Considering the welfare of sows and piglets during farrowing and lactation

Introduction

The objective of any farrowing system is to support the survival of as many well grown, healthy piglets as possible, while simultaneously providing for the needs of the sow. However, balancing the needs of sows and piglets is a challenging task. In addition, the safety of the stockperson, ease of operation, and high levels of hygiene must be considered together with the welfare of the sow and her litter.

The main challenges arise because a farrowing system must accommodate the sow and her piglets at the same time; yet the sow and her litter each have specific and sometimes conflicting needs. Furthermore, these needs change throughout the different stages which occur before, during, and after farrowing (giving birth). Every farrowing system design therefore carries a degree of welfare compromise for the sow and/or the piglets.

Conventional farrowing systems: Farrowing crates within a pen

Sows have specific needs prior to giving birth. These include: separation from other sows, thermal comfort and shelter, a quiet, clean environment with few disruptions, and access to feed and water. The design of the pen with a farrowing crate is such that the sows are separated from other sows and their litters; so as to prevent competition between sows and piglets for resources (feed, water, and milk). The room temperature can be controlled at a level which is comfortable for the sow; water is always available and each sow is fed a balanced diet that meets their individual requirements. Separate heated areas are provided for piglets. However, alongside these benefits, sows housed in farrowing crates within pens have restricted mobility, and their behavioural expression is limited (Jarvis et al., 2002). The reason for restricting sow mobility, however, is to reduce pre-weaning piglet mortality – therefore maximising their survival.

Currently, pre-weaning piglet mortality in New Zealand averages 12% on farms using farrowing pens with crates; and is 16 - 18% on outdoor based systems (Welch, 2012). The main causes of pre-weaning piglet mortality are stillbirth, poor viability, starvation, and accidental crushing by the sow (overlaying) (Marchant et al., 2000). Skilled, competent stockpersons and individual care of sows and piglets can reduce the likelihood of piglet deaths caused by stillbirth, poor viability and/or starvation. However, it is the physical movements of the sow (lying down from standing, and rolling over) which lead to piglet crushing (Damm et al., 2005). Without constant supervision this is difficult to prevent.

To date, a crate within a pen is the best method to reduce crushing-related piglet deaths. This is the most commonly used farrowing system worldwide; including New Zealand.

The New Zealand National Animal Welfare Advisory Committee (NAWAC) recently reviewed the use of farrowing crates in New Zealand. The review concluded that:

"The Committee considers that the use of farrowing crates for the limited period of five days prior to farrowing and four weeks afterwards should be retained.
"Although NAWAC believes that the confining of sows in farrowing crates for this length of time does not provide for every behavioural need of sows, their use provides the best welfare outcome for the welfare needs of piglets and the best total welfare of piglets and sows, based on currently available farrowing practices and scientific knowledge and as appropriate to the environment and circumstances of the animals.
"NAWAC does not consider that there is any practical alternative system that provides comparable levels of piglet welfare while better meeting the welfare needs of sows." (NAWAC, 2016).

In New Zealand, current standard practice on both indoor and outdoor farms is to wean piglets at approximately 4 weeks of age. On indoor farms, sows are typically housed in a farrowing crate within a pen (Figure 1). Sows may be accommodated in the crate no more than 5 days before they farrow. After farrowing, the sow may be kept in a crate for a maximum of 4 weeks during lactation (NAWAC, 2010). Indoor farrowing systems feature an area called a 'creep', which is a separate piglet-only zone usually heated with an overhead infrared lamp and/ or a heated floor pad. The creep attracts the piglets away from the sow when they are not suckling, providing a thermal environment that meets the piglets' needs without overheating the sow, and a safe area for them to rest away from the sow. A sow is biologically capable of having more than two litters per year; therefore, a sow will be housed in farrowing accommodation twice within 12 months.

Figure 1. Left: A sow and her litter in a farrowing crate. Note the heat lamp behind the sow. Right: A sow and her litter in a farrowing crate showing the piglet creep area at the head of the sow, with heat lamp, and solid floor.

Pen-based farrowing systems and outdoor huts

Some farmers have adopted alternative farrowing pen systems, which may be a 'loose' pen (no crate), or may utilise a farrowing crate temporarily in early lactation (i.e. for 3 – 7 days after farrowing) (Figure 2). In these systems, the sow has more space in which to turn around, express a wider range of behaviours, and is able to be more physically active (Bradshaw and Broom, 1999). Many studies have investigated piglet mortality in these alternative systems, and it is generally accepted that piglet mortality is higher due to a higher incidence of piglet crushing. Furthermore, stockperson safety can be compromised in the event that an unrestrained sow is behaving aggressively, particularly when piglet husbandry tasks are carried out. Higher, more variable piglet mortality; and stockperson safety are some of the key reason why these systems have not been widely adopted by producers worldwide.

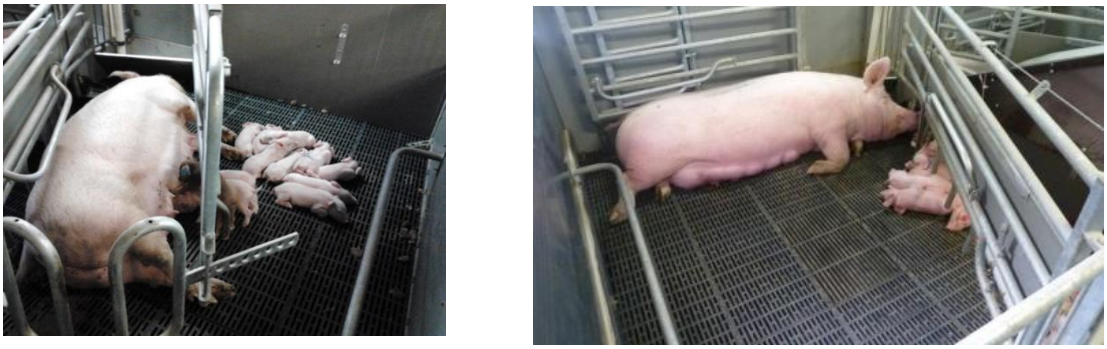

Figure 2. Sow with piglets in an alternative indoor farrowing pen showing the closed (left) and open (right) conformations of the pen.

Outdoor-based farms use individual farrowing huts (Figure 3). Sows are typically in these huts for the same duration as they would be in an indoor farrowing system (from 5 days before until 4 weeks after farrowing; twice a year). When piglets are weaned from the sow, they are moved indoors. Sows in outdoor farrowing huts are provided with straw bedding, which can enable them to express nest building behaviour. The sow can leave the hut at will, and during the first week after giving birth the piglets are unable to follow the sow outside due to a fender or barrier which keeps them inside the hut. The hut size allows sows to turn around, and to interact with piglets. Some limitations to outdoor huts include no supplementary heat source for piglets, as the straw bedding is a fire risk, and because there is no source of electricity to the individual huts. In addition, piglets do not have a separate area to retreat to; and one-on-one animal husbandry is a challenge, particularly when a sow is preventing access to her litter. These factors contribute to piglet mortality, which is significantly higher outdoors than indoors. In the 2016 review of farrowing crates, NAWAC described

outdoor farrowing huts as providing the best outcomes in terms of sow welfare, but the worst outcomes for piglet welfare (NAWAC, 2016). As such, requiring all indoor farmers to convert to outdoor based systems is not a solution to improving *net* welfare, when the sow and the piglets are both considered.

Figure 3. Farrowing huts on an outdoor farm. Note the image on the left showing the fender, which prevents piglets exiting the hut whilst allowing the sow to step over.

The "triangle of needs"

Piglet survival to weaning is one of the most important measurable outcomes of the farrowing and lactation period (Baxter et al., 2011). This key performance indicator is of relevance to the piglets, the sow, and the farmer, who together form the "triangle of needs" (Baxter et al., 2011). The survival of the piglets affects the sow through indicating her reproductive and maternal capability. Thus, a sow that rears a litter with high survival is likely to be retained in the herd, as opposed to being culled on the basis of poor performance. The farmer's requirements align well with that of the piglets' as the farmer needs as many healthy, well grown piglets as possible to survive to weaning, which directly influences farm profitability. It is also important that the safety of stockpersons, ease of operation, and high levels of hygiene is considered in the design of a farrowing system. If access to sows and piglets is difficult or poses a risk to human safety, routine husbandry procedures may not be carried out properly, which could compromise animal welfare (FAWC, 2015). However, in any farrowing system, the largest conflict of interests exists between the sow versus the piglets.

Space

One such example of a conflict is the requirement for space. A combination of static and dynamic space is required in the farrowing area. Static space is the area required for the sow to lie on one

side whilst giving birth and during nursing. Dynamic space is required for piglets to be born safely, allowing room for newborns to stand, locate the udder and suckle (Baxter et al., 2011).

As lactation progresses, sows prefer to spend more time away from their piglets (Bøe, 1991; 1993; 1994). This mimics the gradual weaning approach seen in wild pig populations, whereby over time sows increase the amount of time between nursing events. Sows housed in farrowing pens with a sow-only 'piglet-free area' chose to spend more time away from their piglets as lactation progressed (Pajor et al., 2000). In the last two weeks of a 5 week lactation, one study found that sows spent 70% of their time in the piglet-free area. This is close to the timing at which piglets are normally weaned (4 weeks of age) in a commercial setting. In a farrowing system designed to allow sows to leave their piglets at will, some sows abandoned their litter so early that piglet health and growth was detrimentally affected (Bøe, 1993).

The investigation of sow-controlled farrowing systems has indicated that sows prefer to regulate the amount of contact they have with their piglets. The trade-off here is that whilst this may reduce stress associated with continuous contact with the litter, the opportunity to avoid piglets may lead to inadequate care for the young. The solution to this is to compromise by weaning the piglets as early as possible without detrimentally affecting their growth, in order to limit the time that a sow spends in a farrowing system. Hence Minimum Standard No. 10(f) of the Animal Welfare (Pigs) Code of Welfare (2010) states that a sow may be confined in a farrowing crate for no more than 4 weeks after farrowing. This limits the length of lactation to a maximum of 28 days; however, with skilled management, the introduction of solid feed to piglets before they are weaned, and an appropriate diet, housing and hygiene after weaning, piglets adapt successfully to weaning at this age.

Temperature

A further compromise between sows and piglets relates to their thermal requirements. At birth, piglets lack brown adipose (fat) tissue, which, in other species, helps to support the control of body temperature (Herpin et al., 2002). Piglets have very little subcutaneous fat at birth, with a total body fat percentage as low as 1-2% (Mersmann, 1974). Newborn piglets experience rapid cooling as a consequence of evaporating fetal fluids on the surface of the skin. A sudden 15-20˚C decrease in ambient temperature is experienced at birth, resulting in an inevitable fall in body temperature by approximately 2˚C within the first 20 minutes of life (Herpin et al., 2002). In healthy newborn piglets, body temperature rises to a normal value of 39˚C within 48 hours. Conversely, the thermal comfort of sows is achieved in the range of 12°C and 22°C (Black et al., 1993) and temperatures above 22°C

increase the risk of heat stress and depressed feed intake in the sow, thus affecting milk production and piglet growth.

Piglet mortality

The most common cause of piglet death pre-weaning is accidental crushing (Svendsen et al., 1986; Marchant et al., 2000; Andersen et al., 2005). Crushing-related deaths have been reported as higher in alternative farrowing pens than in crates within a pen (0.62 piglets per litter in pens; 0.52 piglets per litter in crates, Weber et al., 2007). Crushing mortality was also higher in gilt litters that were farrowed in pens (1.4 piglets per litter) compared to crates (0.6 piglets per litter) (Jarvis et al., 2005), and a greater rate of piglet crushing was recorded in penned sows (45%) than in crated sows (20%) (Cronin et al., 2000). Higher piglet mortality from birth to weaning in pen-based vs. crate-based farrowing systems has been reported in Cronin and Smith (1992); Blackshaw et al. (1994); Marchant et al. (2000) and Hales et al. (2014). Conversely, Weber et al. (2007); Pedersen et al. (2011) and KilBride et al. (2012) did not find a difference in piglet mortality from birth to weaning between farrowing pens and farrowing crates. Lower piglet mortality has been observed when sows were confined in a crate within a pen for 4 days after farrowing, relative to when sows were free to move unrestricted within a pen for the entire birth and lactation period (Moustsen et. al., 2013). Crushing mortality was significantly higher (83% of all dead piglets) in the unrestricted pens than in pens with temporary crate confinement in early lactation (65% of all dead piglets) (Moustsen et al., 2013). Housing a sow in a crate within a pen for a few days after birth offers a compromise between confining the sow to reduce piglet mortality, and improving the sow's welfare during lactation by allowing her more space to move around. It is generally agreed, however, that there is a greater risk of piglet crushing, and hence higher piglet mortality, in farrowing systems with reduced or no confinement in crates.

Summary

Every farrowing system - be it a crate, a pen, or a hut, has some degree of welfare compromise that affects the sow, the piglets, or both. Pre-weaning piglet mortality is an indicator of economic performance, but is also an important indicator of piglet welfare. Farrowing systems which utilise a crate from before farrowing to weaning are the most commonly used farrowing system in all pig producing countries. This system produces the lowest pre-weaning piglet mortality; however, while many facets of sow welfare are well provided for, their welfare is compromised due to restricted mobility and limited behavioural expression. Concerns for the welfare of sows housed in crates have led to a restriction of the sow’s lactation length to a maximum of 4 weeks in this system. Larger

farrowing pens that may temporarily use a crate do provide more space for the sow, and with it, the ability to move and turn around. The trade-off is that piglet mortality is higher, as crushing mortality is significantly higher in these systems compared to crates. Farrowing huts are used in outdoor systems, and while the sow is able to build a nest and can leave the hut, the piglets' needs for a separate protected space away from the sow, that meets their specific thermal needs, is lacking. Pre-weaning piglet mortality is the highest in this farrowing system.

A significant body of international research has been conducted in an effort to develop pen-based alternative indoor farrowing systems that reduce or eliminate the use of farrowing crates, without compromising sow and/or piglet welfare. Upon reviewing this research, NAWAC concluded that there is no practical alternative to pens with farrowing crates that provides comparable levels of piglet welfare while simultaneously improving the welfare of sows. To date, the trade-offs present in every farrowing system have made it extremely difficult to find an optimal system that meets the needs of the sow without compromising the welfare of the piglets.

References

Andersen, I. L., Berg, S. and Bøe, K. E. 2005. Crushing of piglet by the mother sow (*Sus scrofa*) – purely accidental or a poor mother? *Applied Animal Behaviour Science 93: 229 – 243.*

Baxter, E. M., Lawrence, A. B. and Edwards, S. A. 2011. Alternative farrowing systems: design criteria for farrowing systems based on the biological needs of sows and piglets. *Animal 5: 580–600.*

Black, J. L., Mullan, B. P., Lorschy, M. L. and Giles, L. R. 1993. Lactation of the sow during heat stress. *Livestock Production Science 35: 153 – 170.*

Blackshaw, J. K., Blackshaw, A. W., Thomas, F. J. and Newman, F. W. 1994. Comparison of behaviour patterns of sows and litters in a farrowing crate and a farrowing pen. *Applied Animal Behaviour Science 46: 175-192*.

Bøe, K. 1993. Maternal behaviour of lactating sows in a loose-housing system. *Applied Animal Behaviour Science 35: 327 – 338.*

Bradshaw, R. H. and Broom, D. M. 1999. Behaviour and performance of sows and piglets in crates and a Thorstensson system. *In: Proceedings of the British Society of Animal Science: 179.*

Cronin, G. M. and Smith, J. A. 1992. Effects of accommodation type and straw bedding around parturition and lactation on the behaviour of primiparous sows and survival and growth of piglets to weaning. *Applied Animal Behaviour Science 33, 191 – 208.*

Cronin, G. M., Lefébure, B. and McClintock, S. 2000. A comparison of piglet production and survival in the Werribee Farrowing Pen and conventional farrowing crates at a commercial farm. *Australian Journal of Experimental Agriculture 40: 17–23.*

Damm, B. I., Forkman, B. and Pedersen, L. J. 2005. Lying down and rolling behaviour in sows in relation to piglet crushing. *Applied Animal Behaviour Science. 90: 3-20.*

Hales, J., Moustsen, V.A., Nielsen, A.F. and Hansen, C.F. 2014. Higher preweaning mortality in free farrowing pens compared with farrowing crates in three commercial pig farms. *Animal 8: 113-120.*

Herpin, P., Damon, M. and Le Dividich, J. 2002. Development of thermoregulation and neonatal survival in pigs. *Livestock Production Science 78: 25 – 45.*

Jarvis, S., Calvert, S. K., Stevenson, K., vanLeeuwen and Lawrence, A. B. 2002. Pituitary-adrenal activation in pre-parturient pigs (*Sus scrofa*) is associated with behavioural restriction due to lack of space rather than nesting substrate. *Animal Welfare 11: 371 – 384.*

Jarvis, S., D'Eath, R. B. and Fujita, K. 2005. Consistency of piglet crushing by sows. *Animal Welfare 14 (1): 43 – 51.*

KilBride, A. L., Mendl, M., Statham, P., Held, S., Harris, M. J., Cooper, S., and Green, L. E. 2012. A cohort study of preweaning piglet mortality and farrowing accommodation on 112 commercial pig farms in England. *Preventive Veterinary Medicine 104: 281 - 291.*

Marchant, J. N., Rudd, A. R., Mendl, M. T., Broom, D. M., Meredith, J., Corning, S and Simmins, P. H. 2000. Timing and causes of piglet mortality in alternative and conventional farrowing systems. *Veterinary Record 147: 209 – 214.*

Mersmann, H. J. 1974. Metabolic Patterns in the Neonatal Swine. *Journal of Animal Science 38: 1022-1030.*

Moustsen, V. A., Hales, J., Lahrmann, H. P., Weber, P. M. and Hansen, C. F. 2013. Confinement of lactating sows in crates for 4 days after farrowing reduces piglet mortality. *Animal 7:648-654.*

NAWAC (National Animal Welfare Advisory Committee), 2010. In: The Animal Welfare (Pigs) Code of Welfare Report. *Ministry for Primary Industries, Wellington, New Zealand.*

NAWAC, 2016. NAWAC review of the use of farrowing crates for pigs in New Zealand. *Ministry for Primary Industries, Wellington, New Zealand.*

Pajor, E. A., Kramer, D. L. and Fraser, D. 2000. Regulation of contact with offspring by domestic sows: Temporal patterns and individual variation. *Ethology 106: 37 – 51.*

Pedersen, L. J., Berg, P., Jørgensen, G. and Andersen, I. L. 2011. Neonatal traits of importance for survival in crates and indoor pens. *Journal of Animal Science 89: 1207-1218.*

Svendsen, J., Bengtsson, A. C. H. and Svensson, L. S. 1986. Occurrence and causes of traumatic injuries in neonatal pigs. *Pig News and Inforation7: 159 – 170.*

Weber, R., Keil, N. M., Fehr, M. and Horat, R. 2007. Piglet mortality of farms using systems with or without crates. *Animal Welfare 16: 277 – 279.*

Welch, B. 2012. The New Zealand Pig Industry – An overview. New Zealand Pig Veterinary Society of the NZVA, presented via PigLink Seminar Series 2012.