Effect of Tonisity Px™ administration on pre-weaning mortality and weight gain

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Introduction

Improving intestinal health in piglets is important to achieving optimal productivity in the farrowing house. Px is an oral isotonic protein drink designed to provide microenteral nutrition to suckling pigs. The aim of this study was to assess the impact of Px on suckling pigs.

Materials and methods

212 sows (Landrace × Large White or Danbred) and their litters (1496 piglets) from 2 farms were used in the study. Farm A was a commercially managed farrow-to-nursery operation of 2500 sows with an average live-born of 13.1 pigs and a historic pre-weaning mortality (PWM) of 13.7%. The farm had a history of clinically significant diarrhea during farrowing with *Clostridium difficile, Clostridium perfringens, Escherichia coli* and type A rotavirus. Farm B was a small family-owned farrow-to-finish farm with 400 Landrace × Large White sows with an average live-born of 13 pigs, a historic PWM of 10-12% and batch farrowing. Farm B had a historically low incidence of diarrhea during farrowing, but documented pathogens included *E. coli* and *Clostridium difficile*, though not rotavirus A.

Sows and their litters were randomised to one of two groups. On the day of farrowing, piglets were individually ear-tagged and weighed. Starting on day 2 of age, litters in the Px group received 500 mL of Px in an open pan, once daily until day 8 of age. Litters in the control group received no extra supplementation. All litters were allowed to suckle normally and had access to an automatic drinker. The amount of Px consumed was recorded daily by weighing the administered volume and any residual liquid in the pan.

Piglets were again weighed at day 8 (D8) and at weaning (D19 Farm A, D17 Farm B) of age. Weaning day was considered the end of study (ES). Creep feed was started in all litters at day 10.

Data collection

The volume of Px consumed was recorded daily. Mortality and apparent cause of death were recorded daily. The presence and severity of diarrhea in each litter was recorded three times per week during the study. Diarrhea was scored from 0 to 3 using the following scale: 0: normal, healthy; 1: a few pigs affected, pasty faeces; 2: most pigs affected, liquid faeces; 3: all pigs affected, liquid faeces, piglets gaunt.

Statistical analysis

The experimental unit for mortality, scour incidence, BW and ADG was the litter. Fisher's exact test was used to assess the relationship between mortality vs treatment and scour vs treatment for each time period (D8, ES).

Scour incidence and severity was analyzed by a generalized linear model using treatment group, sow body condition and parity as fixed effects. When Farm B results were analyzed, the farrowing week (batch) was also included as a fixed effect.

The body weight was analyzed by a linear mixed model including treatment group, gender and sow's parity as fixed effects, and litter as random effect. BW on D1 was included as a covariate (for body weight on D8 and at ES). The number of days from D1 to ES was included as covariate for the analysis of body weight at ES. When Farm B results were analyzed, the farrowing week (batch) was also included as fixed effect.

The average daily gain was analyzed by a linear mixed model; including treatment group, gender and sow's parity as fixed effects and litter as random effect. BW on D1 was included as covariate. The number of days from D1 to ES was included as covariate for the analysis of the ADG until ES. When Farm B results were analyzed the farrowing week (batch) was also included as fixed effect.

For mortality, scour incidence, BW and ADG, the farm and the interaction between the farm and the treatment group were also included when Farm A and Farm B combined results were analyzed. Tests were two-tailed and carried out with a risk $\alpha = 5\ \%$. P-values of ≤ 0.05 were considered statistically significant, while $0.05 < P \leq 0.10$ was considered a near-significant trend. All statistical analyses were performed with R software.†

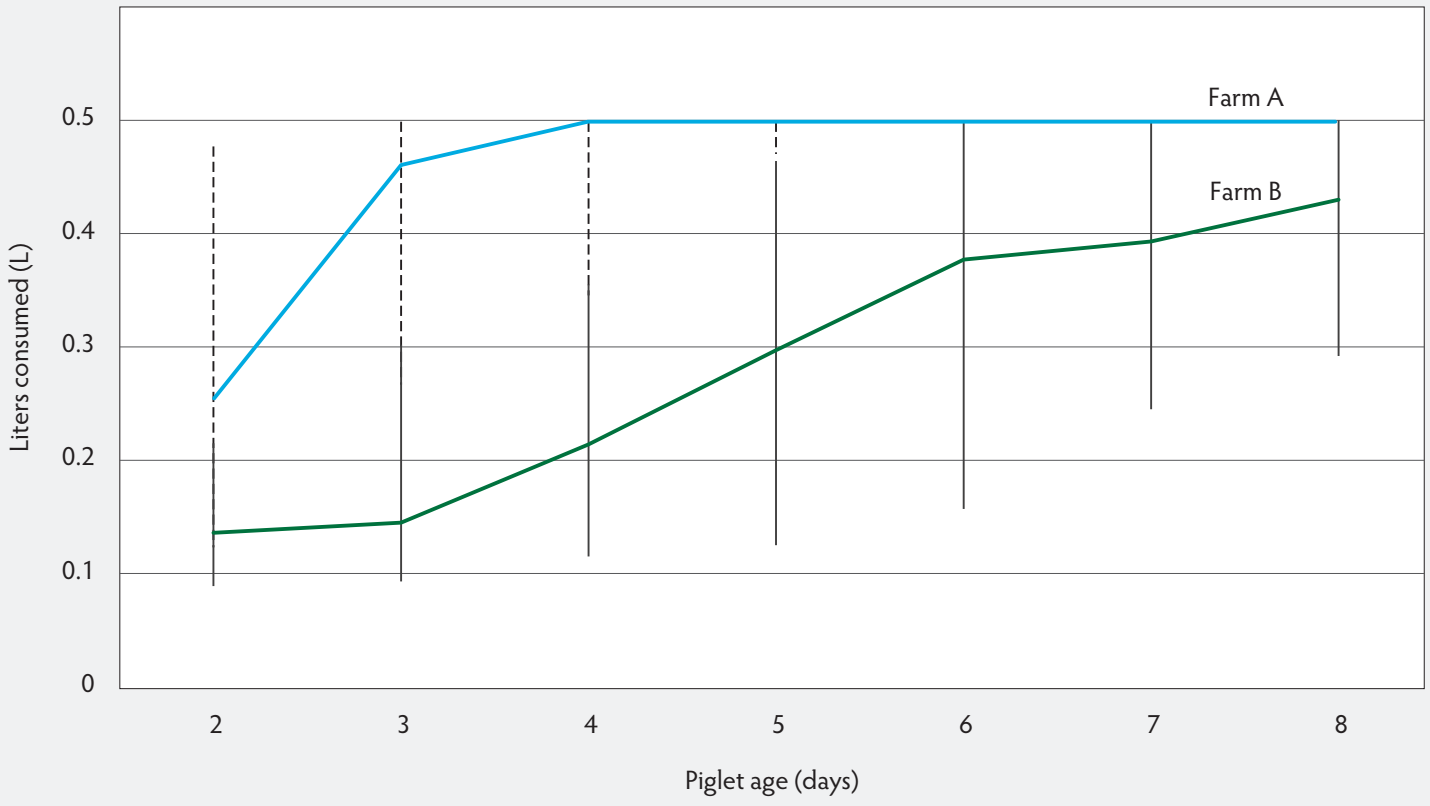
Results

Px consumption

On Farm A, consumption of Px increased quickly during the first week of life. By day 3 of age, the median consumption of Px was

† R Core Team (2015). R: A language and environment for statistical computing. R Foundation for Statistical Computing, Vienna, Austria. ISBN 3-900051-07-0, URL `http://www.R-project.org`.

Figure 1: Px Consumption by litters



500 mL/litter/day. Litters contained an average of 14 piglets, with a median consumption of 36 mL/pig on day 3 of treatment. See Figure 1.

On Farm B, the consumption of Px also increased steadily during the first week of life, reaching a median consumption of 430 mL/litter on day 8. Litters contained an average of 12 piglets, with a median consumption of 18 mL/pig on day 3 of treatment.

Mortality

Using the litter as the experimental unit, pre-weaning mortality was calculated at ES for both farms combined (Table 1). There was a significant difference in PWM between the two treatment groups, in which Px litters had a lower mortality by 3 percentage points (9.99% v 6.91%, $P = 0.04$). This equates to a 31% reduction in mortality.

Weight gain

The body weight on day 1 was significantly different between farms. Therefore, body weight and ADG were analysed separately for each farm using the litter as the experimental unit.

On Farm A, piglets in the Px group tended to weigh more than the control group at day 8 ($P < 0.1$) and weighed significantly more at day 19 (240 grams, 0.53 lb, $P < 0.05$). Pigs in the Px group had a higher average daily gain both in the first week ($P < 0.1$) and until day 19 ($P < 0.05$). See Table 2. Farm B results were the combination of 2 farrowing batches and showed no significant differences in body weight or ADG.

Incidence and severity of scour in litters

There was no significant difference in the incidence or severity of scour (scour score ≥ 2) between the control and Px litters on either farm (Table 3). However, on farm B, an abnormally high incidence of scour (24-25%) occurred in all litters during the time of the study, which was December – January.

Discussion

Px consumption

This study has shown that piglets less than one week old will drink significant volumes of liquid Px from an open pan. Various factors may have contributed to this, including palatability and texture of the liquid.

Delivering the product in an open pan facilitates the pigs natural curiosity and eliminates the learning and tactile barriers to drinking that are posed by mechanical nipple drinkers. Open pans do allow the possibility of faecal contamination and do require daily cleaning.

Pre-weaning mortality

This study demonstrated that Px had a significant impact on the pre-weaning mortality when given during the first week of life. The impact seen on pre-weaning mortality is interesting and

Table 1: Pre-weaning mortality rates

	Mean	95% CI	*P* value
Control	9.99%	7.6 – 12.3%	**0.0431**
Px	6.91%	4.6 – 9.2%	

Table 2: Body weight and ADG

	Total n	Px*	Control*	*P* value
Body weight d1 (kg ± SE)	1462	1.41 ± 0.04	1.37 ± 0.04	NS
Body weight d8 (kg ± SE)	1376	2.29 ± 0.05	2.23 ± 0.05	$P < 0.1$
Body weight d19 (kg ± SE)	**1330**	**4.25 ± 0.11**	**4.01 ± 0.11**	**P < 0.05**
ADG d1 – d8 (kg/d)		0.123 ± 0.007	0.114 ± 0.007	$P < 0.1$
ADG d1 – d19 (kg/d)		**0.158 ± 0.006**	**0.145 ± 0.006**	**P < 0.05**

* Values are least-squares means ± standard error. NS = not significantly different.

Table 3: Litter incidence of scour (scour score ≥ 2)

Site	Treatment group	Number of litters without scour (%)	Number of litters with scour (%)	*P* value
Farm A	Control	45 (83.3%)	9 (16.7%)	$P = 0.801$
	Px	47 (81.1%)	11 (19.0%)	
Farm B	Control	39 (75.0%	13 (25.0%)	$P = 1.0$
	Px	38 (76.0%)	12 (24.0%)	

could be explained by several different mechanisms. The 3% Px solution does not contain a significant number of calories, so extra caloric intake is not a likely explanation. The quantities consumed per piglet equate to 3-5% of a 1 kg piglets' bodyweight, so it is unlikely that correction of dehydration is the primary mode of action. It is possible however that some piglets may be subclinically dehydrated, in which case Px could be exerting an effect. The effect could also be due to the ingredient profile of Px, which contains key amino acids to support the metabolic requirements of intestinal enterocytes.

Weight gain

Significant differences in the weights on both day 8 and at weaning were seen on Farm A. On Farm B, it is likely that the seasonal increase in scour affected the results of the study. Farm B litters also had a lower consumption of Px which may have reduced the beneficial impact of the product.

Scour

The incidence of scour in Farm B was much higher than usual for that farm but was the same in both the control and treatment groups. The increase was attributed to winter conditions. The optimal use of Px in supporting pigs with scour was not investigated in this study. A second concern with any protein source, especially before weaning, is that it may contribute to the development of scour. The protein levels in Px are very modest but it was appropriate to examine this possibility. However, there was no significant difference in scour scores between treatment groups on either farm, thus reducing this cause for concern.

Conclusion

Px was well accepted by neonatal pigs. Px administration was associated with a significant reduction in pre-weaning mortality, as well as improved weaning weights.