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Running head: Sands et al. Creep feed provision and type in piglets

Pre-and post-weaning performance of piglets offered different types of creep feed

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ABSTRACT

We determined the impact of creep feed provision and type on pre- and post-weaning growth performance of piglets. At 2 weeks post-farrow, litters (n=50) were given no creep feed or provided a simple creep feed, a complex creep feed, or both until weaning at ~28 d. Creep feed, regardless of type, resulted in increased growth ($P < 0.05$) of piglets in the final week pre-weaning and immediate week post-weaning, which was not maintained at the end of the nursery period. Piglets showed no preference for creep feed type ($P > 0.05$).

Keywords: creep feed, feed intake, growth performance, pigs, weaning

Creep feeding is a common practice in swine production aimed at stimulating dry feed intake and providing nutrients to piglets in order to increase their weaning weight and to attenuate the stressful weaning transition effects (Dong and Pluske 2007). The benefit of creep feeding is reliant on individual feed intake, which is reported to be generally low and highly variable (Bruininx et al. 2002). It has been shown that the positive effects of provision of creep feed may be more due to enhancing exploratory behavior in piglets (i.e., allowing natural rooting behaviors) and exposure to feed in a dry form than provision of nutrients (Middelkoop et al. 2019), suggesting that the type of creep feed provided is not an important factor. Overall, it has not been clearly demonstrated whether the potential benefits of creep feed are due to enhanced nutrient intake or to exposure to dry feed and increased familiarity with dry feed. Therefore, the objective of this study was to determine the effect of feeding either a simple or complex creep feed on pre- and post-weaning performance of piglets. Moreover, we investigated piglet preference for creep feed type.

MATERIALS AND METHODS

The experimental protocol was approved by the University of Saskatchewan's Animal Research Ethics Board (AUP #20130054) and followed the Canadian Council on Animal Care guidelines (CCAC, 2009).

Animals, feeding, and experimental design

A total of 50 sows (parities 1-5; 250 ± 25.5 kg BW; Camborough Plus $\times$ C3378; PIC Canada Ltd.) were housed in farrowing crates at the Prairie Swine Centre (Saskatoon, SK) over 5 blocks with 7 - 12 sows per block. Sows were moved into farrowing crates ~5 d before their expected farrow date and fed a standard commercial lactation diet (Masterfeeds; 0.90 % SID Lys, 2400 kcal NE) which met nutrient requirements for lactating sows (NRC,

2012). Sows were fed according to a standard feeding curve using an automated feeding system (Gestal, JYGA Technologies, Saint-Lambert-de-Lauzon, QC). Standard production procedures were performed for all piglets (e.g., tail docking, ear notching for identification, iron supplementation, castration of males). Within 48 h of farrowing, piglets were cross-fostered between sows in order to equalize litter size to 12–14 piglets/litter if required. Sows and their litters (n=12-14 per treatment) were randomly assigned to 1 of 4 creep feeding treatment protocols in a randomized complete block design. The creep feeding protocols were 1) no creep feed provided (**CON**), 2) simple creep feed provided (**SC**); 3) complex creep feed provided (**CC**), and 4) both complex and simple creep feed provided (**SCC**). The CC consisted of a standard wheat- soybean meal-based nursery starter diet containing 12.5% whey permeate (Masterfeeds; 1.40 % SID Lys, 2450 kcal NE) and the SC consisted of a standard sow lactation diet (Masterfeeds; 0.90 % SID Lys, 2400 kcal NE). For the SCC treatment, SC and CC were provided in separate feeders. The individual test diet preference was calculated by contrasting the feed intake of the two test diets offered simultaneously. The location of the creep feed type remained constant for each litter throughout the entire creep feeding period but was varied across litters to reduce the effects of feeder location on intake of the two creep diets.

Data collection

Litter weight was recorded weekly on d 7, 14, 21, and at weaning (28 d) and any mortalities recorded. At d 14 post-farrowing, litters were placed on their respective creep protocol treatment. Creep feed offered and creep feed intake were recorded daily and adjusted for wastage by collecting and weighing spillage from a rubber matting placed under the feeders. Fresh creep feed was provided each day until weaning. Upon weaning, piglets were mixed and housed in groups of 10-13 pigs/pen (n=14-16 pens/treatment) according to their

pre-weaning treatment. All pigs were fed a standard 2-phase commercial nursery feeding program (Masterfeeds) for 4 wk (d 28–56) with each phase lasting 2 wk. Diets were formulated to meet or exceed nutrient requirements (NRC, 2012) and were provided ad libitum. Individual pig body weight and per pen feed intake were recorded on a weekly basis for 4 wk.

Statistical analysis

All data were verified for normality and homogeneity of the variance using PROC UNIVARIATE (SAS 9.4 Inst., Inc., Cary, NC) and analysis completed by the PROC MIXED model (SAS 9.4 Inst., Inc., Cary, NC). All data for piglets (lactation and nursery) were analyzed as a randomized complete block design (one-way ANOVA) with treatment (CON, CC, SC, and SCC) as the main effect and the sow nested into the block as a random effect. Since we detected significant differences across treatments in birth weight, this variable was included in the model as a covariate for the other parameters, but only retained if significant. The feed preference data during lactation was analyzed as a randomized complete block design with treatment (lactation diet vs starter diet) as main effect and the sow nested in the block as a random effect. The experimental unit for the lactation data (performance, feed intake and feed preference) was the litter. In the nursery period, the experimental unit was the pen. The effects were considered statistically significant at $P < 0.05$ and trends considered at $P \geq 0.05$ and $P \leq 0.10$. When differences were observed, treatment means were separated using LSD with Tukey adjustment.

RESULTS AND DISCUSSION

The objective of the present study was to determine if the provision and type (simple vs. complex) of creep feed would enhance pre- and post-weaning feed intake and growth of

piglets. We also attempted to determine if pigs prefer a simple or complex creep feed (Table 1). There appears to be no preference for either simple or complex creep diets ($P > 0.05$). This is consistent with findings from Collins et al. (2013) who reported no difference in lifetime performance of pigs fed either a complex (i.e., inclusion of animal protein sources) or a simple (i.e., cereal-based) creep feed. It should be noted that the conclusions of the present study are based on a small number of litters, even considering that the overall creep intake in all litters also did not indicate any impact of creep feed type on intake ($P > 0.05$).

Pre-weaning performance

Table 1 shows pre-weaning performance data. The initial BW of piglets on the CON and SC treatments was higher ($P < 0.05$) than other treatments but this difference was not evident at the onset of provision of creep feed ($P > 0.05$). Furthermore, there was no difference in litter growth performance between treatments prior to provision of creep feed ($P > 0.05$). After initiation of provision of creep feed, there was no difference in ADG in the first week. The lack of effect of creep feed provision during the first week (d 14 – d 21) may be associated with feed intake showing progressive increase over time only after 18 d of age in piglets (Huting et al. 2017). This finding also corroborates a recent study showing that growth performance is not impacted after the first week of creep feed provision (Middelkoop et al. 2020). However, in the second week, there was an increase in ADG in piglets receiving the SC treatment compared to CON and CC, with SCC being intermediate ($P < 0.05$). This resulted in a trend for improved overall ADG in litters receiving the SC and SCC creep treatments ($P = 0.06$). This result suggest that complex creep feed may not be required to achieve enhanced post-weaning performance. Even though we did not observe difference in overall creep feed intake across treatments ($P > 0.05$), there was a numerical advantage for ADFI in SC (6.02 g/pig/d) and SCC (6.68 g/pig/d) piglets over CC (4.14 g/pig/d) piglets

during the first week. There is evidence indicating enhanced pre-weaning creep feed intake when piglets are able to observe and interact with the sow while she is eating (Oostindjer et al. 2011). In the present study, despite the lack of effects of treatments on the preference test ($P > 0.05$), SC piglets may have been encouraged to explore and eat a similar diet to what the sows were eating, which possibly triggered higher weight gain.

Post-weaning performance

Table 2 shows post-weaning performance data. Pigs that received no creep feed pre-weaning had slightly reduced ADG ($P < 0.10$) in the first week post-weaning compared to SC, and significantly lower ADG than CC and SCC piglets ($P > 0.05$). Our findings agree with studies showing that creep feed intake during the pre-weaning phase stimulates early postweaning performance (Bruininx et al. 2002). However, there was no difference ($P > 0.05$) in performance after the first week and no effect on ADG throughout the entire nursery period or on final body weight. This may be explained by the relatively low creep feed intake observed in the present study, which may not have increased the percentage of eaters among litters and, therefore, did not result in higher weight gain. For example, the creep feed intake reported by Bruininx et al. (2002) was 377 g/piglet from d 11-28 while in the present study piglets consumed around 190 g/piglet. While we did not observe a benefit of creep feeding on postweaning performance in the current study, it is important to note that the data presented are averages for litter or pen and does not account for potential positive effects of creep feed on individual piglets. Previous work has indicated there may be a benefit of providing creep feed, but this is restricted to those piglets that consume the creep feed (Shea and Beaulieu 2014). Most importantly, a recent study revealed a small percentage (i.e., 20%) of litters being definite creep feed eaters, while over 90% being considered eaters and possible eaters, which suggests that creep feed may benefit piglets individually (Seddon et al. 2015). Another

factor to consider is that while creep feed had no benefit on overall pig growth, there may be other benefits that were not determined in this study. For example, Chen et al. (2020) reported an enhanced intestinal structure and enzyme activity around weaning in piglets offered a soft pellet creep feed pre-weaning. Of note, when contrasted to control piglets, growth performance was improved pre-weaning by the SC treatment and post-weaning by the CC treatment. This may indicate that the potential of creep feed for improvements in pre-weaning performance are associated with piglets consuming the same diet as the sow benefits in the post-weaning period are related to increased familiarity with dry feed. Overall, future work should attempt to determine effect of creep provision on individual piglet performance and potential impact beyond growth performance and further explore the differential effects of creep feed type pre- and post-weaning.

CONCLUSIONS

Results of the present study indicate that providing piglets creep feed before weaning had limited effects on piglet performance, which was enhanced only in the week before and after weaning. Moreover, there is not enough evidence to support the idea of piglet preference to creep feed type.

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Table 1. Effects of creep feed provision and type on pre-weaning performance of piglets^{z,y}

Item	Treatment				SEM	P-value
	Control	SC	CC	SCC		
n	14	12	12	12		
Birth weight (kg)	1.52 ^a	1.53 ^a	1.45 ^{ab}	1.43 ^b	0.03	0.04
d 14 weight (kg) ^x	4.69	4.74	4.57	4.60	0.13	NS
Wean weight (kg)	8.17	8.59	8.19	8.25	0.20	0.08
Average daily gain (kg/d)						
d 0-7	0.180	0.187	0.181	0.187	0.01	NS
d 7-14	0.273	0.273	0.262	0.265	0.00	NS
d 0-14	0.219	0.223	0.216	0.220	0.00	NS
d 14-21	0.278	0.291	0.294	0.283	0.11	NS
d 21-28	0.221 ^b	0.259 ^a	0.223 ^b	0.239 ^{ab}	0.01	0.01
d 14-28	0.274	0.290	0.276	0.284	0.00	0.06
Creep consumed (g/pig/d)						
d 14-21	-	6.02	4.14	6.68	1.41	NS
d 21-28	-	13.85	13.83	20.62	4.37	NS
d 14-28	-	9.88	9.04	13.62	2.55	NS
Overall creep type consumed (g/pig) ^w						
SC	-	-	-	83.69	19.14 ^w	NS ^w
CC	-	-	-	106.98		

CC, complex creep provided; Control, no creep feed provided; NS, not significant; SC, simple creep provided; SCC, both simple and complex creep provided; SEM, standard error of the mean.

^zValues are least square means. n = litters/treatment

^yCreep feed was offered to piglets from d 14 after birth until weaning.

^xBeginning of creep feed provision

^wTotal intake of SC and CC per pig in litters offered both diets (SCC) during the pre-weaning period. The SEM and P-value are related to the comparison between SC and CC values.

Table 2. Effects of creep feed provision and type on post-weaning performance of piglets^{z,y}

Item	Treatment				SEM	P-value
	Control	SC	CC	SCC		
n	14	16	15	14		
Initial BW (kg)	8.14	8.19	8.13	8.08	0.28	NS
Final BW (kg)	21.60	21.91	21.99	22.15	0.44	NS
Average daily gain (kg/d)						
d 28-35	0.163 ^b	0.181 ^{ab}	0.209 ^a	0.192 ^a	0.01	< 0.05
d 35-42	0.446	0.454	0.452	0.453	0.04	NS
d 42-49	0.584	0.588	0.604	0.621	0.04	NS
d 49-56	0.723	0.731	0.721	0.742	0.02	NS
d 28-56	0.480	0.496	0.489	0.502	0.12	NS
Average daily feed intake (kg/d)						
d 28-35	0.163	0.172	0.185	0.176	0.01	NS
d 35-42	0.468	0.466	0.488	0.490	0.02	NS
d 42-49	0.732	0.725	0.744	0.772	0.03	NS
d 49-56	0.970	0.971	0.978	1.002	0.03	NS
d 28-56	0.584	0.583	0.599	0.610	0.01	NS
Gain:Feed (kg/kg)						
d 28-35	0.985	1.048	1.099	1.087	0.04	NS
d 35-42	0.935	0.971	0.919	0.931	0.07	NS
d 42-49	0.803	0.802	0.817	0.797	0.03	NS
d 49-56	0.754	0.751	0.742	0.731	0.01	NS
d 28-56	0.867	0.823	0.852	0.825	0.03	NS

BW, body weight; CC, complex creep provided; Control, no creep feed provided; NS, not significant; SC, simple creep provided; SCC, both simple and complex creep provided; SEM, standard error of the mean.

^zValues are least square means. n = pens/treatment

^yCreep feed was offered to piglets from d 14 after birth until weaning.