Strategies to improve the welfare of hyperprolific sows and their piglets

Animal welfare is an essential element of modern animal production. First and foremost, animal welfare is grounded on ethical concerns that derive from the fact that animals are sentient beings, for example, able to suffer and experience emotions.

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Societal concern over the welfare of farm animals has increased as of late and a growing number of citizens in many countries now demand that farm animals are reared, transported and slaughtered as humanely as possible. For example, according to a survey done in 2015 and involving more than 27,000 citizens from 28 Member States of the EU, 94% of them think that it is important to protect the welfare of farm animals.

Interestingly, this percentage ranged from 86-99%, showing that even in the EU countries that are supposedly less concerned about the welfare of animals, a clear majority of citizens believe that it should be protected.

Because of public interest in the welfare of farm animals, the European Commission has issued several directives that lay down minimum standards for the protection of farm animals, including pigs. Although EU legislation on pig welfare does not specifically address the welfare of hyperprolific sows and their piglets, it does include several elements that are relevant.

One of these elements is weaning age: according to the EU directive, piglets cannot be weaned before 28 days of age unless there is a risk of health problems for sow or piglets. Piglets can, however, be weaned as young as 21 days if they are weaned into adequate housing facilities.

Improving animal welfare may have additional benefits. As many welfare problems have a detrimental effect on production, improving the welfare of farm animals very often has positive effects on performance. Also, improving animal welfare is one of the strategies that may contribute to reduce the use of antimicrobials in farm animals.

An in-depth discussion of the concept of animal welfare is well beyond the scope of this article. However, it is important to mention that animal welfare encompasses not only the physical health of the animals (the absence of diseases and injuries) but also their behaviour and emotions.

Five Freedoms

For many years, the Five Freedoms have provided a useful framework to identify the welfare problems of farm animals. These freedoms, which represent ideal states rather than actual standards for animal welfare are:

- Freedom from thirst, hunger and malnutrition.
- Freedom from thermal and physical discomfort.
- Freedom from pain, injury and disease.
- Freedom to express most patterns of normal behaviour.
- Freedom from fear and distress.

More recently, the Five Freedoms have been criticised on the grounds that they can be misunderstood as aiming at eliminating all negative experiences (which is not realistic or even desirable) but also because they fail to capture our current understanding of the biological processes underlying animal welfare.

As an alternative to the Five Freedoms, the so-called Five Domains Model for assessing animal welfare was developed to address these problems.

The model incorporates four physical domains of 'nutrition', 'environment', 'health', 'behaviour', and a fifth 'mental' domain. Each physical domain has an impact on the affective state of the animal (on the fifth domain), and the net outcome in the mental domain resulting from the combination of the four physical domains represents the animals' overall welfare state.

There is a vast amount of information on the welfare of pigs, but the specific welfare problems of hyperprolific sows and their piglets have received much less attention. A sow is considered hyperprolific when she farrows more piglets than the number of functional teats she has.

One of the most obvious welfare problems caused by hyperprolific sows is an increase in neonatal mortality. Additionally, the high energy demands of hyperprolific sows during lactation may result in a loss of body condition that, in turn, increases the risk of skin ulcers. Undoubtedly, these are two important welfare issues.

However, as illustrated by both the Five Freedoms and the Five Domains, an assessment of the welfare risks caused by using hyperprolific sows must include other problems that are not directly related to health but can have a negative effect on the affective state or the behaviour of the animals.

Behavioural restriction caused by a prolonged crating period of nurse sows and disruption of the mother-offspring bond caused by artificial rearing and other husbandry practices are examples of these problems.

The aim of this article is not to review the welfare problems of sows and piglets in general, but to describe the welfare problems that are either caused or exacerbated by using hyperprolific sows, as well as to discuss possible strategies to mitigate them.

The main welfare problems of hyperprolific sows and their piglets that are addressed in this article are summarised in Table 1.

Welfare problems of piglets born to hyperprolific sows	
Problem	**Cause**
• Increased risk of hypothermia and starvation, potentially causing neonatal mortality • Health-related problems and increased stress reactivity	Low bodyweight at birth
• Increased risk of hypoxia • Increased competition at the udder	Large litter size
• Disruption of the mother-offspring bond	Cross-fostering, use of nurse sows and artificial rearing
Welfare problems of hyperprolific sows	
Problem	**Cause**
• (Possible) reduced heat • Pain and fatigue at farrowing tolerance	Large litter size
• Disruption of the mother-offspring bond	Cross-fostering, use of nurse sows and artificial rearing
• Longer crating period • Udder engorgement	Use of nurse sows

Table 1. Main welfare problems caused or exacerbated by using hyperprolific sows

WELFARE PROBLEMS OF PIGLETS BORN TO HYPERPROLIFIC SOWS

Increased neonatal mortality and stillbirth prevalence

Neonatal mortality is a major welfare problem. The amount of suffering experienced by piglets that end up dying shortly after birth is likely to vary depending on the cause of death. However, at least some causes of neonatal mortality such as injuries (caused by crushing by the sow, for example) and starvation result in moderate to severe suffering.

Although neonatal mortality can be high in very small litters, there is a positive correlation between litter size and neonatal mortality. This correlation is due mainly to the fact that large litter size is associated with lower birth weight. Piglets born to hyperprolific sows have an average bodyweight at birth lower than that of piglets born to conventional sows.

The effects of low bodyweight at birth on neonatal mortality are largely explained by the fact that small piglets have a poorer thermoregulatory capability than larger piglets, and hypothermia is known to play a key role in neonatal mortality. Although several studies indicate that crushing by the sow is the ultimate cause of piglet death, crushing often results from the effects of perinatal hypothermia and starvation.

Starvation is often secondary to, and interacts with, the effects of perinatal hypothermia, Hypothermic and undernourished piglets are more lethargic, less competitive at the udder and less likely to achieve an adequate intake of colostrum. Furthermore, they spend more time close to the sow and are more likely to be crushed.

Increased litter size is positively correlated with stillbirth prevalence and with the risk of hypoxia, partly due to prolonged farrowings. Although it has been suggested that stillbirth is unlikely to be associated with suffering, sub-lethal hypoxia reduces piglet viability and increases the risk of hypothermia and starvation.

Increased competition at the udder

Large litter size results in a more intense competition between piglets for teat access and this in turn may lead to an increased risk of hypothermia and starvation.

Increased litter size is associated with more facial lesions in piglets. Facial lesions are a direct welfare problem and may result in more producers resorting to tooth reduction, which is known to be painful.

Effects of low bodyweight at birth on health, stress physiology and behaviour

Beyond its effects on neonatal mortality, low bodyweight at birth may have detrimental effects on the welfare of piglets that survive. These effects include health-related problems and an increased reactivity to stressors.

Additionally, piglets with low bodyweight show behavioural differences when compared with larger piglets and some of these differences may be relevant from an animal welfare standpoint.

Large litter size is positively correlated with the percentage of animals with knee abrasions, a direct welfare problem with an increase in the risk of infection. Low bodyweight at birth and increased litter size are also associated with a higher prevalence of splayleg.

Pigs that have a low bodyweight at birth tend to show an increased reactivity to stressors (as measured through the activity of the hypothalamic-pituitary-adrenal axis) later in life compared with pigs that have a higher birth weight. This finding must be interpreted with caution, as a higher activity of the HPA is not necessarily linked to a negative affective state.

However, an increased reactivity of the HPA axis could theoretically contribute to some of the negative effects that stressors have on health, including the effects of weaning stress on intestinal health.

Small piglets show less tendency to play than large piglets. Again, these results must be interpreted cautiously when drawing conclusions on the welfare of piglets born to hyperprolific sows. However, play is not only an indicator of good welfare because it is reduced or absent when animals are in a poor welfare state, but also because play behaviour is rewarding and hence may contribute to better welfare.

Disruption of the mother-offspring bond

Disruption of the mother-offspring bond can be a consequence of cross-fostering, use of nurse sows and artificial rearing. Cross-fostering is a rather widespread practice in pig production, regardless of whether sows are hyperprolific. However, it may be more common on farms with hyperprolific sows. Nurse sows and artificial rearing are used on farms with hyperprolific sows.

Piglets recognise maternal odours and show a preference for their dam compared to other sows by 12 hours of age. By 24 hours of age, piglets can recognise their home pen. Therefore, piglets older than 12-24 hours will experience separation distress when taken away from their mother.

The possible effects of artificial rearing on the welfare of piglets can be best understood by looking at the effects of early weaning. A discussion of the effects of weaning on piglet welfare is well beyond the scope of this article. However, it has been repeatedly shown that weaning is stressful, and the amount of stress increases as weaning age decreases.

Further, the stress of early weaning may have long-lasting effects on piglet health. Admittedly, artificial rearing is not equivalent to early weaning, as one of the main stressors of weaning, for example, transition from milk to solid feed, does not occur with artificial rearing.

However, separation from the mother, which is another major stressor encountered by piglets at weaning, does occur.

WELFARE DEMANDS OF HYPERPROLIFIC SOWS

Increased energy demands during pregnancy due to large litter size may reduce heat tolerance

Increased litter size leads to an increase in metabolic loading during late pregnancy, and this might in turn increase the risk of sows suffering from heat stress. Heat stress is an important welfare issue in several countries and it has significant detrimental effects on performance.

To the best of our knowledge there is no available information on the possible differences between hyperprolific and conventional sows in their response to high temperatures. However, it is accepted that genetic selection for production traits leads to reduced heat stress tolerance in farm animals.

Pain and fatigue caused by prolonged farrowing

Although pain caused by parturition in animals has received little attention, there is increasing evidence that even normal parturition may be painful and it has been suggested that pain caused by parturition is a welfare problem in several species, including pigs.

Furthermore, pain caused by farrowing may have important effects on the behaviour of the sow both at parturition and shortly after and painful farrowings are associated with increased offspring mortality in pigs.

As the average bodyweight at birth of piglets born to hyperprolific sows is smaller than that of piglets born to conventional sows, it could be argued that pain caused by the expulsion of foetuses will be less pronounced in hyperprolific sows than in conventional sows. However, increased litter size results in prolonged farrowings which could be more painful.

This latter hypothesis is somehow supported by the findings of Mainau et al. (2010), who developed an 'ease of farrowing score' based on the total duration of farrowing, the birth interval, the total time standing or sitting, the number of position changes during the day before and the day of farrowing, the sow posture at birth, the viability of the piglets and their position at birth (head or back born). A common factor analysis model yielded three main factors and 'farrowing duration' was the factor explaining the largest proportion of variance in the 'ease of farrowing score'.

Udder lesions caused by large litter size

As mentioned before, increased litter size leads to more intense competition at the udder and this is likely to cause udder lesions in the sow. This problem may be particularly important in nurse sows and a cross-sectional study done with more than 50 sow herds in Denmark showed that nurse sows had more udder lesions than conventional sows.

Skin lesions

Shoulder sores may develop during the first and second week of lactation and are presumed to be painful. Demands for milk synthesis increase with litter size and, if sows cannot maintain a high feed and water intake, they will start to lose body condition and may be at greater risk of developing injuries such as shoulder sores.

Well-managed hyperprolific sows

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wean heavier litters than conventional sows and the prevalence of shoulder sores was positively correlated with litter weight at weaning in an epidemiological study carried out on Danish farms. Besides the increased energy demands of raising a large litter, the positive correlation between litter size at weaning and the prevalence of shoulder sores can also be due to sows spending more time in lateral recumbency when suckling large and heavier litters.

Udder engorgement in sows that transition to nurse sows

When a sow is transitioning to become a nurse sow, she does not lactate for several hours and this may cause udder engorgement and discomfort.

Although pain and discomfort caused by udder engorgement has received little attention in sows, it has been suggested that cessation of milking at dry-off causes discomfort in dairy cows and it could be argued that something similar might happen in sows.

Disruption of the mother-offspring bond

Sows can distinguish their own piglets from foreign ones using odour cues at seven days of age. It is very likely, therefore, that separation of the sow from her litter causes distress.

Prolonged crating

Farrowing crates are widely used in the EU and elsewhere. However, there is scientific evidence that farrowing crates cause welfare problems as they fail to meet the behavioural needs of the sow. Some nurse sows are kept in farrowing crates for longer periods than conventional sows rearing their own litters.

Welfare problems caused by farrowing crates are likely to be particularly pronounced immediately before farrowing when the sow is highly motivated to build a nest and the space restriction imposed by the crate causes frustration and stress. However, it has been reported that prolonged crating may also cause chronic stress.

STRATEGIES TO REDUCE WELFARE PROBLEMS

Nutritional strategies

In general, nutritional strategies do not seem to be particularly useful to improve the welfare of pregnant or lactating hyperprolific sows. During pregnancy and lactation, daily intake does not satisfy the nutritional requirements of the sow, which undergoes a process of net tissue accretion (during most of pregnancy) or mobilisation (during late gestation and during lactation) which plays an important role in maintaining nutritional equilibrium.

Having said this, however, it is worth mentioning that nutritional strategies may contribute to improving sow welfare around farrowing. Indeed, the time around farrowing is very challenging for the sow. As the gestation and lactation diets are very different from each other, feeding a special diet from a few days before through a few days after farrowing may help the sow to transition from pregnancy to lactation diets and hence reduce stress and improve welfare.

Nutrition can have a significant effect on the welfare of piglets born to hyperprolific sows and there are two aspects that are particularly relevant: oral administration of colostrum and creep-feeding. Oral administration of colostrum to weak piglets is a common husbandry practice on many farms and is likely to be particularly useful when dealing with hyperprolific sows.

Giving 10-15ml of colostrum once or twice during the first 24 hours of life should be enough to ensure a successful suckling period.

Furthermore, the benefits of combining maternal lactation with a milk formula during the suckling period was already reported by Azain et al. (1996), who found that supplemental milk replacer resulted in a significant increase in weaning weight and total litter weight. Milk replacer also reduced the difference in piglet weaning weight which is commonly found between primiparous and multiparous sows.

Pustal et al. (2015), found similarly positive results with piglets born to hyperprolific sows and reported a lower prevalence of treated facial lesions in supplemented piglets, probably due to a reduction in piglet competition at the udder.

Creep-feeding is a common husbandry practice on many farms to nutritionally support suckling piglets. The creep feed is a highly palatable and easily digestible diet that is offered to nursing piglets after the first week or 10 days of lactation. The main objective of creep-feeding is to facilitate a smooth transition at weaning and may contribute to reduce bodyweight variability after weaning.

Creep-feed is especially beneficial for large litters and for piglets that have been suckled for more than 21 days. Piglets with higher creep-feed intake get acquainted with a solid diet before weaning and, as a result, start to consume solid feed earlier after weaning and hence suffer less stress.

Genetic selection

There is clear evidence that genetic selection may reduce neonatal mortality either by selection for survival or by selection for related traits.

Husbandry-related strategies

Husbandry-related strategies (including an adequate supervision at farrowing) are extremely important to mitigate the welfare problems of hyperprolific sows and their piglets.

In practice, stockmanship requirements are higher on farms with hyperprolific sows than on farms with conventional sows to ensure both welfare and performance.

As mentioned, farrowing is likely to be painful and prolonged farrowings may pose a greater challenge than shorter ones. It has been shown that administering an analgesic to farrowing sows has positive effects on piglet performance and this may be even more important in hyperprolific sows.

There is some controversy in the literature on the optimal level of supervision during farrowing. Although inadequate or excessive intervention may have a negative effect on both welfare and performance, a reasonable degree of intervention by skilled stockpeople is likely to be beneficial.

For example, Andersen et al. (2007), observed that helping piglets to obtain colostrum by placing them at the udder and assisting them finding a teat reduced neonatal mortality. Early intake of colostrum is essential for all piglets and this is likely to be even more critical for small piglets. According to Furniss et al. (1988), early colostrum intake may be more critical for survival than immediate warmth, perhaps because early colostrum intake serves a triple purpose; providing maternally derived immunity and energy and assisting thermoregulation.

In fact, colostrum is a source of very digestible nutrients and various forms of bioactive compounds such as immunoglobulins, hydrolytic enzymes, hormones, and growth factors. In commercial conditions, the management of piglets during lactation by using cross-fostering, nurse sows and/or milk formula supplementation is a key issue to guarantee their welfare and productivity. Even though the final protocol will depend on many circumstances, including the health status of the herd and the facilities, our advice for a high health status, well-managed hyperprolific farm would include:

- Reduce cross-fostering to a minimum, keeping as many piglets as possible with their dams.
- Implement a regular nursing programme when there is a moderate surplus of piglets (1.0-1.5 surplus piglets per farrowed sow).
- Use a system of milk formula supplementation when there is a higher surplus of piglets (more than 2.0 surplus piglets per farrowed sow).

A combination of the last two approaches may also be successful.

Reducing fear of people in sows not only improves their welfare but also contributes to reducing neonatal mortality.

Conclusions

Hyperprolific sows and their piglets suffer several important welfare problems, which must be addressed using a combination of nutritional and husbandry strategies, as well as through genetic selection.

Good husbandry is of paramount importance to mitigate welfare problems of hyperprolific sows and their piglets, and therefore the decision of whether hyperprolific sows can be used on a given farm must consider the quality of stockmanship.

A major welfare problem of hyperprolific sows and their piglets is the disruption of the mother-offspring bond that results from cross-fostering, use of nurse sows and artificial rearing. Although artificial rearing is not equivalent to very early weaning, both practices share a fundamental feature, early separation of piglets from their mother. Whether artificial rearing is an acceptable practice from an animal welfare standpoint is open to debate. Furthermore, weaning earlier than 21 days is not allowed in the EU on a routine basis and artificial rearing implies that piglets are separated from their mother at a younger age. Therefore, the legal implications of artificial rearing in the EU deserve further thought. ■

References are available from the authors on request

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