

2021

Effects of Providing a Sensory Attractant Powder to Suckling Pigs in Late Lactation and After Weaning on Post-Weaning Pig Performance

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Recommended Citation

Wensley, M. R.; Tokach, Mike D.; Goodband, Robert D.; Gebhardt, Jordan T.; Woodworth, Jason C.; DeRouchey, Joel M.; McKilligan, Denny; and Upah, Nathan (2021) "Effects of Providing a Sensory Attractant Powder to Suckling Pigs in Late Lactation and After Weaning on Post-Weaning Pig Performance," *Kansas Agricultural Experiment Station Research Reports*: Vol. 7: Iss. 11. <https://doi.org/10.4148/2378-5977.8169>

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Funding Source

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Effects of Providing a Sensory Attractant Powder to Suckling Pigs in Late Lactation and After Weaning on Post-Weaning Pig Performance¹

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Summary

A total of 28 litters (241 × 600, DNA) and 355 nursery pigs (241 × 600, DNA; initially 12.2 lb) were used in a 29-d trial (4 d pre-weaning and 29 d post-weaning). The trial was conducted to determine the effect of providing a sensory attractant powder (Baby Pig Restart APF; TechMix Global; Stewart, MN) to suckling pigs 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 powder); 2) post-weaning treatment (without or with powder); and 3) body weight category (light or heavy). Overall, pre-weaning powder application did not have a significant effect on piglet weaning weight ($P = 0.485$) or post-weaning growth performance. Likewise, post-weaning powder application had no effect on the growth performance of pigs after weaning. The percentage of pigs that lost weight in the first 3 d after weaning was reduced by approximately 20 percentage points when pigs were provided powder both pre- and post-weaning compared to the other three treatment combinations ($P = 0.015$). This interaction diminished by d 7 and no other treatment effects were observed for the percentage of pigs that lost weight after weaning. In summary, sensory attractant powder had limited effects on growth performance of pigs after weaning. However, sensory attractants may encourage activity around the feeder after weaning when pigs also receive the same sensory attractant pre-weaning, as indicated by the percentage of pigs that lost weight after weaning. More research is needed to better understand the implications of early sensory learning and its effect on subsequent feed intake.

¹ Appreciation is expressed to TechMix Inc. (Stewart, MN) for their technical and financial support in this trial. This project was also supported by the National Pork Board and the Foundation for Food and Agriculture Research grant #18-147.

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Introduction

Weanling pigs are sensitive to sensory factors including, taste, odor, and texture, which may have an effect on feed consumption after weaning. Adding sensory enhancers to improve the acceptance of diets has been shown to increase feed intake; however, the responses observed are often inconsistent. The concept of sensory learning is another area of research that could offer further benefits around the time of weaning. Providing taste and smell stimuli prior to weaning and then reintroducing the same stimuli post-weaning may increase feed acceptance after weaning as a result of association. Applying a sensory attractant powder in the pan of creep feeders prior to weaning may help stimulate earlier feed intake by conditioning pigs to the taste and smell of the powder before its application post-weaning. Familiar olfactory stimuli have also been proposed to reduce weaning stress, therefore improving the weaning transition; however, additional data are needed to better understand the potential to influence pig performance. Hence, the objective of this study was to determine the effects of providing a sensory attractant powder to suckling pigs in late lactation and after weaning on feed intake and growth post-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. Four days prior to weaning, pigs were weighed and litters were allotted to 1 of 2 treatment groups in a randomized complete block design based on sow parity and average piglet BW. Treatments consisted of a control (without powder) or a treatment with powder, in which approximately 90 g of sensory attractant powder per day, divided into 2 feedings (AM and PM), were provided in the pan of rotary creep feeders for 4 d prior to weaning. Litters assigned to the control were not exposed to rotary creep feeders. Pigs were weaned at approximately 21 d of age.

At weaning, a total of 355 pigs (DNA 241×600 , initially 12.2 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 $2 \times 2 \times 2$ factorial with main effects of pre-weaning treatment (without or with powder); post-weaning treatment (without or with powder); and BW category (light or heavy). Pens of pigs assigned to the powder treatment group were offered approximately 45 g of sensory attractant powder per day, divided into 2 feedings (AM and PM) top-dressed on feed in the feeder pan for 2 d post-weaning. On d 3, approximately 45 g of feed (taken from the back of the feeder) were divided into 2 feedings (AM and PM) was top-dressed on feed in the feeder pan as a way to simulate powder application. This was done to maximize the behavioral response of top dressing.

Baby Pig Restart APF (TechMix Global; Stewart, MN) was used as the sensory attractant powder for this experiment. Baby Pig Restart APF is a powdered attractant designed to entice pigs to eat dry feed more quickly, while also providing additional

nutrients and energy needed to avoid starve-outs, and is formulated to contain 19.5% crude protein and 2.75% crude fat. In addition to powder application, all pigs received a common 9/64 in. pelleted corn soybean-meal-based phase 1 and 2 diet throughout the duration of the 25-d trial. Phase 1 diets were provided from d 0 to 7 and phase 2 diets from d 7 to 25.

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 weighed and feed disappearance measured on d 3, 7, 14, and 25 of the trial 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. Block was included in the model as a random effect which incorporated both sow parity and average piglet BW.

Post-weaning data were analyzed as a 2 × 2 × 2 factorial with main effects of: 1) pre-weaning treatment (without or with powder); 2) post-weaning treatment (without or with powder); 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 percent 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

Sensory attractant powder had limited effects on the average growth performance of pigs before or after weaning. These results were not unexpected, as the goal of powder application was to increase post-weaning feeder interaction, which could encourage earlier feed intake and reduce the percent of pigs that lost weight after weaning.

Pre-weaning powder application did not influence piglet weaning weight ($P = 0.485$; without = 12.1 lb; with = 12.3 lb). 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), as well as the interaction between post-weaning treatment and BW category. A 2-way interaction was observed for pre-weaning treatment and BW category. Powder application pre-weaning decreased overall ADFI ($P = 0.027$) after weaning in the lightweight pig population (without = 0.59 lb; with = 0.56 lb), whereas powder application pre-weaning increased ADFI after weaning in the heavyweight pig population (without = 0.70 lb; with = 0.76 lb). Because ADFI did not impact ADG, differences in G:F were observed. Powder application pre-weaning improved overall G:F ($P = 0.013$) after weaning in the lightweight pig population (without = 0.68; with = 0.71), whereas powder application pre-weaning worsened G:F after weaning in the heavyweight pig population (without = 0.71; with = 0.67).

For the main effect of powder application pre-weaning, no differences were observed on post-weaning performance (Table 2). Similarly, no differences were observed for powder application post-weaning. From d 0 to 7, regardless of BW category, no differences were observed in growth performance in the first 7 d after weaning. This suggests heavyweight pigs struggle to make the weaning transition, similar to lightweight pigs. However, overall, heavyweight pigs had increased ADG ($P < 0.001$) compared to lightweight pigs. This was in response to increased ADFI ($P < 0.001$). No evidence for differences were observed in G:F.

For the percentage of pigs that lost weight after weaning, no 3-way interactions were observed. A 2-way interaction between pre- and post-weaning treatment was observed on d 3 ($P = 0.015$; Figure 1). Powder application, both pre- and post-weaning, reduced the percentage of pigs that lost weight by approximately 20 percentage points compared to the other three treatment combinations. This interaction diminished by d 7 and no other interactions were observed. The main effects of pre- and post-weaning treatment and BW category are also shown (Figures 2, 3, and 4). Significance was detected on d 3 for the main effect of post-weaning treatment. Because the interaction of pre- and post-weaning treatment was already discussed, the main effect will not be emphasized. Regardless of day, no evidence for treatment differences was observed for pre-weaning treatment or BW category. Numerically, a greater percentage of heavyweight pigs lost weight during the first 7 days compared to the lightweight pigs, which may support the growth performance observed from d 0 to 7.

In summary, sensory attractant powder application both 4-d pre- and 2-d post-weaning reduced the percentage of pigs that lost weight on d 3 after weaning; however, sensory attractant application had limited effects on the growth performance of pigs after weaning. More research is needed to better understand the implications of early sensory learning, its effect on subsequent feed intake, and whether longer application would provide further benefit.

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Table 1. Interaction of pre- and post-weaning sensory attractant powder application on the growth performance of nursery pigs^{1,2}

Pre-wean powder:		Without		With		SEM	<i>P</i> = ³		
Item	Post-wean powder:	Without	With	Without	With		Pre-wean	Post-wean	Interaction
Post-wean BW, lb									
d 0		12.2	12.3	12.3	12.1	0.08	0.593	0.714	0.045 ⁴
d 3		11.5	11.6	11.6	11.7	0.11	0.494	0.415	0.710
d 7		12.3	12.4	12.4	12.5	0.14	0.428	0.356	0.610
d 14		14.9	15.1	15.0	15.0	0.22	0.880	0.777	0.758
d 25		23.6	23.5	23.8	23.4	0.40	0.903	0.562	0.665
d 0 to 7									
ADG, lb		0.011	0.003	0.018	0.049	0.0147	0.072	0.443	0.197
ADFI, lb		0.15	0.15	0.16	0.18	0.010	0.056	0.467	0.460
G:F		-0.04	-0.09	0.05	0.23	0.121	0.099	0.575	0.341
F/G ⁵		13.6	50.0	8.89	3.67	---	---	---	---
d 7 to 14									
ADG, lb		0.38	0.37	0.37	0.36	0.022	0.753	0.552	0.853
ADFI, lb		0.53	0.52	0.55	0.54	0.018	0.163	0.640	0.978
G:F		0.73	0.70	0.67	0.67	0.032	0.216	0.634	0.705
F/G ⁵		1.39	1.41	1.49	1.50	---	---	---	---
d 14 to 25									
ADG, lb		0.78	0.77	0.80	0.76	0.025	0.831	0.374	0.594
ADFI, lb		1.05	1.03	1.06	1.03	0.037	0.793	0.449	0.824
G:F		0.75	0.75	0.76	0.74	0.019	0.928	0.865	0.588
F/G ⁵		1.35	1.34	1.33	1.36	---	---	---	---
d 0 to 25									
ADG, lb		0.45	0.44	0.46	0.45	0.015	0.508	0.413	0.883
ADFI, lb		0.65	0.64	0.67	0.65	0.021	0.360	0.472	0.988
G:F		0.70	0.69	0.69	0.69	0.013	0.897	0.703	0.878
F/G ⁵		1.44	1.45	1.46	1.44	---	---	---	---

¹For 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 powder) or a treatment with powder, in which approximately 45 g of sensory attractant powder were provided to litters of pigs twice daily (AM and PM) in the pan of rotary creep feeders for 4-d prior to weaning.

²For the post-weaning portion of the experiment, a total of 355 pigs (DNA 241 × 600) were used in a 25-d growth trial with 5 or 6 pigs per pen and 15 replicates per treatment. Treatments were arranged in a 2 × 2 × 2 factorial with main effects of pre-weaning treatment (without or with powder); post-weaning treatment (without or with powder); and BW category (light or heavy). Pens of pigs assigned to the powder treatment group were offered approximately 22.5 g of sensory attractant powder twice daily (AM and PM), that was top-dressed on feed in feeder pans for 2 d after weaning. On d 3 approximately 22.5 g of feed (taken from the back of the feeder) was top-dressed on feed in the feeder pans twice daily as a way to simulate powder application.

³No 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 post-weaning treatment and BW category were observed. Overall, a 2-way interaction for ADFI (*P* = 0.027) and G:F (*P* = 0.013) was observed for pre-weaning treatment and BW category.

⁴An interaction between pre- and post-weaning treatment was observed for BW on d 0. When testing d 0 BW as a covariate for growth performance, statistical significance was not detected. Therefore, d 0 BW was removed from the model as a covariate.

⁵Feed-to-gain was calculated from ADFI and ADG treatment LSMs. Therefore, statistical analysis was not done for F/G. For the statistical outcome of feed efficiency, refer to G:F.

Table 2. Main effect of pre- and post-weaning sensory attractant powder application, and body weight category on the growth performance of nursery pigs^{1,2}

Item	Pre-wean powder		SEM	P =	Post-wean powder		SEM	P =	BW category		SEM	P =
	Without	With			Without	With			Light	Heavy		
Post-wean BW, lb												
d 0	12.2	12.2	0.06	0.593	12.2	12.2	0.06	0.714	10.3	14.2	0.06	<0.001
d 3	11.6	11.6	0.08	0.494	11.6	11.6	0.08	0.415	9.8	13.4	0.08	<0.001
d 7	12.4	12.5	0.10	0.428	12.3	12.5	0.10	0.356	10.6	14.2	0.10	<0.001
d 14	15.0	15.0	0.16	0.880	15.0	15.1	0.16	0.777	12.9	17.2	0.16	<0.001
d 25	23.5	23.6	0.28	0.903	23.7	23.4	0.28	0.562	20.4	26.7	0.28	<0.001
d 0 to 7												
ADG, lb	0.01	0.03	0.010	0.072	0.01	0.03	0.010	0.443	0.03	0.01	0.010	0.322
ADFI, lb	0.15	0.17	0.007	0.056	0.16	0.17	0.007	0.467	0.15	0.17	0.007	0.081
G:F	-0.06	0.14	0.085	0.099	0.01	0.07	0.085	0.575	0.12	-0.04	0.085	0.195
F/G ³	15.0	5.67	---	---	16.0	5.67	---	---	5.00	17.0	---	---
d 7 to 14												
ADG, lb	0.38	0.37	0.015	0.753	0.38	0.37	0.015	0.552	0.32	0.42	0.015	<0.001
ADFI, lb	0.52	0.55	0.013	0.163	0.54	0.53	0.013	0.640	0.47	0.60	0.013	<0.001
G:F	0.71	0.67	0.023	0.216	0.70	0.68	0.023	0.634	0.68	0.70	0.123	0.430
F/G ³	1.37	1.49	---	---	1.42	1.43	---	---	1.47	1.43	---	---
d 14 to 25												
ADG, lb	0.77	0.78	0.018	0.831	0.79	0.76	0.018	0.374	0.69	0.86	0.018	<0.001
ADFI, lb	1.04	1.05	0.026	0.793	1.05	1.03	0.026	0.449	0.91	1.17	0.026	<0.001
G:F	0.75	0.75	0.014	0.928	0.75	0.75	0.014	0.865	0.76	0.74	0.014	0.498
F/G ³	1.35	1.35	---	---	1.33	1.36	---	---	1.32	1.36	---	---
d 0 to 25												
ADG, lb	0.44	0.45	0.010	0.508	0.46	0.44	0.010	0.413	0.40	0.50	0.010	<0.001
ADFI, lb	0.64	0.66	0.015	0.360	0.66	0.64	0.015	0.472	0.57	0.73	0.015	<0.001
G:F	0.69	0.69	0.009	0.897	0.69	0.69	0.009	0.703	0.69	0.69	0.009	0.752
F/G ³	1.45	1.47	---	---	1.43	1.45	---	---	1.43	1.46	---	---

¹For 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 powder) or a treatment with powder, in which approximately 45 g of sensory attractant powder were provided to litters of pigs twice daily (AM and PM) in the pan of rotary creep feeders for 4 d prior to weaning.

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³Feed-to-gain was calculated from ADFI and ADG treatment LSMeans. Therefore, statistical analysis was not done for F/G. For the statistical outcome of feed efficiency, refer to G/F.

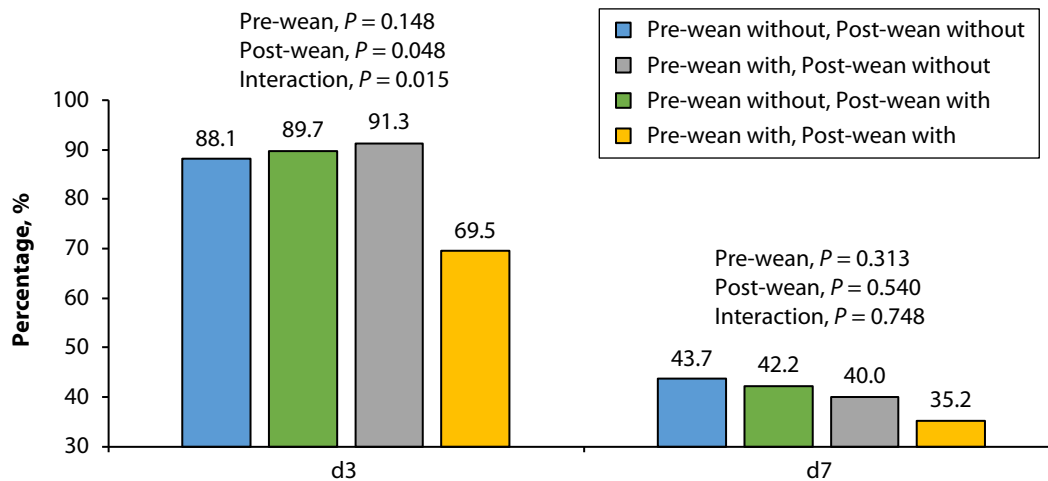


Figure 1. Interaction of pre- and post-weaning sensory attractant powder application on the percentage of pigs that lost weight from weaning to d 3 or from weaning to d 7. No 3-way interactions between pre- and post-weaning treatment and BW category were observed. Likewise, no 2-way interactions between pre-weaning or post-weaning treatment and BW category were observed. Therefore, the data are not shown.

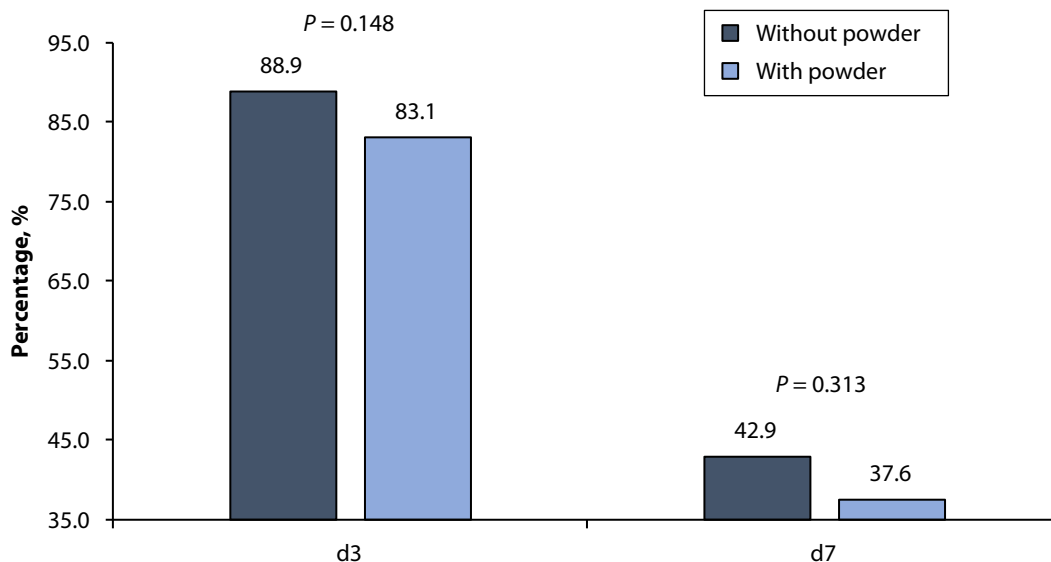


Figure 2. Main effect of pre-weaning sensory attractant powder application on the percentage of pigs that lost weight from weaning to d 3 or from weaning to d 7.

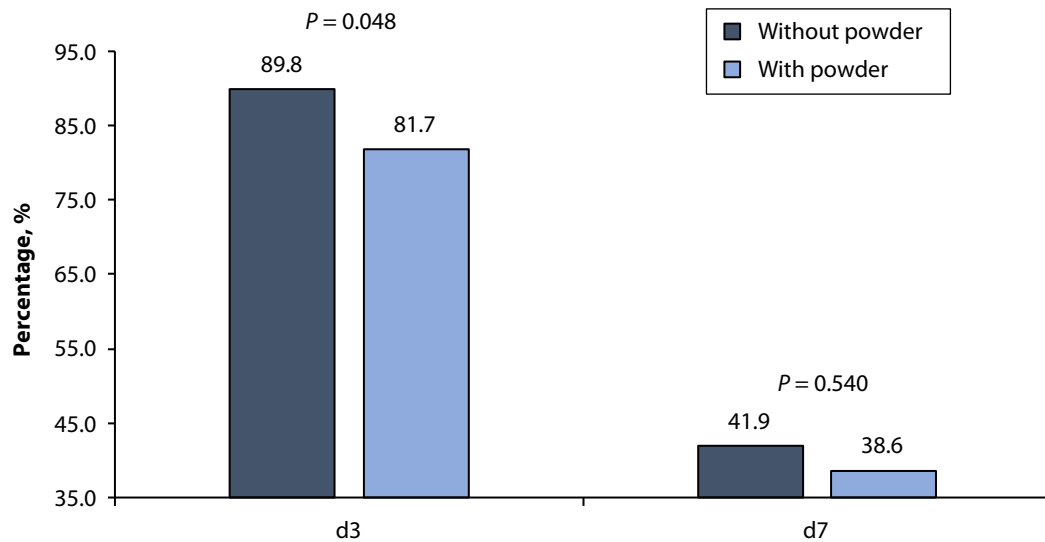


Figure 3. Main effect of post-weaning sensory attractant powder application on the percentage of pigs that lost weight from weaning to d 3 or from weaning to d 7.

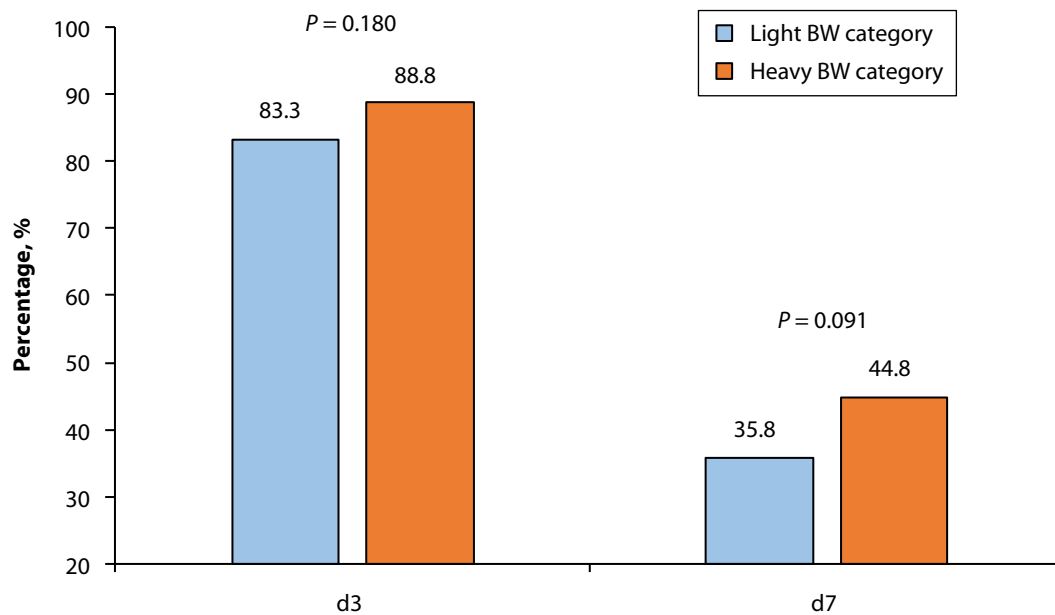


Figure 4. Main effect of body weight category on the percentage of pigs that lost weight from weaning to d 3 or from weaning to d 7.