The Effect of Broadcasting Sow Suckling Grunts in the Lactation Shed on Piglet Growth

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ABSTRACT : An on-farm trial was conducted in temperature-controlled lactation rooms at a commercial pig farm to investigate the efficacy of broadcasting sow suckling grunts from day 4 of lactation, on increasing piglet growth to weaning. In the Broadcast treatment, sows and litters were exposed to a 3-min broadcast from loud-speakers every 42 min. The Control treatment was not exposed to the broadcast. All sows and litters had similar husbandry and piglets were provided with creep feed on the floor twice daily. In each of the three replicates in time, the Broadcast and Control treatments were allocated to different lactation rooms at random and there were 12 sows and litters per treatment per replicate. A total of four identical lactation rooms were available for the trial, each containing 28 conventional sow and litter crates with piglet heater in the creep area. A non-trial room separated the two treatment rooms in each replicate to minimise the chance that the broadcast grunt stimulation was audible to the Control treatment litters. Five "normal and average-looking" piglets from the trial litters were weighed twice, 7 d apart. The cohort of five piglets was identified by ear-tags and formed the experimental unit for the statistical analysis. The average (±SD) age of piglets at initial weighing was 7.7 (±2.22) days. For each litter, mean piglet live weight at day 14 of lactation was estimated by linear regression of the two weights recorded seven days apart, when on average, the Broadcast treatment had been exposed to the stimulation for 10 days. Piglets in the Broadcast treatment were heavier ($p<0.01$) at day 14 of lactation compared to Control treatment (4.24 and 3.92 kg, respectively) and tended to have a greater average daily weight gain over the 7-d period (245 and 228 g/day, respectively; $p<0.08$). The results suggest piglet growth was improved by about 8% in response to the regular, timed broadcast of sow suckling grunts in the lactation shed. The independent contributions of milk and creep feed to the improved growth remain to be determined. *(Asian-Aust. J. Anim. Sci. 2001. Vol 14, No. 7 : 1019-1023)*

Key Words : Pigs, Growth, Lactation, Suckling, Auditory Stimulus

INTRODUCTION

The average interval between suckling bouts reported for sows is about 45 to 50 min (Ellendorf et al., 1982; Cronin and Smith, 1992; Arey and Sancha, 1996). Factors such as litter size and stage of lactation appear to affect the interval. For example, Auldist et al. (1998) reported the average inter-suckling bout interval progressively shortened from about 51 min for sows with litters of six piglets to 43 min for sows with litters of 14 piglets from day 10 to 14 of lactation, while there was no effect from day 24 to 28 of lactation. Although average inter-suckling bout interval ranges from about 45 to 50 min, milk supply in the sow's mammary glands however, is replenished by about 35 min after the previous milk let-down (Špinka et al., 1997). This suggests that sow suckling behaviour is partly responsible for limiting piglet growth.

If sows were induced to suckle at intervals of 42 instead of 48 min between bouts, the number of suckling bouts per 24 h would increase from 30 to 34. In theory, the extra four suckling bouts per day represent an increase in milk production of about 10%, suggesting even a short reduction in suckling bout interval may be significant to piglet growth. Two experiments have tested this principle. In the first, Špinka et al. (1997) separated sows from their piglets by shutting the piglets in the creep area for periods of either 70 or 35 min. This procedure resulted in average inter-suckling intervals of 71 and 43 min, respectively, with a concomitant increase in milk production of 21%. In the second experiment, Auldist et al. (2000) used a manual cross-suckling procedure and reported the inter-suckling bout interval was reduced from 46 min in the control treatment to 39 min in the cross-suckled treatment. Average daily gain by the litter was increased by almost 25% by cross-suckling.

Sound signals between sows and piglets are very important in triggering the start of suckling bouts (Fraser, 1980; Algers and Jensen, 1985; Algers, 1993). Newberry and Wood-Gush (1985) reported for sows kept in a group outdoors in "naturalistic" conditions in the 2.3 ha Edinburgh Pig Park, that over 50% of observed suckling bouts occurred within 5 min of the end of a suckling bout by another sow. In most cases, the two respective sows were located within 10 m of one another. In another study of group housed lactating sows, in a Family Pen System which had reduced space compared to the former study,

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Wechsler and Brodmann (1996) reported a temporal overlap in suckling bouts in over 80% of all observed bouts. While there do not appear to be any studies of synchronisation of suckling behaviour by sows housed in farrowing crates indoors, anecdotal observations suggest it is quite common for nearby sows to suckle at the same time or at least soon after another sow(s). Such a "cascade" of suckling behaviour through the shed is probably influenced by the suckling noises of other sows and litters. How this process starts is not known.

While the initiation of suckling bouts sooner than expected through the broadcast of tape-recorded sow suckling grunts was reported by Stone et al. (1974), no details of the duration of the grunt signal, the interval between successive signals or piglet growth data were provided. In contrast, Widowski et al. (1984) found no evidence for the inducement of suckling behaviour with the broadcast of tape-recorded sow grunts at 45-min intervals. Another method for inducing suckling behaviour is classical conditioning. In a report, Cronin (1998) conditioned nine sows and litters to associate the rapid-suckling grunt phase of suckling behaviour, which immediately precedes milk let down, with visual and audio signals. After a period of training, the signals were operated by an automatic timing device at an interval 10% shorter than the previously recorded "average" inter-suckling bout interval for the conditioned sow and litter. Over the next 3 d, suckling bouts were recorded to occur within 5 min of the conditioned signal in a high proportion of cases, resulting in a reduction in the average inter-suckling bout interval of about 10%. While the classical conditioning technique is not suited to practical application on pig farms, the broadcast of tape-recorded sow grunts is a more practical option. The aims of this on-farm trial were to measure the efficacy of broadcasting tape-recorded sow suckling grunts in the lactation shed to increase piglet growth.

MATERIALS AND METHODS

Animals and housing

The trial was conducted over a period of 4 mo (February to May) at a commercial pig farm near Ballarat (37°52'S, 143°78'E), which is situated 113 km west of Melbourne, the capital city of Victoria. The farm is an accredited member of the Australian Pork Industry Quality Assurance Program (APIQ) and is certified under the Safe Quality Food 2000 QA system. Due to constraints related to biosecurity, experimenters could only access the farm on Thursdays, meaning that there was limited control over the age of piglets when they were weighed. Four replicates in time, each involving 24 mixed parity sows allocated to one of 2 treatments, were involved. However, in replicate 2, severe piglet scours occurred and the data for the entire replicate were discarded.

The Large White × Landrace sows at the farm farrowed in conventional farrowing crates and within 3 d litter size was standardised in most litters to either nine or 10 piglets by cross-fostering. At 4 d post-farrowing, sows were transferred with their litters to standard sow and litter crates in the lactation shed, where the present trial was conducted and where the sows and litters remained until weaned at about day 19 of lactation. During lactation, sows were fed twice daily a mash ration containing 24% CP, 1.1% available lysine and a digestible energy level of 14.3 MJ/kg. Water was available *ad libitum* via a drinker inside the sow feed trough. Stockpeople checked sows and litters a minimum of three times daily.

The lactation shed was an insulated building containing six adjacent rooms of identical design and with automated blinds to regulate ventilation and maintain room temperature at about 23°C. Lactation rooms each contained 28 crates which were cleaned by power washing at weaning and re-populated with sows and their 4-d old litters over a 2-d period. Four of the 6 rooms were used in the trial, with the two end rooms excluded to minimise potential between-room temperature variations. In each of the four time replicates, two of the 4 rooms were selected for use in the trial. The allocation of treatments to rooms was at random with the limitation that the two trial rooms per replicate were separated by at least one other (non-trial) room to avoid the possibility of the Broadcast (sound) treatment affecting the Control treatment.

The sow and litter crates in the lactation rooms were arranged in four rows of 7 crates. Each crate was fitted with a thermostatically-controlled piglet heater set to 30°C and fresh creep feed (23% CP, 1.25% available lysine, 7.6% oil, 15 MJ/kg digestible energy) was offered to piglets twice daily on the floor of the creep area. Crates at the ends of rows were not used in the trial. Twelve sows and litters were selected per room for involvement in the trial from either 3 or 4 of the different rows, with similar numbers used per row where possible.

Broadcast treatment

Two loud-speakers were installed in the Broadcast treatment room to deliver the auditory stimulus to sows and litters. All Broadcast treatment subjects were located within 8 m of a loud-speaker. The loudness of the broadcast was measured using a Radio Shack Digital Sound Level Meter. Noise levels at 2 and 4 m from a loud-speaker were about 80 and 74 dB, respectively. The day-time background noise level in the shed without the broadcast in operation was about 66 dB. As a comparison, the sound level generated by two squealing piglets fighting over a teat at the sow's udder, measured at a distance of 4 m, registered about 85 dB. The sow suckling grunt sequence broadcast in the trial was a compilation of the rapid suckling grunts (Fraser, 1980;

Cronin and Smith, 1992) of seven different Large White×Landrace sows recorded at the Institute's piggery, edited together so that sow suckling grunts could be broadcast sequentially. The sow grunts were recorded using a microphone held within 15 cm of each sow's snout. The microphone was connected to a laptop computer, which saved the grunt noises as an electronic audio (WAV) file. The seven sows made somewhat different grunt noises, providing contrast between sow grunts within the 3-min sequence. Background noise including piglet noises were not filtered out. The compiled sow grunt WAV file was executed in a 486 PC fitted with an ISA sound card and operating Microsoft Windows 95. The grunt signal from the PC was amplified using a Pioneer A-103 Stereo Amplifier and pigs were exposed to the sounds via loud-speakers (Studio Acoustics SA850N, 100 Watt Universal, Indoor/Outdoor Speakers) located in the (Broadcast treatment) lactation room and remote from the PC and amplifier. The 3-min sow suckling grunt sequence, which was broadcast every 42 min from the time sows and litters entered the room (day 4 of lactation) to weaning, was initiated in the PC by the Grunter© audio file timer program.

Control treatment

The Control treatment was located in a different lactation room than the Broadcast treatment. The sow grunt broadcast was not provided. The husbandry of the sows and piglets in the Control treatment was otherwise considered identical to that of the Broadcast treatment, as the same staff and husbandry procedures were used in both sheds.

Measurements and animals

Due to the constraint of only having access to the farm on a set day each week, treatment sows and litters were selected while in their first week of occupancy of the lactation rooms. Litters included in the trial contained a minimum of seven piglets and were deemed by visual appraisal to be "normal and average-looking", i.e. the piglets looked healthy and sound; litters containing thin or scouring piglets were not used. Sow body condition was subjectively scored according to the scale described by Lightfoot (1979) and republished in 1994 (Anonymous). The number of piglets in the litter was recorded and a cohort of five piglets per litter were selected randomly, without reference to sex, weighed as a group and ear tagged. Colonial FS60 stainless steel platform scales (Colonial Weighing Australia Pty Ltd, Sunshine) with upgrade IQ plus® 350 Digital Weight Indicator, accurate to 20 g, were used to weigh the five selected piglets per litter. The ear tags used were small, swivel tags (Leader Products Pty Ltd, Craigieburn). Measures of piglet live weight and sow body condition score were repeated 7 d later.

Data collation and statistical analysis

Because the Broadcast treatment involved an auditory stimulus which may have affected all sows and litters located within the same room, it was necessary to use different rooms for the Broadcast compared to the Control treatment. In each of the four time replicates, one lactation room was randomly allocated to the Broadcast treatment and another to the Control treatment. This introduced some unavoidable experimental design constraints such as a 1 or 2 wk difference between the ages of the piglets in the two treatment rooms within time replicates and thus some confounding of time and location with treatment. Mean day 14 weight of piglets in each litter was estimated from the regression of live weight and age on the two occasions when weighing occurred, using MS Excel 97 and assuming a linear relationship between piglet live weight and age in days (R.H. King, Pers. Comm.). Statistical analysis to determine differences due to the broadcast treatment was therefore conducted on the estimated mean piglet weight at day 14 of lactation and the average daily weight gain by piglets between the two weighing occasions, using a one-way analysis of variance blocked on time replicate in Genstat 5 for Windows, Release 3.2 (Lawes Agricultural Trust, Rothamsted Experimental Station). The experimental unit was the sow and litter. One Broadcast treatment piglet in replicate 1 died due to a gastro-intestinal illness during the trial. The data for the litter were treated as a missing value in the statistical analysis.

RESULTS AND DISCUSSION

The months when the different replicates of the trial were conducted and the mean (±SD) ages of litters in the trial when first weighed, are shown in Table 1. The pooled mean age of piglets at the first weighing was 7.7 d (±2.22; range 5 to 12). Sow parity number (2.9±1.68 and 2.7±1.87, respectively, for the Broadcast and Control treatments), litter size on the occasion of the second weighing (9.75±0.56 and 9.75±0.65, respectively) and sow body condition scores were not different between the treatments. Mean (±SD) scores for sows at the first and second assessment, respectively, were 3.1 (±0.21) and 3.0 (±0.18), where 0 indicated an emancipated state and 5 a grossly fat state (Lightfoot, 1979).

Piglets in the Broadcast compared to Control treatment were about 8% heavier at 14 days of age (mean±SD were 4.24 (±0.40) and 3.92 (±0.55) kg, respectively; $F_{1,67}$=7.86, $p<0.01$, $LSD_{(p=0.05)}$=0.226) and tended ($p<0.08$) to have a higher daily rate of gain between the two occasions when weights were measured (mean±SD were 245 (±35.4) and 228 (±43.2) g/day, respectively; $F_{1,67}$=3.30, $LSD_{(p=0.05)}$=18.3). Table 1 presents the mean (plus SD) growth

Table 1. The month of the year when the different replicates were conducted and the mean (plus SD) age at first weighing, estimated piglet weights on day 7 and 14 of lactation and the average daily gain per piglet between the two weighing occasions

Treatment	Broadcast					Control			
	Time	Age at 1st weighing	Est. weight on day 7	Est. weight on day 14	Ave daily gain over 7 days	Age at 1st weighing	Est. weight on day 7	Est. weight on day 14	Ave daily gain over 7 days
Replicate	mo	d	kg	kg	g	d	kg	kg	g
1	February	5.5	2.68	4.29	229	5.5	2.50	4.02	218
		(0.52)	(0.33)	(0.45)	(20.8)	(0.52)	(0.37)	(0.66)	(44.8)
3	April	10.4	2.45	4.18	247	8.8	2.11	3.74	232
		(0.79)	(0.30)	(0.47)	(48.6)	(0.58)	(0.37)	(0.56)	(47.3)
4	May	9.8	2.44	4.25	259	5.8	2.36	4.01	235
		(0.83)	(0.20)	(0.29)	(25.4)	(0.62)	(0.22)	(0.40)	(39.1)

parameter values for the 12 litters per treatment in each replicate of the trial.

Piglet weights were not recorded by the farm management at birth or during lactation. Thus, because of the nature of this on-farm trial, it was not known whether mean piglet weights for the two treatments were similar on day 4 of lactation, and if not, whether any difference contributed to treatment effects. Similarly, we did not choose the cohort of five piglets per litter based on sex, so that while it was possible that an imbalance in sex ratio may have occurred between treatments, this was unlikely. Nevertheless, if we assume initial piglet weights were similar, implying the Broadcast treatment was effective in increasing piglet growth, then there are at least two alternative explanations of how this could occur. First, as suggested by Stone et al. (1974), milk production was increased in response to the broadcast stimulus, and second, that piglets consumed more creep feed in the Broadcast treatment. In the event that the former outcome occurred, pork producers may need to re-evaluate their feeding strategy, particularly for younger sows as suggested by Boyd et al. (2000). Nevertheless, further research in a controlled experiment is required to verify the contribution of either or both causes to the improved piglet growth.

A number of factors may limit the responsiveness of sows and/or piglets to broadcast suckling grunts, such as the use of "foreign" sows to provide the recorded grunt sounds and background noise levels. Although Blackshaw et al. (1996) have provided evidence that sows have individual suckling vocalisations, previous research by Lewis and Hurnik (1986) using a T-maze test, found that naïve piglets responded to the broadcast of sow suckling grunts by moving preferentially towards, compared to away from, the broadcast of grunts from a "foreign" sow. Further, Wechsler and Brodmann (1996) in a trial with a single group of four lactating sows found no statistical difference in the occurrence of suckling behaviour following the broadcast signal, when the recorded grunt signal was from one of the group members compared to a "foreign" sow (21/26 versus 14/26 tests, respectively; $p>0.05$). In contrast, imitation of sow suckling grunts provided by a human in the trial by Wechsler and Brodmann (1996) failed to induce suckling behaviour in 26 tests. Thus, broadcast of recorded sow suckling grunts should be an effective method of inducing suckling behaviour as sows and piglets appear to respond to signals from "foreign" sows. Clearly, the interval between successive signals is likely to be important. Signals that occur too frequently may result in habituation and a reduced response. Further research is required to determine the optimum interval between broadcast signals as well as the duration of the signal at each broadcast. Another factor that may influence the efficacy of the broadcast is background noise level. For example, continuous loud noise from exhaust fans (85 dB) compared to low background noise levels (59 dB) was reported by Algers and Jensen (1985) to disrupt the pattern of suckling behaviour and reduce the ingestion of milk by piglets. In the present trial, day-time background noise was measured at about 66 dB, while the broadcast grunt signal was measured at 80 dB at 2 m from the loud-speaker. Thus, on farms with high background noise levels, e.g. greater than 80 dB, the efficacy of the broadcast technique may be reduced.

The cost of equipment to broadcast the sow grunt sequence in this on-farm trial amounted to $AUD230 for the amplifier, of which only one unit was required for the farm, and weather-proof loud speakers, of which one pair per lactation room was used, at a cost of $AUD150 per pair. The cost of speaker wire to connect the loud-speakers to the amplifier was minimal and the PC used was an "old" 486 computer fitted with an ISA sound card ($AUD41). The Grunter© audio file timer program to initiate the broadcast of the sow grunt sequence at the set time interval was composed by Mr. J.G. Cronin for this trial without charge.

In conclusion, the results of the trial indicate that piglets were about 8% heavier at 14 days of age in the Broadcast compared to the control treatment and suggest the potential

for a practical way of increasing piglet growth on commercial farms. These results support the findings of Stone et al. (1974) who reported that milk production by sows was increased in response to the broadcast of tape-recorded sow suckling grunts. However, the relative contributions of sow's milk and creep feed to the improved growth of piglets in the present trial are not known. Further studies are required to determine how piglet growth was improved and to investigate the efficacy of the broadcast stimulus on "treated" sows at their subsequent lactation. Finally, in theory at least, if the stimulation is effective during the suckling period, it should also be effective in the post-weaning period, inducing weaned piglets to feed more readily thereby reducing the check to growth at weaning.

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