A water dispenser modified to promote water use by piglets in the first days after birth

P. A. PHILLIPS[1] and D. FRASER[2]

[1]*Engineering and Statistical Research Centre; and* [2]*Animal Research Centre, Research Branch, Agriculture Canada, Ottawa, ON., Canada K1A 0C6.* *Contribution nos. I-995*[1] *and no. 1531*[2], *received 8 March 1988, accepted 3 January 1989.*

Phillips, P. A. and D. Fraser. 1989. **A water dispenser modified to promote water use by piglets in the first days after birth.** Can. Agric. Eng. **31**: 175–177. Piglet water dispensers were modified by adding a plastic hose and a small aquarium air pump so that the water surface bubbled constantly. One bubbling dispenser and one unmodified "control" dispenser were provided to each of 32 litters of piglets. Water use and piglet weight gains were monitored for the first 2 d after birth. On average, the piglets used about twice as much water from the bubbling dispenser (115 g/d per piglet) as from the control (51 g/d per piglet). Piglets with low body weight gains during the 48 h (likely reflecting inferior milk supply by the sow) drank considerable amounts of water beginning on the first day after birth, mostly from the bubbling dispenser. Litters with large weight gains drank relatively little on day 1, but showed greater use of the bubbling dispenser by day 2. The bubbling dispenser promotes early water use by piglets and may help to prevent dehydration in cases where the sow's initial milk supply is inadequate.

INTRODUCTION

Drinking water is commonly provided to unweaned piglets by means of automatically-filled bowls, low-mounted nipple drinkers, or small, portable troughs filled by an inverted reservoir. The various devices appear to be well accepted by relatively mature piglets approaching weaning age, but very young piglets use open bowls or troughs much more readily than nipple drinkers (Bekaert and Daelemans 1970; Ehlert et al. 1981). However, little emphasis has been given to encouraging drinking by very young piglets, perhaps because of the common assumption that nursing piglets have no need for additional fluid.

This assumption is probably true for healthy piglets receiving adequate milk from the sow. However, extra fluid may be needed by piglets suffering from diarrhea or receiving inadequate milk either because of their own weakness or through poor milk production by the sow (see Ehlert et al. 1981; Svendsen and Andréasson 1981). Inadequate milk production is a common problem of sows, especially during the first 1 – 3 d after farrowing (Martin and McDowell 1975; Bäckström et al. 1984). Litters of affected sows may lose weight or gain very little during the first days after birth (Thompson and Fraser 1988), and significant mortality may result (Bäckström et al. 1984).

In a previous study, we noted that piglets drank considerable amounts of water during first days after birth, especially in litters that had unusually low weight gains during this period (Fraser et al. 1988). This suggested that piglets receiving little milk may be able to compensate for any resulting dehydration by consuming water as early as the first day after farrowing. If this is true, then provision of supplementary water to new-born litters might reduce piglet deaths in litters whose dam has a low initial milk yield. However, unless piglets explore their farrowing pen thoroughly, they may fail to discover a piglet water dispenser in the first day or two after farrowing. We wanted, therefore, to produce a water dispenser that would attract very young piglets. After some initial attempts, we carried out the following experiment to test whether an inexpensive aquarium air pump could cause sufficient sound and movement of the water surface to attract piglets during the first 2 d after birth.

MATERIALS AND METHODS

A commercially available piglet water dispenser (Creep Waterer No. 79, Nelson Products Co., Sioux Rapids, IA) was modified to permit air to bubble continuously in the plastic drinking bowl (Fig. 1). The dispenser consisted of a 4-L reservoir mounted over a rectangular plastic drinking bowl containing approximately 190 mL of water about 30 mm deep. Air flowing at about 1700 cc/min from an aquarium air pump (model E800, R. C. Hagen Corp., Mansfield, MA) was directed into the bowl via a 3 mm i.d. plastic tube. The tube outlet was positioned to discharge the air into the center of the bowl about 20 mm below the water surface. The cost of the water dispenser was $18 (Can.) and the pump and tubing cost $10.

The experiment involved 32 litters from the specific-pathogen-free Yorkshire and Landrace herd at the Animal Research Centre, Ottawa. Sows were housed in farrowing crates in pens measuring 2.1 × 1.6 m. A 0.9-m-long 800-W radiant heater (Kalglo Electronics Co., Bethlehem, PA) was suspended 0.9 m above the floor at one side of the farrowing crate (shared with the adjacent crate) to create a warm, unenclosed creep area for the piglets. Sows received water from a nipple drinker 0.6 m above the floor, well out of reach of the piglets. The pens had a solid concrete floor in the central area and sections of metal slats at the front and rear of the pen; these ensured that any urine or water spilled from the sow's drinker would drain rapidly to a waste channel below and not be accessible to the piglets. Rubber mats (1.0 × 0.5 m) were available for the piglets under the creep heater.

The litters ranged from 5-16 piglets born alive. In six litters, it was possible to adjust litter size to 9-12 piglets by fostering between litters of similar age. When put on the test, the litters averaged 9.8 piglets, with a range of 5-13.

Feeding of the sows and care of the piglets followed normal farm routines with ear-notching for individual identification and clipping of the needle teeth on the first morning after birth. Piglets had no access to supplementary solid feed during the test period. Ambient temperature in the farrowing rooms averaged 26°C with daily ranges of 24-28°C.

Each experimental litter was provided with two piglet water dispensers: one "bubbling" dispenser and one unmodified "control" dispenser. The dispensers were located at either end of the heated creep area, one near the front of the pen and one near the rear. To balance any possible effect of position, the bubbling dispenser was in the front position for half the litters and in the rear position for the other half.

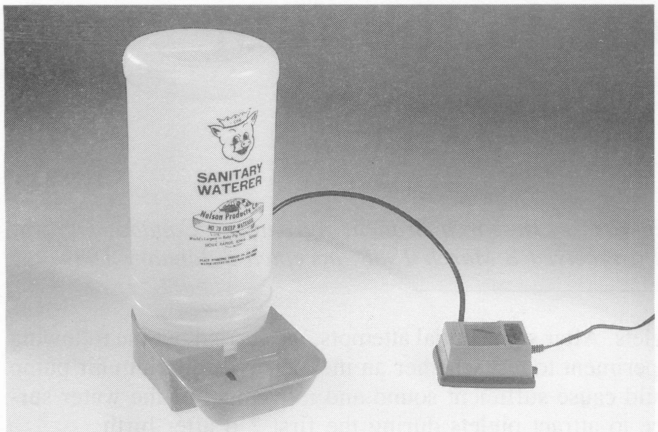

Fig. 1. Commercial piglet water dispenser with the water bowl modified to bubble air continuously from an aquarium pump.

The test period lasted 48 h beginning at 07:00-09:00 h on the first morning after the litter was born. At that time each piglet was weighed to the nearest 5 g, and the two water dispensers were filled with tap water, weighed, and installed in their assigned positions. At the same time on the next two mornings, the piglets were again weighed, and the dispensers were weighed, cleaned, refilled, weighed, and replaced.

Daily weight loss from each water dispenser was used as an estimate of water use after correcting for a 60-g evaporation from the control dispensers and 120 g from the bubbling dispensers, as determined by preliminary trials in an empty pen. Spillage of water from the dispensers could not be measured readily. Spillage was expected to account for about 20% of water loss based on earlier experiences (Fraser et al. 1988), but the data were not adjusted for spillage in this study.

For statistical analysis, daily water use from each dispenser was divided by the number of piglets in the litter (ignoring any litter-mates that died in the 24-h period) to give an estimated daily water use per piglet. These values were used to compare water use from the two dispensers, using Student's *t* test for paired comparisons (Snedecor and Cochran 1967, p. 92). Total daily water use, from both dispensers combined, was compared with the litters' mean daily weight gains and mean birth weights using Pearson correlations and multiple linear regression (Snedecor and Cochran, 1967, p. 381).

RESULTS

Over the 48-h test, the piglets used about twice as much water from the bubbling dispenser (115 $\pm$ 16 g/d per piglet, mean $\pm$ SEM) as from the control (51 $\pm$ 6 g/d per piglet; $P<0.001$ by Student's *t* test). Of the 32 litters, 24 used more water from the bubbling dispenser than from the control; those that failed to follow this trend were generally litters with low total water use. Use of each dispenser type was similar for the front and rear positions in the pen.

The results also showed that the total amount of water used by the pigs (from both dispensers combined) was related to the early weight gains of the litters. The average weight gains of the 32 litters varied widely, ranging from -23 to 230 g per piglet on the first day, and from -70 to 227 g per piglet on the second. On the first day, litters with low average weight gain tended to use more water than litters of high average weight gain (correlation: $r=-0.410$, $n=32$, $P<0.02$), and litters of high average birth weight also tended to use more water than litters of low average birth weight ($r=0.478$, $n=32$, $P<0.01$). The two factors (average birth weight and average weight gain on day 1) accounted for 42.2% of the variation in litter water use on day 1 in a multiple linear regression. On the second day average water use was higher (193 $\pm$ 23 g/d per piglet) than on the first day (136 $\pm$ 21), and the correlations of water use with weight gain ($r=-0.057$) and with birth weight ($r=0.228$) were smaller and not statistically significant.

In view of the relationship between water use and weight gain, the use of the two dispensers was analyzed separately for litters with low weight gains and litters with high weight gains (Fig. 2). On the first day, the 12 litters with the lowest 48-h weight gains (litters with average gains ranging from 15 to 98 g/d per piglet over the 48 h) used an average of 153 g/d per piglet from the bubbling dispenser compared to 54 g/d per piglet from the control dispenser. These litters followed a similar pattern on the second day. The 12 litters with the highest weight gains (125 to 197 g/d per piglet over the 48 h) used little water on day 1, with no difference between the two dispensers. By day 2, these litters were using appreciable amounts of water and significantly more from the bubbling dispenser. On day 1 the 12 low-gaining litters used significantly more water than the 12 high-gaining litters (207 $\pm$ 42 vs. 98 $\pm$ 22 g/d per piglet; $P<0.05$ by Student's *t* test), but not on day 2.

DISCUSSION

Use of water in this study, averaging 136 and 193 g/d per piglet on days 1 and 2, respectively, was considerably higher than the 31 and 52 g/d per piglet recorded on days 1 and 2 in our previous study (Fraser et al. 1988) and much higher than values reported in earlier research (Aumaitre 1964; Bekaert and Daelemans 1970; Svendsen and Andréasson 1981). The high water use seen here may be due to the ready availability of water from the two dispensers, and to the relatively warm ambient temperatures (26°C) and powerful creep heaters used in the present experiment. Warm conditions are desirable to prevent chilling and hypoglycemia among new-born piglets. However, such temperatures may also increase moisture loss from the animals and create a risk of dehydration among piglets receiving little milk from the sow (Fraser et al. 1988).

The sound and movement of the bubbling water probably promotes water use in two ways. First, when only one, unmodified, dispenser is present, some piglets never find the water source in the first 2 d after birth (Fraser and Phillips, unpubl. data). The bubbler obviously attracts piglets and probably ensures that most piglets learn to find the water and can therefore drink if the need arises. In this way, use of the bubbling dispenser may promote the survival of piglets not receiving enough milk to meet their fluid requirements. Second, piglets may return repeatedly to the bubbler simply through curiousity. This may explain the use of the bubbler by rapidly-gaining piglets on day 2 (Fig. 2). However, this use of water is probably of no significance for piglet health and survival.

The cost of using a bubbling dispenser design should be very low. Once piglets have discovered the water source, a process likely requiring a few hours but no more than 2 d, the bubbling dispenser could be exchanged for the less costly original. A ratio of one modified dispenser for 15 breeding sows would probably suffice. To avoid purchasing many individual small air pumps as were used in this study, compressed air could be generated from a larger single pump for distribution to small lines.

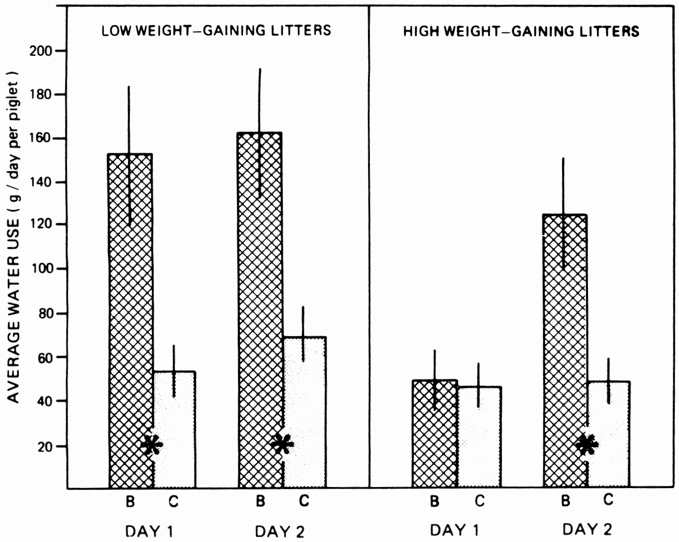

Fig. 2. Water use (mean ± SEM) from the bubbling (B) and control (C) water dispensers by piglets on day 1 and day 2 after farrowing. Results are shown for the 12 litters with the lowest weight gains and the 12 litters with the highest weight gains over the 48-h tests. Asterisks indicate significant differences between the dispenser types ($P<0.01$) as shown by a paired-comparison t test.

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