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Summary

A total of 80 sows (Line 241; DNA Genetics) across three farrowing groups were used in a study to evaluate the effect of feeding live yeast and yeast extracts to lactating sows on sow and litter performance. Sows were blocked by BW and parity on d 110 of gestation and allotted to 1 of 2 dietary treatments. Dietary treatments consisted of a standard corn-soybean meal lactation diet or a diet that contained yeast-based pre- and probiotics (0.10% Actisaf Sc 47 HR+ and 0.025% SafMannan; Phileo by Lesaffre, Milwaukee, WI). Diets were fed from d 110 of gestation until weaning (approximately d 19). A tendency ($P = 0.073$) was observed for increased feed intake from farrowing to weaning when sows were fed a diet with yeast additives compared to the control diet. There was no evidence ($P > 0.10$) that sow treatment influenced any other sow or litter performance criteria. In conclusion, feeding live yeast and yeast extracts tended to increase feed intake during lactation but did not influence other sow or litter performance measurements.

Introduction

Supplementing live yeast and yeast extracts in sow diets has been researched due to the potential for a healthier/heavier piglet which may be more equipped to handle weaning stress, leading to improved nursery performance. Supplementing live yeast has positively influenced IgG in sow plasma and colostrum, allowing increased maternal transfer of immunity to their offspring.[3,4] Furthermore, feeding live yeast and yeast extracts may positively modulate sow gut microflora, which may provide piglets with more

[1] Department of Diagnostic Medicine/Pathology, College of Veterinary Medicine, Kansas State University.

[2] Phileo by Lesaffre, Milwaukee, WI.

[3] Peng, X., C. Yan, L. Hu, Y. Huang, Z. Fang, Y. Lin, S. Xu, B. Feng, J. Li, Y. Zhuo, D. Wu, and L. Che. 2020. Live yeast supplementation during late gestation and lactation affects reproductive performance, colostrum and milk composition, blood biochemical and immunological parameters of sows. Anim. Nutr. 6:288-292. doi: 10.1016/j.aninu.2020.03.001.

[4] Zanello, G., F. Meurens, D. Serreau, C. Chevaleyre, S. Melo, M. Berri, R. D'Inca, E. Auclair, and H. Salmon. 2012. Effects of dietary yeast strains on immunoglobulin in colostrum and milk of sows. J. Vet. Imm. Immunopath. 152:20-27. doi: 10.1016/j.vetimm.2012.09.023.

exposure to beneficial and less pathogenic bacteria through the sow's feces.[5] Other research has shown that when *Saccharomyces cerevisiae* was fed to sows during gestation and lactation their offspring in the nursery had improved ADG, increased BW, and improved gross energy digestibility.[6]

Currently, there are many studies evaluating yeast product's impact on sow and litter performance; however, results tend to be variable warranting more research. Thus, the objective of this study was to evaluate the effects of feeding the live yeast *Saccharomyces cerevisiae* strain NCYC Sc 47 and a yeast cell wall fraction with concentrated mannan-oligosaccharides and β-glucans from *Saccharomyces cerevisiae* on sow and litter performance.

Materials and Methods

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

Animals and treatment structure

A total of 80 mixed-parity sows (DNA 241, DNA Genetics) were used across three batch farrowing groups at the Kansas State University Swine Teaching and Research Center in Manhattan, KS. On d 110 of gestation, sows were weighed and moved into the farrowing house. Females were blocked by parity and BW and allotted to 1 of 2 dietary treatments within farrowing group. Dietary treatments consisted of a standard corn-soybean meal lactation diet or a diet that contained yeast-based pre- and probiotics (0.10% Actisaf Sc 47 HR+ and 0.025% SafMannan; Phileo by Lesaffre, Milwaukee, WI). The live yeast *Saccharomyces cerevisiae* strain NCYC Sc 47 (ActiSaf Sc 47 HR+) served as the yeast-based probiotic. The yeast-based prebiotic included a yeast cell wall fraction with concentrated mannan-oligosaccharides and β-glucans from *Saccharomyces cerevisiae* (SafMannan).

From d 110 until farrowing (approximately d 115), sows were fed approximately 6 lb of their respective treatment diets. Post farrowing, sows were allowed *ad libitum* access to feed during lactation, which was recorded by weighing the amount of feed placed in the feeder and the amount remaining at weaning. Both diets were formulated to meet or exceed NRC (2012)[7] requirement estimates (Table 1). The diets for the first farrowing group were manufactured at the Kansas State University O.H. Kruse Feed Technology Innovation Center (Manhattan, KS) with the diets for the following two farrowing groups being manufactured at a commercial feed mill (Hubbard Feeds; Beloit, KS).

Sow BW was measured at entry into the farrowing house, 24 h after farrowing, and at weaning. Sow backfat depth (measured 4 in. from the midline at the last rib) was measured at entry to the farrowing house and at weaning. Cross-fostering of piglets

[5] Hasan, S., S. Junnikkala, O. Peltoniemi, L. Paulin, A. Lyyski, J. Vuorenmaa, and C. Oliviero. 2018. Dietary supplementation with yeast hydrolysate in pregnancy influences colostrum yield and gut microbiota of sows and piglets after birth. PLoS ONE. 13.5: e0197586. doi: 10.1371/journal.pone.0197586.
[6] Lu, H., P. Wilcock, O. Adeola, and K. M. Ajuwon. 2019. Effect of live yeast supplementation to gestating sows and nursery piglets on postweaning growth performance and nutrient digestibility. J. Anim. Sci. 97:2534-2540. doi:10.1093/jas/skz150.
[7] National Research Council. 2012. Nutrient Requirements of Swine: Eleventh Revised Edition. Washington, DC: The National Academies Press. doi: 10.17226/13298.

was performed to equalize litter size within sow treatment group within 48 h of birth. Litters were weighed on d 2, 10, and at weaning. Pre-weaning mortality was calculated as the total mortality (d 0 to wean) per sow divided by the total born alive per sow with cross-fostered pigs accounted for in the calculations.

Chemical analysis

Complete diet samples were taken during manufacturing using a feed probe from every fifth 50-lb bag for the first sow group. Diet samples were collected using the same method but at the time of feed additions for the second and third farrowing groups. Complete diet samples were stored at -4°F until they were homogenized, subsampled, and submitted for quantification (Analabs; Fulton, IL) of active live yeast (Table 1).

Statistical analysis

Performance data were analyzed using the lme4 package of R (Version 4.0.0, R Foundation for Statistical Computing, Vienna, Austria) as a randomized complete block design. Blocking structure accounted for farrowing group, parity, and BW, and sow was considered the experimental unit. Treatment was included as a fixed effect and block was included as a random effect. Counts of total born, litter size, and parity were analyzed using both a Poisson and negative binomial distribution, and model fit was superior using the negative binomial response distribution through evaluation of the Bayesian Information Criterion. The proportion of piglets within each litter born alive, stillborn, born mummified, and pre-weaning mortality was analyzed using a binomial distribution. Differences between treatments were considered significant at $P \leq 0.05$ and marginally significant at $0.05 < P \leq 0.10$.

Results and Discussion

Adding yeast additives from d 110 of gestation through weaning resulted in no statistical difference ($P > 0.10$) for sow BW or BW change throughout lactation (Table 2). Furthermore, there was no evidence of treatment differences ($P > 0.10$) for sow backfat at entry or weaning, or the loss in backfat from entry to weaning. There was a tendency ($P = 0.073$) for increased feed intake from farrowing to weaning when sows were fed a diet with yeast additives compared to the control diet. There was no difference ($P > 0.10$) in wean-to-estrus interval.

There was no evidence ($P > 0.10$; Table 3) that the addition of a live yeast and a yeast extract in sow diets influenced litter characteristics including litter size, litter weight, or mean piglet BW on d 2 post-farrowing, d 10 post-farrowing or at weaning. Furthermore, the addition of yeast additives showed no evidence of a difference ($P > 0.10$) on litter or piglet ADG or preweaning mortality.

In conclusion, feeding live yeast and yeast extracts from d 110 of gestation through lactation tended to increase lactation feed intake but did not affect any other sow or litter performance criteria.

Table 1. Composition of lactation diets (as-fed basis)[1]

Ingredients, %	
Corn	64.4
Soybean meal (46.5% CP)	30.0
Soybean oil	2.0
Calcium carbonate	0.90
Monocalcium P (21% P)	1.15
Salt	0.50
L-Lys-HCl	0.20
DL-Met	0.05
L-Thr	0.07
L-Trp	0.01
Trace mineral premix	0.15
Vitamin premix without phytase	0.25
Sow add pack	0.25
Phytase[2]	0.08
Yeast additives[3]	±
Total	100
Calculated analysis	
SID amino acids, %	
Lys	1.07
Ile:Lys	67
Leu:Lys	140
Met:Lys	30
Met and Cys:Lys	56
Thr:Lys	63
Trp:Lys	20.7
Val:Lys	73
His:Lys	44
Total Lys, %	1.21
NE, kcal/kg	2,508
SID Lys:NE, g/Mcal	4.25
CP, %	19.9
Ca, %	0.77
P, %	0.63
STTD P, %	0.50
Live yeast, CFU/g[4]	76,133 or 14,866,666

[1] Feed was manufactured at the O.H. Kruse Feed Technology Innovation Center (Manhattan, KS) for the first farrowing group and then feed was manufactured by a commercial feed mill (Hubbard Feeds; Beloit, KS).
[2] Live yeast was provided by 0.10% Actisaf Sc 47 HR+ and yeast extracts were provided by 0.025% SafMannan (Phileo by Lesaffre, Milwaukee, WI).
[3] Ronozyme HiPhos 2700 (DSM Nutritional Products, Parsippany, NJ) provided 919 FTU/lb and a STTD P release of 0.12%.
[4] Average quantification between feed samples was taken from the three farrowing groups. The control diet had 76,133 CFU/g of live yeast and the diets with added yeast had 14,866,666 CFU/g of live yeast detected.

Table 2. Effects of including live yeast and a yeast extract in lactation diets on sow performance[1]

Item	Control	Yeast[2]	SEM	*P* =
Count, *n*	40	40	---	---
Parity	2.2	2.2	0.24	0.999
Lactation length, d	18.7	18.7	0.15	0.603
Sow BW, lb				
Entry	540.2	540.1	11.04	0.978
Farrow	493.3	493.9	10.92	0.920
Wean	479.6	482.7	11.27	0.694
Sow BW change, lb				
Entry to farrow	-46.7	-46.6	3.22	0.974
Farrow to wean	-13.5	-11.7	3.14	0.663
Entry to wean	-60.3	-58.3	4.58	0.750
Sow backfat, mm				
Entry	12.7	12.5	0.35	0.684
Wean	10.1	10.3	0.35	0.705
Change (entry to wean)	-2.6	-2.2	0.24	0.197
Sow ADFI, lb				
Farrow to wean	12.5	13.0	0.27	0.073
Wean-estrus interval, d	4.4	4.3	0.14	0.748

[1] A total of 80 mixed-parity sows (DNA 241, DNA Genetics) and litters were used in a lactation study from d 110 of gestation until weaning.
[2] Live yeast was provided by 0.10% Actisaf Sc 47 HR+ and yeast extracts were provided by 0.025% SafMannan (Phileo by Lesaffre, Milwaukee, WI).

Table 3. Effects of including live yeast and a yeast extract in lactation diets on litter performance[1]

Item	Control	Yeast[2]	SEM	*P* =
Litter characteristics				
Total born, *n*	16.2	16.6	0.65	0.639
Born alive, %	91.4	91.1	4.50	0.960
Stillborn, %	7.0	5.4	4.04	0.764
Mummy, %	1.5	3.5	2.90	0.575
Litter size, *n*				
d 0	14.7	15.1	0.61	0.998
d 2	14.2	14.3	0.60	0.836
d 10	13.3	13.9	0.59	0.448
Wean	12.9	13.5	0.58	0.498
Litter weight, lb				
d 2	51.2	51.6	1.17	0.797
d 10	102.1	101.8	3.83	0.946
Wean	157.3	160.2	4.32	0.635
Mean piglet BW, lb				
d 2	3.63	3.61	0.074	0.849
d 10	7.67	7.36	0.261	0.312
Wean	12.14	11.94	0.262	0.579
Litter ADG d 2 to wean, lb/day	5.7	5.8	0.21	0.741
Piglet ADG d 2 to wean, lb/day	0.44	0.43	0.014	0.786
Preweaning mortality, %	10.7	9.6	4.88	0.873
Wean age	18.7	18.7	0.15	0.603

[1] A total of 80 mixed-parity sows (DNA 241, DNA Genetics) and litters were used in a lactation study from d 110 of gestation until weaning. Litters were cross-fostered to equalize litter size up to 48-h post-farrowing within treatment group.

[2] Live yeast was provided by 0.10% Actisaf Sc 47 HR+ and yeast extracts were provided by 0.025% SafMannan (Phileo by Lesaffre, Milwaukee, WI).