Providing supplemental milk to piglets preweaning improves the growth but not survival of gilt progeny compared with sow progeny

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ABSTRACT: Gilt progeny have lighter weaning weights and greater postweaning medication and mortality rates compared with the progeny of older parity sows. Because weaning weight has been positively correlated with postweaning survival, this study aimed to determine whether the provision of supplemental milk preweaning could improve weaning weight and subsequent weights as well as postweaning survival of gilt progeny. The study was replicated in summer and winter as the effects of supplemental milk were expected to vary with season. The progeny of 80 gilts (parity 0) and 80 sows (parity 2 to 5) were allocated to both treatments: with or without supplemental milk in these 2 seasons with 5 sheds/season. Litter size was standardized (10 to 11 piglets) and each piglet was weighed at birth, d 21, weaning (4 wk), and 10 wk of age. Medications and mortalities were recorded both preweaning and postweaning. Pigs were housed within treatment groups postweaning, and ADFI and G:F were measured. Gilt progeny were 200 g lighter at birth in both replicates (P < 0.001) and were 500 g lighter at weaning in the winter replicate (P < 0.05) compared with sow progeny. The provision of supplemental milk improved weaning weight for both gilt and sow progeny by 800 g in summer (P < 0.05) and by 350 g in winter (P < 0.05). This improvement in weaning weight had no effect on the incidence of death or disease in milk-supplemented progeny of either gilts or sows (P > 0.05). Supplemental milk disappearance (the daily difference between the volume of milk provided and the residue left in the drinker) was greater in summer than winter (by 130 mL/piglet d–1; P < 0.05) as were the associated weaning weight benefits. The weaning weights of supplemented gilt progeny reached or exceeded that of nonsupplemented sow progeny. Gilt progeny had greater postweaning mortality (2.6%) and medication rates (6.2%) than sow progeny (1 and 2.2%, respectively; both P < 0.05) in both seasons, but medication rates were greater in winter (7.2%) for both treatment groups than in summer (1.9%; P < 0.05). Gilt progeny also had less postweaning ADFI than sow progeny in winter (528 and 636 g, respectively; P < 0.05) with no dam parity effect on G:F (both P > 0.05). The hypothesis that supplemental milk provision did increase gilt progeny weaning weight was supported (especially in summer) but the supplementation had no effect on postweaning weights and survival. Efforts to improve gilt progeny postweaning growth and survival need to be aimed at improving health and immunity, not just weaning weight.

Key words: body weight, growth, gilt, parity, supplemental milk, survival

INTRODUCTION

Dam parity is an important predictor of piglet survival and growth as demonstrated by increased postweaning medication and mortality rates (Holyoake, 2006) and increased risk of slow growth in gilt progeny relative to sow progeny (Larriestra et al., 2002). Poor postweaning performance of gilt progeny may be due to their lighter weaning weight (Holyoake, 2006), as weaning weight has been positively associated with subsequent growth and survival (Larriestra et al., 2002). Previous studies suggested that provision of supplemental full cream milk was effective at improving preweaning BW gain, as piglets can achieve a greater intake of liquid feed compared with dry feed (Pluske et al., 1995) and
full cream milk is more readily consumed than synthetic milk supplements (King et al., 1998).

Supplemental milk consumption by sow-reared piglets varies with season. The greatest benefits of supplemental milk occur during warmer periods as sow milk production (and therefore litter weaning weight) is lower due to reduced sow feed intake (Azain et al., 1996) and redirection of blood flow away from the mammary glands to the skin for heat exchange (Black et al., 1993; Messias de Braganca et al., 1998).

Gilt progeny are a significant proportion of the growing herd and are regarded as being more susceptible to disease than sow progeny (Deen and Larriestra, 2002). The overall study objective was to eliminate the difference in weaning weight between progeny from gilts and sows and therefore the difference in postweaning BW gain and survival. The first hypothesis for this study was that gilt progeny provided with supplemental milk during the preweaning period would increase their weaning weight and therefore improve their growth and survival postweaning compared with sow progeny and nonsupplemented gilt progeny. The second hypothesis was that the benefits of supplemental milk would be more obvious in summer because greater supplemental milk intake would be expected at this time.

MATERIALS AND METHODS

Animal experiments were performed according to the Australian Code of Practice for the Care and Use of Animals for Scientific Purposes (NHMRC, 2004) and approved by both the University of Sydney and the farm Animal Ethics Committees.

Animal Housing

This study was conducted on a 1,300-sow commercial farm in southern New South Wales, Australia, in winter (July to September 2005) and repeated in summer (January to March 2006). Gilts were mated at a minimum of 231 d of age and 145 kg BW. Dams were individually stall housed for the first 5 wk of gestation and then group housed in straw bedded sheds (ecosheds) according to their mating week.

Temperatures in the farrowing sheds were monitored using data loggers during each experimental period and ranged from 14 to 26°C in winter (average 21°C) and from 20 to 36°C in summer (average 26°C) with thermostatically controlled blinds and drip coolers. Each farrowing pen had a creep area with a thermostatically controlled overhead heater lamp (set at 24 and 28°C for older and younger piglets, respectively) and a solid plastic mat base.

Piglets were weaned at approximately 26 ± 5 d of age and transferred to weaner pens with a maximum BW range of 4.5 kg for pigs within the pen. Weaner pens were elevated above the floor with solid partitions next to aisles and open bar dividers between adjacent pens. Pens had concrete partly slatted floors (75%), allowing each pig 0.54 m² floor space. Weaner sheds were heated, naturally ventilated sheds that were stocked on an all-in-all-out (by week weaned and by room) basis.

The dams were fed ad libitum with a lactation diet within 5 d after farrowing. Pigs had ad libitum access to a pelleted 3-phase diet from weaning until 10 wk of age. The starter diet was fed for 10 d postweaning (15.2 MJ DE/kg and 0.9 g available lysine/MJ DE) followed by the second diet (14.9 MJ DE/kg and 0.89 g available lysine/MJ DE), which was fed for 2 wk, and then the final diet (14.3 MJ DE/kg and 0.79 g available lysine/MJ DE), which was fed for the remaining 3 wk.

Experimental Design

All animal BW were collected without prior restriction of feed or water. Before farrowing, gilts (parity 0) and parity 2 to 5 sows (Landrace × Large White F1 generation) were randomly allocated to treatment groups (with or without supplemental milk provided to progeny preweaning). Dams were randomly allocated to farrowing pens in a randomized block design within 5 all-in-all-out farrowing sheds with around 40 dams/treatment group for both the winter and summer replicates.

At processing (within 36 h of birth), litter sizes were standardized to approximately 10 piglets/litter by fostering within dam parity treatment groups and individual piglets were identified at birth with numbered ear tags. Piglets were injected with 1.6 mL of procaine penicillin (Ilium Propen; Troy Laboratories Pty Ltd., Australia) and 105 mg Fe/piglet (Ferriade; BOMAC Laboratories Ltd., New Zealand) and tails were docked.

Litters in the milk treatment groups were provided with reconstituted full-cream bovine milk powder (150 g powder/L of warm water) with a final composition of 24.3 to 25.3% protein, 26.1 to 28.3% fat, and 39.6 to 41% lactose (a randomly collected sample was tested from the milk supplied during the winter and the summer replicates). Piglets had ad libitum access to milk (fresh milk was added twice daily in winter and thrice daily in summer) from 3 d of age until weaning via a bowl-type drinker. The volume of milk provided and the residue were measured daily to calculate the disappearance rate. “Pig days” was used as a time measure to account for piglets removed during the measurement period (due to death or wasting).

Individual piglet BW (±0.02 kg) were recorded at birth, 21 d of age, at weaning (approximately 26 d of age), and at 10 wk of age. Piglet mortalities and medications were recorded preweaning and postweaning for both seasonal
replicates, but medication data from the winter replicate were omitted due to incomplete records. When diarrhea occurred preweaning, the entire litter was medicated. Wasting piglets were removed from the trial (off trial pigs) if they were deemed to have a low chance of survival without intense intervention. Dams were removed from the trial if the majority of their piglets were observed to be losing BW.

After weaning, the piglets were allocated randomly to weaner pens (20 pigs/pen) by gender and treatment group (gilt or sow progeny and with or without milk supplementation). The growth performance [BW gain of individual pigs, ADFI, mortalities, and pen G:F of 5 pens/gender per treatment group (total of 40 pens/seasonal replicate)] was determined from weaning to 10 wk of age. Pen G:F was calculated with pig BW gain using pig days (see above) compared with the difference between feed provided and feed remaining for each diet stage. Feed was weighed (±0.1 kg) into the feeder as required to provide ad libitum access.

**Statistical Analysis**

The pig growth and survival data were analyzed by either generalized linear mixed models (GLMM; binomial distribution) or REML for fitting linear models using GenStat version 14 (VSN Int., 2011). Table 1 specifies the model type and final model description of fixed and random effects for each growth or survival measure. All 2-way interactions were investigated and nonsignificant interactions were excluded from each model. Non-significant main effects were retained in each model.

**RESULTS**

**The Effect of Supplemental Milk on Piglet Preweaning Performance**

Weaning (4 wk; 7.30 and 7.54 kg) and 21 d BW (6.03 and 6.57 kg) were significantly less for gilt progeny than sow progeny, respectively (Table 2; P < 0.05). Supplementation of gilt progeny with milk led to heavier piglets at weaning (7.60 kg) when compared with nonsupplemented gilt (7.02 kg) and sow (7.24 kg) progeny (P < 0.05; Table 2). Milk supplementation had no effect on within-litter weight variation at 21 d of age or at weaning compared with nonsupplemented litters within the same dam parity groups (P > 0.7).

Preweaning piglet mortality rates were influenced by dam parity but not improved by the provision of supplemental milk (started at 3 d of age). Piglet mortality rates (before 3 d of age) were significantly greater in sow litters compared with gilt litters (7.8 and 5.5%, respectively; P = 0.017). Piglet mortality rates were not significantly different (P > 0.9) between dam parity groups in the remainder of the preweaning period (both 6%) and the provision of supplemental milk did not reduce preweaning piglet mortality.

Preweaning litter medication rates were influenced by dam parity with significantly more gilt-reared litters medicated for preweaning diarrhea (54%) than sow-reared litters (18%) in the summer replicate (P < 0.001; data incomplete for the winter replicate). There was no significant difference, however, in the number of medicated litters between supplemented and nonsupplemented litters (P > 0.8). Individual piglet medications for conditions other than diarrhea (usually lameness) were minimal and evenly spread across treatment groups. Dam removals for litter ill thrift were limited to gilts with 6 removed in the winter replicate and 4 removed in the summer replicate.

**The Effect of Season on Supplemental Milk Disappearance and Piglet Performance**

Sow progeny (24.75 kg) were significantly heavier than gilt progeny (23.64 kg) at 10 wk of age (P < 0.05; Table 2), and this remained significant even after a separate analysis adjusted for weaning weight differences. The greater weaning weight of supplemented gilt progeny when compared with nonsupplemented sow progeny did not lead to greater 10-wk weights (Table 2). However, within dam parity groups, supplemented piglets were still significantly heavier than nonsupplemented piglets at 10 wk of age in summer (Table 2), which was due to a heavier weaning weight as there was no change in ADG and a separate analysis adjusting for weaning weight eliminated this effect.

Postweaning piglet survival was influenced by dam parity but was not improved with preweaning milk supplementation. Postweaning mortality rates were significantly greater for gilt progeny relative to sow progeny (2.6 and 1%, respectively; P < 0.05). Gilt progeny also had greater postweaning medication rates (6.2 and 2.2%, respectively; P < 0.01) and a greater removal rate “off trial” (6 and 2.8%, respectively; P < 0.05) than sow progeny. Milk supplementation during the preweaning period did not affect the postweaning mortality rate or medication rate (P > 0.10).

Dam parity significantly influenced postweaning ADFI (P < 0.05) but had no effect on G:F (P = 0.16). Gilt progeny had a significantly decreased ADFI (P < 0.001) postweaning compared with sow progeny (542 and 630 g/d, respectively). Preweaning milk supplementation had no significant effect on postweaning ADFI (P = 0.22). Preweaning milk supplementation and dam parity did not affect postweaning G:F (P > 0.05).
on piglet growth were influenced by season. The average piglet weaning weights were greater in the winter than the summer replicate ($P < 0.05$) and the greater weaning weight of sow progeny compared with gilt progeny was only evident in winter (Table 2). The disappearance of supplemental milk and the associated increase in weaning weight was greater ($P < 0.05$) in the summer than the winter replicate (Figure 1). There was a similar weaning weight benefit between gilt and sow progeny from providing supplemental milk in both summer (800 g) and in winter (350 g). Supplemented gilt progeny only weighed more than nonsupplemented sow progeny during summer ($P < 0.05$; Table 2), when supplementary milk intakes were greater ($P < 0.05$; Figure 1). During winter, milk supplementation did not lead to a significant increase ($P > 0.05$) in the BW of progeny within dam parity groups but still bridged most of the growth gap between different dam parity groups (Table 2). In contrast, during summer, supplemented piglets were heavier than nonsupplemented piglets at weaning within...
Table 2. The effect of dam parity and season on pre- and postweaning performance of piglets with (supplemented; SM) or without (control) access to supplemental milk$^1 \pm$ SEM.

<table>
<thead>
<tr>
<th>Item</th>
<th>Winter</th>
<th>Winter</th>
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<th>Summer</th>
<th>Summer</th>
<th>Summer</th>
<th>Summer</th>
<th>Parity</th>
<th>Season</th>
<th>Supplementation</th>
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<tr>
<td></td>
<td>Gilt progeny</td>
<td>Sow progeny</td>
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<td>Supplemented</td>
<td>Control</td>
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<td>Control</td>
<td>Supplemented</td>
<td>Control</td>
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<tr>
<td>Number of litters</td>
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<td>37</td>
<td>43</td>
<td>39</td>
<td>38</td>
<td>38</td>
<td>44</td>
<td>48</td>
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<td>Litter size after fostering (2 d)$^2$</td>
<td>10.1</td>
<td>10.2</td>
<td>10.6</td>
<td>11.0</td>
<td>10.2</td>
<td>10.2</td>
<td>11.2</td>
<td>11.0</td>
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<td>Weaning age, d ± SD</td>
<td>26 ± 2</td>
<td>26 ± 2</td>
<td>26 ± 2</td>
<td>26 ± 2</td>
<td>27 ± 3</td>
<td>27 ± 2</td>
<td>24 ± 1</td>
<td>24 ± 2</td>
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<tr>
<td>Average pig BW, kg</td>
<td>1.43 ± 0.018</td>
<td>1.64 ± 0.017</td>
<td>1.45 ± 0.018</td>
<td>1.66 ± 0.017</td>
<td>1.60 ± 0.017</td>
<td>1.62 ± 0.017</td>
<td>1.60 ± 0.017</td>
<td>1.63 ± 0.017</td>
<td>&lt;0.001</td>
<td>&gt;0.1</td>
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<tr>
<td>Birth weight</td>
<td>6.22 ± 0.12</td>
<td>5.95 ± 0.12</td>
<td>7.01 ± 0.13</td>
<td>6.71 ± 0.13</td>
<td>6.30 ± 0.12</td>
<td>5.69 ± 0.11</td>
<td>6.62 ± 0.12</td>
<td>5.97 ± 0.11</td>
<td>&lt;0.05</td>
<td>&lt;0.05</td>
<td>&lt;0.05</td>
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<tr>
<td>Weaning (4 wk)</td>
<td>7.50 ± 0.14</td>
<td>7.14 ± 0.14</td>
<td>8.01 ± 0.15</td>
<td>7.64 ± 0.14</td>
<td>7.70 ± 0.15</td>
<td>6.90 ± 0.13</td>
<td>7.66 ± 0.14</td>
<td>6.88 ± 0.12</td>
<td>&lt;0.05</td>
<td>&lt;0.05</td>
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<tr>
<td>10 wk</td>
<td>22.67 ± 0.53</td>
<td>22.69 ± 0.53</td>
<td>24.58 ± 0.55</td>
<td>24.60 ± 0.56</td>
<td>25.38 ± 0.56</td>
<td>23.93 ± 0.54</td>
<td>25.64 ± 0.56</td>
<td>24.17 ± 0.53</td>
<td>&lt;0.05</td>
<td>&lt;0.05</td>
<td>&gt;0.05</td>
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<tr>
<td>Mortality &lt; 3 d, %</td>
<td>5.7 ± 0.9</td>
<td>8.2 ± 1.3</td>
<td>5.24 ± 0.9</td>
<td>7.6 ± 1.6</td>
<td>6.0 ± 1.0</td>
<td>7.4 ± 1.2</td>
<td>9.1 ± 1.3</td>
<td>5.5 ± 0.9</td>
<td>&lt;0.05</td>
<td>&lt;0.05</td>
<td>&gt;0.05</td>
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<tr>
<td>Mortality &gt; 3 d, %</td>
<td>3.3 ± 0.6</td>
<td>4.1 ± 0.7</td>
<td>5.1 ± 0.8</td>
<td>3.0 ± 0.6</td>
<td>6.0 ± 1.0</td>
<td>7.4 ± 1.2</td>
<td>9.1 ± 1.3</td>
<td>5.5 ± 0.9</td>
<td>&lt;0.05</td>
<td>&lt;0.05</td>
<td>&gt;0.05</td>
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<tr>
<td>Litters medicated, %</td>
<td>–</td>
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<td>–</td>
<td>52.9 ± 7.4</td>
<td>54.8 ± 7.1</td>
<td>17.7 ± 4.9</td>
<td>18.9 ± 4.9</td>
<td>&lt;0.001</td>
<td>–</td>
<td>&gt;0.5</td>
</tr>
<tr>
<td>Piglets taken “off trial” &gt; 3 d$^3$, %</td>
<td>0.8 ± 0.5</td>
<td>1.0 ± 0.6</td>
<td>0.7 ± 0.4</td>
<td>0.8 ± 0.4</td>
<td>0.4 ± 0.2</td>
<td>0.12 ± 0.1</td>
<td>2.1 ± 1.1</td>
<td>0.7 ± 0.4</td>
<td>&gt;0.05</td>
<td>&lt;0.05</td>
<td>&gt;0.05</td>
</tr>
<tr>
<td>Average daily piglet intake, mL/piglet d$^{-1}$$^4$</td>
<td>67 ± 17</td>
<td>–</td>
<td>124 ± 15</td>
<td>–</td>
<td>196 ± 16</td>
<td>–</td>
<td>253 ± 16</td>
<td>–</td>
<td>&lt;0.05</td>
<td>&lt;0.05</td>
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<tr>
<td>Postweaning</td>
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<tr>
<td>ADFI, g/d$^4$</td>
<td>547.8 ± 11.0</td>
<td>535.9 ± 13.0</td>
<td>630.8 ± 13.2</td>
<td>618.9 ± 11.1</td>
<td>640.2 ± 10.1</td>
<td>628.3 ± 11.0</td>
<td>653.7 ± 10.7</td>
<td>641.8 ± 10.3</td>
<td>&lt;0.001</td>
<td>&lt;0.001</td>
<td>&gt;0.1</td>
</tr>
<tr>
<td>ADG, g/d$^4$</td>
<td>385.9 ± 8.6</td>
<td>381.8 ± 9.7</td>
<td>431.4 ± 10.0</td>
<td>427.4 ± 8.8</td>
<td>422.9 ± 8.0</td>
<td>419 ± 8.6</td>
<td>425.5 ± 8.3</td>
<td>421.5 ± 8.17</td>
<td>&lt;0.001</td>
<td>&lt;0.001</td>
<td>&gt;0.05</td>
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<tr>
<td>G:F$^4$</td>
<td>0.704 ± 0.010</td>
<td>0.708 ± 0.011</td>
<td>0.689 ± 0.011</td>
<td>0.693 ± 0.010</td>
<td>0.670 ± 0.010</td>
<td>0.675 ± 0.011</td>
<td>0.655 ± 0.011</td>
<td>0.660 ± 0.010</td>
<td>&gt;0.1</td>
<td>&lt;0.001</td>
<td>&gt;0.05</td>
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<tr>
<td>Mortality, %</td>
<td>2.01 ± 0.67</td>
<td>3.36 ± 1.15</td>
<td>0.79 ± 0.37</td>
<td>1.33 ± 0.49</td>
<td>2.03 ± 0.65</td>
<td>3.40 ± 1.10</td>
<td>0.80 ± 0.38</td>
<td>1.35 ± 0.52</td>
<td>&lt;0.05</td>
<td>&lt;0.5</td>
<td>&gt;0.1</td>
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<tr>
<td>Medicated piglets, %</td>
<td>11.10 ± 2.00</td>
<td>12.42 ± 2.52</td>
<td>4.15 ± 1.47</td>
<td>4.70 ± 1.38</td>
<td>3.02 ± 0.88</td>
<td>3.42 ± 0.99</td>
<td>1.07 ± 0.48</td>
<td>1.21 ± 0.47</td>
<td>&lt;0.01</td>
<td>&lt;0.001</td>
<td>&gt;0.1</td>
</tr>
<tr>
<td>Piglets taken “off trial,” %</td>
<td>15.98 ± 2.55</td>
<td>9.66 ± 2.34</td>
<td>3.34 ± 1.60</td>
<td>1.91 ± 0.87</td>
<td>3.85 ± 1.27</td>
<td>2.20 ± 0.77</td>
<td>4.58 ± 1.56</td>
<td>2.63 ± 0.91</td>
<td>&lt;0.05</td>
<td>&lt;0.05</td>
<td>&lt;0.05 (female)</td>
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<td>&gt;0.05</td>
<td>&gt;0.05</td>
<td>&gt;0.05 (male)</td>
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</table>

$^1$All values expressed in this table were generated from the model in which they were analyzed (see Table 1) and the SEM were predicted from these models.

$^2$Fostering was done within treatment groups.

$^3$Only one piglet was taken “off trial” before 3 d of age so this analysis was not done.

$^4$Adjusted for pig removal over the measurement period (“pig days”)
Milk supplementation for gilt progeny growth

Figure 1. Average daily supplemental milk disappearance for litters reared on gilts and sows in winter and summer replicates. Progeny reared on both gilts (parity 0) and sows (parity 2 to 5) had ad libitum access to milk (fresh milk was added twice daily in winter and thrice daily in summer) from 3 d of age until weaning (26 ± 5 d of age). Full-cream milk powder was reconstituted to a final composition of 24.3% protein, 28.3% fat, and 39.6% lactose. The volume of milk provided and the residue were measured daily to calculate the “disappearance” rate. “Pig days” was used as a time measure to account for piglets removed during the measurement period (due to death or wasting). Litter size was standardized within 36 h of birth to 10 to 11 piglets/litter.

and across both dam parity groups (P < 0.05) but the magnitude of the difference that was maintained to 10 wk of age was no longer significant (P = 0.07).

Supplemental milk disappearance was influenced by season and dam parity. Daily milk disappearance was significantly greater (P < 0.05) in summer than winter after 10 d of age (Figure 1; Table 2). Milk disappearance was significantly (P < 0.05) less among gilt litters compared with sow litters after 12 d of age, after adjusting for average piglet weight in a litter after fostering (Figure 1). This disappearance rate was adjusted (pig days) for preweaning piglet removals as litter size was expected to influence litter supplemental milk disappearance rate.

Preweaning mortality was influenced by season with a supplemental milk interaction. Greater preweaning mortalities were observed in summer compared with winter for all treatment groups (8 and 4%, respectively; P < 0.001), with supplemented sow progeny suffering greater mortality rates than any other treatment group (P = 0.015). Nonsupplemented piglets during summer had the lowest rate of being taken “off trial” (0.3%) compared with supplemented piglets in general and nonsupplemented piglets in winter (all 1%; P < 0.001; Table 2).

Postweaning mortality, medication, and “off trial” rates were influenced by dam parity and season with no effect of supplemental milk. Postweaning, a greater percentage of gilt progeny (12.5%) were taken off trial in winter than sow progeny (3%; P < 0.05), but there was no difference in off trial rates between gilt and sow progeny in summer (P > 0.05). There was no seasonal effect on mortality rates (P > 0.9) but piglets of both dam parity had greater medication rates during winter (7.2%) compared with summer (1.9%; P < 0.001).

The ADFI and ADG both had significant interactions (P < 0.001) between dam parity and season whereas G:F was only influenced by season. Gilt progeny had a significantly less (P < 0.001) ADFI and ADG than sow progeny but only in winter (Table 2). The G:F was better in winter (0.699) than summer (0.665; P < 0.001) for gilt and sow progeny alike.

The Effect of Birth Weight on Piglet Growth and Survival

Piglet birth weight was a great determinant of subsequent BW and survival (both P < 0.001) and so had to be corrected for in most analyses (Table 1). Gilt progeny were lighter at birth than sow progeny (1.43 and 1.64 kg, respectively; P < 0.001). However, within-litter birth weight variation was greater for sow litters compared with gilt litters (0.29 and 0.24 kg, respectively; P < 0.001). There was no seasonal influence on piglet birth weight (P = 0.28) or within-litter birth weight variation (P = 0.09).

DISCUSSION

Progeny from gilts were lighter at birth and through 10 wk of age when compared with sow progeny. Gilt progeny also were more likely to need treatment preweaning and postweaning and more likely to die postweaning. These results confirmed previous findings by others (Larriestra et al., 2002; Pineiro et al., 2005; Holyoake, 2006).

Providing supplemental milk to gilt progeny during the preweaning period proved to be an effective strategy for improving their weaning weight as had also been found by Spencer et al. (2003). This increased weaning weight of supplemented progeny had a sustained effect through to 10 wk of age, similar to results from Dunshea et al. (1999) although it was no longer a significant difference. There was no further effect of supplemental milk once the piglets had been weaned, which is evident by the lack of effect on postweaning ADG and ADFI as has been reported previously by Wolter et al. (2002).

The increased weaning weight of supplemented gilt progeny did not, however, improve their lifetime survivability (medication and mortality rates) compared with sow progeny. Preweaning, however, it is unlikely that supplemental milk could actually increase piglet survival because the majority of deaths occur in the first 3 d of life when voluntary supplemental milk intake is minimal. If piglets are orally drenched with the supplemental milk, however, improved survival can be found in low birth weight piglets early in lactation (Moody et al., 1966). Weaning weight had no apparent influence on postweaning survival (medication and mortality rate) as had been
indicated by Larriestra et al. (2002). Further investigation is required into the greater disease susceptibility of gilt progeny compared with sow progeny, particularly in relation to pathogen carriage or immunity or both.

The litter weaning weight benefits resulting from provision of supplemental milk rely on the quantity of milk voluntarily consumed. Supplemental milk disappearance was greater when the lactating dam was less able to keep up with litter milk demand, such as during summer and from around 12 d of age onwards as has been reported by Pluske et al. (1995). Providing supplemental milk therefore increased progeny weaning weights to a greater degree in summer when milk disappearance rates were greatest. During winter, when supplemental milk disappearance rates were least, BW of supplemented gilt progeny reached or exceeded that of nonsupplemented sow progeny, which was similar to results found by Spencer et al. (2003).

The disappearance of supplemental milk appeared to be a litter effect more than an individual piglet effect. There was a lot of variation in disappearance rates between litters ranging from 6 mL/d to 4.5 L/d in winter and 19 mL/d to 7.5 L/d in summer as has been previously reported by Azain et al. (1996). The variation in milk consumption between individual piglets within a litter, however, is likely to have been low because supplementation did not affect the within-litter standard deviation of piglet BW. This litter effect on supplemental milk disappearance is likely to result from the strength of the sow–piglet bond (King et al., 1998).

It appeared that litters nursed by sows had greater supplemental milk disappearance than litters nursed by gilts. This occurred in both seasons but with the same improvement in BW gain for both gilt and sow litters (summer = 800 g; winter = 350 g). Because there is a positive correlation between piglet growth and piglet milk intake (Glencross et al., 1997), this difference is most likely just due to wastage. The reasons for an apparent dam parity influence on supplemental milk wastage are unknown.

Season influenced the effect that dam parity had on weaning weight. All litters had lighter weaning weights in summer than winter but the severity of litter growth rate restriction depended on dam parity. The reduction in weaning weight of sow progeny in summer was even greater than that of gilt progeny, which is similar to findings by Spencer et al. (2003) who reported a growth rate reduction of 30 and 11% for sow and gilt litters, respectively, in summer. The lack of difference between gilt and sow litter weaning weights during summer was also found by Boyce et al. (1997). This most likely reflects the effect of heat stress on dam milk production (Black et al., 1993) and particularly that sows are more affected by heat stress than gilts and that this is reflected in their milk production (or piglet weaning weights). More investigation needs to be conducted into different cooling systems for older parity sows, in line with those that have been performed for gilts (Bull et al., 1997).

There was a seasonal effect on postweaning medication and ill thrift rates with both being greater for gilt progeny than sow progeny but only during winter. The weaner sheds during the summer replicate appeared to be more conducive to piglet performance, with faster growth and decreased rates of clinical disease. The ability of the immune system of the pig to respond to pathogenic challenge can be altered by cold weather in 2 ways: first, directly through cold stress reducing the responsiveness of immune cells (especially macrophages; Cheng et al., 1990), and secondly, indirectly due to poorer ventilation in pig sheds in winter (attempting to conserve heat) causing greater pathogen challenge (Kelley, 1980). The poorer growth performance of gilt progeny compared with sow progeny during the winter replicate can probably be attributed to an increased incidence of disease and the consequential reduction in ADFI and growth rate. The same effect has been previously observed between gilt and sow progeny (Pineiro et al., 2005).

Birth weight was the most important risk factor identified in this experiment to explain the relatively poor performance of gilt progeny compared with sow progeny. This is in agreement with Gardner et al. (1989). In this experiment, gilt progeny were found to be 200 g lighter at birth compared with the progeny of older parity sows, in agreement with others (Omtvedt et al., 1965; Hendrix et al., 1978). Birth weight therefore needed to be factored into all analyses. Dam parity, however, still had a significant influence on piglet growth and survival (mortality and medication rates) preweaning and postweaning independent of birth weight, which still requires further investigation.

The first hypothesis was therefore rejected as although full cream milk did increase weaning weight of supplemented progeny, it did not improve postweaning BW gain or survival. The second hypothesis was partially rejected as although piglets in the summer replicate did consume significantly more milk and therefore had greater weaning weights, there were no other effects of supplemental milk available to be magnified. Postweaning growth and survival of gilt progeny appears to be linked to clinical disease so efforts to improve gilt progeny postweaning growth and survival need to be aimed at improving health and immunity, not just weaning weight.

LITERATURE CITED

Milk supplementation for gilt progeny growth


