

# More Nipple Cup Drinkers to Fewer Pigs on the Day of Weaning Into a Conventional Nursery Results in Reduced Aggression and More Visits to the Drinker

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## Abstract

**Title:** More nipple cup drinkers to fewer pigs on the day of weaning into a conventional nursery results in reduced aggression and more visits to the drinker.

**Background:** Piglets develop their drinking behaviour over the first few days after weaning. Enhancing drinking opportunities for nursery pigs can affect growth, health, welfare, and overall profit. The objectives of this study were to determine how 1, 2, or 3 drinkers per pen affected drinker visit numbers, length of visits at the drinker, and aggressive interactions in the drinker vicinity on placement day for nursery pigs.

**Methods and Findings:** One-hundred and fifty crossbred gilts (21 ± 4 days of age at weaning) weighing 5.38 ± 2.65 kg were enrolled and assigned to pens by body weight with 25 pigs per pen. Six pens were used with 2 pens per treatment. Each pen contained 1, 2, or 3 stainless steel nipple cup drinkers. Four measures were collected: number and length of visits to the drinker which started each time the individual nursery pig's head was in the drinker and terminated when the pig's head moved out of the drinker for a period lasting 5 s or more and number and length of aggressive interactions in the drinker vicinity defined as any fight, bully, head-knock, or chase which occurred in a radius of 0.61 m or less from the edge of the drinker. Total number and length of visits to the nipple cup drinker were greatest for treatment 2 (2 drinkers per pen; 1,894 ± 289 visits and 21,413 ± 6,236 s) and lowest for treatment 1 (1 drinker per pen; 1,129 ± 88 visits and 13,277 ± 1,117 s). Pigs in treatment pens given 3 drinkers had the lowest total number (676 ± 269 interactions) and the shortest length (4,614 ± 1,912 s) of aggressive interactions in the vicinity of the drinkers.

**Conclusion:** Offering multiple drinkers provided more frequent and longer water access along with decreased aggression near the water source which could improve nursery pig welfare on placement day.

**Keywords:** Behaviour; Pig; Water; Welfare

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## Introduction

Farm animals form a social hierarchy or rank order that can affect accessibility to key resources within their pen including food and water [1,2]. In competitive situations, more highly ranked animals might have greater access to water and feed resources. Therefore, middle to lower ranking animals could have greater water accessibility if the producer considers water resource placement strategy and the ratio of animals to water resource

[3]. Anderson [4] considered water bowl number and location for dairy cattle drinking behaviour and concluded that 2 bowls were not better because they were too close. Deligeorgis et al. [5] investigated drinker location (front right, front left, back right, or back left) within farrowing stalls for piglet drinking behaviour over the first 2 days of lactation. Newborn piglets visited the drinker more during the day when compared to night and piglets preferred drinkers that were positioned front right

and back right (where the heat lamp was situated). However, little published information exists in the scientific literature that assesses the correct placement for key resources needed to facilitate unhindered nursery pig drinking [6-8]. Many factors should be considered when optimizing drinking availability [9]. One factor that is overlooked relates to the optimal pig-to-water source ratio. Current recommendations are 1:10 [10], but there is limited supporting science. Therefore, the study objectives were to determine how 1, 2, or 3 drinkers per pen affected (1) visit numbers and time spent at the drinker, and (2) aggressive interactions in the drinker vicinity on placement day for nursery pigs.

## Materials and Methods

### Housing and animals

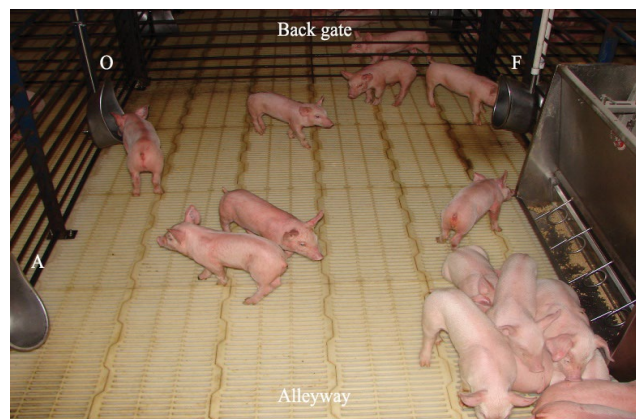
This project was approved by the Iowa State University Animal Care and Use Committee and conducted at a commercial nursery facility in central Missouri. A total of 150 PIC crossbred ( $21 \pm 4$  days of age) gilts weighing  $5.38 \pm 2.65$  kg were assigned to pens by body weight. Piglets all came from the same sow farm, where piglets during lactation had access to a stainless-steel nipple water drinker right up to weaning. Each nursery pen measured  $1.83 \times 3.05$  m, providing  $0.22$  m<sup>2</sup>/pig. Steel penning dividers were  $3.05$  m length  $\times$   $91$  cm height. Tenderfoot (Tandem Products, Inc, Minneapolis, MN, USA) flooring was utilized in all pens and pigs had ad-libitum access to a corn-soy diet formulated to meet or exceed NRC requirements [11]. Diets were provided through a 5-hole stainless steel feeder  $68.6$  cm height  $\times$   $91.4$  cm length. The building was curtain sided; the pigs received a natural light cycle. Farm personnel observed all pigs at 0730 and 1530. Environmental temperature was electronically recorded using data loggers (Hobo Pro series, Forestry Supplies, Inc, Jackson, MS, USA). Each data logger was suspended over each pen from the feed auger at a height of  $92$  cm from the ground. Ambient temperature ( $^{\circ}$ C) and relative humidity (%) were recorded at 10-min intervals for the duration of the trial. Environmental measurements averaged  $28.84^{\circ}$ C and  $48.97\%$  relative humidity (2100 [arrival] to 0900).

### Treatments

A total of 6 pens were used ( $n=2$  per treatment) with each pen housing 25 pigs. Each pen contained 1, 2, or 3 stainless steel nipple cup drinkers that measured  $28.58$  cm height  $\times$   $17.78$  cm width (Farmweld DRIK-O-MAT Wean-to-Finish Cup, Farmweld, Teutopolis, IL, USA). Treatment 1 was defined as 1 nipple cup drinker per pen (1:25) and the drinker was positioned on the same side as the feeder and close to the back gate (F). Treatment 2 was defined as 2 nipple drinkers per pen (1:12), and the drinkers were positioned close to the back gate (O) and F. Treatment 3 was defined as 3 drinkers per pen (1:8). Nipple cup drinker positions were F, O, and the third drinker was positioned across from the feeder next to the alleyway gate (Figure 1).

### Behavioural measures

Behaviour was recorded over 12 hours using a DVR (RECO-204, Darim Vision Corp, Pleasanton, CA, USA) at 1 frame/s. One 12 V black and white close circuit television camera (Model WV-CP484,



**Figure 1** Placement of nipple cup drinkers within the nursery pen. Treatment 1 was defined as 1 nipple cup drinker per pen (1:25) and the drinker was positioned on the same side as the feeder and close to the back gate (F). Treatment 2 was defined as 2 nipple drinkers per pen (1:12), and the drinkers were positioned close to the back gate (O) and F. Treatment 3 was defined as 3 drinkers per pen (1:8). Nipple cup drinker positions were F, O, and the third drinker was positioned across from the feeder next to the alleyway gate (A).

Panasonic Matsushita Co Ltd, Kadmoa, Japan) was positioned over each drinker and had the capacity of recording during dark hours using infrared. Behavioural video acquisition was collected in real time using the Observer software (The Observer, Version 5.0.25 Noldus Information Technology, Wageningen, The Netherlands). Four measures were collected at the individual pig level; number and length of visits to the nipple cup drinker and number and length of aggressive interactions in the vicinity of the nipple cup drinker. A visit started each time the individual nursery pig's head was in the drinker and terminated when the pig's head moved out of the drinker for a period lasting 5 s or more [12]. Aggression in the vicinity of the drinker was defined as any fight, bully, head-knock, or chase [13] which occurred in a radius of  $0.61$  m or less from the edge of the drinker. Data was collected by an experienced observer and sorted by pen, treatment, and hour. Averages were calculated per treatment for each hour in the 12-hour observation period and data will be presented descriptively.

## Results

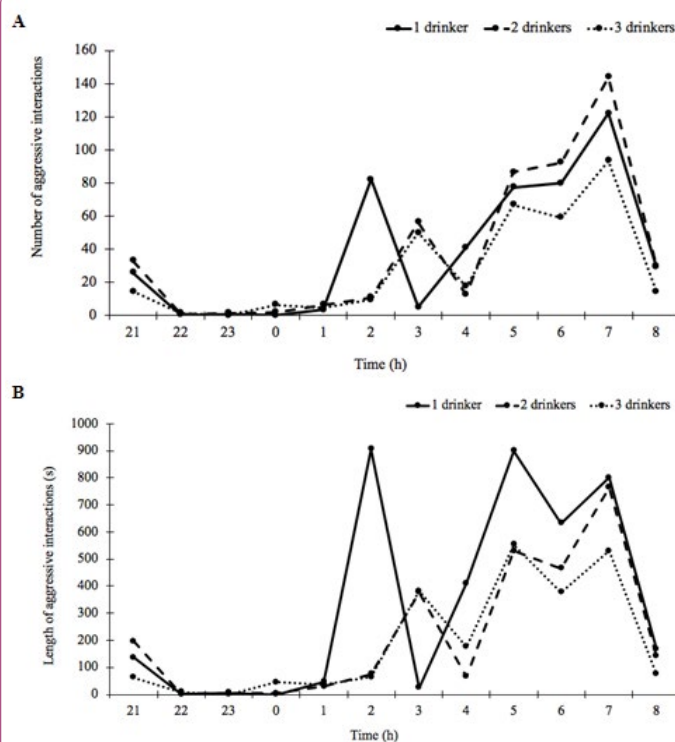
Total number and length of visits to the nipple cup drinker were greatest for treatment 2 (2 drinkers per pen;  $1,894 \pm 289$  visits and  $21,413 \pm 6,236$  s), followed by treatment 3 (3 drinkers per pen;  $1,796 \pm 47$  visits and  $20,065 \pm 3,277$  s). Pigs in pens with 1 nipple cup drinker had the lowest number of total visits ( $1,129 \pm 88$ ) and the shortest visit length ( $13,277 \pm 1,117$  s). Hourly averages per treatment for number and length of visits to the nipple cup drinkers are depicted in Figure 2A and 2B. In the first hour of placement (2100 to 2200), pigs in treatment pens with 2 or 3 nipple cup drinkers had more visits to the drinkers and pigs in treatment pens with 2 nipple cup drinkers spent longer visiting the drinkers. For the next 3 hours (2200 to 0100), regardless of

treatment, there were very few visits with little time spent at the drinkers. Between 0100 and 0900 for all treatments, the number of visits to the drinker increased, however, there were more visits with longer durations for pigs in treatment pens with 2 drinkers, followed by 3 drinkers per pen and then 1 drinker per pen, respectively.

The total number of aggressive interactions near the drinker was greatest for treatment 2 pens (2 drinkers per pen;  $954 \pm 379$  interactions), followed by treatment 1 pens (1 drinker per pen;  $936 \pm 151$  interactions). Pigs in pens with 1 drinker spent more time involved in aggressive interactions near the water source ( $8,060 \pm 375$  s), followed by pens with 2 drinkers ( $5,307 \pm 2,374$  s). Pigs in treatment pens given 3 drinkers had the lowest total number ( $676 \pm 269$  interactions) and the shortest length ( $4,614 \pm 1,912$  s) of aggressive interactions in the vicinity of the drinkers. Hourly averages per treatment for number and length of aggressive interactions near the nipple cup drinkers are depicted in **Figure 3A and 3B**. In the first hour of placement (2100 to 2200), pigs in treatment pens with 1 or 2 drinkers had more and longer aggressive interactions around the drinker vicinity. For the next 3 hours (2200 to 0100), regardless of treatment, there were very few aggressive interactions in the drinker vicinity. From 0200 to 0300, pigs in treatment pens with 1 drinker per pen had more and longer aggressive interactions than pigs with 2 and 3 drinkers per pen. Pigs in pens with 3 drinkers had fewer and shorter aggressive interactions in the drinker vicinity from 0400 to 0900, respectively.

## Discussion

Nursery pigs experience numerous stressors during weaning,

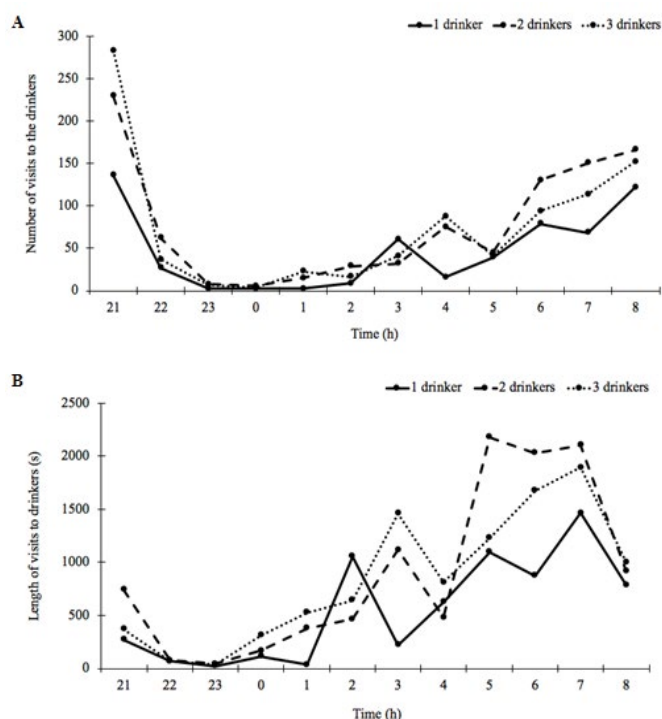


**Figure 3** A) Average number; and B) length of aggressive interactions (seconds) near the nipple cup drinker per hour in the 12-hour observation period based on treatment.

for example, abrupt sow separation, close human contact, transportation, a different physical environment, dietary change, and social mixing [14-16]. Nursery pig drinking research is important because it effects growth, weight, health, welfare, and overall profit. Drinking behaviour develops the first few days after pigs are mixed and placed in pens with their new cohorts when the net absorption of fluid and electrolytes is temporarily decreased [14,17].

Typical drinker types used for nursery pigs include: bowl, nipple, or push-levers [9]. From the present study, pigs offered multiple drinkers per pen visited more often and spent more time drinking whilst experiencing shorter aggressive interactions. These findings agree with Turner et al. [12] who reported more drinker-related aggression when a 1:20 drinker to pig ratio was allocated to the pen when compared to pens of pigs where the drinker to pig ratio was 1:10. Interestingly, pig's offered 2 drinkers had the greatest number of aggressive interactions near the nipple cup drinker. However, there were only 2 pens per treatment and there was a large variation in aggressive interaction number between the pens. Hence, this variation could be due to differences in social hierarchies in these pens [2]. Additionally, not all of the drinkers might have been considered equal due to their location, i.e. air flow, leakage, dunging areas, human interference, or inter-pen pig interaction [9]. Further work could evaluate whether pigs show a location preference for drinker placement within the pen.

When parcelling out hours for the number and length of visits and aggressive interactions, there was an initial peak in the first hour after placement followed by a minimum plateau until 0200. A secondary peak occurred from 0200 to 0400 with an even greater



**Figure 2** A) Average number; and B) length of visits (seconds) to the nipple cup drinker per hour in the 12-hour observation period based on treatment.

peak from 0500 to 0700. These behavioural peaks could be due to circadian drinking rhythms [18], temperature [19], establishing social order [2], and feeding and drinking relationships [20]. Although feeding related activities were not collected it has been well documented that pigs are prandial feeders-drinkers [21,22].

## Conclusion

In conclusion, aggressive behaviour on placement day was reduced in pens of pigs where multiple drinkers per pen were utilized and provided a lower drinker to pig ratio. This work adds

to the limited information in the published literature to help producers with water resource placement within a nursery pen.

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