues et al. (2021b) fed grower pigs diets containing either a standard amino acid profile (NRC, 2012) or one in which threonine, methionine, and tryptophan were supplemented at 120% of the requirements for growth. Pigs fed the amino acid blend had improved growth performance and immune status (e.g., increased serum albumin and glutathione, reduced serum haptoglobin and superoxide dismutase) when challenged with Salmonella than their unsupplemented counterparts. The same amino acid profile improved growth performance and immune status (i.e.,

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(Time of feeding on farrowing time... cont'd from page 1)

These results suggest that feeding in the morning may be beneficial for maximizing the number of farrowing events that occur and are completed when workers are present.
It is sometimes necessary to provide assistance to sows and piglets during farrowing in order to improve piglet survival (e.g., drying of piglets, ensuring colostrum intake, assisting with piglet delivery), resulting in increased labour costs. Close monitoring of the farrowing process allows for more effective intervention, resulting in increased number of pigs weaned which can have a significant impact on profitability. Staff availability is a limiting factor in providing farrowing monitoring and assistance as staff must be available 24 hours per day, increasing labour costs. There is evidence in cattle and ewes that feeding at night results in an increase in the incidence of calving during the day. In commercial farms, sows are typically fed during daytime hours, with a high percentage of farrowing occurring unassisted overnight. With the availability and adoption of automated feeding technology for sows in farrowing, it is possible to easily adjust feeding time pre-farrow. Increasing the probability and proportion of farrowing events that occur during the day will reduce labour requirements and improve productivity as well as improve pig performance.

The objective of this project was to determine the effect of feeding time (morning vs evening) of farrowing in sows. We hypothesized that when feeding time is shifted to the evening prior to farrowing that there will be an increase in the proportion of farrowing events that occur during the day.

A total of 278 sows were used in groups of 12 sows/block and 11 blocks/treatment. Sows were moved into farrowing rooms approximately 5 days before expected farrowing date and placed on a common lactation diet and fed according to established sow feeding curves with feed intake controlled and monitored automatically. Each room of sows were placed on either morning (0700 h) or evening (1900 h) initiation of feeding in the pre-farrowing period (~d110 of gestation). All sows were switched to a common feeding program post-farrow. Cameras

Table 1. Effect of initiation of feeding time (AM vs. PM) on sow and litter characteristics and performance[1]

	AM	PM	SEM	P -value
Born alive	14.81	14.84	0.03	0.940
Stillborn	1.65	1.89	0.21	0.274
Mummies	0.47	0.28	0.17	0.279
Total born	16.71	16.78	0.34	0.839
Total wean	11.51	12.12	0.24	0.014
Foster in	1.22	1.29	0.20	0.743
Foster off	1.80	1.80	0.23	0.995
Mortality	2.28	1.78	0.23	0.036
Duration of farrowing (h)	5:29	5:26	2.37	0.915

SEM, standard error of mean
[1]Values are least square means

Table 2 Effect of initiation of feeding time (AM vs. PM) on sow feed intake[1]

	AM	PM	SEM	P -value
Parity	2.99	3.21	0.23	0.284
Days in treatment	7.56	8.20	0.28	0.004
Total feed intake	18.79	21.31	0.82	0.003
Daily feed intake	2.62	2.71	0.05	0.070

SEM, standard error of mean
[1]Values are least square means

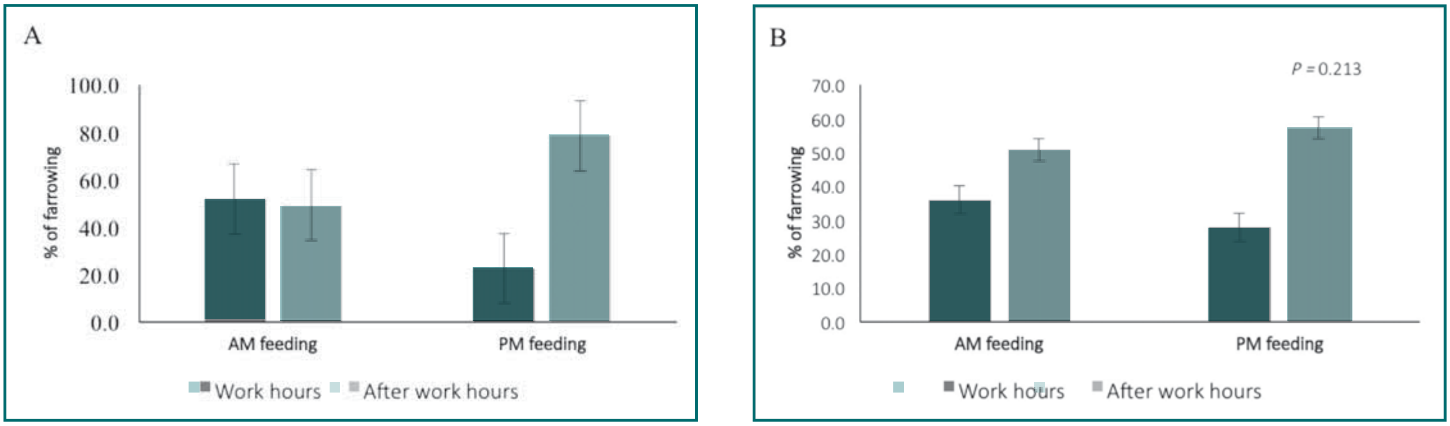

Figure 1. Effect of initiation of feeding time (AM vs. PM) on frequency of farrowing initiation (A) and farrowing completion (B) during work hours (0700 to 1500 h) or after work hours (1500 to 0700 h)

were placed above each farrowing crate to allow for recording of all farrowing events. Initiation of farrowing, completion of farrowing, and farrowing duration data were collected. Total number of piglets born alive, stillborn and mummies, total number of weaned piglets, foster on, foster off and pre-weaning mortality were recorded.

RESULTS AND DISCUSSION

Of the 278 sows initially placed on test, 10 sows were removed due to low birth numbers and 30 were excluded from data calculations due to malfunctioning feeders resulting in insufficient feed intake data, 20 sows were removed due to mortality or problem with the video recording.

Sow and litter characteristics and performance: There was no difference in sow parity between treatments (Table 1; $P > 0.10$). There was no difference in total number of piglets born alive, stillborn and mummies, foster on and foster off (Table 1; $P > 0.10$). However, there was an increase in total number of piglets weaned and a decrease in pre-weaning mortality in sows that received PM feeding (Table 1; $P < 0.05$).

Sow feed intake: Sows receiving PM feed had an increased total feed intake (Table 2; $P = 0.003$) and a tendency for increased daily feed intake (Table 2; $P < 0.10$). The increase in the total feed intake could be because they received the PM feed about one day extra compared to the AM fed sows (Table 2; $P = 0.004$). Frequency of start and end of farrowing: Initiating sow feeding in the morning increased the frequency of farrowing initiation during the day (7:00 am to 3:00 pm) compared to evening-fed sows (Figure 1A; $P < 0.001$; 51.43% vs 21.95%, respectively). There was no difference between morning and evening feeding time on the frequency of farrowing completion during work hours and/or after work hours (Figure 1B; $P > 0.10$). There was no difference in farrowing duration between treatments ($P > 0.10$).

IMPLICATIONS

These results suggest that initiating feeding in the morning may be beneficial for maximizing the number of farrowing events that occur and are completed when workers are present. Further research is required to determine optimal initiation of feeding time pre-farrow to further improve farrowing outcomes.

(Amino Acids as Functional Nutrients... cont'd from page 3)

acute phase response, antioxidant balance) in Salmonella-challenged nursery pigs (Rodrigues et al., 2021b). Likewise, Valini et al. (2023), using the same amino acid blend, observed improved growth performance and immune status, including reduced body temperature and Salmonella shedding, and improved average daily gain, body weight, and nutrient utilization in grower pigs that were challenged with Salmonella and housed in unsanitary conditions. Rodrigues et al. (2021b) also observed decreased fecal myeloperoxidase, an indication of reduced intestinal damage, with the amino acid blend, indicating a role of these amino acids in supporting gut health during an enteric pathogen challenge. The effectiveness of supplementation with this amino acid blend may be dependent on specific conditions, as van der Meer et al. (2016) showed improved immune status but limited effect on growth performance in wean to finish pigs under low sanitary conditions even though the same amino acids were supplemented at the same level as Rodrigues et al. (2021b).

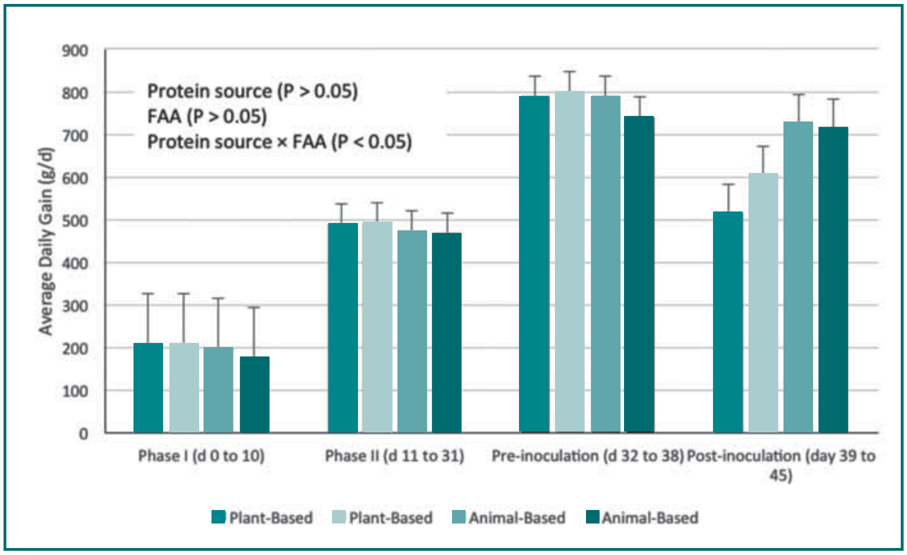

Figure 3. Growth performance of weaned pig pre- and post-inoculation with Salmonella and fed diets without (FAA-) or with a functional amino acid blend supplying methionine, threonine, and tryptophan at 120% of NRC (2012) requirements for growth during the post-inoculation period (FAA+0), for 1 week pre- and post-inoculation (FAA+1), or for 2 weeks pre- and 1 week post-inoculation (FAA+2) (n=8 pigs/treatment). Adapted from Rodrigues et al. (2021c).

Factors affected functional amino acid impact

The timing and duration of functional amino acid provision may impact the effectiveness of supplementation at improving performance and immune status. Rodrigues et al. (2021c) demonstrated a further increase in growth performance in pigs provided the blend of functional amino acids when the adaptation period prior to Salmonella infection was increased from 0 to 2 weeks (Fig. 3). Not all components of the immune response responded the same way to functional amino acids supplementation time, however, with acute phase response responding positively to a longer adaptation time while antioxidant balance did not. While there was no overall effect of amino acid supplementation, van der Meer et al. (2016) observed improved average daily gain in the nursery period and improved feed efficiency in the finisher period in pigs housed in unsanitary conditions. Moreover, the response to sanitary conditions was greater during the nursery period, indicating that supplementation may be more beneficial

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KNOW THE TEMPERATURE REQUIREMENTS OF YOUR PIGS

Just as we feel colder on a windy or humid day, pigs experience the temperature of their environment differently based on different factors. There is a difference between the room temperature and the effective environmental temperature for the pigs (the 'feels-like' temperature). For this reason, temperature requirements for pigs depend on many factors such as air temperature, air movement, humidity, flooring material, bedding/dryness (of the floor), age and size of the pigs, group size, feed type and intake level, and health status. The aim of temperature control in the barn is to keep pigs in their thermoneutral zone. This is the temperature range in which an animal is comfortable, having neither to generate extra heat to keep warm nor expend metabolic energy on cooling mechanisms such as panting. The bottom temperature of the thermoneutral zone is the lower critical temperature, whereas the upper temperature of the thermoneutral zone is the upper critical temperature.

Table 3 provides the optimum temperatures and desirable limits for pigs of all ages as measured at pig level. Producers should try to keep the temperature within these limits by using heat sources in the colder months, and by increasing ventilation in the warmer months.

Table 3. Recommended light levels and photoperiods for pig barns.

Category	Optimum Temperature* °C (°F)	Optimum °C (°F)
Creep area - newborn piglets	35 (95)	32-38 (89-100)
Creep area - older piglets *(2-5 kg [4-11 lbs])*	30 (85)	27-32 (81-89)
Young pigs *(4-5 days post weaning)*	30 (85)	33-37 (91-99)
Young pigs *(5-20 kg [11-44 lbs]) in weaned pens*	27 (80)	24-30 (75-86)
Growing pigs *(20-55 kg [44-121 lbs])*	21(79)	16-27 (61-81)
Finishing pigs	18 (65)	10-24 (50-75)
Gestating sows	18 (65)	10-27 (50-81)
Lactating sows	18 (65)	13-27 (55-81)
Boars	18 (65)	10-27 (50-81)

** Stated temperatures reflect the desired temperatures in the environment directly surrounding the pig, and not necessarily the overall temperature of the barn. Supplementary heat sources (e.g. heat mats) can be used to achieve desired temperatures.*

When temperature falls below the lower critical temperature, pig heat production increases 2-4% per °C. Cold pigs will huddle and lie with minimal body contact to the floor and piglets will shiver. Both shivering and heat production take energy that the pig cannot use towards growth; this results in reduced feed efficiency along with increased susceptibility to disease.

When temperature gets above the upper critical temperature, pigs need to use energy to cool down. Hot pigs will separate from one another and seek out wet parts of the pen - when pigs are warm, they eat less, and growth performance suffers. Keeping a room too hot also wastes energy, increasing energy costs and reducing performance, temperature control is therefore important. Table 4 shows the recommended setpoint temperatures during the heating season for various ages of pigs.

Pigs prefer a diurnal pattern for environmental temperature with a preference for higher temperatures during the day when active, and lower temperatures at night taking advantage of

Pigs within their thermoneutral zone sleep side by side without huddling and without moving away from each other

Table 4. Recommended setpoint temperatures (°C) for various ages of pigs (heating season)

Room and body weight (kg)	Solid floor	Slatted floor	Solid floor with straw
Gestation	17	19	15
Lactation	16	18	14
Nursery			
7 kg	26	28	25
20 kg	23	24	22
Grower/Finisher (all in/all out)			
25-50 kg	21-15	23-15	20-14
55-90	14	15	13-10

huddling while sleeping. Research at the University of Minnesota showed that it is possible to drop the nighttime temperature after day five in the nursery room by 8.3°C without affecting growth performance.

This resulted in a 30% and 20% savings in heating fuel and electricity use, respectively. Research at PSC showed that when given a choice, early-weaned piglets chose warmer temperatures during the day and lower temperatures at night. Another trial showed that grow-finish pigs could handle daily temperature fluctuations up to 13°C without affecting growth performance as long as this fluctuation is through a slow and steady change and mean daily temperature is within the optimal range. These trials show that there are opportunities to reduce energy use by reducing the temperature setpoints at night below the optimal or desirable temperatures for nursery and grow-finish pigs. It is very important to ensure there are no abrupt temperature fluctuations.

> "There are opportunities to reduce energy use by reducing the temperature setpoints at night below the optimal or desirable temperatures for nursery and grow-finish pigs."

Research at Prairie Swine Centre has also shown that group-housed gestating sows can handle lower temperatures than the recommended temperature setpoint of 17°C. When sows were given an option to control room temperature, group-housed gestating sows tended to maintain the room temperature at around 12.7°C when fed a standard diet and at around 11.9°C when fed a high fibre diet. This resulted in approximately a 75% and 11% reduction in natural gas and electrical consumption (during the heating season) respectively, when compared to rooms with pre- set temperature of 16.5°C, and translated to a reduction in facility costs of $2.80 per market hog.

This research suggests that it is safe to reduce the room temperature for group-housed gestating sows. It also shows diet type can have an impact on the preferred temperature of pigs, with high fibre diets reducing ideal room temperature. This is

Group-housed gestating sows can handle lower temperatures than the recommended temperature setpoint of 17°C.

because dietary fibre has a high heat increment, meaning that it produces more heat inside the animal's body than other types of feed. As a result, the animal does not feel cold as quickly. Increasing dietary fibre in gestating sow diets only makes sense when the increase in the cost of these diets is lower than the savings in energy reduction through the slightly lower room temperature requirement.

Besides diet type, feeding level is also relevant, as full fed animals can withstand colder temperatures. Table 5 shows the tremendous drop in the lower critical temperature when growing pigs increased their feed intake. In other words, producers can decide to increase or decrease feed or fuel to maximize net returns.

Table 5. Relation between body weight, feed intake, and lower critical temperature in groups of growing pigs at normal levels of feeding (Source: Canadian Farm Buildings Handbook).

body weight (kg)	Feed intake 0.5	1	1.5	2	2.5	3
	Lower critical temperature (C)					
20	21	14				
40		20	14	8		
60			18	16	8	
80			16	11	7	
100			18	13	9	
120				15	11	8

What's the cost?

Let's consider a 200 head grow-finish room. The winter temperature recommendations are 21°C for 25-kg pigs reduced to 15°C for 75-kg pigs. Let's consider three temperature scenarios within this room and the impact that it has on energy costs.

- Scenario 1 — 21°C-15°C = represents the correct temperature recommendations.
- Scenario 2 — 21°C-18°C = temperature is maintained at 21°C until pigs are 50 kg and reduced to 18°C for 75-kg pigs and stays constant until animals reach their market weight.
- Scenario 3 — 21°C = maintains pigs at 21°C throughout the full production cycle.

Saskatoon and Winnipeg are the two locations chosen for this example. Calculations use monthly average temperatures over a 30-year period with a prairie energy cost of $0.031/kWh. Winnipeg had lower average temperatures than did Saskatoon.

The following values look only at the heating costs to maintain the desired temperatures and do not consider the energy costs of ventilation. The carbon tax is not part of the calculation.

Saskatoon

The cost to maintain the recommended temperature (21°C-15°C) would be $162.01/yr. Moving to the 21°C-18°C and 21°C temperature scenarios represents an additional $90.40/yr and $226.43/yr increase in heating costs, respectively.

Winnipeg

It would cost $179.10/yr in heating to maintain the recommended setpoint temperature of 21°C-15°C. Moving to the 21°C-18°C and 21°C temperature scenarios again would represent a large increase in the heating bill: an additional $88.65/yr for the 21°C-18°C scenario and $222.23/yr for the 21°C scenario.

A Survey of Best Management Practices of Swine Farms Across Canada Part 2

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As a follow up to the to the article in the previous edition of Centred on Swine (Volume 31, Number 2) this article will continue to focus on the adoption of best management practices; and how we are doing as an industry. As stated before, feed cost garner most of attention and rightly so, however we should not lose focus on those things that we do on-farm daily to ensure we are optimizing each phase of our farms. Day-to-day activities can be lost in all the noise of everything going on in the barn. Ensuring we are doing all the little things right everyday add up to bigger savings than you might think possible.

How are we doing as an industry?

Two projects funded by Swine Innovation Porc and carried out by Prairie Swine Centre (PSC) and Centre de développement du porc du Québec (CDPQ) examined the adoption of best management practices on farms throughout Canada. The first project audited 24 farms across Canada (2018), with a minimum of two farms in each province, consisting of a questionnaire and an on-site visit. The second project focused on a survey (2023) of pork producers, throughout Canada, of various best management practices implemented in their operations.

Each project had good representation of size and type of operations across the industry. Size of operations ranged from 300 to 6,000 sows, while farrow-to-finish and farrow-to-wean operations represented approximately 80% of respondents, with the balance being wean-to-finish operations. Focus of each project was similar. Each focused on best management practices looking at biosecurity/herd health, feed/feeder management, and personal protection, water use/management, in addition to each phase of production (breeding, gestation, farrowing, nursery, and grower-finisher). We analyzed the results from each project, measuring the change in the adoption of best management practices across projects.

Personal Protection

Ensuring a safe work environment is the responsibility of every employer and one that the Canadian pork industry takes seriously. Results in Table 1 indicate pork producers are committed to providing the safest workplace possible for their employees. Audit results indicate that dust masks, hearing protection and hydrogen sulphide (H2S) monitors are being used to varying degrees in on farms across Canada.

While all farms that use H2S monitors use them for pit pulling, it is very important to use them in other key day-to-day activities where H2S could arise. Situations includes power washing and entering the manure transfer station; research indicates that H2S concentrations can exceed acceptable limits any time manure is disturbed. Locations of peak H2S concentrations vary within the room, and vary over time. Therefore, it is essential monitors be provided to all swine barn workers at these key times as H2S may be present in higher than anticipated concentrations. While approximately 60% of participating farms offer H2S training, it is very important that recertification does not get lost in day-to-day activities. Training and standard operating procedures should be provided, at least every three years, so workers can learn how to deal with routine operation and emergencies generating high H2S concentrations.

Table 1. Level of adoption of selected personal protection management strategies.

Category	Compliant	Somewhat compliant	Not compliant
Are dust mask used in the facility? It is recommended to use dust masks in the facility.	83 %	0 %	17 %
Is hearing protection used in the facility? It is recommended to use hearing protection in the barn.	100 %	0 %	0 %
Are hydrogen sulphide monitors used in the facilities? It is recommended to always use hydrogen sulphide monitors in the facility.	0 %	50 %	50 %
Do you provide training on hydrogen sulphide awareness? It is recommended to provide training regarding hydrogen sulphide awareness.	54 %	4 %	42 %
Do you provide animal handling training? It is recommended to provide animal handling training.	75 %	4 %	21 %

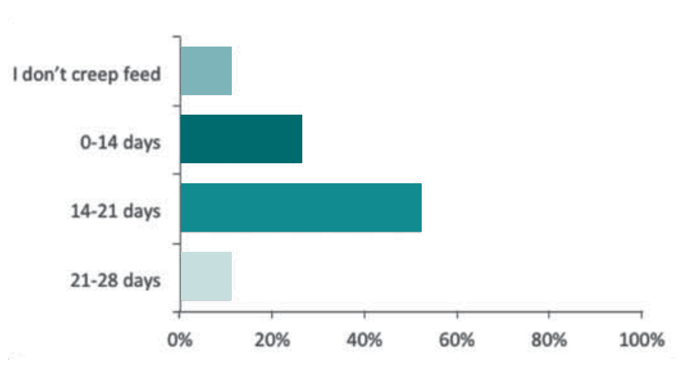

Figure 1. Average age for creep feeding in farms across Canada.

Creep Feeding

Creep feeding is a common practice in swine production, with approximately 90% of farms indicating that they provide creep feed (Figure 2). Most producers generally implement creep feeding 5-7 days prior to the anticipated weaning date. There are a number of perceived benefits including provision of nutrients, higher weaning weight, and improved transition at weaning, however the benefits of creep feed exist when pigs eat the feed. Intake of creep feed is usually low and highly variable among pigs with approximately 30-50% eating creep feed. It is generally higher in smaller piglets with little to no intake observed in larger piglets. The achieved benefit of creep feeding on growth performance in the suckling and/or nursery period remains inconsistent. Finding new or proven strategies to increase the consumption of creep feed is essential on whether or not utilizing creep feed is important to your operation.

Other work has demonstrated the benefits of providing creep feed is related to enhancing exploratory behaviour in piglets (i.e., allowing natural rooting behaviours) and exposure to feed in a dry form than provision of nutrients. Therefore, it is possible that providing expensive creep diets is not necessary to achieve the benefits of creep feed on weaning weight and overall performance, and that simple diets such as a typical lactation diet, would be sufficient. Creep feed is the most expensive diet used in pig production, costing between $600-1800/tonne. Identification of less expensive alternatives would help to reduce production costs.

Research has shown that piglets visit tray feeders more frequently compared to the standard feeder. In addition, the different presentation of creep feed appeared to increase the percentage of piglets per litter showing evidence of creep feed consumption. A large tray feeder that encourages social feeding and foraging is more effective at attracting piglets to creep than a standard feeder. The manner, in which we utilize creep feed (to attract piglets), can be improved as a whole (Figure 3) as approximately 40% of respondent use some type of tray feeder.

Results from the survey indicate costs associated with creep feed range from $600-$2,000/mt. However research indicates that overall there appears to be little benefit of providing creep feed in general or of providing complex, expensive creep feed. Specifically work at PSC indicates piglets showed no preference for simple or complex creep feed. In addition, there was little impact of provision of creep feed on pre-weaning performance, with increased ADG only in the final week pre-weaning. While there was a slight benefit to providing creep feed on growth performance in the first week post-weaning, there was no benefit at the end of the nursery.

Sorting Pigs

The majority of grower-finisher systems are based on ad libitum feed and water intake. Although access to feed or water may be temporarily limited by another pig, all pigs are able to obtain as much of these resources as they want. As the number of pigs per feeder space increases, pigs adapt their eating behaviour to reduce the effect of this restriction. Pigs increase their rate of eating (gram/min), and decrease their total duration of eating (min/day) when feeder-stocking density (pigs/feeder space) increases. As long as they are able to obtain adequate amounts of feed, dominant pigs respond by eating more quickly rather than increasing their defence of the feeder.

Reducing the floor space allowance of pigs is known to reduce feed intake and average daily gain. When housed in crowded

(A Survey of Best Management Practices ... cont'd on page 10)

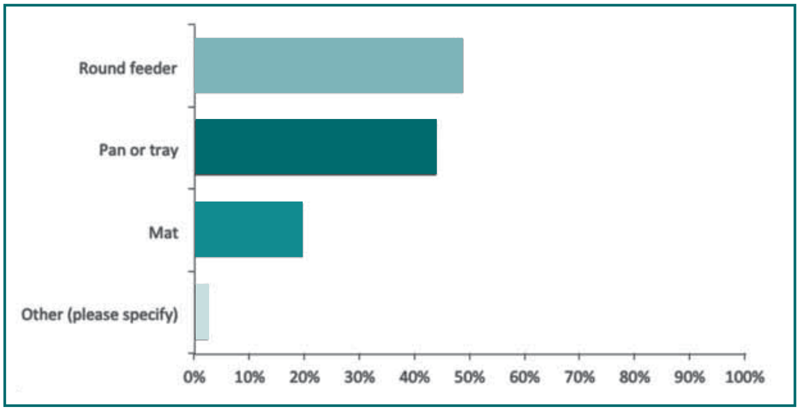

Figure 2. Types and adoption of different types of creep feeders used on farms in Canada.

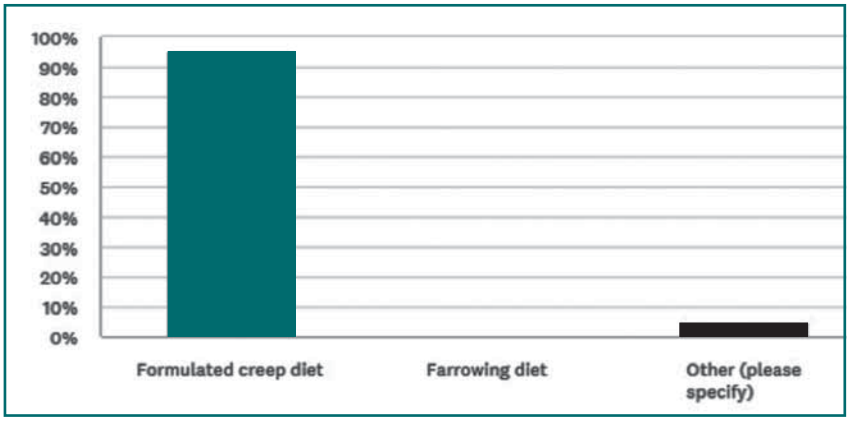

Figure 3. Different types of diets used for creep feeding.

(A Survey of Best Management Practices ... cont'd from page 9)

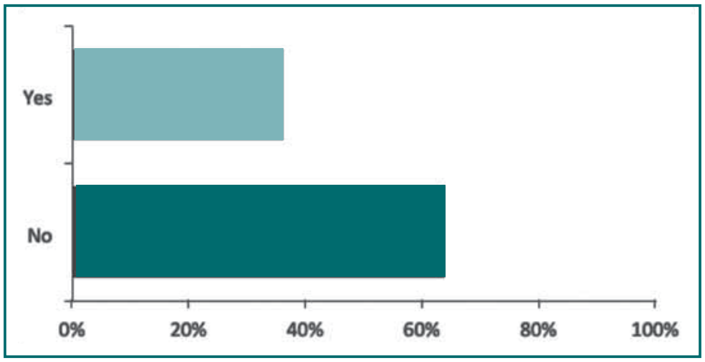

Figure 4. Percent of pigs sorted by size entering the finishing phase

conditions, there is a loss in productivity for at least part of the feeding period. The impact of crowding, results in depressed production across all social groups, and is not affected by dominance. Research conducted at Prairie Swine Centre studied the impact of sorting pigs as they enter the grower-finisher phase.

Results from the audit indicate that approximately half of participating farms sort pigs when transferred into the finishing barn. There are multiple factors to consider when deciding to sort or not at this phase. Research indicates that finisher pigs fed ad libitum do not benefit from sorting. However, sorting on the basis of nutritional needs can be effective in cases such as split-sex feeding, as well as for newly-weaned pigs, in order to provide the best diets to each group.

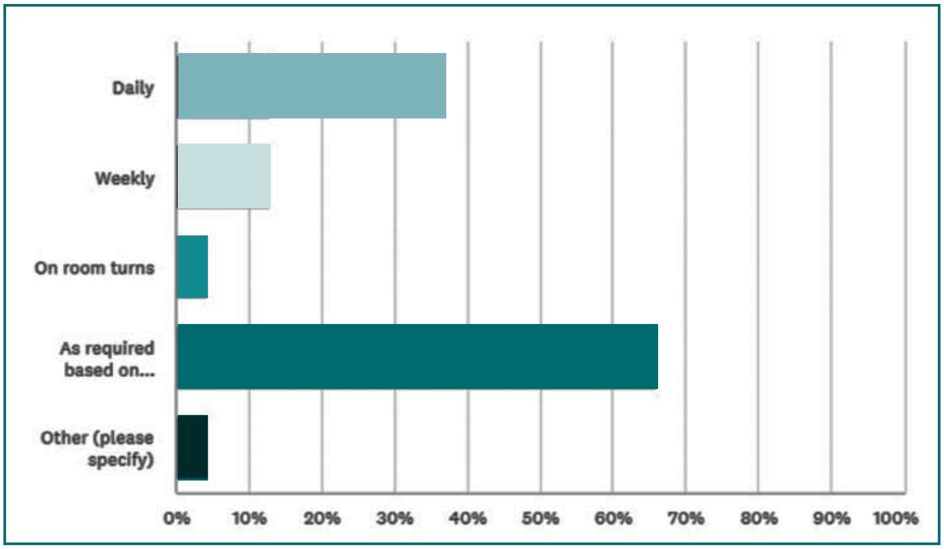

Figure 5. Average frequency of feeder adjustment on farms throughout Canada.

Feeder Management

As any livestock producer knows, feed costs are always the single biggest factor representing 60-70 percent of the total cost of production. Starting in 2021 widespread dryness seen throughout western Canada resulted in record high feed costs for many producers. Residual effects of these high grain prices carried throughout 2022 and well into 2023. Grain prices increased significantly with wheat and barley prices close to doubling the values seen in the fall of 2020. While we see continued weakness well into 2024 we shouldn't lose sight of the importance daily tasks can have on profitability.

The goal of proper feeder adjustment is to reduce the time spent eating and thus increased feeder capacity This becomes more important at certain times of the production cycle. For instance closer to market (just before first pull) or in situations where double stocking is utilized at the start of a phase, as the amount of linear feeder space will be challenges in these situations. It is important to base your feeder adjustment on pan coverage and not on feeder setting for a number of reasons.

Age of your feeder. Feeders contain various mechanical parts, and they wear out over time producing different results over an extended period. Diet type has a huge impact on feeder adjustment, as feeding pellets or mash requires different adjustments to achieve the same results. Feeding pellets generally making feeder adjustment an easier task for producers resulting from a more consistent product creating more predictable flow-ability throughout the feed system. Diet changes also affect feeder adjustment. Least cost formulation saves producers money, but results in a variety of different ingredients used at any point in time. Different ingredients have different flow-ability throughout the system, especially when mash diets are used. Therefore, pay attention to feeder adjustment when there are significant changes in ingredients used on your farm. For example shifting from wheat to corn. The general rule of thumb according to many is every feeder every day, which translates into adjusting approximately 10% of your feeders on a daily basis.

We all know that adjusting feeders is not that exciting of a task in the daily list of things that occur on our farms. Figure 5 summaries survey data looking at the frequency of feeder adjustment. A majority of respondents (66%) indicate we adjust

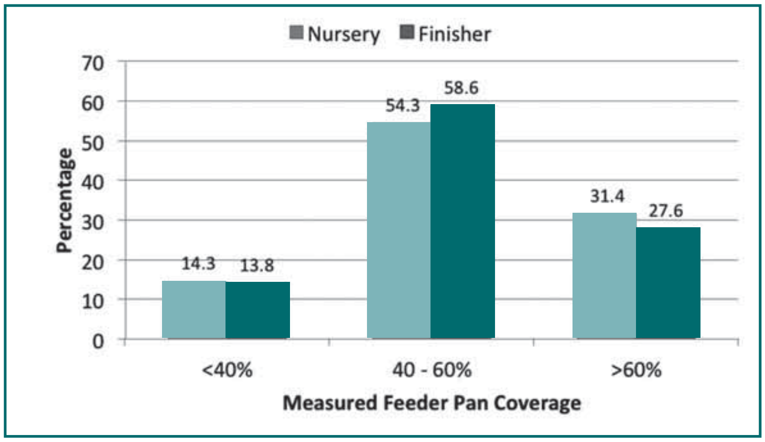

Figure 6. Measured feeder pan coverage on 24 farms across Canada.

feeders adjust as required. What does this really mean? Does it mean we are adjusting 10% of our feeders each day? Maybe it means adjusting feeders that have an obvious problem such as an empty or over-filled feeder. Most producers have more than enough things to do on a daily and it is easy to avoid what we think are non-essential tasks. Determining the ideal time to schedule feeder adjustment is farm specific, and depends on number of factors that include labour availability and feed cost. I would encourage you to conduct random audits to how well your operations compare.

When it comes to feeder adjustment, how well are we doing as an industry? Figure 6 shows just over 50% of measured feeders achieved an ideal feeder adjustment while 30% and 14% of feeders were over or under adjusted respectively. Why is this important? While over adjustment doesn't impact pig performance, it does increase feed wastage, and under adjustment eliminates feed waste, but will have a negative impact on pig performance. What is the impact on the bottom line of the operation? If we look at a 16-week finishing period that turns 3.25 times/year, and use the information presented in Figure 5. Results indicate there would be 58 and 27 feeders that would be over and under adjusted respectively; this could translate up to $4.00/pig lost revenue associated with feed wastage.

1) 16 pigs/room, 3.25 turns/year = 910 pigs/year
   a) 16 @ 12 feeders/room = 192 feeders

2) Over adjustment @ 30%
   a) 50 feeders over adjusted (23.5 pigs = 1,353 pigs
   b) Equavalent to 5 rooms or 3 - 4 feeders /room

3) Too tight @ 14%
   a) 27 feeders adjusted too tight = 634 pigs
   b) 2 rooms or 1 - 2 feeders/room

1) Over adjustment @ 30%
   a) 50 feeders over adjusted (23.5 pigs = 1,353 pigs
   b) Feed budget 340 kgs - wean to finish

2) Every 1% increase in feed wastage = $1.48/pig

3) 1,353 @ 3.25 turns = 4,397 pigs/year = $6,508
   a) 3% wastage = $4.44/pig or $19,500

Conclusion

Based on some of the results we can see that little changes can make a big impact on the overall profitability of your operation. While most producers are aware of individual best management practices throughout their barns, day-to-day activities and emergencies sometimes get in the way. Currently there seems to be a margin for improvement as we achieve a 40-50% of measured and surveyed best management practices. I don't think doing 100% of things 100% of the time is possible. If we can move that needle incrementally from 40 to 50% then to 60% can save producers substantial dollars over the long run.

(Amino Acids as Functional Nutrients... cont'd from page 5)

in the immediate post-weaned period. This is supported by Rodrigues et al. (2021a) who demonstrated that the negative impacts of disease challenge are greater in the nursery period than in grower-finisher pigs, potentially due to a more immature intestinal tract in this period. Schweer et al. (2019) and Jasper et al. (2020) were able to improve growth performance in pigs inoculated with PRRS virus by increasing lysine:energy ratio at the time of challenge, however, no improvement was observed if the adjustment was made post-challenge (Gabler, 2021).

Functional amino acid supplementation in the nursery period may also provide long-term benefits, as Rodrigues et al. (2022a) demonstrated improved growth in pigs that had received a supplemental functional amino acid blend in the nursery period but were fed a common grower diet at the time of Salmonella-challenged in unsanitary conditions. This blend of amino acids, however, was only partially able to attenuate the negative effect of disease challenge in low-birth weight pigs during the subsequent disease challenge. Other components in the diet may also affect functional amino acid effectiveness, as supplementation with the same blend of functional amino acids was able to improve performance of nursery pigs that had received a plant-based diet, however, provided no further benefit to those pigs that had received animal-based protein sources in the nursery (Fig. 2; Rodrigues et al., 2022b).

The appropriate intervention may be dependent on the type of challenge experienced, and is likely related to the specific immune response to different challenge types and the proportion of the decrease in performance that is due to either reduced feed intake or alterations in nutrient utilization (Rodrigues et al., 2021a, Pastorelli et al., 2012). For example, while nutrient adjustment was effective in PRRS infected pigs, this adjustment was not effective in pigs challenged with Mycoplasma hyopneumoniae (Jasper, 2020). This may also explain why the blend of functional amino acids was effective during an enteric pathogen challenge (Rodrigues et al., 2021bc) but had reduced effectiveness during a sanitary challenge (van der Meer et al., 2016).

Conclusions

Disease challenge can have a substantial negative effect on productivity and profitability of swine production, however, there are a number of dietary strategies that can be used to improve pig robustness. Functional amino acids have been investigated for their role during disease challenge and ability to support both the immune response and growth performance. While these have been shown to be effective under some circumstances (i.e., normal birth weight, enteric challenge), this is not always the case. Overall, adjustments to dietary amino acid content is another tool that can be incorporated into pig health programs. Dietary strategies to improve pig health should, however, be based on the specific circumstances and goals of the production unit.

Personal Profile

Jen-Yun Chou, Ph.D.
Research Scientist, Ethology

Jen-Yun's background is multidisciplinary at the interface of applied animal behaviour, animal welfare and social science. She obtained her PhD degree in Clinical Veterinary Sciences at the University of Edinburgh in 2019 and holds an MA in Science, Technology and Society. She has experience working as an animal welfare advisor at an international non-profit organization and has conducted research at various research institutes across Europe and North America. Her research projects collaboratively explore issues surrounding ending piglet painful procedures and providing pigs with a better physical and social environment. She is also interested in subjects such as One Welfare, welfare at transport/ slaughter and on-farm euthanasia.

She did a postdoctoral research project from 2020-2021 at the Swine Teaching and Research centre at the University of Pennsylvania, USA, focusing on sow housing in early gestation. She was also a Marie Skłodowska Curie postdoctoral fellow at the Pig Development Department, Teagasc and the Institute of Animal Welfare Science, University of Veterinary Medicine, Vienna, Austria, investigating social behaviour and social network in pigs. Jen-Yun has ongoing research collaborations with partners in the US, Europe and Taiwan, where she is from originally. Her goal is to show animal welfare can be beneficial and profitable for all stakeholders and to contribute to improving pig welfare globally.

The NSERC Industrial Research Chair in Swine Welfare website is here!

Coming Events

Alberta Pork Congress
June 12-13, 2024
Red Deer, Alberta

Ontario Pork Congress
June 19-20, 2024
Stratford, Ontario

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