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Effects of Providing a Liquid Sensory Attractant to Suckling Pigs in Lactation and After Weaning on Post-Weaning Pig Performance[1,2]

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Summary

A total of 28 litters (241 × 600, DNA) corresponding with 355 nursery pigs (241 × 600, DNA; initially 13.0 lb) were used in 42-d trial (17-d pre-weaning and 24-d post-weaning). This trial was conducted to determine the effect of providing a sensory attractant liquid (BlueLite Pro2Lyte; TechMix Global; Stewart, MN) to suckling pigs on the underline of sows after farrowing and in late lactation, and after weaning on post-weaning feed intake and growth. Treatments were arranged in a 2 × 2 × 2 factorial with main effects of: 1) pre-weaning treatment (without or with attractant); 2) post-weaning treatment (without or with attractant); and 3) body weight category (light or heavy). Overall, pre-weaning liquid sensory attractant did not have a significant effect on piglet weaning weight or post-weaning growth performance. Likewise, post-weaning application had limited effects on the growth performance of pigs after weaning. Liquid sensory attractant pre-weaning increased the percentage of lightweight pigs that lost weight from weaning to d 3 by approximately 16 percentage points, whereas liquid sensory attractant pre-weaning decreased the percentage of heavyweight pigs that lost weight after weaning by approximately 17 percentage points (pre-weaning treatment and BW category interaction, $P = 0.003$). This interaction diminished by d 7. Significance was also detected for the main effect of BW category. A greater percentage of heavyweight pigs lost weight on d 3 ($P = 0.007$) and d 7 ($P = 0.051$) compared to lightweight pigs. In summary, liquid sensory attractant that was applied pre- and post-weaning had limited effects on the growth performance of pigs; however, varying responses were observed for the percentage of pigs that lost weight immediately after weaning. Strategies to reduce the number of pigs that lose weight after weaning warrant further investigation.

[1] This project was supported by the National Pork Board and the Foundation for Food and Agriculture Research grant #18-147.

[2] Appreciation is expressed to TechMix Inc. (Stewart, MN) for their technical and financial support in this trial.

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Introduction

Sensory learning encourages pigs to use their senses to explore their environment. Using sensory learning in combination with feeding could ease the weaning transition by training pigs to respond to familiar taste, odor, or texture stimuli. It has been suggested that providing the same stimuli both before and after weaning may further increase feed acceptance after weaning as a result of association.[5] We hypothesized that applying a liquid sensory attractant at various stages of early life including on the underline of sows after farrowing and prior to weaning, and on the feed post-weaning would condition pigs to the taste and smell of the attractant. Applying liquid sensory attractant pre- and post-weaning was postulated to evoke the greatest response as it would provide pigs familiar olfactory stimuli, consequently reducing feed neophobia post-weaning. Furthermore, it was hypothesized that administration of a liquid sensory attractant pre-weaning, but not post-weaning, would have the most detrimental effects leading to decreased feed intake and increased body weight loss after weaning. Therefore, the objective of this study was to determine the effects of a liquid sensory attractant pre- and post-weaning on the feed intake and growth of pigs after weaning.

Materials and Methods

The Kansas State University Institutional Animal Care and Use Committee approved the protocol used in this experiment.

A total of 28 litters (241 × 600, DNA) were used during one lactation period at the Kansas State University Swine Teaching and Research Center in Manhattan, KS. Sows were fed a common lactation diet throughout the experimental period. Within 24 h of farrowing, litters of pigs were weighed and allotted to 1 of 2 treatment groups in a completely randomized design based on farrowing date. Sow parity, average piglet BW, and average litter size were balanced across treatment groups. Treatments consisted of a control (without liquid sensory attractant) or a treatment with liquid sensory attractant, in which approximately 3 fluid ounces of liquid sensory attractant per day, divided into 2 applications (AM and PM), were sprayed on the underline of sows for 2 d beginning the morning after farrowing. Treatment application was later resumed for 2 d prior to weaning. In total, pigs received liquid sensory attractant for 4 d pre-weaning. Pigs were weaned at approximately 21 d of age.

At weaning, a total of 355 pigs (241 × 600, DNA; initially 13.0 lb) were weighed and evenly divided into light or heavy BW categories within pre-weaning treatment and allotted to nursery pens. Each pen was randomized to 1 of 4 treatments with 5 or 6 pigs per pen and 15 replications per combination of pre- and post-weaning treatment, with body weight category equally distributed across treatment groups. Treatments were arranged in a 2 × 2 × 2 factorial with main effects of pre-weaning treatment (without or with attractant); post-weaning treatment (without or with attractant); and BW category (light or heavy). Pens of pigs assigned to the liquid attractant treatment group were offered approximately 2 fluid ounces of liquid per day, divided into 3 applications (7:00 am, 12:00 pm, and 5:00 pm), sprayed on the feed in the feeder pan. Treatment application continued for 3-d post-weaning.

[5] Oostindjer, M., J. E. Bollhuis, H. van den Brand, and B. Kemp. 2009. Prenatal flavor exposure affects flavor recognition and stress-related behavior of piglets. Chem. Senses. 34:775-787. doi: 10.1093/chemse/bjp063.

BlueLite Pro2Lyte (TechMix Global; Stewart, MN) was used as the liquid sensory attractant for this experiment. BlueLite Pro2Lyte is a dry powdered electrolyte that when mixed with water creates an isotonic solution. This liquid solution may be used as an attractant to entice pigs to eat dry feed more quickly, while also providing additional nutrients needed to avoid starve-outs. Pigs were fed a common pelleted corn soybean-meal-based phase 1 and 2 diet throughout the duration of the 24-d trial. Phase 1 diets were provided from d 0 to 7, and phase 2 diets from d 7 to 24.

Each pen (4 × 4 ft) contained a 4-hole, dry self-feeder, and nipple waterer for *ad libitum* access to feed and water. Pigs were individually weighed on d 3 post-weaning to determine initial changes in body weight. Additionally, daily feeder weights were recorded for the first 7 d after weaning to determine initial feed intake and feed disappearance over time. Weekly weigh days resumed on d 7 of the trial, in which pigs were individually weighed and feed disappearance measured to determine ADG, ADFI, and G:F. The percentage of pigs within a pen that lost weight from d 0 to 3 and d 0 to 7 were also determined.

Data analysis

Pre-weaning data were analyzed as a randomized complete block design using the PROC GLIMMIX procedure of SAS v. 9.4 (SAS Institute, Inc., Cary, NC) with litter as the experimental unit. Treatment was considered a fixed effect and no blocking factor was used.

Post-weaning data were analyzed as a factorial with main effects of: 1) pre-weaning treatment (without or with liquid); 2) post-weaning treatment (without or with liquid); and 3) body weight category (light or heavy). Pen was considered the experimental unit and no random effect was used for the analysis. Least square means were applied to estimate the interactive and main effects of pre-weaning treatment, post-weaning treatment, and body weight category. A binomial model was used to determine the percentage of pigs within pen that lost weight from d 0 to 3 and d 0 to 7 post-weaning. Results were considered significant at $P \leq 0.05$.

Results and Discussion

At the start of the experiment, piglet 24-h birth weight was significantly heavier ($P = 0.026$) for litters assigned to the liquid sensory attractant treatment compared to litters assigned to the control group. This was a result of the randomized allotment process as sows farrowed. No differences were observed in total piglet gain pre-weaning. Therefore, litters that received liquid sensory attractant during lactation continued to have numerically heavier BW at weaning compared to the control group, although this response was not significant.

No 3-way interactions between pre- and post-weaning treatment and BW category were observed for growth performance after weaning. Likewise, no 2-way interactions between pre- and post-weaning treatment were observed (Table 1), with the exception of BW on d 0, which is a reflection of lighter starting weights (24-h birth) at the start of the experiment for pigs that did not receive liquid attractant before or after weaning. No evidence for treatment differences were observed for the 2-way interaction between post-weaning treatment and BW category; however, a 2-way interaction was observed for pre-weaning treatment and BW category. Application of a liquid sensory

attractant pre-weaning decreased overall ADG ($P = 0.005$; without = 0.51 lb/d; with = 0.48 lb/d) and ADFI ($P = 0.013$; without = 0.74 lb/d; with = 0.69 lb/d) after weaning in the lightweight pig population, whereas in the heavyweight pig population application of a liquid sensory attractant increased overall ADG (without = 0.57 lb/d; with = 0.62 lb/d) and ADFI (without = 0.57 lb/d; with = 0.62 lb/d). No differences in F/G were observed. For the main effects of pre- and post-weaning liquid sensory attractant, no differences were observed on post-weaning performance (Table 2).

Treatment differences were observed for the main effect of BW category. Overall, heavyweight pigs had increased ADG ($P < 0.001$) and ADFI ($P < 0.001$) compared to lightweight pigs. No differences in F/G were observed.

Daily intake after weaning showed a gradual increase in feed intake over time after pigs were weaned (Figure 1). Although not statistically significant, pigs that received liquid sensory attractant post-weaning generally had higher feed intake during the first 3 d after weaning (treatment application period).

For the percentage of pigs that lost weight after weaning, a 3-way interaction was observed on d 3 (Figure 2; $P = 0.016$). It was expected that providing a liquid sensory attractant pre-weaning, but not post-weaning, would lead to increased BW loss immediately after weaning; however, the response observed in the heavyweight pig population conflicted with this hypothesis. A greater percentage of heavyweight pigs that received liquid sensory attractant either not at all, only post-weaning, or both pre- and post-weaning lost weight compared to pigs that received liquid sensory attractant only pre-weaning. In contrast, a lesser percentage of lightweight pigs that received liquid sensory attractant either not at all, only post-weaning, or both pre- and post-weaning lost weight compared to pigs that received liquid sensory attractant only pre-weaning. This response was in agreement with our initial hypothesis. The interaction observed diminished by d 7, but does indicate a difference in how light and heavyweight pigs may respond to sensory intervention strategies. A similar response was observed for the 2-way interaction between BW category and pre-weaning treatment ($P = 0.003$; data not shown). Liquid sensory attractant applied pre-weaning increased the percentage of lightweight pigs that lost weight from weaning to d 3 by approximately 16 percentage points whereas liquid sensory attractant applied pre-weaning decreased the percentage of heavyweight pigs that lost weight after weaning by approximately 17 percentage points. This indicates that treatment interventions may impact light and heavyweight populations differently. No 2-way interactions were observed between pre- and post-weaning treatment, or between BW category and post-weaning treatment. Additionally, no differences were observed for the main effect of pre- and post-weaning treatment (Figures 3 and 4). Significance was detected for the main effect of BW category (Figure 5). A greater percentage of heavyweight pigs lost weight on d 3 ($P = 0.007$) and d 7 ($P = 0.051$) compared to lightweight pigs.

The lack of response observed herein may be attributed to the timing of application, frequency of application, or because the product was not concentrated enough to elicit a response. Additionally, it is unknown if a 4-d application period was sufficient to condition pigs to the attractant or if more time was needed. In summary, liquid sensory attractant applied pre- and post-weaning had limited effects on the growth performance of pigs; however, varying responses were observed for the percentage of pigs that lost

weight immediately after weaning. Strategies to reduce the number of pigs that lose weight after weaning warrant further investigation.

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Table 1. Interaction of pre- and post-weaning sensory attractant liquid application on the growth performance of nursery pigs[1,2]

Pre-wean liquid:		Without		With			$P =$[3]		
Item	Post-wean liquid:	Without	With	Without	With	SEM	Pre-wean	Post-wean	Interaction
Post-wean BW, lb									
d 0		12.7	13.0	13.2	13.1	0.07	< 0.001	0.141	0.005
d 3		12.6	13.0	13.0	13.1	0.17	0.122	0.126	0.327
d 7		13.7	13.9	13.9	14.0	0.20	0.419	0.493	0.861
d 14		16.8	17.0	17.2	17.2	0.22	0.189	0.549	0.678
d 24		26.0	26.0	26.5	26.5	0.37	0.213	0.992	0.930
d 0 to 7									
ADG, lb		0.14	0.13	0.11	0.13	0.144	0.493	0.998	0.489
ADFI, lb		0.35	0.36	0.33	0.34	0.021	0.349	0.479	0.930
F/G[4]		2.50	2.77	3.00	2.62	0.065	0.286	0.939	0.427
d 7 to 14									
ADG, lb		0.43	0.44	0.45	0.46	0.019	0.287	0.666	0.948
ADFI, lb		0.56	0.55	0.53	0.55	0.021	0.363	0.724	0.387
F/G[4]		1.30	1.25	1.18	1.20	0.034	0.076	0.772	0.678
d 14 to 24									
ADG, lb		0.92	0.90	0.93	0.92	0.022	0.448	0.538	0.787
ADFI, lb		1.28	1.25	1.28	1.31	0.027	0.330	0.948	0.275
F/G[4]		1.39	1.39	1.38	1.42	0.009	0.820	0.231	0.225
d 0 to 24									
ADG, lb		0.55	0.54	0.55	0.55	0.015	0.622	0.882	0.559
ADFI, lb		0.80	0.79	0.78	0.80	0.018	0.946	0.677	0.280
F/G[4]		1.45	1.46	1.42	1.45	0.010	0.422	0.389	0.686

[1]For the pre-weaning portion of the experiment, a total of 28 litters (241 × 600, DNA) were used during one lactation period. Treatments consisted of a negative control (without liquid) or a treatment with liquid, in which approximately 3 fluid ounces of liquid sensory attractant per day, divided into 2 applications (AM and PM), were sprayed on the underline of sows for 2 d beginning the morning after farrowing. Treatment application was later resumed for 2 d prior to weaning. In total, pigs received liquid sensory attractant for 4 d pre-weaning.

[2]For the post-weaning portion of the experiment, a total of 355 pigs (241 × 600, DNA) were used in a 24-d growth trial with 5 or 6 pigs per pen and 15 replicates per liquid attractant treatment. Treatments were arranged in a 2 × 2 × 2 factorial with main effects of pre-weaning treatment (without or with liquid); post-weaning treatment (without or with liquid); and BW category (light or heavy). Pens of pigs assigned to the liquid attractant treatment group were offered approximately 2 fluid ounces of liquid per day, divided into 3 applications (7:00 am, 12:00 pm, and 5:00 pm), sprayed on the feed. Treatment application continued for 3 d post-weaning.

[3]No 3-way interactions between pre- and post-weaning treatment and BW category were observed for growth performance after weaning.

[4]Feed-to-gain was calculated from G:F.

Table 2. Main effect of pre- and post-weaning sensory attractant liquid application, and body weight category on the growth performance of nursery pigs[1,2]

	Pre-wean liquid				Post-wean liquid				BW category			
Item	Without	With	SEM	*P* =	Without	With	SEM	*P* =	Light	Heavy	SEM	*P* =
Average pig BW, lb												
24-h birth	3.1	3.5	0.12	0.026								
Weaning	12.9	13.2	0.40	0.559								
Total gain	9.8	9.7	0.36	0.934								
Average litter size, n	15.4	13.8	0.75	0.151								
Post-wean BW, lb												
d 0	12.9	13.1	0.05	< 0.001	12.9	13.1	0.05	0.141	10.7	15.3	0.05	< 0.001
d 3	12.8	13.1	0.12	0.122	12.8	13.1	0.12	0.126	10.8	15.1	0.12	< 0.001
d 7	13.8	14.0	0.14	0.419	13.8	14.0	0.14	0.493	11.7	16.1	0.14	< 0.001
d 14	16.9	17.2	0.16	0.189	17.0	17.1	0.16	0.549	14.6	19.6	0.16	< 0.001
d 24	26.0	26.5	0.26	0.213	26.3	26.2	0.26	0.992	22.9	29.6	0.26	< 0.001
d 0 to 7												
ADG, lb	0.14	0.12	0.017	0.493	0.13	0.13	0.017	0.998	0.14	0.12	0.017	0.342
ADFI, lb	0.35	0.33	0.015	0.349	0.34	0.35	0.015	0.479	0.32	0.36	0.015	0.050
F/G[3]	2.50	2.75	0.046	0.286	2.62	2.69	0.046	0.939	2.29	3.00	0.046	0.119
d 7 to 14												
ADG, lb	0.43	0.45	0.013	0.287	0.44	0.45	0.013	0.666	0.39	0.50	0.013	< 0.001
ADFI, lb	0.56	0.54	0.015	0.363	0.55	0.55	0.015	0.724	0.50	0.60	0.015	< 0.001
F/G[3]	1.30	1.20	0.024	0.076	1.25	1.22	0.024	0.772	1.28	1.20	0.024	0.084
d 14 to 24												
ADG, lb	0.91	0.93	0.016	0.448	0.92	0.91	0.016	0.538	0.83	1.00	0.016	< 0.001
ADFI, lb	1.27	1.29	0.019	0.330	1.28	1.29	0.019	0.948	1.16	1.40	0.019	< 0.001
F/G[3]	1.40	1.39	0.006	0.820	1.39	1.42	0.006	0.231	1.40	1.40	0.006	0.789
d 0 to 24												
ADG, lb	0.54	0.55	0.010	0.622	0.55	0.55	0.010	0.882	0.50	0.60	0.010	< 0.001
ADFI, lb	0.79	0.79	0.013	0.946	0.79	0.79	0.013	0.677	0.72	0.86	0.013	< 0.001
F/G[3]	1.46	1.44	0.007	0.422	1.44	1.44	0.007	0.389	1.44	1.43	0.007	0.993

[1]For the pre-weaning portion of the experiment, a total of 28 litters (241 × 600, DNA) were used during one lactation period. Treatments consisted of a negative control (without liquid) or a treatment with liquid, in which approximately 3 fluid ounces of liquid sensory attractant per day, divided into 2 applications (AM and PM), were sprayed on the underline of sows for 2 d beginning the morning after farrowing. Treatment application was later resumed for 2 d prior to weaning. In total, pigs received liquid sensory attractant for 4 d pre-weaning.

[2]For the post-weaning portion of the experiment, a total of 355 pigs (241 × 600, DNA) were used in a 24-d growth trial with 5 or 6 pigs per pen and 15 replicates per liquid attractant treatment. Treatments were arranged in a 2 × 2 × 2 factorial with main effects of pre-weaning treatment (without or with liquid); post-weaning treatment (without or with liquid); and BW category (light or heavy). Pens of pigs assigned to the liquid attractant treatment group were offered approximately 2 fluid ounces of liquid per day, divided into 3 applications (7:00 am, 12:00 pm, and 5:00 pm), sprayed on the feed. Treatment application continued for 3-d post-weaning.

[3] Feed-to-gain was calculated from G/F.

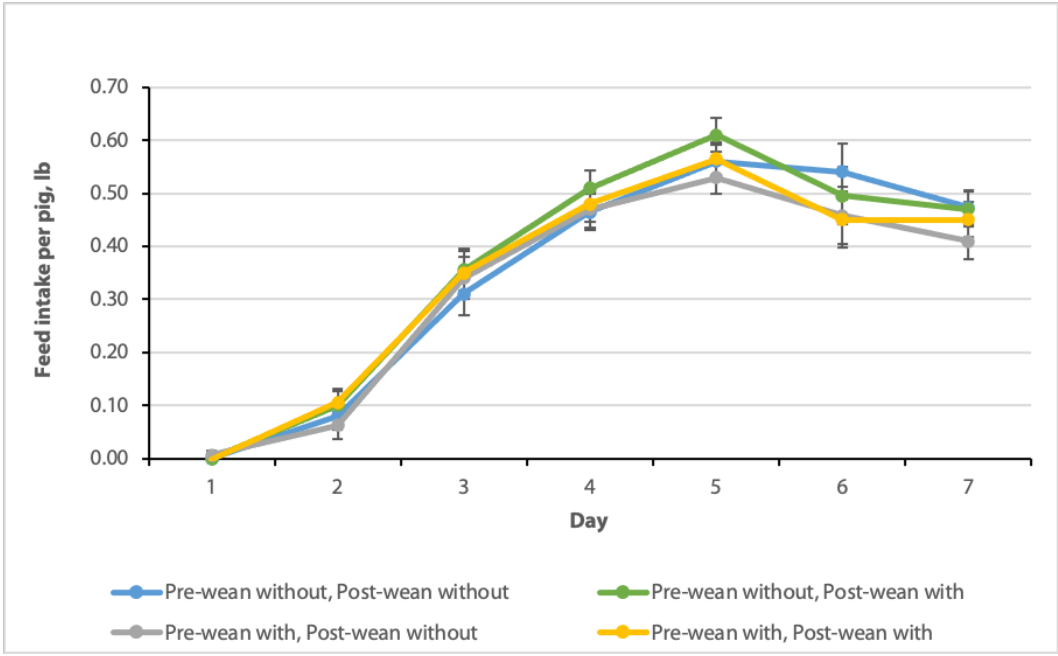

Figure 1. Interaction of pre- and post-weaning sensory attractant spray application on daily feed intake per pig from weaning to d 7.

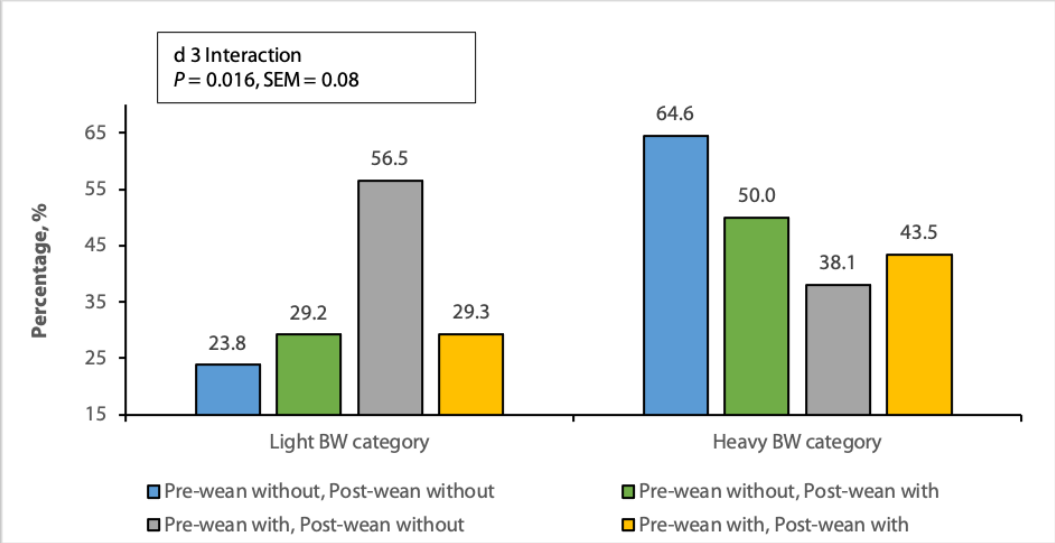

Figure 2. Interaction of pre- and post-weaning sensory attractant liquid application and BW category on the percentage of pigs that lost weight from weaning to d 3. No 3-way interaction from weaning to d 7 was observed.

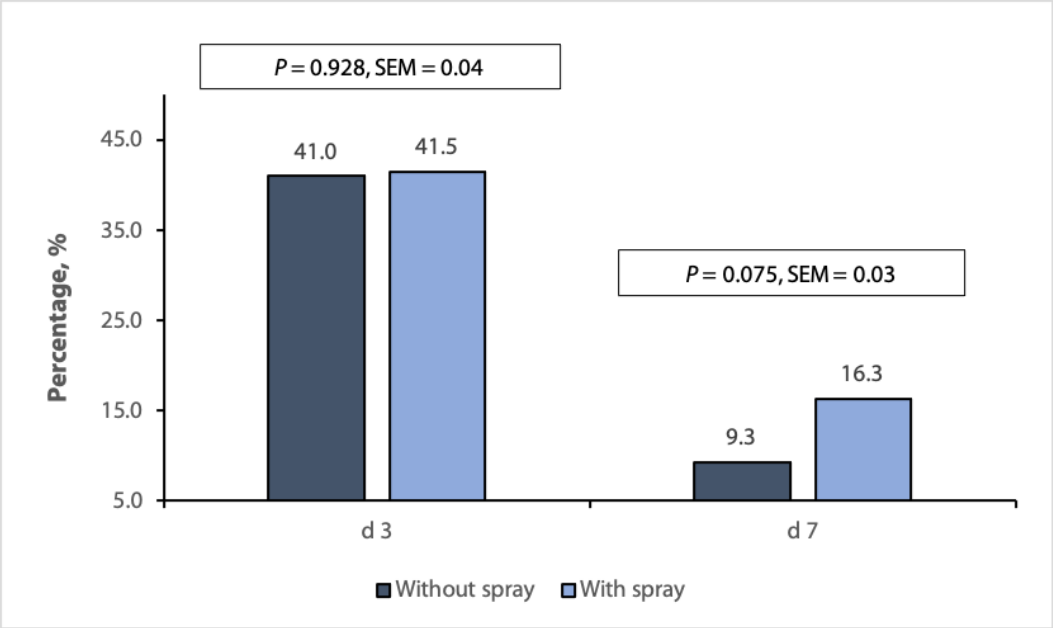

Figure 3. Main effect of pre-weaning sensory attractant liquid application on the percentage of pigs that lost weight from weaning to d 3 or from weaning to d 7.

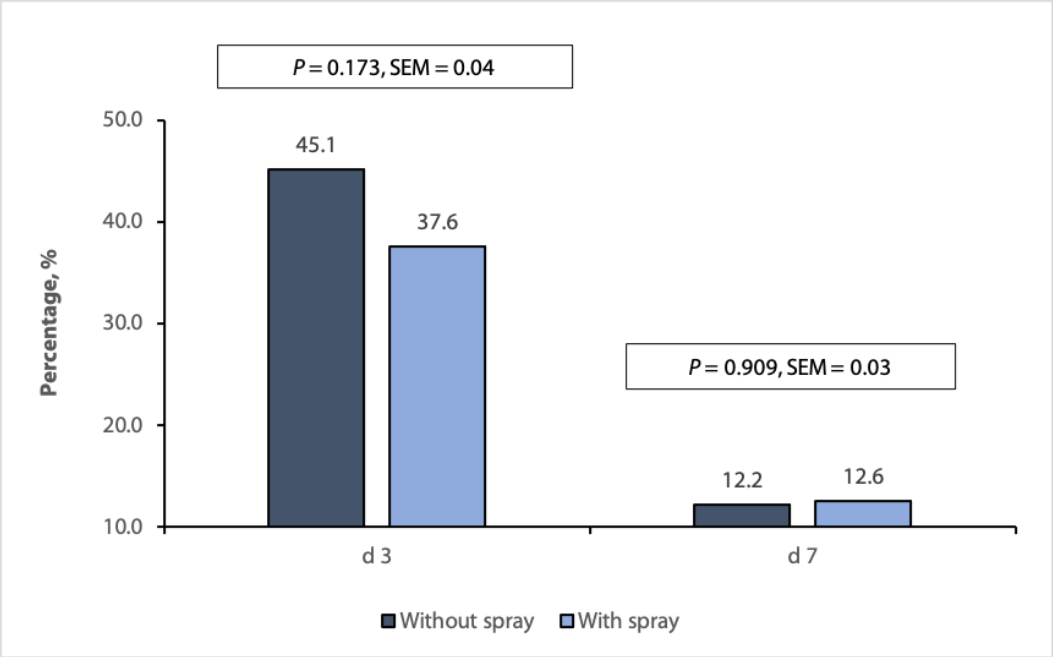

Figure 4. Main effect of post-weaning sensory attractant liquid application on the percentage of pigs that lost weight from weaning to d 3 or from weaning to d 7.

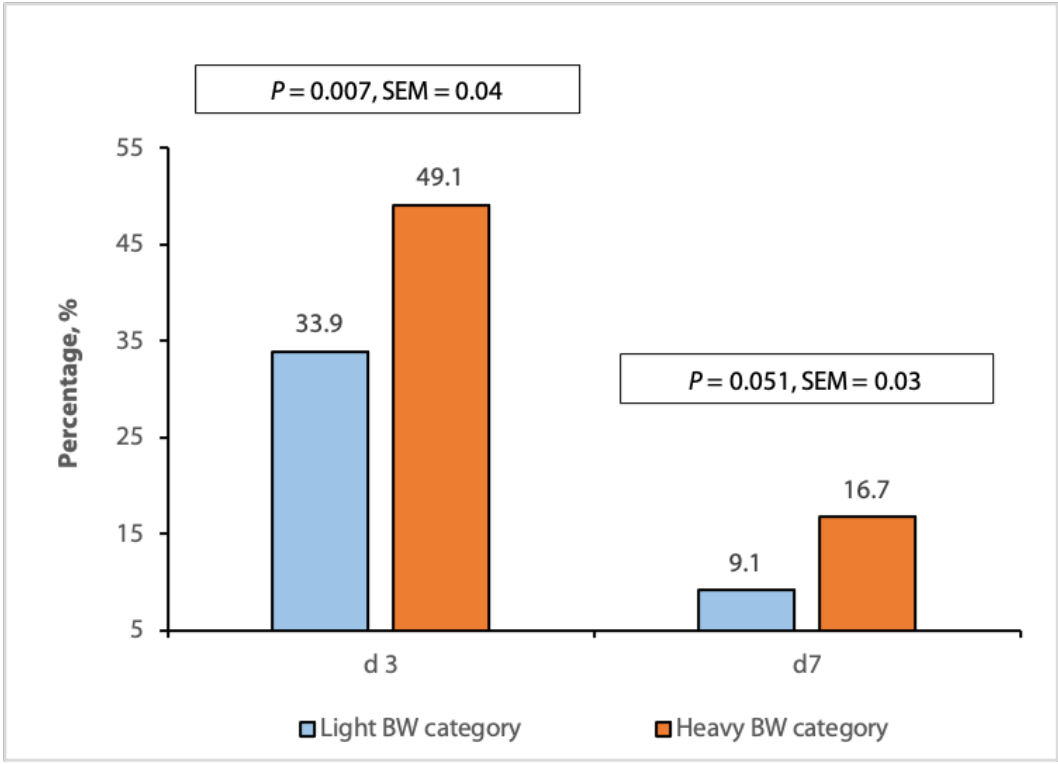

Figure 5. Main effect of body weight category on the percentage of pigs that lost weight from weaning to d 3 or from weaning to d 7.