Increasing piglet survival through an improved farrowing management protocol

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White, K. R., Anderson, D. M. and Bate, L. A. 1996. **Increasing piglet survival through an improved farrowing management protocol.** Can. J. Anim. Sci. **76:** 491–495. The profitability of swine production units is significantly decreased by the high rate of mortality which occurs during parturition or shortly thereafter. This study compared the survival rates of pigs subjected to different farrowing management protocols. Sixty litters of crossbred piglets (York × Landrace) were randomly assigned to one of two protocols for management at farrowing. The first, unattended or control group, corresponded to the traditional commercial farrowing practice used on most hog farms today which provides for no attention during farrowing. The second protocol consisted of attending the farrowing and executing a sequence of procedures to the newborn animals. Mortality rates and their causes, weight gains, and haematocrit levels were recorded for the first 3 wk of life. Total preweaning mortality was 18.2 and 10.1% for the control and attended groups, respectively. The main impact of the treatment was the reduction of the animals that otherwise would have been classified as stillbirths. The stillbirth rate decreased from 6.8 to 1.6% while the mortality rate during the first day decreased from 5.2% in the unattended litters to 2.2% in the attended litters, respectively. At weaning the weight of the attended piglets was higher ($P < 0.05$) than those of the unattended animals. The overall weight gain was higher in the attended litters when compared with those of the control litters (3.99 ± 0.08 and 3.68 ± 0.06 kg, respectively). Processing each pig takes about 2 min, but waiting for the next pig requires approximately 15 min per piglet. The reduction in mortality of 44% (equivalent to about one piglet per litter) plus the benefit of enhanced performance in the attended group could justify the implementation of a farrowing protocol which involves adding the extra labour at farrowing time, especially if several sows are attended by the same attendant.

Key words: Piglets, mortality, farrowing, weight gain, haematocrit

White, K. R., Anderson, D. M. et Bate, L. A. 1996. **Augmentation du taux de survie des porcelets grâce à un meilleur protocole de conduite des mises bas.** Can. J. Anim. Sci. **76:** 491–495. La rentabilité des ateliers de production porcine est fortement abaissée par le taux élevé de mortalité survenant à la mise bas ou peu après. Nous comparons les pourcentages de survie des porcelets exposés à divers régimes de conduite de la mise bas. Soixante portées de porcelets croisés (York × Landrace) étaient réparties au hasard entre deux régimes, l'un sans surveillance durant la mise bas, c.-à-d. la pratique courante dans la plupart des exploitations porcines commerciales, et le second avec surveillance et exécution d'une séquence d'interventions sur les porcelets nouveaux-nés. Les mortalités et leurs causes, le GMQ et l'hématocrite étaient consignés dans les 3 premières semaines de vie. Le taux total de mortalité en pré-sevrage était, respectivement, de 18,2 et 10,1% dans les groupes sans et avec surveillance. L'avantage des derniers tenait principalement à une diminution de ce qui autrement aurait été classé comme cas de mortinatalité. Le pourcentage de morts-nés tombait, en effet, de 6,8 à 1,6%, tandis que le taux de mortalité au 1er jour passait de 5,2 à 2,2%. Au sevrage, le poids de porcelets nés sous surveillance était supérieur ($P < 0{,}05$) à celui des porcelets de l'autre groupe. De même le GMQ global des portées était plus élevé, soit 3,99 ± 0,08 contre 3,68 ± 0,06 kg. Cela ne prend environ que environ que 2 minutes d'attention à la la mise bas pour chaque porcelet, mais il faut compter environ 15 mn d'attente avant l'arrivée du porcelet suivant. La réduction de 44% des mortalités, l'équivalent d'un porcelet environ par portée, ajoutée aux meilleures performances obtenues dans le groupe sous surveillance pourrait justifier la mise en place d'un protocole qui demande plus de travail à l'époque des mises bas, surtout si une même personne s'occupe de plusieurs truies.

Mots clés: Porcelet, mortalité, mise bas, gain de poids, hématocrite

Pre-weaning mortality in swine ranges between 15 and 25% in many herds (Friendship et al. 1986; Christison et al. 1987; Vaillancourt and Tubbs 1992) and the cost of these losses may be substantial to the producer (Bundy et al. 1984). The majority of the losses take place during the first day (Fahmy and Bernard 1971) and a large proportion of these are associated with animals classified as stillborn (Bäckström 1973). Therefore, it seems that the first few hours after birth should be a target period for mortality reduction.

Causes of death vary from farm to farm and are related the different environmental and management conditions. The major causes of pre-weaning mortality, identified more than 20 yr ago, are: starvation, chilling, crushing, and disease (Edwards 1972). The reasons for piglet losses today remain the same and, as before, smaller piglets and those born towards the end of the farrowing are particularly susceptible. If piglets are aided in finding a teat and obtaining colostrum within 45 min of birth, their chance of survival increases (English et al. 1977).

As in the past, most sows are allowed to farrow unattended. When labour is progressing normally, the farmer prepares for the farrowing by ensuring that the supplementary heat source is ready and does not further interfere until the normal piglet care procedures, such as teeth clipping, tail docking, and iron injections are conducted at the end of farrowing, usually the following morning. Attending farrowings, however, has been demonstrated to reduce piglet losses (English and Morrison 1984). Usually batch farrowing enables the attendant to be present at the farrowing barn (Bille et al. 1974) and provide simultaneous assistance to multiple litters. Synchronization of farrowing for these purposes can be effectively conducted using prostaglandin $F_{2\alpha}$ (King et al. 1979). Nevertheless, in most mid-size operations the management system or the number of animals does not always permit batch farrowing; therefore, attending farrowings is not a common practice due to the increased cost of labour associated with waiting for a sow to start parturition. Using a device which may alert the attendant to the start of farrowing, however, eliminates idle waiting time in the farrowing room (Bate et al. 1991).

The purpose of this study was to compare the effectiveness of a farrowing management protocol that involved attending farrowing with the traditional method of unattended farrowing pigs. The main parameters to consider were piglet survival and performance.

MATERIALS AND METHODS

Animal Facilities

The study was conducted in a 100-sow farrow-to-finish commercial operation producing F_1 gilts. The farrowing room had five rows of eight pens (2.15 m × 1.4 m) each containing a diagonal crate 2.0 m × 0.76 m. Each row was separated by a central walkway. Each pen had a 250-W heating lamp located in the centre of a plywood cover which reduced convective heat losses from the creep area. A feeding dish and a water nipple placed on the front wall of the crate supplied the sow and another nipple located on the rear wall of the pen provided water for the piglets. The walls of the pens and all the floors were made of solid concrete. Sawdust bedding was replaced every morning. The room was under negative pressure ventilation created by double speed fans. The average dry bulb temperature in the farrowing room was 22°C while in the creep area the average temperature reading was 32°C. Sows were fed twice a day; prepartum, a home mixed gestation ration containing 14% crude protein, and post farrowing, a home mixed lactation ration containing 16% protein. Water was available ad libitum.

Experimental Protocol

Sixty sows, gestating crossbred litters (York × Landrace) ranging from 1st to 13th parity were randomly assigned to one of two experimental protocols. Sows in the control group were not assisted in farrowing and represented the normal management of the farm. At an average of 1 d of age each piglet was weighed, ear notched for identification, injected i.m. with 1 mL of injectable iron dextran and given an oral supplement of a commercial antibiotic Furoxone at a dosage of 1 mL per piglet. A blood sample was collected from the suborbital sinus of each piglet as described by Friend and Brown (1971), placed in a capillary tube and centrifuged to quantify haematocrit concentration.

After the beginning of labour, the sows of the attended group were fitted with a photoelectric probe from a farrowing alert system as described by Bate et al. (1991). The birth of the first pig activated the telephone dialler of the system, advising the attendant that farrowing had commenced. Within a maximum of 15 min after this signal, the attendant arrived at the barn and conducted the following management protocol. The beginning of the farrowing as indicated by the time of the alarm and the time of birth for each subsequent pig was recorded. All piglets were dried with a clean towel to reduce the heat loss due to evaporative cooling, and the umbilical cord was tied. The pig's oral and nasal cavities were suctioned to clear any mucus or other debris. The piglets were then weighed. Piglets weighing 1 kg or more received 30 s of oxygen whil those weighing less than 1 kg received 45 s of oxygen via a facial mask connected to a medical oxygen tank by a flexible, rubber hose. A 1 mL blood sample was then collected from the suborbital sinus. Subsequently each piglet received a 12 mL oral dose of first milking bovine colostrum which had previously been frozen in sample jars. Two days before the sow was scheduled to farrow, the colostrum was taken out of the freezer and left to thaw in a refrigerator. It was warmed in water at 37°C before use. The piglets were then identified with consecutive numbers by ear notches, and had their tails docked. Piglets were orientated to an available teat and left with the littermates. All of these procedures were begun as soon as the pig was born or as soon as possible if two pigs were born within a few seconds. The procedure was always completed within 2 min, usually before the next piglet was born. Pigs weighing more than 1 kg at birth had their needle teeth removed as part of the procedure while those weighing less than 1 kg had their teeth removed at 2 d of age. At the end of the farrowing, all pigs in the litter received the same iron and antibiotic treatment described for those piglets in the control group.

After day 2, piglets of both groups were treated in the same manner. Piglets were weighed and had blood samples drawn on days 7, 14, and 21. Post-mortem examinations were conducted in the Nova Scotia Animal Pathology Laboratory on all pigs that died by day 21.

Animal Care

The experimental protocol was approved by the local Animal Care Committee and complied with the requirements of the Canadian Council on Animal Care (1993).

Statistical Analysis

Fisher's Exact Test and Continency Tables were used to compare the treatments for total mortality and for the number of piglets that died due to the three most common causes which were stillbirths, starvation, and colibacillosis. Other specific causes of mortality were few and not analysed separately. Life test procedure with parity included was used to analyse the chronological distribution of the mortality data. The haematocrit and body weight data were analysed using repeated measurement analysis of variance.

The model included the effect of treatment. Parity or age were not included. All statistical analysis were conducted using software of the SAS Institute, Inc. (1985).

RESULTS

Sows in the attended and the control group had an average of 4.7 and 5.0 parities, respectively. The parity, however, had no significant effect on the mortality rate of the piglets. The average litter size was similar for both treatment groups but litters in the attended groups had more piglets alive at birth and at 21 days than litters of the control group (Table 1).

Treatment resulted in a large difference in the percent of pre-weaning mortality ($P < 0.05$), with 18.2% in the controls and 10.1% in the attended group (Table 2). Through post-mortem examination, deaths were categorized into six causes: stillbirth, starvation, trauma, disease, genetics, and other. Disease was further subdivided into colibacillosis and others. Only mortality due to stillbirth, starvation, and colibacillosis proved to be different among treatment groups, with each other cause being higher in the unattended group ($P < 0.05$).

Life test procedure included parity. Parity and treatment were not significant when mortality was measured over time. However, the number of piglets dead at birth was lower in the attended farrowings with an average of 1.6% of all piglets born compared with 6.8% in the unattended group ($P < 0.05$, Table 3). On the first day, the mortality rate was lower ($P < 0.05$) among the piglets from the attended group than among those of the control group. Thereafter the mortality rate remained low and similar for both treatments.

The first weight recorded for the piglets born in the unattended farrowings was greater ($P < 0.01$) than that recorded for those pigs in the attended farrowings (1.41 kg and 1.34 kg, respectively), presumably because the unattended piglets had consumed milk before the initial weighing. This difference disappeared by the first week and at weaning, the piglets from the attended litters weighed more ($P < 0.05$) than those of the unattended litters (5.33 kg and 5.09 kg, respectively) (Table 4). Both linear and quadratic effects of treatment were significant over time. From birth to 21 d, the piglets in the attended litters gained an average of 3.99 kg while those in the unattended litters only gained 3.68 kg ($P < 0.05$). The average accumulated difference in biomass produced by the combination of the increased performance and the higher number of piglets weaned was 7.51 kg in favour of the attended group.

The haematocrit levels in the piglets from attended farrowings had a large decrease in the first week ($P < 0.05$). The first haematocrit measurement in the animals of the attended group was much higher than those of the unattended group ($P < 0.05$) with means of 40.9 and 32.1%, respectively. By day 7 the percentage haematocrit in the piglets of the attended litters decreased to levels significantly lower than those found in the animals of the unattended group (Table 5). Haematocrit was similar for both groups at subsequent measurements (day 14 and day 21). Linear, quadratic and cubic effects of treatment over time are significant. The effect of treatment was not consistent over time.

Table 1. The average number of piglets in the litters at different times

	Farrowing management	
	Unattended	Attended
Number of litters	30	30
Total pigs born	308	318
Pigs per litter		
Born alive and stillborn	10.3	10.6
Alive at birth	9.7	10.4
Alive on day 21	8.4	9.5
Average parities	5.0	4.7

Table 2. Percentage of mortalities attributed to different causes in unattended and attended farrowings

	Farrowing management			
	Unattended		Attended	
	no.	%	no.	%
Total mortality	56	18.2	32	10.1
Causes of mortality				
Stillbirth	18*a*	32.1	5*b*	15.6
Starvation	15*a*	26.8	4*b*	12.5
Trauma	6	10.7	5	15.6
E. coli	12*a*	21.4	9*b*	28.1
Other disease	3	5.3	3	9.4
Genetics	0	0.0	2	6.3
Other	2	3.7	5	15.6

*a,b*Numbers within rows with different letters are significantly different ($P < 0.05$).

Table 3. Chronological distribution of deaths in unattended and attended farrowings

	Farrowing management			
	Unattended		Attended	
Time period	no.	%[z]	no.	%
Day 0	21*a*	6.8	5*b*	1.6
Day 1	16*a*	5.2	7*b*	2.2
Day 2	1	0.3	2	0.6
Day 3	3	1.0	5	1.6
Days 4–7	7	2.3	8	2.5
Days 8–14	4	1.3	3	1.0
Days 15–21	4	1.3	2	0.6

[z]Mortality as a percentage of the total number of pigs born within each treatment.
*a,b*Numbers within rows with different letters are significantly different ($P < 0.05$).

Table 4. Mean body weight (kg) in pigs subjected to different farrowing management

	Farrowing management[z]		Level of
Time	Unattended	Attended	significance
Birth	1.41	1.34	**
Day 7	2.61	2.58	NS
Day 14	3.85	3.88	NS
Day 21	5.09	5.33	*

[z]Between subject mean square error is 2.2; ** ($P < 0.01$), * ($P < 0.05$).

Table 5. Mean haematocrit in piglets subjected to two farrowing management protocols

	Farrowing management[z]		Level of significance
	Unattended	Attended	
Birth	33.1	40.9	**
Day 7	35.3	33.7	**
Day 14	36.3	35.7	NS
Day 21	35.8	35.1	NS

[z]Between subject mean square error is 33.8; ** ($P < 0.01$).

The attended farrowing management took an average of 156 min extra per litter to complete. Most of this time, however, was expend waiting for the birth of the next piglet. When several litters were being born at the same time the efficiency increased as processing each pig takes approximately 2 min.

DISCUSSION

The slight difference in parity in the two experimental groups did not seem to have affected the results. Undoubtedly attending the farrowings was, as suggested by Bille et al. (1974) and Kingston (1989), effective in reducing mortality. The main impact of this management protocol appears to be in reducing the number of stillborn animals and those dying of starvation with some reduction in mortality due to disease.

The number of piglets classified as stillborn by the presence of atelectatic lungs does not represent the real numbers of piglets being classified as born dead. Many of the piglets which, under traditional management systems such as our control group, are found dead in the morning could be saved if an attendant removes placental and mucus debris from the oral and nasal passages and stimulates respiration. This was suggested by English and Morrison (1984) and confirmed in our studies. Premature detachment of the placenta during the process of parturition induces hypoxia (Randall 1971) thus reducing the strength with which the pig is born making it unable to inhale for the first time and therefore succumbing shortly after expulsion. An hypoxic pig at birth could start respiration but if it lacks the strength to secure a suckling position it would succumb to starvation and hypothermia. The oxygen provided in the management protocol may have compensated for this deficiency in some of the pigs that otherwise would have been classified as stillborn or would have died shortly after birth without ingesting colostrum. The reduction in the rate of stillbirth observed could have been further mediated by the physical handling of the piglet during drying which serve as a stimulus to breath.

Another predisposing reason of mortality is chilling of the pig shortly after birth (Curtis 1970). This is mainly the result of evaporative cooling of the placental fluid and it causes an initial reduction of rectal temperature of about 2°C (Curtis 1970; Le Dividich and Noblet 1981). This hypothermic state will ultimately reduce colostrum intake (Le Dividich and Noblet 1981) and absorption (Bate and Hacker 1985). No animal was classified as dying from chilling in this trial. If the postmortem revealed absence of food in the digestive tract and depletion of liver glycogen reserves, the piglet was classified as dying of starvation although it may have been hypothermic before dying. Chilling also reduces the alertness of the pig making it more prone to be crushed (Pomeroy 1960). The process of drying the newborn piglet, supplying it with warm colostrum, and guiding it to a nipple reduced the chilling effect by evaporative cooling while providing the animal with a source of energy. These last actions must also have played a role in reducing the incidence of starvation observed in the animals of the attended group. The lower, although significant, impact of the treatment on the reduction of mortality due to disease could be attributed to the fact that these piglets received bovine instead of porcine colostrum at birth. Although this may have increased immediate energy levels as well as provide some local protection within the digestive tract, the immunoglobulin G of bovine colostrum is not specific for pathogens affecting swine. It is reasonable to suggest that providing a swine derived source of immunoglobulin G would enhance protection against porcine pathogens and probably reducing the observed losses.

The higher weights recorded for the animals in the control group at birth can be attributed to the fact that these animals had an opportunity to suckle for several hours prior to their first weighing. Animals in the attended group were weighed immediately after birth, prior to ingestion of any colostrum. The subsequent superior performance observed in the animals of the attended group reflect the overall benefit of the initial treatment even though the attended litters averaged 0.7 more pigs.

It appears that in reality the treatment does not affect overall haematocrit distribution. The significantly higher percentage of haematocrit measured in the pigs of the attended group can be attributed to the fact that the blood samples were collected prior to ingestion of any fluid. This normally reduces the neonatal haematocrit concentrations. However, tying the umbilical cord, thus preventing blood loss, can not be discarded as a factor influencing or preventing reduction in haematocrit concentration.

In this study, the procedures used in the attended farrowings reduced losses immediately after parturition, mainly by avoiding death that normally would be considered as stillborn. The benefits derived from raising 1.1 extra pigs per litter, plus the enhanced growth performance may offset the extra cost of hiring an attendant. The economic benefits of this procedure would be maximized when several litters are being born simultaneously as is the case in operations which use batch farrowing.

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