Journal of Applied Animal Welfare Science

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Published online: 04 Jun 2010.


To link to this article: http://dx.doi.org/10.1207/s15327604jaws0201_3

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Segregated Early Weaning and Welfare of Piglets

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Segregated early weaning (SEW), introduced with the objectives of eradicating or controlling diseases and improving performance, is becoming increasingly popular among producers. The main features of SEW are weaning piglets early and moving the newly weaned piglets to a site isolated from the sows and other animals. In this article, we describe the key features of SEW and factors leading to its development. We review some of the main welfare issues involved with raising pigs in this way. We describe experiments that were crucial in the development of SEW and that showed positive effects on the health status and weight gain of piglets. We also review experiments that indicated welfare problems associated with this system. Specifically, we look at the effects of early weaning on the behavior and well-being of piglets. In addition, we look at other features of SEW, such as repeated cross-fostering and transport of young piglets. We provide directions for future research and offer recommendations for producers.

Under natural conditions, weaning is a gradual process. Sows begin nursing their litters less frequently after approximately the first week of lactation, although some

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nursing continues until piglets are approximately 12 weeks of age or older (Jensen & Recén, 1989; Newberry & Wood-Gush, 1985). In contrast, sows and piglets on most farms are kept together continuously for a period that usually ranges from 3 to 4 weeks, after which piglets are removed abruptly. In addition to a sudden change in diet, for which the piglet’s digestive system may be poorly adapted (Cranwell, 1995; de Passillé, Pelletier, Ménard, & Morisset, 1989), the piglet loses contact with the sow, is often mixed with piglets from other litters, and is moved to a new, unfamiliar pen. Piglets then must regulate their own intake of both feed and water (Fraser, Milligan, et al., 1997).

Given this disruption, it is not surprising that piglets show a strong behavioral response to weaning—they usually become much more active, vocalize at a high rate, and begin to engage in behavioral vices such as belly nosing (rooting a pen mate’s ventral surface with the snout). Piglets also consume less feed than required for maintenance and tend to lose weight (Leibbrandt, Ewan, Speer, & Zimmerman, 1975). Moreover, these problems are aggravated when weaning conditions are unsuitable (Dybkjær, 1992) or when piglets are weaned at even younger ages (Algers, 1984; Bøe, 1993). Weaning and early weaning were recognized as animal welfare issues long before the development of segregated early weaning (SEW).

DEVELOPMENT OF SEW

SEW was introduced with the objective of eradicating or controlling diseases to achieve higher production. Commingling of piglets from different breeding herds was causing major health problems in the swine nursery, so SEW techniques were developed as sanitary strategies designed to control spreading of infections. The performance benefits of reducing the exposure of pigs to pathogens are well known. Challenging an animal’s immune system can lead to decreased feed intake and allocation of nutrients away from growth and into the production of immune cells and immunoglobulins (Dritz, Owen, et al. 1996).

In the pioneering work leading to SEW, Alexander, Thornton, Boon, Lysons, and Gush (1980) showed that many pathogens could be eliminated by letting the sow farrow in isolation, medicating the sow and litter, and weaning the piglets in a separate site at 5 days of age. More recent work has shown, however, that performance and health benefits can still be realized when sows are not isolated, the medication is reduced, and weaning is done at 10 to 21 days (Clark et al., 1994; Dritz, Chengappa, et al., 1996; Harris, 1988; Pettigrew, Walker, & White, 1995). The improved growth occurs principally at the nursery phase and can be very impressive. For example, Dritz, Chengappa, et al. (1996) reported 50-day weights of 23.7 kg for SEW pigs versus 12.5 kg for controls.

The development of diets that were more palatable and digestible for the early-weaned pig (Tokach, Goodband, & Nelssen, 1994) was instrumental in al-
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Following for successful implementation of SEW, and much of the recent research on SEW pigs has focused on their dietary requirements. Given that these pigs are laying down muscle at a faster rate, their daily amino acid requirements are also higher (Owen et al., 1995). The use of spray-dried porcine plasma as a source of protein in diets for weaner pigs has been shown to produce higher feed intakes and daily gains than diets using dried skim milk (Hansen, Nelssen, Goodband, & Weeden, 1993). Diets containing spray-dried porcine plasma are highly preferred in preference tests and palatability studies (Ermer, Miller, & Lewis, 1994). However, recent results suggest that the more expensive plasma may not provide an advantage when fed to high-health SEW pigs (Coffey & Cromwell, 1995; Stahly, Cook, Swenson, Williams, & Zimmerman, 1995), although the reasons for this are still a matter of debate (Dritz, Owen, et al., 1996).

The success of SEW depends on two principles. First, to reduce vertical contamination (the spread of infection from sows to piglets), piglets must be weaned while still protected by maternal immunity. The age at weaning depends on the specific pathogens of concern, the vaccination status of the sow, and the ability of the sow’s colostrum to provide passive immunity to the pathogens present. The appropriate weaning age varies from less than 10-days old for control of Mycoplasma hyopneumoniae to 21-days old for the transmissible gastroenteritis virus. Second, to minimize horizontal contamination (the spread of infection from one group of pigs to another), piglets should be weaned in off-site nursery buildings operated on an all-in/all-out basis. To minimize age variation, weanings may occur two or three times a week. Nurseries are operated under very strict biosecurity programs that limit access of pathogens and employ regular cleaning and disinfection between each weaning group.

In addition to reduced exposure to pathogens and increased weight gains, SEW may allow for other production advantages such as a 2% to 3% decrease in preweaning mortality and a slight increase in the number of farrowings per sow per year (from 2.35 to 2.45; Moore, 1996). Sow herd size may also be increased by 25% to 35% without the need for more farrowing accommodation, as each litter uses the farrowing facility for a shorter period. SEW, however, increases the weaning-to-estrus interval by 1 day and slightly reduces the litter size at birth. Veterinarians also face new forms of diseases in nurseries and in fattening units. Because of the large size of SEW herds, infections can spread very rapidly and affect more animals than in smaller, conventional herds. Finally, the buildings and the management routines of a farm must be adapted to meet the demands of SEW.

Welfare issues

SEW offers certain welfare advantages to piglets, the most obvious being the reduced exposure to infectious diseases. This system also allows piglets from differ-
ent litters to be mixed at a relatively early age. Mixing piglets at 10 to 14 days of age may cause less fighting than mixing at 3 to 4 weeks, the time frame for traditional weaning and mixing. Under natural conditions, the sow and her litter will remain isolated for approximately the first 10 days of lactation. Then, piglets join the sow’s normal social group and mix with piglets of other litters. Work on non-SEW piglets has shown some advantages in allowing piglets to commingle at this age, thus avoiding problems associated with mixing piglets at weaning (Pluske & Williams, 1996). Unfortunately, there are also certain features of the SEW system that may negatively impact the welfare of piglets and sows. Following, we describe some of these issues and review recent research addressing them.

Preweaning Practices

SEW involves preweaning practices intended to achieve uniformity in piglet size and immunity status. These practices include vaccination, medication, and cross-fostering. Compared with earlier versions of medicated early weaning, vaccination programs and medication are de-emphasized within SEW systems; however, extensive cross-fostering occurs, and this practice can lead to a number of problems.

In conventional systems, producers often move piglets from one litter to another to equalize litter sizes. Such cross-fostering is normally performed during only the first day or two after farrowing with little apparent effect on sows or piglets. In SEW units, to meet the requirements for piglets of highly uniform body weights, cross-fostering is often done repeatedly during lactation. These adoptions are frequently done at older ages and can have negative effects on the piglets. For example, extensive cross-fostering of piglets maintains a continuous cycle of porcine respiratory and reproductive syndrome transmission (McCaw, Holcamp, Roberts, & Davis, 1996), whereas limited cross-fostering within 24 hr of birth helps control infections (McCaw & Desrosiers, 1997).

Repeated changes—moves from one litter to another—may also have detrimental effects on the behavior of sows and piglets. Suckling piglets develop teat fidelity within the first days after birth and almost always suckle at the same teat or pair of teats until weaning. Teat fidelity is an advantage to the suckling young because it reduces competition and fighting at the udder. Piglets who do not develop teat fidelity fight more throughout lactation and have lower weight gains (de Passillé, Rushen, & Hartsock, 1988). Moreover, studies have shown that only 25% to 50% of piglets fostered after 2 days of age suckled within 6 hr after adoption (Price, Hutson, Price, & Borgwardt, 1994) and that piglets fostered at 7 days of age gained less weight (Horrell & Bennett, 1981). These observations suggest that cross-fostering disrupts the teat order and induces fighting between resident and fostered piglets.
In a recent study, Robert and Martineau (1997, 1998) compared control litters with litters in which three piglets were fostered once every 3 days. A piglet could be fostered one to six times between birth and weaning at 18 days of age. During the first 2 hr following cross-fostering, the numbers of fights were much higher in treated litters than in control litters. Almost all of the fights occurred when a fostered piglet attempted to gain access to a teat belonging to one of the resident piglets. The fighting in fostered litters increased the frequency of failed nursings (i.e., those in which no milk letdown occurred) and reduced the total number of successful nursings. These results confirm the Horrell’s (1982) observations that although sows have more nursings after fostering, many of these nursings are nonproductive. The frequency of face lacerations was also found to be higher in fostered piglets (Robert & Martineau, 1998), suggesting that cross-fostering may be one of the factors involved in the development of exudative epidermitis, a skin disease frequently found in SEW nurseries. In combination, these data suggest that cross-fostering is stressful for piglets and sows in the short term. However, the impact of this management practice on later aggressive behavior of piglets and on subsequent maternal and reproductive performance of sows is not known.

Weaning Age

Of the potential welfare problems associated with SEW systems, the one that has generated the most attention is the early age at which piglets are separated from the sow. Early weaning of piglets was identified as a welfare issue even when early meant 3 to 4 weeks of age. In fact, weaning at less than 3 weeks of age is illegal in certain countries, such as the member nations of the European Union. There is also experimental evidence that piglets weaned at less than 4 weeks of age (under non-SEW systems) eat less feed and gain weight at a slower rate immediately after weaning (Leibbrandt et al., 1975), show a weakened immune response (Belcha, Pollmann, & Nichols, 1983; Metz & Gonyou, 1990), are more active and more likely to engage in belly nosing (Bøe, 1993; Metz & Gonyou), and vocalize at higher rates (Weary, Fraser, & Pajor, 1997). Piglets weaned at 12 to 14 days of age eat very little during the first 36 to 48 hr after weaning. Piglets weaned at 3 to 4 weeks of age usually begin eating with 24 hr (Metz & Gonyou). Many of these effects are most pronounced during the first week after weaning, but others, such as belly nosing, have been shown to persist for several weeks or longer (Bøe, 1993).

Although these results provide a basis for concern, SEW involves features that may offset the negative effects. Indeed, as we have mentioned, pigs reared under SEW actually grow faster and eat more feed during the nursery phase than piglets reared in conventional systems. Thus, to the extent that a pig’s well-being is determined by its weight gain (Fraser, Weary, Pajor, & Milligan, 1997), SEW can be
seen as positive. Unfortunately, experimental work on the behavior and welfare of SEW piglets is just beginning.

Three recent studies have examined the behavioral response of piglets weaned at different ages, all using the high-quality feeds and practices designed for SEW. Worobec, Duncan, and Widowski (1997) found that the incidence of belly nosing was approximately twice as high when piglets were weaned at 14 versus 28 days and twice as high again when piglets were weaned at 7 days. Hohenshell, Lay, Zimmerman, and Cunnick (1997) found no difference in belly nosing between piglets weaned at approximately 10 and 30 days, although the piglets weaned at the younger ages were more active and spent more time manipulating pen mates in other ways. Patience, Gonyou, Whittington, Beltranea, and Rhodes (1997) found that belly nosing was almost twice as frequent among piglets weaned at 12 days compared with those weaned at 21 days. Also, the younger piglets spent more time eating, drinking, and chewing objects. Early-weaned piglets continued to display higher levels of nosing and chewing on pen mates throughout the growing-finishing period (Patience et al., 1997).

All of these studies, comparing piglets weaned under similar conditions, do not allow us to evaluate the effects of SEW versus those of conventional weaning. They do, however, point to problems of weaning at younger ages, even when using state-of-the-art facilities. This is important, as a range of weaning ages are used in SEW systems. Younger ages help break the transmission of a greater range of swine diseases between sows and piglets (Dritz, Nelssen, Goodband, Tokach, & Chengappa, 1994). If, however, a similar health status can be achieved, there are potential welfare advantages and no production disadvantages to weaning at older ages. For example, Dritz, Signer, et al. (1994) reported no difference in weight gain between SEW pigs weaned at 9 and 19 days.

OTHER PROBLEM ISSUES

There are at least three other welfare issues associated with SEW that urgently require some attention: (a) impact of early weaning on the sow, (b) management of low-weight piglets, and (c) transportation of newly weaned piglets. Even research on conventionally raised pigs has tended to ignore the impact of weaning on the sow. In a preliminary study on this topic, piglets were weaned at 5 weeks of age, and the behavior of the sows were recorded for 2 hr after weaning (Pajor, Weary, Fraser, & Kramer, 1996). Sows vocalized at a much higher rate after weaning, grew more active, and returned repeatedly to the piglets’ resting area. It is likely that weaning earlier in lactation is more difficult for the sow. For example, at 2 weeks of age, milk production is still increasing. The natural weaning process, initiated when piglets begin eating solid feed, has barely begun (Pajor, Fraser, & Kramer, 1991). In SEW units, sows appear to encounter some reproductive problems such as a delay.
in return to estrus and a reduction in subsequent litter size (Moore, 1996). Sows may not be ready for weaning at this early stage of lactation.

To avoid the spread of infection among piglets, it is important to wean them within a narrow range of ages (ideally within a range of only 1–2 days). However, piglets must also have reached a minimum size in order to thrive under the weaning conditions provided for piglets of that age. This combination of constraints results in a group of piglets (typically 4%–7% of those weaned) who fail to meet the minimum weight requirements of their age cohort for segregated weaning. These small, at-risk piglets are often sold at low prices to units outside the SEW system and are generally ignored in any evaluation of the program. Although these piglets have, in some respects, the greatest requirements for specialized housing and management, the low value placed on them can translate into inadequate access to this type of specialized care.

A final point relates to transporting young piglets. Even when the nursery is only a short distance away, piglets must still be removed from the farrowing pen, loaded onto a vehicle, unloaded, and placed into a nursery pen. In many cases, however, the large numbers of animals required for the efficient use of SEW facilities mean that piglets are supplied by a number of producers and are transported over longer distances. Some producers also move animals to areas with lower feed costs or better slaughter facilities. These moves can stretch over very great distances, involving as much as 24 hr of travel. The requirements of adult pigs during transport have received some attention (Randall, 1993), but the special problems of transporting young piglets have not been studied. It is likely that these animals require specialized facilities and management. The experiences of producers who successfully transport young piglets over large distances should be studied, and the results should be made more widely available to the industry.

FUTURE PERSPECTIVES

Although research on the welfare of SEW pigs is still in its infancy, we can already recognize both positive and negative aspects of the system. By considering the two components of SEW, segregation and early weaning, we may develop management programs that not only retain most of the benefits of the system but also limit the problems. Segregation ensures that piglets move into clean nurseries. This can be ensured by moving the piglets to a separate all-in/all-out facility. However, the cost of an additional site will be justified for only large or cooperative production units. In order to obtain similar results within small units, a greater emphasis on hygiene should be developed. If restrictions are imposed on transportation methods and duration, the benefits currently obtained from segregation may be retained with little threat to animal welfare.
Because of the need for expensive feed and environmental control, the early-weaning component of the system is costly and requires a very high standard of management. Also, very early weaning, at approximately 10 days, provides no benefit when piglets are from herds with a high health status (Dritz, Signer, et al., 1994). We suggest that most producers will find production and welfare advantages to weaning piglets closer to 21 days of age.

ACKNOWLEDGMENTS

We thank David Fraser, Liesl Hohenshell, Guy-Pierre Martineau, Ed Pajor, Allison Taylor, and Erin Worobec for their helpful comments on previous versions of this article.

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